

## THE PTERIDOPHYTA OF TAIWAN

CHARLES E. DEVOL<sup>(1)</sup>

About 640 species of ferns and fern allies have been reported from Taiwan. Since this island lies partly in the tropics and also has a large number of mountain peaks of over 10,000 feet, there is a very wide range of habitats on Taiwan, thus supporting both tropical and temperate types of vegetation.

Matsumura (1904), Sasaki (1928), Kudo (1931), Suzuki (1931) and Masamune (1936, 1954) have prepared enumerations of the ferns for all or parts of Taiwan. Hayata, Nakai, H. Ito, and Tagawa have described many new species and made a number of studies and revisions on many of the families and genera of our ferns, Keng (1952) prepared a report on the Pteridophytes giving descriptions of the genera, and stating the number of species per genus. DeVol (1959) published a key to the genera of the Pteridophytes and Ito (1944) published an illustrated flora giving pictures and descriptions of 512 species of ferns found in Japan and Taiwan, nearly all of which are known from Taiwan.

Up to the present time no work on the ferns of Taiwan has been published, which includes keys to all the genera and species. This paper seeks to bring together the work of many botanists. A revised key has been prepared for the genera. Descriptions of genera, keys to species, and descriptions of all species together with distribution records are given. The author owes much to those who have preceded him and all his co-workers here in the Botany Department especially to M. T. Kao, our field collector and to my assistant, C. C. Chuang.

The delimitations of the fern families has been the subject of debate for many years (Ching 1940 b, Copeland 1947, Tindale 1961, 1963) This is not the place to go into a discussion of the merits of the different systems. The purpose this paper is to enable students to identify the ferns of Taiwan and not to endorse or criticise any arrangement of ferns. Families are recognized but any system is only considered a tentative arrangement.

The same can be said for the genera. I have not split the genera as finely as some, nor made them include as wide an assemblage as many do.

The keys only go as far as species, no effort has been made at this time to recognize varieties.

The references are not necessarily to original descriptions of species, very often they are those most easily accessible to our students and may be written in Chinese or Japanese as well as in English or Latin.

Chinese names of genera and species are given when they are known. Japanese names can be found in Masamune's and Sasaki's enumerations.

---

<sup>(1)</sup> Professor of Botany, National Taiwan University.

**A REVISED KEY TO THE GENERA OF THE PTERIDOPHYTES  
FOUND ON TAIWAN AND ADJACENT AREAS**

1. Sporangia borne in strobili, sporocarps. axils of small leaves,  
or at base of grass-like sporophylls..... 2
1. Sporangia borne on the back or margin of ordinary fronds or  
on specialized fronds, or portions of fronds..... 9
2. Aquatic plants..... 3
2. Terrestrial or epiphytic plants..... 6
3. Floating on water ..... 4
3. Rooting in mud (paddy fields, ponds or ditches, may be dry in  
certain seasons)..... 5
4. Leaves less than 1 mm long, without midrib, imbricating, upper  
lobe papillate, lower lobe submersed, sporocarps in pairs at base of  
lower lobe..... *Azolla*
4. Leaves 1 or more cm. long, with midrib, papillae with apical  
hairs, sporocarps borne in clusters on dissected root-like  
submersed leaves..... *Salvinia*
5. Leaves grass-like, elongated, tufted, with basal sporangia;  
stem corm-like..... *Isoetes\**
5. Leaves 4-lobed, rhizomes widely creeping, sporocarps attached  
to stipe, or at base of stipe..... *Marsilea*
6. Rush-like plants with hollow, jointed stems; strobili terminal..... *Equisetum*
6. Stems creeping or erect, not jointed, hollow or grooved ..... 7
7. Stems dichotomously branching; sporangia 3-lobed, borne on  
the branches, in axils of minute scale-like leaves..... *Psilotum*
7. Stems covered with small closely imbricating leaves..... 8
8. Spores of two kinds, median and lateral leaves usually dimorphic.... *Selaginella*
8. Spores of one kind, vegetative leaves not dimorphic..... *Lycopodium*
9. Aquatic plants, floating or rooting in mud, fertile fronds with  
narrow pinnae, sori marginal, indusia reflexed ..... *Ceratopteris*
9. Terrestrial, epiphytic or petrophilous plants ..... 10
10. Tree ferns with an erect trunk-like stem, and fronds in a  
terminal crown ..... 11
10. Not tree ferns, but sometimes with very large leaves ..... 16
11. Trunk about 1 cm. in diameter, and 1 m. tall; fronds about 30 cm.  
long, deeply bipinnatifid; sori linear, parallel to costa; indusia as  
in *Blechnum* when young but shoved back and sporangia  
appearing acrostichoid when old ..... *Diploblechnum*

---

\* Not reported from Taiwan

11. Trunk up to 8 cm or more in diameter ..... 12
12. Sori costal, borne in areolae, parallel to midrib; exindusiate;  
fronds pinnate ..... *Brainea*
12. Sori medial, dorsal on veins, fronds bipinnatifid to tripinnatifid..... 13
13. Trunks very short, usually less than 1 m. tall; sori linear on one  
or both sides of veins, indusia linear, single or back to back  
with lacinate margins ..... *Diplazium*
13. Trunks up to 3 or 4 m tall, fronds often very scaly beneath..... 14
14. Indusia very thin cup-like, globose, easily abraded ..... *Cyathea*
14. Indusia absent..... 15
15. Rachis and rachillae dark and polished..... *Gymnosphaera*
15. Rachis and rachillae not polished ..... *Alsophila*
16. Ferns with slender twining rachis..... *Lygodium*
16. Rachis not twining..... 17
17. Sporangia borne on spike-like, or panicle-like parts, or borne on  
fertile fronds or parts of fronds which are conspicuously  
unlike the sterile..... 18
17. Sporangia borne on the back or margin of ordinary foliage fronds  
(stipe of fertile frond may be longer or pinnae slightly contracted)..... 44
18. Sterile part of blade linear and grass-like, or finely dichotomously  
dissected (segments 1-2 mm broad); with short terminal or  
digitate fertile apical spikes; sporangia with apical  
annulus and longitudinal dehiscence..... *Schizaea*
18. Ferns not as above ..... 19
19. Fertile and sterile fronds dimorphous..... 20
19. Fertile and sterile segments parts of the same frond..... 38
20. Leaves simple (usually entire, if lobed only with terminal lobes or  
pedately lobed, never pinnately lobed)..... 21
20. Leaves deeply pinnatifid to decompose ..... 26
21. Lamina covered with stellate hairs ..... *Pyrrosia* (*Cyclophorus*)
21. Lamina without stellate hairs..... 22
22. Sporangia in sori or coenosori, epiphytes ..... 23
22. Sporangia covering the much constricted lamina..... 24
23. Sori superficial ..... *Lemmaphyllum*
23. Sori sunken, pustulate; fertile fronds 30-40 cm long, sterile fronds  
12-15 cm long ..... *Myromecophia* (*Phymatodes*)
24. Sterile leaf with 3 or 4 main veins at base..... *Cheiropleura*
24. Sterile leaf with only one main vein at base ..... 25
25. Rhizome creeping, stipes uniseriate..... *Leptochilus*
25. Rhizome short, stipes tufted ..... *Hemigramma*

26. Sporangia nearly sessile, borne in clusters (not usually on the margin or dorsal side of pinnae), without a true annulus; dehiscence terminal; with long trichomes mixed in with the clusters of sporangia.....*Osmunda*
26. Sporangia stalked, borne on contracted pinna, with a definite annulus, dehiscence lateral..... 27
27. Fertile fronds without a blade but with sori grouped in globose bead-like groups; sterile frond with anastomosing veins .....*Onoclea\**
27. Fertile fronds not bead-like..... 28
28. Fern without scales or normal hairs; both fertile and sterile leaves pinnate (or sterile only deeply pinnatifid) .....*Plagiogyria*
28. Ferns with either scales or hairs, or both scales and hairs..... 29
29. Rhizome scandent, reaching to tops of trees; pinnae articulate to rachis.....*Lomariopsis*
29. Terrestrial ferns; pinnae not articulate to rachis ..... 30
30. Sori parallel to costa; indusia linear, continuous, reflexed almost to costa..... 31
30. Sori not parallel to costa ..... 32
31. Sterile frond pinnate or deeply pinnatifid.....*Blechnum*
31. Sterile frond bipinnatifid .....*Matteuccia*
32. Veins free ..... 33
32. Veins reticulate..... 35
33. Indusia formed by reflexed leaf margin..... 34
33. Exindusiate, both fertile and sterile leaves pinnate .....*Egenolfia*
34. Small ferns; indusia nearly meeting at costa; stipe bearing thin chaffy scales.....*Cryptogramma*
34. Medium sized to large ferns; indusia narrow, not reflexed to costa; stipe usually only scaly near base, scales dark brown.....*Pteris*
35. Without included veinlets .....*Bolbitis*
35. With included veinlets..... 36
36. Lamina pubescent, hairs multicellular, especially so near margins....*Quercifilix*
36. Lamina glabrous..... 37
37. Venation as in *Tectaria* .....*Hemigramma*
37. Excurrent veinlets in areolae, not forking, directed away from costa.....*Bolbitis*
38. Fertile pinnae at the apex, middle, or lower portion of an otherwise sterile frond; sporangia borne in dense clusters, not borne on back or margin of lamina; sporangia opening by terminal dehiscence .....*Osmunda*

38. Fertile leaf or pinnae much constricted at apex or with a spike or panicle-like fertile segment branching from or below the sterile blade ..... 39
39. Sterile blade entire, simple; veins reticulate..... 40
39. Sterile blade deeply lobed or compound..... 42
40. Fertile apical portion much constricted, linear; sporangia acrostichoid.....*Belvisia (Hymenolepis)*
40. Sporangia borne on a spike-like segment..... 41
41. Terrestrial plants .....*Ophioglossum*
41. Epiphytes, pendent .....*Ophioderma*
42. Sterile blade tripartite, each division with an elongate linear lanceolate terminal leaflet and one or two elongate lobes, thus appearing 7-9 lobed; veins free; fertile spike long-stalked.....*Helminthostachys*
42. Sterile blade pinnately divided, or tripartite with many small ultimate divisions..... 43
43. Epiphyte, with humus collecting leaf base, upper fertile pinnae much constricted, bead-like.....*Aglaomorpha*
43. Terrestrial, leaves fleshy, fertile segment branching from sterile frond .....*Botrychium*
44. Fronds 1-cell thick, thin, translucent ..... 45
44. Fronds more than 1-cell thick..... 59
45. Indusia tubular, mouth truncate or expanded; receptacle exserted ..... (Trichomanes) 46
45. Indusia 2-lipped, divided to base or conical below and 2-lipped above; receptacle shorter than lips of indusia (except in in *Meringium*)..... (Hymenophyllum) 56
46. Fronds distant, rhizome often filiform ..... 47
46. Fronds clustered..... 52
47. Fronds simple ..... 48
47. Fronds pinnate to decomound ..... 49
48. Fronds reniform to orbicular. upper margin deeply cleft, stipitate.....*Gonocormus*
48. Fronds orbicular, margin entire or lobed, peltately attached, or obovate and shortly stipitate; false veins and a marginal vein usually present .....*Microgonium*
49. Lateral false veinlets present .....*Crepidomanes*
49. Lateral false veinlets absent ..... 50
50. Margins with a row or two of specialized cells..... 51
50. Margins without specialized cells .....*Vandenboschia*
51. Lamina glabrous .....*Crepidopteris*

51. Lamina bearing long brown hairs.....*Pleuromanens*
52. Cells transversely elongated; fronds; small, pinnately divided....*Abrodictyum*
52. Cells not transversely elongated, fronds large, rhizome stout..... 53
53. Fronds pinnate .....*Cephalomanens*
53. Fronds bipinnatifid to decompose ..... 54
54. Stipes without bristles, terrestrial ferns .....*Nesopteris*
54. Stipes with bristles.....53
55. Receptacle very long exerted; bristles on stipe about 2 mm long; cell walls very thick and pitted; terrestrial ferns.....*Selenodesmium*
55. Receptacle shortly exerted; bristles of various lengths up to 5 mm or more; cell walls thin; terrestrial or epiphytic.....*Callistopteris*
56. Receptacle exerted..... 57
56. Receptacle included..... 58
57. Fronds dichotomous, more or less fan shaped, segments may be of unequal length .....*Microtrichomanens*
57. Fronds pinnately compound, margins usually toothed .....*Meringium*
58. Margin of fronds and lips of indusia entire.....*Mecodium*
58. Margin of fronds and lips of indusia toothed.....*Hymenophyllum*
59. Fronds simple, some deeply pinnatifid ..... 60
59. Fronds compound..... 93
60. Sporangia following the veinlets often covering the lamina..... 61
60. Sporangia in distinct sori or coenosori..... 65
61. Venation obscure on fertile fronds..... 62
61. Venation distinct, reticulate..... 63
62. Fronds with stellate hairs, veins reticulate .....*Pyrrosia* (*Cyclophorus*)
62. Fronds without stellate hairs, veins parallel, meeting in a marginal line.....*Elaphoglossum*
63. Leaves glabrous, base of lamina attenuate .....*Antrophyllum*
63. Leaves pubescent, base of lamina cordate..... 64
64. Venation meniscoid; margin entire .....*Abacopteris*
64. Venation irregular; margin deeply lobed .....*Dictyocline*
65. Sori exindusiate, (usually superficial sometimes immersed in leaf tissue) often with a reflexed margin covering the sporangia..... 66
65. Sori with indusia ..... 86
66. Sori in a continuous marginal, submarginal or single medial line; fronds linear, very narrow..... 67
66. Sori usually dorsal; when marginal, round and distinct..... 71
67. Sporangia confined to apex of lamina borne in a deep groove; branched hairs on margin of lamina.....*Scleroglossum*
67. Sporangia not confined to apical part of lamina ..... 68

68. Fronds with stellate hairs.....*Saxiglossum*  
68. Fronds without stellate hairs ..... 69
69. Fronds less than one mm broad, with a costa and a single branched veinlet running parallel to costa; idioblasts present; sporangia borne in a single medial line.....*Vaginularia*  
69. Fronds 3-10 mm broad (very rarely wider); coenosori marginal or on either side of costa and parallel with the costa..... 70
70. Spicular idioblasts present in epidermis, at  $\times 20$ - $\times 30$  showing as short dark wrinkled lines running cross ways of frond; sporangia in continuous marginal, submarginal, or in medial lines.....*Vittaria*  
70. Without spicular idioblasts; herbarium sheets stained purplish; coenosori lying in a groove on either side of costa; margins reflexed and costal ridge wide with edges protruding toward the margins.....*Drymotaenium*
71. Sori linear..... 72  
71. Sori round or oval (immersed sori may be in a longitudinal slit)..... 73
72. Veins distinct, sori parallel to oblique veins.....*Colysis*  
72. Veins hidden, sori oblique to costa; nearly parallel in species with very narrow leaves.....*Loxogramme*
73. Lamina covered with stellate hairs.....*Pyrrisia* (Cyclophorus)  
73. Lamina without stellate hairs..... 74
74. Sori marginal, deeply immersed, opening toward margin as in Davallia; fronds deeply pinnatifid.....*Prosaptia*  
74. Sori dorsal..... 75
75. Hirsute on margins, costa or lamina..... 76  
75. Margins not hirsute..... 79
76. Lamina entire.....*Grammitis*  
76. Lamina pinnatifid..... 77
77. Sorus covered by lower half of the pinna turned toward midrib.....*Calymmodon*  
77. Sorus not covered by fold of pinna..... 78
78. Each lobe or pinna with a single simple or forked vein; sori superficial.....*Xiphopteris*  
78. Each lobe or pinna with a main vein and pinnately arranged veinlets; sori sunken or superficial.....*Ctenopteris*
79. With distinct humus collecting fronds or with the base of frond modified for humus collecting ..... 80  
79. Without humus collecting leaves..... 81
80. With distinct humus collecting leaves.....*Drynaria*  
80. With base of leaf widened to serve as a humus collector.....*Pseudodrynaria*

81. Margins cartilaginous, sori large..... 82
81. Margins not cartilaginous..... 83
82. Margins with a notch between main lateral veins.....*Crypsinus*
82. Margins not notched; sori often sunken; fronds deeply pinnatifid .....*Phymatodes*
83. Sori covered with peltate scales, at least when young ..... 85
83. Sori without peltate scales..... 84
84. Fronds always deeply pinnatifid; sori large, in one row on each side of costa.....*Polybodium*
84. Fronds simple, undivided, or pinnatifid; sori usually small and multiseriate .....*Microsorium*
85. Veins usually obscure, sori in a single line on either side of costa.....*Lepisorus*
85. Veins distinct, sori in a row between the lateral veins.....*Neocheiropteris*
86. Indusia reniform; sori in a single row on either side of costa .....*Oleandra*
86. Indusia linear..... 87
87. Venation obscure..... 88
87. Venation distinct..... 89
88. Fronds lanceolate, long attenuate, rooting at apex.....*Camptosorus*
88. Fronds palmatifid or deeply pinnatifid.....*Doryopteris*
89. Venation reticulate forming areolae..... a
89. Venation not reticulate..... 90
- a. Sori costal.....*Blechnum*
- aa. Sori often double, following oblique veinlets .....*Diplaziopsis*
90. The lateral parallel veins uniting in a continuous marginal vein; sori single.....*Thamnopteris* (*Asplenium*)
90. Veins free..... 91
91. Sori often doubled; indusia placed back to back.....*Diplazium*
91. Sori single..... 92
92. Sori arranged in opposite pairs, borne on adjoining veins; indusia opening toward each other, the two sori becoming confluent.....*Phyllitis*
92. Sori not arranged in pairs .....*Asplenium*
93. Fronds palmately divided .....*Dipteris*
93. Fronds not palmately divided..... 94
94. Fronds pseudodichotomously branched ..... 95
94. Fronds pinnate in plan ..... 96
95. Fronds pinnate above last fork, veinlets more than once forked.....*Dicranopteris*
95. Fronds bipinnate above last fork, veins only once forked.....*Hicriopteris*



96. Sori in compact groups, sporangia wall thick; pulvini at base of pinnae, fleshy stipules at base of stipes..... 97
96. Sori not in compact groups; sporangia wall 1-cell thick, without pulvini or stipules..... 99
97. Sporangia in a synangia.....*Marattia*
97. Sporangia free, crowded into a double line, opening by a longitudinal slit..... 98
98. Fronds pinnate, sori medial.....*Archangiopteris*
98. Fronds at least bipinnate, mature fronds very large; sori submarginal.....*Angiopteris*
99. Sori exindusiate or apparently without indusia, margins not reflexed except in *Hypolepis*.....100
99. Sori covered by reflexed leaf margin, or by an indusium at least when young.....126

#### SORI EXINDUSIATE

100. Sporangia completely covering the undersurface of the terminal pinnae, fronds pinnate, lower pinnae sterile .....*Acrostichum*
100. Sporangia not acrostichoid.....101
101. Stipe and rachis dark polished.....102
101. Stipe and rachis not dark nor polished.....106
102. Undersurface of lamina farinose, sporangia borne along the free veins .....*Pityrogramma*
102. Undersurface not farinose .....103
103. Undersurface, stipe and rachis densely tomentose; hairs covering the sporangia; veins obscure .....*Gymnopteris*
103. Undersurface not tomentose; veins clearly visible .....104
104. Ferns very small, tripinnatifid, up to 15 cm tall; sporangia following the veins; veins with swollen tips, not reaching the margin; without hairs or scales on undersurface.....*Anogramma*
104. Ferns medium to large; sori round, dorsal on veins; veins running to the margin.....105
105. Undersurface bearing straight white hairs on costa .....*Phegopteris* (*Thelypteris*)
105. Undersurface bearing scales on costa.....*Gymnosphaera*
106. Stipes articulate to rhizome, rhizome scales clathrate, fronds uniseriate .....107
106. Stipes not articulate to rhizome, scales usually not clathrate (except in *Ctenitis* and *Dictyopteris*).....111
107. Margins cartilaginous with a notch between lateral veins .....*Crypsinus*
107. Margins not as above.....108

108. Fronds pinnate, pinnae articulate to rachis.....*Arthromeris*
108. Fronds deeply pinnatifid; if pinnate, then with adnate pinnae .....109
109. Sori linear.....*Colysis*
109. Sori round.....110
110. Veins conspicuously anastomosing; sori small, multiseriate .....*Microsorium*
110. Veins free or with one row of costal areolae; sorus borne on  
the end of included veinlet .....*Polypodium*
111. Sporangia following the nearly parallel veins.....*Coniogramme*
111. Sori linear, round, oblong; or sporangia following reticulate veins.....112
112. Veins free .....113
112. Veins not free .....122
113. Lamina articulate to top of stipe .....*Gymnocarpium*
113. Lamina without a distinct joint at top of stipe .....114
114. Ferns without any ordinary hairs or scales, both surfaces  
glandular .....*Monachosorum*
114. Ferns strictly glabrous or with hairs or scales or both .....115
115. Fronds glabrous, stipe more or less scaly.....116
115. Fronds with hairs on veins, rachis or leaf blade, scales often  
present on stipe.....118
116. Sori round.....117
116. Sori linear, fronds bipinnate to decomound .....*Cornopteris*
117. Fronds pinnate.....*Dryopteris Scottii*
117. Fronds decomound (4-pinnate); base of pinnules with a large  
thin scale; indusia present when young, fugaceous .....*Acrophorus*
118. Sori oblong, fronds hirsute, bipinnatifid.....*Leptogramma*
118. Sori round.....119
119. Sori marginal, covered by reflexed leaf margin when young,  
stipe, rachis, costa bearing multicellular hairs.....*Hypolepis*
119. Sori dorsal.....120
120. Fronds pinnate, often proliferous; stipe and rachis scaly.....*Polystichum*
120. Fronds pinnatifid, bipinnatifid, or tripinnatifid .....121
121. Hairs on upper surface of rachis and veins usually  
multicellular, brown, crisped.....*Ctenitis*
121. Hairs white, straight, unicellular.....*Thelypteris*
122. Veins reticulate, forming irregular areolae.....123
122. Venation meniscioid .....124
123. Sporangia following the reticulate veins; veinlets hispid.....*Dictyocline*
123. Sori round (with reniform indusia when young) usually  
appearing exindusiate when old; veinlets and sori with  
glandular hairs .....*Dictyopteris (Tectaria)*

124. Fronds proliferous.....*Goniopteris*  
 124. Fronds not proliferous.....125  
 125. Rhizome creeping; fronds distant .....*Abacopteris*  
 125. Rhizome short, erect; fronds tufted.....*Stegnogramma*

### SORI WITH INDUSIA

126. Sori dorsal, sometimes terminal on veinlets and thus very near  
 the margin .....127  
 126. Sori marginal or submarginal.....155  
 127. Indusia inferior.....128  
 127. Indusia superior .....130  
 128. Indusia stalked, globose, splitting at top when mature .....*Peranema*  
 128. Indusia lobed or cleft into narrow segments.....129  
 129. Stipes breaking some distance above rhizome, lamina pinnate  
 to bipinnate.....*Woodsia*  
 129. Stipes not breaking off in the middle, lamina 3 to 4 pinnate.....*Cystopteris*  
 130. Indusia linear, or curved and crossing veinlet in  
*Athyrium* sometimes broad, almost reniform.....131  
 130. Indusia round, reniform or oblong.....137  
 131. Sori parallel to costa or main veins of pinnule .....132  
 131. Sori oblique to costa and main veins of pinnule.....134  
 132. Sori continuous (coenosori) .....133  
 132. Sori distinct, often immersed in tissue .....*Woodwardia*  
 133. Fronds pinnate; rhizome short; stipes tufted.....*Blechnum*  
 133. Fronds bipinnate; rhizome erect, tree-like, up to  
 one m. tall.....*Diploblechnum*  
 134. Sori usually doubled, indusia placed back to back .....135  
 134. Sori single, linear; or curved and crossing veinlet.....136  
 135. Veins free, or only basal veinlets uniting as in *Cyclosorus*.....*Diplazium*  
 135. Veins anastomosing forming areolae .....*Diplaziopsis*  
 136. Sori single, linear; rhizome scales clathrate; basiscopic edge of  
 leaflet decurrent on edge of rachis groove; stipes with 2 vascular  
 strands below, uniting upwards into a 4-armed strand, fronds  
 usually small .....*Asplenium*  
 136. Sori curved, crossing veinlet; scales soft, thin; edges of rachis  
 grooved on upper side, often thin and raised, leaflet of lamina  
 not decurrent, stipes with 2 vascular strands uniting upwards  
 into a U-shaped strand, fronds terrestrial, large .....*Athyrium*  
 137. Indusia reniform or oblong .....138  
 137. Indusia round.....152  
 138. With a large thin scale at base of each pinnule, indusia oblong  
 attached by its base, fugaceous.....*Acrophorus*

138. Not bearing a scale at base of pinnules.....139
139. Venation free.....140
139. Venation various, not free.....149
140. Pinnae articulate to rachis.....141
140. Pinnae not articulate to rachis.....142
141. Stipes articulate to a pseudopodium just above the rhizome,  
stipes distant.....*Arthropteris*
141. Stipes not articulate to rhizome, stipes tufted.....*Nephrolepis*
142. Lamina more or less pubescent, at least on upper surface along  
rachis and costa.....143
142. Lamina not pubescent, stipe and rachis often scaly.....147
143. Hairs white, straight.....144
143. Hairs brown, crisped, multicellular on upper surface of rachis and  
veins, stipes scaly.....*Ctenitis*
144. Lamina bipinnatifid to bipinnate.....*Thelypteris*
144. Lamina tripinnatifid to decompound.....145
145. Undersurface of lamina with bullate scales, first pinnules always  
anadromous.....*Rumohra*
145. Undersurface without bullate scales.....146
146. Hispid along veins, scales at base of stipe sparse.....*Thelypteris*
146. Both surfaces densely pilose, base of stipe covered with bright  
rufous scales.....*Hypodematium*
147. Fronds cespitose, rhizome short.....148
147. Fronds distant, rhizome creeping, first pinnules anadromous.....*Rumohra*
148. First pinnule in all except the two basal pinnae catadromous.....*Dryopteris*
148. First pinnules always anadromous; rachis zigzag, abruptly  
joined to straight stipe.....*Acrorumohra*
149. Veins reticulate, forming irregular areolae (Tectaria).....150
149. One or more pairs of the opposite veinlets uniting.....151
150. Areolae with included veinlets.....*Tectaria*
150. Areolae without included veinlets; yellow glandular hairs borne  
along veinlets on underside.....*Dictyopteris*
151. Only one or two lowest pairs of opposite veinlets uniting.....*Cyclosorus*
151. All opposite veinlets uniting and forming an excurrent intermediate  
veinlet (meniscioid venation).....*Abacopteris*
152. Pinnae articulate to rachis.....*Nephrolepis*
152. Pinnae not articulate to rachis.....153
153. Fronds simply pinnate, margins entire or serrulate.....154
153. Fronds pinnate to decompound, margins often aristate; pinnae usually  
with an auricle, or with the first pinnule enlarged, veins free.....*Polystichum*

154. Veins reticulate; sori multiseriate ..... *Cyrtomium*  
 154. Veins free or with one or two rows of areolae, sori medial in a  
 single row on each side of costa, at end of anterior basal veinlet  
 ..... *Cyrtogonellum*

### SORI MARGINAL

155. Indusia 2-lipped ..... *Cibotium*  
 155. Indusia not 2-lipped ..... 156  
 156. Indusia opening on margin or toward margin ..... 157  
 156. Indusia opening away from the margin ..... 166  
 157. Indusia long, linear, rhizome scales very narrow ..... 158  
 157. Indusia tubular, cup-shaped, or attached at base and with sides free ..... 159  
 158. Veins free; pinnae short, dimidiate, margin often lobed, sori  
 usually continuous on unlobed pinnae ..... *Lindsaya*  
 158. Veins forming costal areolae, pinnae lanceolate, margins rarely  
 lobed, sori continuous ..... *Schizoloma*  
 159. Rhizomes scaly; stipes articulate to rhizome in most species ..... 160  
 159. Rhizome hairy or with very narrow scales; stipe not articulate to  
 rhizome ..... 163  
 160. Indusia tubular ..... *Davallia*  
 160. Indusia attached at base, sides free ..... 161  
 161. Terrestrial ferns, rhizome bearing small scales and hairs ..... *Leucostegia*  
 161. Epiphytes, rhizomes covered with large scales ..... 162  
 162. Fronds coriaceous ..... *Humata*  
 162. Fronds thin, finely dissected ..... *Araiostegia*  
 163. Ultimate segments cuneate, rhizome scales very narrow  
 ..... *Stenoloma (Sphenomeris)*  
 163. Ultimate segment not cuneate; sori at ends of single veins ..... 164  
 164. Indusia attached at base, sides free; rhizome covered with narrow  
 brown scales; fronds pinnate to bipinnatifid ..... *Tapeinidium*  
 164. Indusia cup shaped, rhizome covered with long stiff hairs ..... 165  
 165. Lowest pinnae longest, sori marginal, indusia united with margin of  
 sinus ..... *Dennstaedtia*  
 165. Lowest pinnae often shortened, sori submarginal, indusia free  
 from margin ..... *Microlepia*  
 166. Indusia reaching nearly to costa, ultimate segments elliptical,  
 very small ..... *Onychium*  
 166. Indusia not reaching to costa, ultimate segments not elliptical ..... 167  
 167. Sori clearly distinct ..... 168  
 167. Sori continuous or confluent ..... 169

168. Rhizome and stipe hairy, hairs multicellular; sori small, borne on end of a single vein; indusia formed by reflexed marginal lobe ..... *Hypolepis*
168. Rhizome scaly; stipes dark, glossy, often scaly at base; sporangia borne upon the reflexed marginal lobes..... *Adiantum*
169. Stipes dark glossy..... 170
169. Stipe not glossy..... 176
170. Venation obscure..... 171
170. Venation distinct..... 172
171. Fronds palmatifid, glabrous indusia continuous..... *Doryopteris*
171. Fronds bipinnatifid, densely covered with reddish tomentum, sporangia eventually covering undersurface of lamina..... *Notholaena*
172. Many veins anastomosing, fronds large, pinnae opposite, pinnules opposite, with stipule-like pinnules at base of pinnae..... *Histiopteris*
172. All veins free..... 173
173. Lamina farinose beneath..... *Aleuritopteris*
173. Lamina not farinose beneath..... 174
174. Indusia distinct but often confluent, ends of veins thickened..... *Cheilanthes*
174. Indusia continuous..... 175
175. Stipe and rachis hispid, stipe covered with small scales; small petrophilous ferns..... *Pellaea*
175. Stipe and rachis glabrous; not scaly; medium to large terrestrial ferns..... *Pteris*
176. Rhizome hairy, not scaly; undersurface of lamina pubescent; with a thin narrow indusium under the thicker reflexed leaf margin..... *Pteridium*
176. Rhizome and base of stipe scaly; undersurface of lamina glabrous; fronds often dimorphous; many species have very long linear ultimate segments; indusia formed by thin reflexed leaf margin (without an inner indusium) ..... *Pteris*

## I. PSILOACEAE

Vascular plants without roots; stems erect or pendent, unbranched or dichotomously branched; rhizomes mycorrhizal, protostelic; aerial stems siphonostelic; leaves elliptical with a midrib, or scale-like and lacking a midrib; sporangia borne in axils of leaves, 2-3 lobed, eusporangiate, lacking tapetum; homosporous; gametophyte subterranean, cylindrical, mycorrhizal, sometimes with vascular tissue. 2 genera.

### 1. *Psilotum* Swz. 松葉蘭屬

Rhizome bearing rhizoids, aerial stem green, simple below, repeatedly dichotomously branching above; pith of sclerenchyma tissue; leaves small, scale-like, vein-less,

scattered; sporangia 3-lobed, on adaxial side of the minute leaves; spores bilateral; sperms spiral, multiciliate. 2 species, one in Taiwan.

1. *P. nudum* (L.) Griseb. 松葉蘭

Brown, 1931:110, Ohwi 1957:3, Tagawa, 1963:6

*P. triquetrum* Swz. Rosenburgh 1915:24

Aerial stems green, erect or pendent, 10–50 cm long, angular; leaves awl-shaped, 1–2 mm long; sporangia in axils of fertile leaves.

Distribution: Tropics and subtropical regions.

TAIWAN: Widely distributed, known from Taipei, Hsinchu, Taichung, Nantou, Pingtung, Taitung, Hwalien Counties.

Habitat: Terrestrial or frequently epiphytic on tree ferns.

## II. EQUISETACEAE

A family with only one genus. See characters listed below.

2. *Equisetum* Linn. 木賊屬

Rush-like perennial plants with underground rhizomes; aerial stems jointed, grooved, hollow, with silica on the ridges and stomata in the grooves, simple or with one to many branches at a node, fertile and sterile stems both green and alike, or the fertile ones lacking chlorophyll; c.s. of the internodes show a large central cavity (the centrum), a smaller cavity under each groove (the vallecular), and a very small cavity under each ridge (the carinal); leaves small, laterally fused into sheaths at the nodes, upper portion of each leaf is a tooth, teeth persistent or deciduous; strobili terminal on stem or branches; sporangia borne on the back of a stalked sporangiophore; spores round, green, with hygroscopic elaters; prothallus green, lobed; chromosome number  $n=108$  for all examined species; sperms large, coiled, multiflagellate. 23 species, one on Taiwan.

1. *E. ramosissimum* Desf. subsp. *debile* (Roxb.) Hauke 接骨草 Hauke, 1962:33, Hauke, 1963:61.

Stems 20 cm to over 1 m tall, 1–5 mm broad, irregularly branched, evergreen; stomata in single lines in the grooves; sheaths green, cylindrical, 4–12 mm long; teeth brown to white, drying and deciduous; cones apiculate.

This subspecies is very similar to the subspecies *ramosissimum* but this one differs chiefly in having an individual endodermis around each vascular bundle rather than having a common endodermis surrounding all vascular bundles.

Distribution: This subspecies is the southern form, being known in Southern Asia from India and Ceylon to the Philippines Indonesia and New Caledonia.

Taiwan: Widely distributed, known from all counties on Taiwan.

Habitat: Along mountain streams and paths, from sea level to 2000 m.

To be continued

## BIBLIOGRAPHY

- (1) BROWN, E. D. W. and F. B. H. BROWN., 1931. Flora of the Southeastern Polynesia II Pteridophytes. Honolulu.
- (2) CHING, R. C., 1940b. On natural classification of the family "Polypodiaceae" Sunyatsenia 5:201-268.
- (3) COPELAND, E. B., 1947. Genera Filicum. Waltham, Mass.
- (4) DEVOL, C. E., 1959. A key to the genera of the pteridophytes found on Taiwan and adjacent areas. Quart. Journ. Taiwan Mus. 12:55-65.
- (5) HAUKE, R. 1962. A resume of the taxonomic reorganization of Equisetum. Am. Fern Journ. 52 (1-2).
- (6) \_\_\_\_\_ 1962. A taxonomic monograph of the genus Equisetum subgenus Hippochaete. Beihefte zur Nova Hedwegia 8. 1-123. pl 21.
- (7) ITO, H., 1944. Filices Japonicae Illustratae 日本羊齒植物圖鑑. Tokyo. (In Japanese)
- (8) ITO, T., 1928. Illustrations of Taiwan Ferns 續臺灣植物圖說. Kyoto. (In Japanese)
- (9) KENG, H. 1952. Families and genera of Formosam pteridophytes. Quart. Journ. Taiwan Mus. 5:25-56.
- (10) KUDO, Y. and SASAKI, S., 1931. An ecological survey of the Vegetation of the border of Lake Jitsugetsuten. Ann. Report of Taihoku Bot. Garden. 1:1-50.
- (11) MASAMUNE, G., 1936. Short Flora of Formosa. Taihoku.
- (12) \_\_\_\_\_, 1954. A List of vascular plants of Taiwan. (Mimeographed List)
- (13) MATSUMURA, J., 1904-12. Index planatarum sive enumeratio plantarum omnium ex insulis Kurile, Yezo, Nippon, Sikoku, Kiusiu, Liukiu et Formosa. 284-352.
- (14) OHWI, J., 1957. Flora of Japan: Pteridophyta. Tokyo.
- (15) ROSENBURGH, VAN ALDEWERELT., 1915. Malayan Fern Allies. Batavia.
- (16) SASAKI, S., 1928. List of plants of Formosa. Taihoku.
- (17) SUZUKI, S., 1931. Florula Taiheizanensis sive enumeratio plantarum in Monte Taiheizan Sponte Crescentium. Ann. Rep. Taihoku Botanic Garden 1:99-185.
- (18) TAGAWA, M., 1963. Colored illustrations of the Japanese Pteridophyto. Osaka.
- (19) TINDALE M. D., 1961. Davalliaceae, Grammitidaceae, Polypodiaceae, Aspidiaceae. Cont. New. So. Wales Natl. Herb. Nos. 208-211.
- (20) \_\_\_\_\_, 1963. Hymenophyllaceae. Flora of New South Wales. Cont. New So. Wales Natl. Herb. No. 201.