MEMOIRS OF THE COLLEGE OF SCIENCE, UNIVERSITY OF KYOTO, SERIES B,
Vol. XXXI, No. 3, Article 2 (Biology), 1965

Taxonomy of the Thelypteroid Ferns, with Special Reference to the Species of Japan and Adjacent Regions

IV. Enumeration of the Species of Japan and Adjacent Regions

by

Kunio IWATSUKI

Botanical Institute, College of Science, University of Kyoto

(Received September 25, 1964)

The following enumeration comprises all the species of the thelypteroid ferns inhabiting in Japan and the neighbouring regions. The regions under revision are restricted to Japan (Hokkaido, Honshu, Shikoku, Kyushu, Ryukyu and Bonin), Saghalin, Kurile, Korea and Taiwan. The limitation of the regions is made in regard to the materials available. In spite of the formal boundary of the region, I have made the efforts to study the specimens outside the regions under consideration and to compare them with those in the present regions, for the specific taxonomy of ferns may be proceeded only when they are investigated throughout their wide distribution areas. It is also inevitable to study the allied species in the adjacent regions to know the specificity of the respective taxa. My field surveys are set forth only in Japan (except for Bonin). Therefore, I can not extend the area of specific review beyond the present regions, from where considerable amount of specimens have been brought into the herbaria.

I have examined the dried specimens of the thelypteroid ferns kept in the following herbaria, the names of which are cited in this publication in abbreviated forms now in general use.

CAL Herbarium of the University of California, Cal.
GH Gray Herbarium & Arnold Arboretum of Harvard University, Mass.
KAG Herbarium of Kagoshima University, Kagoshima.
KYO Herbarium of Kyoto University, Kyoto.
MAK Makino Herbarium of Tokyo Metropolitan University, Tokyo.
NY New York Botanical Garden, N. Y.
TAK Herbarium of the Research Laboratory, Takeda Pharmaceutical Industries, Osaka.

TI Herbarium of Tokyo University, Tokyo.
TNS National Science Museum, Tokyo.
US United States National Herbarium, Smithsonian Institution, Wash.

I am much indebted to the directors and curators of these herbaria.

To save too much complexity, synonymy is only briefly compiled. When the citation of older literature will be necessary, the following three publications may be most useful:

MATSUMURA, J., 1904. Index Plantarum Japonicarum I.

ITO, H., 1939. In NAKAI & HONDA, Nova Flora Japonica 4, Polypodiaceae-Dryopteridoideae I.

TAGAWA, M., 1959. Index Pteridophytorum Japonicorum, in Col. Ill. Jap. Pterid.

For further comparisons with the species outside our regions, CHING's comprehensive series of publications may be most referable (see the pages of references in Part 1).

Since the third supplement of CHRISTENSEN's *Index Filicum* was published in 1934, many publications have been appeared concerning the thelypteroid ferns in our regions. In the present paper, reference is made only to the selected publications containing some original reports. The herbarium specimens are cited only when it is inevitable. Even in such cases, the citation is restricted to the representative specimens, usually bearing the collector's field numbers.

I have already published a few short revisions of the species of the thelyteroid ferns. In the present paper, the duplication of the reports is avoided when the circumstances allow. Notes already touched in some earlier papers will be excluded in the present paper for the sake of simplifying the volume of the paper.

Genus **Stegnogramma** BLUME

The structure and affinity of this genus are discussed in my revision of *Stegnogramma* BLUME emend.[1] This genus comprises twelve species including three subspecies and three varieties, and ranges Himalayan regions, South China, Japan to Taiwan, Malaysia, a species extending to North Africa in the west and Polynesia in the east and another in the New World[2]. To the regions now under consideration, five species and a variety is credited up to the present. They are distinguished from each other by such diagnostic features as summarized in the following key:

A Veins anastomosing.
  B Venation copiously and irregularly reticulate into numerous areoles between costules.
    C Fronds pinnate in plan, having more than three pairs of free, short-stalked lateral pinnae, the lowest not the longest. ..... *S. griffithii* var. *griffithii*.
    C Fronds pinnatifid in plan, having none (or very occasionally one sessile

1) Acta Phytotax. Geobot. **19** : 112–126. 1963.
2) Amer. Fern Journ. **54** : 141–143. 1964.

pair) of free lateral pinnae, the lowest usually the longest. .... *S. griffithii* var. *wilfordii.*

B Venation goniopteroid, with more than 4 pairs of adjoining veinlets..... ..... *S. dictyoclinoides.*

A Veins all free.

B Dwarfed plants, fronds less than 30 cm in length, pinnae ovate-oblong to oblong-lanceolate, obtuse or moderately acute at apex, not more than 3 cm in length.

C Lowest pair of pinnae much longer than the next above, the apices of laminae caudately long attenuate. ..... *S. tottoides.*

C Lowest pair of pinnae usually shorter than the next above, less than 1 cm in breadth, the apices of laminae acuminate. .... *S. gymnocarpa* subsp. *amabilis.*

B Plant larger in normal condition, pinnae lanceolate, acuminate at apex, generally more than 6 cm in length. ..... *S. pozoi* subsp. *mollissima.*

Sect. *Dictyocline* (Moore) K. Iwats.

1. **Stegnogramma griffithii** (Moore) K. Iwats. Acta Phytotax. Geobot. **19**: 117. 1963.——*Dictyocline griffithii* Moore, Gard. Chron. **1855**: 854, Ind. Fil. lix. 1857 et 316. 1861. Type: Assam, *Griffith*; Nakai, Bot. Mag. Tokyo **47**: 157. 1933.——*Hemionitis griffithii* (Moore) Hook. fil. et Thoms. ex Hook. Sp. Fil. V, 192. 1864. ——*Aspidium griffithii* (Moore) Diels in Engler & Prantl, Nat. Pfl.-fam. I (4): 186. 1899.

Hemionitis wilfordii Hook. Exot. Ferns t. 93. 1859. Type: Taiwan, *Wilford.*

Hemionitis griffithii vars. *pinnata* et *pinnatifida* Hook. Sp. Fil. V, 193. 1864. Types: Khasia, *Hooker f. & Thomson*; Taiwan, *Wilford*, respectively.

Rhizome thick, short creeping or ascending, bearing numerous roots and stipes approximately, to 5 mm in diameter, sparsely scaly and hairy. Stipes 2–8, contiguous to each other on the apical portion of rhizome, terete, stramineous but blackish brown at base, 10–25 (–35) cm long, 2 mm or so in diameter, hairy throughout, scaly at basal portion. Fronds simple, pinnatifid to pinnate, oblong subdeltoid or broadly oblanceolate, truncate or moderately cordate at base, acute, acuminate or caudate at apex, 10–30 cm long, 5–20 cm broad at basal broadest portion; rachis straight, sparsely hairy; basal one to several pairs of lateral lobes decurrent at base to rachis, lateral lobes one to ten pairs, subopposite, oblong to oblong subdeltoid, acute to acuminate at apex, crenate or dully undulate at margin; costae slightly bent upwards, hairy on both sides. Venation irregularly reticulate; costules more or less distinct, three to six irregular rows of areoles between the adjacent costules, costular areoles the largest; included veinlet absent, or rarely one or two of the minor areoles included in the costular ones. Scales not so dense on rhizome and on basal portion of stipes, linear subtriangular or lineari-lanceolate, subtruncate at base, acute and long tailed at apex, composed of five to ten irregular rows of long cells with not so thick walls, almost entire at margin, 4–6 mm long, at most 1 mm broad, hairy at margin or sparsely so on both surfaces. Hairs

dense on every portion of plants, setose, straight or hooked at apex, unicellular, pale or brownish in dried condition. Sori elongate along veins, reticulate, naked; sporangia setose with the hairs having the hooked apices.

Terrestrial on clayey floor of mountain forests or on humus rich or sandy ground along stream in moist dense forests.

This species is divisible into two varieties, both of which are found in our regions.

Var. **griffithii**.——*Dictyocline griffithii* MOORE, l. c.

Hemionitis griffithii var. *pinnata* HOOK. l. c.

Rather rare at lower elevations of Taiwan.

TAIWAN. Prov. Taihoku: Urai, *Faurie 227* (KYO). Prov. Taichû: Jitsugetsutan, *S. Kitamura s. n.* (KYO). Prov. Kwarenkô: near Sakadan, *Tagawa 3323* (KYO).

Distribution: Himalayan regions including those of China and North India.

Var. **wilfordii** (HOOK.) K. IWATS. Acta Phytotax. Geobot. **19**: 117. 1963.—— *Hemionitis wilfordii* HOOK. l. c.

Not so rare at lower elevations of southern Japan, the Ryukyus and Taiwan. Also known from South China, North India, Burma and Annam.

Sect. *Stegnogramma*.

2. **Stegnogramma dictyoclinoides** CHING, Sinensia **7**: 92. 1936. Type: Yunnan, Ping-pien Hsien, *Tsai 62728*; TAGAWA, Acta Phytotax. Geobot. **9**: 94. 1940; K. IWATS. Acta Phytotax. Geobot. **19**: 118. 1963.

Rhizome oblique, ascending, bearing numerous wiry roots and remainings of stipe bases. Stipes terete, slender, 10–20 cm long, stramineous with dirty base, densely hairy throughout, scaly only at the basal portion. Fronds simple, pinnatifid or lower 1 or 2 pairs of pinnae free, broadly lanceolate, caudately acute at apex, subtruncate or cordate at base, oblong subtriangular, 10–20 cm long, 5–10 cm wide; the basal pinnae slightly shorter than the next above, deflexed, sessile or decurrent at base; lateral lobes 5–10 pairs, oblong subdeltoid, acuminate at apex, entire or irregularly undulate at margin; texture soft herbaceous, dark green. Hairs dense on every axis of plants, unicellular, setose or hooked at apex, pale, spreading and needlelike. Venation goniopteroid; costules almost straight or slightly flexuous, veins usually 4–6 in pairs, excurrent veinlets continuous, the areoles thus formed rather irregular. Sori naked, elongate and reticulate along veins.

Terrestrial on humus-rich floor of forest at about 1700 m elevation in Taiwan, known only one collection. Also known from Yunnan and Annam.

Sect. *Leptogramma* (J. SMITH) K. IWATS.

3. **Stegnogramma tottoides** (H. ITO) K. IWATS. Acta Phytotax. Geobot. **19**: 121. 1963.——*Leptogramma tottoides* H. ITO, Bot. Mag. Tokyo **49**: 434. 1935. Type: Taiwan, Mt. Arisan, *Hayata & Sasaki s. n.* (TI!); TAGAWA, Journ. Jap. Bot. **25**: 114. 1950, excl. pl. ex Korea.——*Leptogramma totta* var. *tottoides* (H. ITO) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 166. 1939.

Leptogramma caudata CHING, Sinensia **7**: 88. 1936 et Icon. Fil. Sin. V, pl. 230. 1958. Type: Fukien, Kuliang Hills, *Metcalf 5002c.*

Dryopteris africana (DESV.) C. CHR. sensu HAYATA, Icon. Pl. Formos. IV, 187. 1914.

Rhizome short, ascending or suberect, 4 mm or more in diameter, bearing numerous stipe-bases and roots densely, sparsely scaly and hairy. Stipes subaccumulated on apical portion of rhizome or solitary and remote, three to ten in number, terete, stramineous throughout but dark brownish at basal portion, scaly and densely hairy, up to 15 cm long, 1 mm or so in diameter. Fronds oblong lanceolate or lanceolate, caudate or long attenuate at apex, gradually narrowing towards base but the basal pair of lateral pinnae about 1.5 to 2 times of the next above in size, up to 25 cm long, 5 cm wide at most; rachis like stipes, stramineous, densely hairy; lateral free pinnae 10 or so in pairs, the upper pinnae broadly decurrent at base and gradually changed to lobes of indistinct apical portion; lateral pinnae oblong to oblong subtriangular, round or moderately acute at apex, truncate or broadly cuneate, or rarely subcordate at base, sessile, lobed a half way at margin with oblong, oblique, subimbricate lobes having rotundate apex and subentire and slightly recurved margin, at most 2.5 cm long and 1.0 cm broad, the lowest pair of pinnae different from the others in size, acute at apex, up to 4 cm long, 1.5 cm broad, very shortly stalked; costae straight or slightly bent upwards, hairy; veins pinnate, veinlets up to 6 pairs in segment, simple, reaching the very margin of lobes, setose; texture herbaceous, dirty green, sometimes brownish green in dried condition, somewhat densely hairy on both surfaces. Scales not so dense on rhizome and lower portion of stipes, oblong subtriangular, round or cordate at base, acuminate and long tailed at apex, entire at margin, pale brown, at most 3.5 mm long, 1.3 mm broad, densely pubescent at margin as well as on surfaces; hairs rather dense on every portion of plant, all setose, straight or hooked at apex, unicellular, the longer ones 1.3 mm or so and the shorter ones up to 0.7 mm long. Sori elongate along veinlets, naked; sporangia setose.

Terrestrial in rather moist places, often in ditches or beside stream; at middle elevations of Taiwan.

TAIWAN. Prov. Tainan: Mt. Arisan, *Faurie 529* (KYO), *Hayata & Sasaki s. n.* (TI), *Honda & Ito s. n.* (TI). Prov. Kwarenkô: near Sakadan, *Tagawa 3370* (KYO). Prov. Takao: near Miharashi, *Tagawa 3185* (KYO); near Hinokiyama, *Tagawa 1760* (KYO); near Daikwanzan, *Tagawa 1231* (KYO).

Distribution: southeastern China (Fukien).

4. **Stegnogramma gymnocarpa** (COPEL.) K. IWATS. Acta Phytotax. Geobot. **19**: 122. 1963.——*Dryopteris gymnocarpa* COPEL. in ELMER's Leafl. Phil. Bot. **3**: 807. 1910. Type: Mt. Apo in Mindanao, *Elmer 11508.*

Leptogramma amabilis TAGAWA, Acta Phytotax. Geobot. **7**: 76. 1938. Type: Ryukyu, Sate on Isl. Okinawa, *G. Koidzumi s. n.* (KYO!); K. IWATS. Acta Phytotax. Geobot. **18**: 114. 1960.——*Leptogramma totta* var. *amabilis* (TAGAWA) H. ITO, Bot. Mag. Tokyo **52**: 642. 1938.

This species is divisible into three subspecies, one of which is known in our regions, endemic to the Ryukyus.

Subsp. **amabilis** (TAGAWA) K. IWATS. Acta Phytotax. Geobot. **19**: 123. 1963. ——*Leptogramma amabilis* TAGAWA, l. c.

Rhizome short creeping, attached at the crevices of hard rocks, paleate. Stipes approximate terete, slender, stramineous or pale green, rarely slightly purplish, hairy throughout, scaly at base, 5–10 cm long. Fronds pinnate or pinnatifid with a few pairs of basal free pinnae, lanceolate or linear lanceolate, caudate at apex, round cuneate to subtruncate at base, 6–13 cm long, 1.5–3.0 cm wide, lateral pinnae sessile, oblong, round at apex, truncate or broadly cuneate at base, slightly lobed at margin; upper lobes round subdeltoid, round or moderately acute at apex, subentire or waved at margin; texture herbaceous, pale green in colour; veins forked or pinnately branched, free, setose. Hairs not so dense on every axis of plants, pale, setose or hooked at apex, unicellular. Sori oblong, elongate along veinlets, naked; sporangia setose.

Known only from the Ryukyus; growing in the crevices of dry cliffs along stream usually in moist dense forest. The species itself is found also in the Philippines and Celebes.

5. **Stegnogramma pozoi** (LAGASCA) K. IWATS. Acta Phytotax. Geobot. **19**: 124. 1963.——*Hemionitis pozoi* LAGASCA, Nov. Gen. Sp. 33. 1816. Type: Spain, *D. G. del Pozo.*

Polypodium tottum WILLD. Sp. Pl. **5**; 201. 1810, non THUNB. 1800. Type; South Africa.——*Gymnogramma totta* SCHLECHT. Adumbr. 15. 1825.——*Nephrodium tottum* DIELS; MATSUM. Ind. Pl. Jap. I, 326. 1904.——*Leptogramma totta* (WILLD.) J. SMITH; NAKAI, Bot. Mag. Tokyo **45**; 104. 1931; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 163. 1939.——*Lastrea totta* (SCHLECHT.) OHWI, Bull. Nat. Sci. Mus. Tokyo **3**: 98. 1956 et Fl. Jap. Pterid. 94. 1957.

Polypodium africanum DESV. Prod. Fam. Foug. 239. 1827. Type: Africa.—— *Dryopteris africana* (DESV.) C. CHR. Ind. Fil. 251. 1905; OGATA, Icon. Fil. Jap. I, pl. 20. 1928.

Gymnogramma mollissima FISCHER ex KUNZE, Linnaea **23**; 255, 310. 1850. Type: South India, *Schmidt.*——*Leptogramma mollissima* (FISCHER ex KUNZE) CHING, Sinensia **7**: 102. 1936 et Icon. Fil. Sin. V, pl. 228. 1958; TAGAWA, Col. Ill. Jap. Pterid. 113, 225. 1959.

Leptogramma totta f. *cristata* NAKAI, Bot. Mag. Tokyo **45**; 105. 1931. Type: in hortis japonensibus culta (TI !).

Leptogramma totta var. *pilosissima* H. ITO, Bot. Mag. Tokyo **49**: 434. 1935 et in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 165. 1939, pro f. Type: Honshu, Mt. Kiyosumi-yama in Chiba Prefecture, *H. Ito s. n.* (TI !).——*Leptogramma mollissima* var. *pilosissima* (H. ITO) KURATA, Journ. Geobot. (Kanazawa) **7**: 41. 1958.

Leptogramma totta var. *yakusimensis* H. ITO, Bot. Mag. Tokyo **49**: 434. 1935 et in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 165. 1939, pro f. Type:

Kyushu, Isl. Yakushima, *G. Masamune s. n.* (TI !).

Two subspecies are credited to this wide ranging and variable species, one being known in our regions.

Subsp. **mollissima** (FISCHER ex KUNZE) K. IWATS. Acta Phytotax. Geobot. **19**: 125. 1963.——*Gymnogramma mollissima* FISCHER ex KUNZE, l. c.

Very variable subspecies. Rhizome long creeping immersed in humus of the floor of forest, exposed on sandy ground along stream in shade or closed in clayey fields, bearing stipes not so remotely or several stipes subaccumulated on some particular portions, hairy and sparsely scaly, 3–6 mm in diameter. Stipes terete, stramineous or brownish at lower portions, rather densely scaly and very densely hairy, usually shorter than fronds, up to 30 cm long. Fronds bipinnatifid, oblong to oblong lanceolate in outline, acute to acuminate at apex, truncate or broadly cuneate at base, up to 50 cm long, 25 cm wide; rachis like upper portion of stipes, sometimes very sparsely scaly, densely hairy throughout; lateral pinnae 15 or more in pairs, lanceolate or linear lanceolate, acuminate or caudate at apex, broadly cuneate or slightly cordate at base, sessile, lobed to 2/3 to 4/5 way down to costa, up to 15 cm long, 2.5 cm wide; the lowest pair of lateral pinnae like the next above or distinctly larger; the upper pinnae gradually decurrent at base conjugated to the next above and below forming not so distinct apical pinna; costae straight or slightly bent upwards, hirsute; segments oblique, oblong or oblong subtriangular, round or acute at apex, entire or crenate at margin; veins pinnate, veinlets to 10 pairs, simple or forked in larger segments, setose, all free; texture herbaceous or soft papyraceous, dark blue green, usually brownish in dried condition. Scales rather dense on basal portion of stipes and sparse on rhizome and rachis, oblong subtriangular with long tail, round or cordate at base, to 10 mm long, 2.5 mm broad, brownish, hirsute at margin and on both surfaces; hairs dense on every portion of plant, unicellular or rarely with occasional septa in larger ones, pale, setose, straight or hooked at apex, larger ones to 1.6 mm long, shorter ones usually 3–5 mm long. Sori elongate along veinlets, oblong or linear, naked, with numerous setose sporangia.

Terrestrial in moist places in shade or open places; very common at every elevation (except the mountains higher than 3000 m alt.) throughout Japan, South Korea, South China, rather rare in the Ryukyus, North India and dubiously in Ceylon.

Genus **Thelypteris** SCHMIDEL

Key to all the species known in the regions under consideration.

A Veins all free.
  B Sori naked, sporangia usually setiferous.
    C Aerophores absent (Subgen. *Phegopteris*).
      D Lateral pinnae, except the basal pair, adnate at base decurrenting to each other, the rachis winged by dilated bases of pinnae.
        E Rhizome long creeping; fronds oblong subdeltoid, broadest at base.

..... 1. *T. phegopteris.*

E Rhizome short; fronds lanceolate, the lower pinnae gradually reduced towards base. ..... 2. *T. decursive-pinnata.*

D Rachis wingless, lateral pinnae sessile, not adnate at base.

E Stipes and rachis shining, castaneous; the base of lower pinnae markedly auricled, especially at the basiscopic side. ..... 3. *T. subaurita.*

E The basal basiscopic pinnules not so prominently longer.

F Fronds large, more than 100 cm in length; stipes and rachis bright brown, with setose unicellular hairs. ..... 4. *T. paludosa.*

F Fronds smaller, usually less than 90 cm in length; stipes and rachis stramineous, with stellate scales and setose unicellular hairs. .....
..... 5. *T. bukoensis.*

C Distinct aerophore present at each base of pinnae.

D Lower pinnae reduced or distinctly shortened (Subgen. *Cyclogramma*).

E Rhizome short, ascending; lower pinnae gradually reduced into auricles, leaves glabrous except on axes, opaque, texture herbaceous; sori subcostal. ..... 6. *T. auriculata.*

E Rhizome long creeping; lowest pinnae or basal 2-3 pairs of pinnae shortened but never reduced into auricles, leaves rather densely hirsute on both laminar surfaces, green, texture herbaceous; sori medial. ..... 7. *T. omeiensis.*

D Lower pinnae not shortened but deflexed (Subgen. *Glaphyropteridopsis*).
..... 32. *T. erubescens.*

B Sori indusiate, sporangia naked or setiferous.

C Aerophore absent (Subgen. *Thelypteris*).

D Fronds bipinnatifid to bipinnate; veinlets reaching the very margin of segments and not separated by cartilaginous membrane.

E Veinlets usually forked, almost eglandular on the fronds underneath.

F Rhizome long creeping in wet place, stipes very sparsely scaly, lower pairs of lateral pinnae not reduced, very shortly stalked, sori round, conjugate to the adjacent to show subacrostichoid appearance in matured condition. ..... 16. *T. palustris.*

F Rhizome erect or ascending on humus rich floor of mountain forest, stipes and rachis very densely scaly, lower lateral pinnae reduced gradually to mere auricles, pinnae sessile, sori round with persistent indusia, not confluent. ..... 17. *T. quelpaertensis.*

E Veinlets simple, usually densely glandular on the frond underneath.

F Lower pinnae not or very slightly reduced.

G Indusia small, fugaceous, or slightly larger and horseshoe-shaped.

H Rhizome not so slender, laminar surfaces as well as the axes of fronds pubescent, segments more or less acute at apices.

I Basal acroscopic pinnules not distinct from the other pinnules. ..... 23. *T. glanduligera.*

I Basal acroscopic pinnules larger, free from the next one. .....

..... 24. *T. angustifrons.*

H Rhizome slender, long creeping, laminar surfaces almost glabrous, segments roundish at apices. ..... 25. *T. cystopteroides.*

G Indusia large, round reniform.

H Rhizome very short creeping or ascending, with fasciculate stipes, the base of stipes scaly and densely hirsute.

I Stipes stramineous or rufo-stramineous, not shining, very rarely scaly at base, pinnae shortly stalked, basal ones more or less deflexed, segments angulate or pectinate at margin, truncate or obtuse at apices. ..... 18. *T. angulariloba.*

I Stipes castaneous, shining, scaly at basal portions, pinnae sessile, basal ones not deflexed, segments entire, round at apices. ..... 19. *T. castanea.*

H Rhizome creeping with approximate or not so remote stipes, the base of stipes scaly and not so densely hirsute.

I Stipes castaneous or bright brown and hairy throughout, the lowest pinnae the longest, not or very rarely deflexed, forming oblong subdeltoid outline of fronds. ..... 19. *T. castanea.*

I Stipes dark or pale brown and subglabrous or sparsely hairy, the lowest pinnae usually deflexed, forming oblong or oblong lanceolate outline of fronds. ..... 20. *T. japonica.*

F Lower pinnae distinctly reduced, a few lowest ones being mere auricles.

G Rhizome not so long, thick, stipes usually 15 cm or more long, lower several pairs of lateral pinnae gradually reduced, segments usually 2 mm or more in breadth, herbaceous, hairs on the costae underneath dense, usually unicellular (or rarely 2–3 celled), soft, short, usually 3–7 mm long, spreading but appressed when longer, sori medial or closer to costule. ..... 21. *T. nipponica.*

G Rhizome long creeping, stipes approximate, very short, lower lateral pinnae reduced to mere auricles, segments 1.0–1.5 (rarely to 2.0) mm broad, soft herbaceous, hairs on the costae underneath not so dense, multicellular (usually 3–7 celled), soft or rarely more or less stiff, long, usually 7–10 mm long, not appressed. ..... 22. *T. beddomei.*

D Fronds bipinnatifid to tripinnate or more compound, veinlets simple or forked, not reaching the very margin of segments.

E Fronds bipinnatifid or bipinnatisect.

F Lower pinnae not or a little narrowing towards base, segments entire or nearly so, veins mostly simple.

G Fronds oblong lanceolate in outline, nearly glabrous underneath, costae hardly hirsute, indusia glabrous. ..... 8. *T. gracilescens.*

G Fronds subdeltoid in outline, pubescent underneath, costae densely hirsute; indusia pubescent. ..... 9. *T. uraiensis.*

F Segments subentire or generally serrate; veinlets mostly furcate or subpinnate. ..... 10. *T. laxa.*
E Fronds tripinnatifid. ..... 11. *T. hattorii.*
E Fronds tripinnate or more compound.
F Fronds mostly 2 m long, every axis of fronds underneath scaly, hairy or nearly glabrous.
G Laminae yellowish green, pinnules rather close together, narrow, (5–15 mm, at most 20 mm wide), the base obliquely broad cuneate, subsessile.
H Laminae oblong or ovate oblong, pale green underneath, petioles stramineous. ..... 12. *T. torresiana.*
H Laminae subtriangular, shining and whitish underneath, petioles brilliant. ..... 13. *T. ogasawarensis.*
G Laminae grass-green, pinnules rather remote, broad (to 30 mm wide), the base truncate and symmetrical, short stalked. .... 14. *T. viridifrons.*
F Fronds usually more than 2 m long, every axis of fronds underneath scaly as well as hirsute, the scales attached to protuberances which remain as more or less short prickles. ..... 15. *T. ornata.*
C Distinct aerophores present at each base of pinnae (Subgen. *Glaphyropteridopsis*). ..... 33. *T. esquirolii.*
A Veins reticulate to form goniopteroid or meniscioid venation.
B Fronds bipinnatifid with lobed pinnae, sinus membrane more or less distinct.
C Lower pairs of pinnae suddenly reduced into auricles, having aerophores at base of pinnae.
D Only one pair of veinlet anastomosing, segments oblong, oblique, roundish or moderately acute at apex, lower surface of pinnae not verrucose and glandular, texture being chartaceous (Subgen. *Glaphyropteridopsis*). ..... 34. *T. taiwanensis.*
D 1.5 or more pairs of veinlets truely anastomosing, segments oblong, obtuse at apex, lower surface of pinnae verrucose, texture being soft herbaceous (Subgen. *Pneumatopteris*).
E Pinnae parallel at margin, rather suddenly narrowing to form acuminate apex, lower surface of pinnae glabrous and eglandular even on rachis, costa and veins underneath. ..... 38. *T. truncata.*
E Pinnae broadest at base, having a larger basal acroscopic pinnule and, in outer half, gradually narrowing towards cuspidate apex, rachis, costa and veins underneath rather densely setose hairy, lower surface of pinnae glandular. ..... 39. *T. kotoensis.*
C Lower pairs of pinnae not or gradually reduced, without aerophores at base of pinnae.
D Pinnae deeply lobed with oblong or oblique segments, having roundish apices, hirsute on the under surface, texture being soft herbaceous

(Subgen. *Cyclosoriopsis*).

E Lower pinnae not reduced, only one pair of veinlets truely anastomosing, densely hirsute on the under surface of pinnae. ..... 28. *T. parasitica.*

E A few pair of lower pinnae gradually reduced, 1.5 or more pairs of veinlets truely anastomosing.

F Entire stipe and lower part of rachis scaly. ..... 27. *T. boninensis.*

F Stipes without scales above base.

G Underside of leaves densely setose hairy.

H Rhizome erect or short creeping, upper pinnae gradually reducing not to form a distinct terminal pinnae. ..... 26. *T. dentata.*

H Rhizome creeping, terminal pinna distinct and much larger than the uppermost lateral one, lower lateral pinnae rhomboid. ..... 31. *T. ensifer.*

G Underside of leaves glabrous or subglabrous with a few hairs.

H Rhizome ascending or creeping, rhizome scales narrow lanceolate, herbaceous. ..... 29. *T. subpubescens.*

H Rhizome erect, arborescent, rhizome scales round subtriangular, membraneous. ..... 30. *T. papilio.*

D Pinnae not deeply lobed with oblong subdeltoid segments, having acute or apiculate apices, glabrous or subglabrous on the under surface, texture being coriaceous or rigidly chartaceous (Subgen. *Cyclosorus*).

E Lower pinnae not or slightly reduced.

F Sori confined to lobes of pinnae, growing on marsh. ..... 35. *T. gongylodes.*

F Sori not confined to lobes of pinnae, growing on open ground. ..... 37. *T. acuminata.*

E A few pairs of lower pinnae distinctly reduced. ..... 36. *T. arida.*

B Fronds imparipinnate with subentire pinnae, sinus membrane absent (Subgen. *Abacopteris*).

C Frond simple or trifoliate.

D Frond mostly simple or rarely hastate to trifoliate, the base round to cordate, the simple frond or the terminal pinna oblong-lanceolate to oblong. ..... 40. *T. simplex.*

D Frond trifoliate or rarely 5-foliate, the base of pinna nearly round to cuneate, the terminal pinna lanceolate to oblong lanceolate. ..... 41. *T. triphylla.*

C Lateral pinnae 2 or more pairs.

D Basal pair of lateral pinnae the longest, hence the lamina deltoid acuminate in outline.

E Terminal pinna entire or subentire, only the basal pair of lateral pinnae shortly stalked. ..... 41. *T. triphylla.*

E Terminal pinna inciso-crenate, more deeply so toward the base, basal 2 or 3 pairs of lateral pinnae shortly stalked. ..... 45. *T. insularis.*

D Basal pair of lateral pinnae not the longest, hence the lamina elliptical to oblong-lanceolate in outline.
E Sori indusiate and mostly confluent, hence in one row between adjacent main veins.
F Rhizome short creeping, bearing stipes rather close together, base of pinnae cuneate, rachis sometimes gemmiferous..... ..... 42. *T. liukiuensis.*
F Rhizome long creeping, bearing stipes at intervals, base of pinnae round, rachis never gemmiferous. ..... 44. *T. longipetiolata.*
E Sori round, indusiate, not confluent, hence in two rows between adjacent main veins. ..... 43. *T. aspera.*

Subgen. *Phegopteris* (Presl) Ching.
Sect. *Phegopteris.*

1. **Thelypteris phegopteris** (L.) Slosson in Rydb. Fl. Rocky Mts. 1043. 1917; Ching, Bull. Fan Mem. Inst. Biol. **6**: 277. 1936; Tagawa, Journ. Jap. Bot. **12**: 747. 1936.——*Polypodium phegopteris* L. Sp. Pl. II, 1089, 1753. Type: Europe.——*Lastrea phegopteris* (L.) Bory, Dict. Class. **9**: 233. 1826; Ohwi, Fl. Jap. Pterid. 94. 1957. ——*Phegopteris polypodioides* Fée, Gen. Fil. 243. 1852; H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 151. 1939; Tagawa, Col. Ill. Jap. Pterid. 107, 238. 1959.——*Nephrodium phegopteris* (L.) Prantl, Exkur. Baiern 23. 1884; Matsum. Ind. Pl. Jap. I, 323. 1904.——*Dryopteris phegopteris* (L.) C. Chr. Ind. Fil. 284. 1905; Ogata, Icon. Fil. Jap. I, pl. 22. 1928.

Rhizome long creeping in humus rich slope of mountain, irregularly branching, 1.3–1.8 mm in diameter, densely (or in old portion sparsely) scaly. Stipes rather remote, usually more than 1 cm apart from each other, 10–30 cm long, terete, stramineous (or yellow green in upper portion), more or less scaly on lower portion, hairy throughout (or sometimes glabrescent in older fronds). Laminae oblong subdeltoid, acuminate at apex, truncate to cordate at base, the lowest pinnae deflexed in varying degree, (5–) 10–15 (–20) cm both in length and in width, pinnate; pinnae pinnatifid 3/4 to 5/6 way down to costae, the basal pair of pinnules, except that of the basal one or two pinnae, decurrenting to rachis forming lobe-like wings, the upper pinnae broadly decurrenting at base; rachis and costae sparsely scaly underneath and setiferous on both sides; segments oblique, round to acute at apex, the margin subentire in smaller ones and variously dentate in larger ones according to their sizes, oblong to subdeltoid, at most 1.8 cm long, 6 mm broad, setiferous on veins and margin and sparsely on laminar surfaces; texture herbaceous or very soft papyraceous, green, decayed in winter. Veinlets simple (or in larger segments rarely forked or tripartite), the apex reaching the very margin of lobes, all free, hairy on both surfaces. Scales on rhizome oblong lanceolate, caudately acute at apex, round at base, margin entire and setiferous, the larger ones 15 mm long, 1.5 mm broad, the surfaces glabrous, consisting in long cells, membraneous or firmer, yellowish brown; scales on laminar axes narrower (smaller ones merely setiferous hairs), bearing disinct marginal hairs; hairs on under surface of

laminae setose, all unicellular, patent, pale, up to 0.5 mm long; hairs on upper surface of laminae somewhat appressed, stiff, to 4 mm long and 25μ in diameter. Sori dorsal on veinlets but almost marginal on segments, round with clavate receptacles, naked, to 1 mm diameter in matured condition; sporangia naked or setiferous with straight or hooked setae; spores bilateral, reticulate on surface, yellow to yellowish brown.

Common in the cold temperate regions, i.e. in mountain or plain areas of northern Japan and higher mountain regions in southern Japan, alpine regions of Taiwan and mountains of Korea; terrestrial on humus rich floor of mountain forest at lower elevations of Hokkaidô and northern Honshu, in mountain regions (more than 1000 m in altitude) of southwestern Honshu, Shikoku, and also rarely on higher mountains of Kyushu, southern Korea and Taiwan.

Distribution: North and temperate America, Aleutian Islands, Siberia, North and Northwest China, North India, Asia Minor and North Europe.

Sect. *Lastrella* (H. Ito) K. Iwats.

2. **Thelypteris decursive-pinnata** (van Hall) Ching, Bull. Fan Mem. Inst. Biol. **6**: 275. 1936.——*Polypodium decursive-pinnatum* van Hall, Nieuwe Verhdl. Nederl. Inst. **5**: 204. 1836. Type: South China.——*Phegopteris decursive-pinnata* (van Hall) Fée, Gen. Fil. 242. 1852; H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 153. 1939; Tagawa, Acta Phytotax. Geobot. **14**: 192. 1952, Col. Ill. Jap. Pterid. 107, 238. 1959; K. Iwats. Acta Phytotax. Geobot. **18**: 114. 1960.——*Nephrodium decursive-pinnatum* (van Hall) Hook. in Blackiston, Five Months Yangtze 365. 1862; Matsum. Ind. Pl. Jap. I, 316. 1904.——*Lastrea decursive-pinnata* (van Hall) J. Smith, Ferns Br. For. 154. 1866; Ohwi, Fl. Jap. Pterid. 95. 1957.——*Dryopteris decursive-pinnata* (van Hall) O. Ktze. Rev. Gen. Pl. II, 812. 1891; Ogata, Icon. Fil. Jap. III, pl. 119. 1930.

Rhizome short, ascending or suberect, covered with scales and hairs. Stipes accumulated, erect or suberect, terete, stramineous, 1.2–1.8 mm in diameter at middle, 5–25 cm in length, densely covered with scales and hairs. Laminae lanceolate or rarely linear or oblong lanceolate, caudate at apex, broadest at middle and gradually narrowing downwards, the basal pinnae being auricled, 30–50 cm in length, 5–13 (–18) cm in width at middle portion, pinnate to bipinnatifid (or very rarely bipinnatisect); rachis like the upper part of stipes, winged throughout by the decurrenting bases of lobes of pinnae, stramineous or green, variously scaly and hairy; larger pinnae alternate, linear lanceolate, acuminate or caudate at apex, at most 12 cm long, 2.3 cm wide, pinnatifid, basal basiscopic segment decurrenting downwards to form auricled wings of rachis, usually opposite to the pinna of the other side, separated from the lower next pinna but gradually becoming continuous in upper portions; lower pinnae gradually becoming smaller, adnate and decurrent at base, forming small indistinct pinnatisect apical part; lower pinnae reduced to auricular one, the basal lobes seldom decurrenting; ultimate segments oblique, oblong or oblong ovate, round or moderately acute at apex, variously lobed to the costa one-third way down, the margin subentire or crenate, the crena round.

Veins pinnate, obscure on surfaces; veinlets simple or 2-3 forked, not or rarely reaching the very margin of lobes. Texture herbaceous or soft papyraceous, green or greyish green, hairy on both surfaces of laminae. Scales on every axis of plants; scales on rhizome and at base of stipes linear or linear subtriangular, attenuate at apex, up to 8 mm long, 0.5 mm broad, brown, shining, soft herbaceous, hairy at margin as well as on surfaces; scales on other parts various in form and size, linear or filamentous, hairy at margin; hairs at every portion of plants, simple, forked, setose, straight or hooked at apex, unicellular. Sori round or oblong on rather lengthened receptacles at dorsal portions of veinlets, many on a segment but usually a row between costule and the margin of segment, exindusiate, but provided with a fasciculated hairs at basiscopic position of receptacle; sporangia setiferous; spores bilateral, variously tubercular, with perispore.

Very common in Japan south than the northern Honshu, and in southern Korea, rather rare in the Ryukyus and Taiwan; terrestrial in moist places in or at edge of forest, in light or deep shade or often in villages at lower elevations.

Distribution: South China, Tonkin and Kashimir.

KUNZE (Bot. Zeit. **1848**. 555, as *Aspidium decursive-pinnatum*) and others consider the small tuft of hairs in the sori to arise from a small scale or imperfect involucre. However, these small tufts of hairs seem to be the remainings from the extinction of the real surface of hairy indusium. These hairs are in tuft in appearance, but are only fasciculate on the receptacle. All of these hairs are unicellular and have no direct connection with the neighbourings. ITO (1939) and TAGAWA (1959) noted that this species had small caducous indusia, but their 'indusia' were merely the tufted hairs placed at the posterior base of a little lengthened receptacles.

This common fern is to some extent variable in size and form of fronds. A Taiwan specimen, *Ohwi 2291*, represents simple or pinnatifid fertile fronds of less than 20 cm in length. Contrary to this, *Chou 382*, from Korea, is bipinnatisect and more than 65 cm in length.

3. **Thelypteris subaurita** (TAGAWA) CHING, Bull. Fan Mem. Inst. Biol. **6**: 267. 1936.——*Dryopteris subaurita* TAGAWA, Acta Phytotax. Geobot. **1**: 57. 1932. Type: Paiwan-sha in Taiwan, *T. Ito s. n.* (KYO !).——*Phegopteris subaurita* (TAGAWA) TAGAWA, Acta Phytotax. Geobot. **7**: 73. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 156. 1939.——*Pseudophegopteris subaurita* (TAGAWA) CHING, Acta Phytotax. Sin. **8**: 315. 1963.

Phegopteris distans (DON) METT. sensu CHRIST, Bull. Herb. Boiss. II, **1**: 1018. 1901; MATSUM. Ind. Pl. Jap. I, 391. 1904.

Aspidium auritum (HOOK.) CHRIST, Bull. Herb. Boiss. II, **4**: 616. 1904, excl. basion.; MATSUM. & HAYATA, Enum. Pl. Formos. 579. 1906.——*Dryopteris aurita* (HOOK.) C. CHR. sensu HAYATA, Icon. Pl. Formos. IV, 148. 1914; OGATA, Icon. Fil. Jap. III, pl. 117. 1930.

Caudex suberect or very short and ascending, thick with the bases of stipes, 1 cm or more in diameter, the apex covered densely with scales. Stipes two to

several on a caudex, 10–30 (–50) cm long, up to 4 mm thick at base, castaneous or rather polished, scaly on lower portion, (usually caducous) hairy throughout. Laminae oblong, long acuminate at apex, gradually narrowing downwards, up to 1 m long, 30 cm wide; larger pinnae placed acute to rachis, sessile, linear subtriangular, the apex long acuminate, the base broad cuneate or truncate with the basal pair of segments twice or more as long as the next pair, deeply (almost to the costae in larger ones) pinnatifid, to 15 cm long, 3 cm wide, the lower pinnae remote, 10 cm or more apart from the next above, reduced into mere butterfly-like pair; segments oblique, round or moderately acute at apex, the margin more or less crenate in medial or larger ones, to 1.5 cm long, 0.5 cm broad, the innermost pinnules very large, about twice as large in size as the next pinnules; both surfaces, especially on axes, hairy, texture thick herbaceous, yellow green or green. Veinlets simple (or rarely forked in the larger segments), the apex distant from the margin of segment, all free. Scales on rhizome linear lanceolate, long acuminate at apex, entire and hairy at margin, up to 8 mm long, 1 mm broad, soft herbaceous, brown, hairy on abaxial surface, the cells long and obscure; scales almost none on expanded laminar portion; hairs setose, pale, straight or hooked at apex, usually 0.3–0.5 mm long, dense throughout the plants but laminar abaxial surface. Sori dorsal on veinlets, medial or slightly supramedial on lobes, round but with elongate receptacles, up to 1 mm in diameter, naked; sporangia setiferous; spores bilateral, tubercular, yellow or pale brown.

Common at lower elevations of the Ryukyus and Taiwan; terrestrial on wet or somewhat dry slope in open places.

Endemic so far to the regions cited above. Closely related *T. aurita* is known from the Sikkim Himalayan regions.

4. **Thelypteris paludosa** (Blume) K. Iwats. Acta Phytotax. Geobot. **19**: 11. 1961.——*Aspidium paludosum* Blume, Enum. Pl. Jav. 168. 1828, non Raddi, 1825. Type: Mt. Burangring in India.——*Polypodium paludosum* Blume, Fl. Jav. Fil. 192, t. 90. 1829 or 1851.——*Pseudophegopteris paludosa* (Blume) Ching, Acta Phytotax. Sin. **8**: 315. 1963.

Polypodium pyrrhorhachis Kunze, Linnaea **24**: 257. 1851. Type: Sikkim, *Schmid-Kochiana 145*.——*Phegopteris pyrrhorhachis* (Kunze) Tagawa, Acta Phytotax. Geobot. **7**: 74. 1938; H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 155. 1939.——*Lastrea pyrrhorhachis* (Kunze) Copel. Gen. Fil. 139. 1947.——*Pseudophegopteris pyrrhorhachis* (Kunze) Ching, Acta Phytotax. Sin. **8**: 315. 1963.

Polypodium distans Don, Prod. Fl. Nepal. 2. 1825, non Kaulf. 1824.——*Phegopteris distans* Mett. Pheg. & Aspid. 16. 1858.——*Nephrodium distans* (Mett.) Diels in Engler & Prantl, Nat. Pfl.-fam. **1** (4): 170. 1899, non Hook. 1862.——*Aspidium distans* (Mett.) Christ, Bull. Acad. Géogr. Bot. **1902**. 253, non Viv. 1825, nec Kuhn, 1868.

Dryopteris brunnea (Wall.) C. Chr. apud C. Chr. Ind. Fil. 255. 1905, Acta Hort. Götheb. **1**: 54. 1924.——*Thelypteris brunnea* Ching, Bull. Fan Mem. Inst. Biol. **6**: 269. 1936; Holtt. Fl. Malaya II, 240. 1954.

Dryopteris somai HAYATA, Icon. Pl. Formos. V, 287. 1915. Type; Mt. Arisan in Taiwan, *T. Soma s. n.* (TI !).——*Phegopteris somai* (HAYATA) TAGAWA, Acta Phytotax. Geobot. **7**: 75. 1938.

Dryopteris christii LÉVEILLÉ, Fl. Kouy-Tschéou 491. 1915, non C. CHR. 1905.——*Dryopteris hirtirachis* C. CHR. Ind. Fil. Suppl. II, 15. 1917.——*Dryopteris brunnea* var. *hirtirachis* (C. CHR.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 271. 1936.——*Phegopteris brunnea* var. *hirtirachis* (C. CHR.) TAGAWA, Acta Phytotax. Geobot. **7**: 75. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 156. 1939.

Rhizome creeping, thick, about 7 mm in diameter, sparsely scaly. Stipes adjacent to each other, two to three in 2 cm, dark castaneous to dirty brown, slightly bulged at base, sparsely scaly on lower portion, hairy throughout, 20–50 (–70) cm long, 4–6 mm in diameter. Laminae oblong lanceolate, acuminate at apex, broadly cuneate at base, 40–60 (–100) cm long, 10–20 (–30) cm wide at widest middle portion; segments linear subtriangular, straight or moderately falcate, 4–18 mm long, 2.5–5.0 mm broad, the basal pair lengthened twice or more than the next; texture soft papyraceous, under surface of laminae rather densely hirsute, axes of upper surface hirsute, upperside of laminar surface glabrous. Veinlets forked to multipartite, ending at laminar part of segments. Scales on rhizome and stipes linear subdeltoid, long tailed at apex, 5–10 mm long, 1 mm or more in the broadest portion, the margin entire and setiferous, the abaxial surface also setiferous, coarse membraneous, light brown, cells oblong, the lateral cell walls rather thick; scales on rachis and costae underneath linear, consisting usually in two to four rows of elongate cells, 2 mm or so, setiferous; hairs on laminar surface various in density, setose, straight or hooked at apex, pale, unicellular, about 0.5 mm in length. Sori dorsal on veinlets, medial, round on slightly elongate receptacles, 1.5 mm in diameter in matured condition, naked; sporangia distinctly setiferous with 1–6 stiff straight hairs of 0.2–0.3 mm in length; spores bilateral, mucronate, brownish or paler.

Terrestrial on humus-rich floor of forest; rather rare at middle evelation of central and southern Taiwan.

TAIWAN. Prov. Taichû: Mt. Arisan, *Honda & Ito s. n.* (TI), *Faurie 507* (KYO), *Inada 32* (TI); Ushoko, *B. Hayata s. n.* (TI). Prov. Takao: Keinan-zan, *Tagawa 1290* (KYO). Prov. Kwarenkô: near Totokun, *Tagawa 3589* (KYO); near Tomiri, *Tagawa 3606* (KYO). Prov. Taitô: near Kaimosu, *Tagawa 2959* (KYO); near Asahi, *Tagawa 3042, 3117* (KYO).

Distribution: South China, North India, Tonkin, Malaysia and Polynesia.

Dryopteris somai is represented only by the type collection, which has somewhat long frond bearing remote pinnae with prominently enlarged basal pinnules.

CHING (1936) classified this species in three varieties according to the hairiness of fronds. This distinction in the density of pubescence is, as noted by me in another publication, the characteristics not worthy of separating any taxon.

5. **Thelypteris bukoensis** (TAGAWA) CHING, Bull. Fan Mem. Inst. Biol. **6**: 272. 1936.——*Dryopteris bukoensis* TAGAWA, Acta Phytotax. Geobot. **1**: 89. 1932. Type:

Mt. Bukô-san in Honshu, *G. Koidzumi s. n.* (KYO !).——*Phegopteris bukoensis* (TAGAWA) TAGAWA, Acta Phytotax. Geobot. **7**: 75. 1938, Col. Ill. Jap. Pterid. 107, 238. 1959; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 155. 1939. ——*Lastrea bukoensis* (TAGAWA) H. ITO ex OHWI, Fl. Jap. Pterid. 95. 1957.

Phegopteris paludosa (BLUME) J. SMITH sensu CHRIST, Bull. Herb. Boiss. **7**: 824. 1899.——*Polypodium paludosum* BLUME sensu MATSUM. Ind. Pl. Jap. I, 337. 1904.

Dryopteris brunnea (WALL.) C. CHR. Ind. Fil. 255. 1905, p. p.

Rhizome long creeping in wet humus-rich floor of light forest, irregularly branching, about 3 mm in diameter, very sparsely scaly. Stipes remote, 2–4 cm apart from each other, terete, 25–35 (–50) cm long, 2.0–2.5 mm in diameter, stramineous, sparsely scaly and hairy throughout. Laminae oblong lanceolate, acute at apex, gradually narrowing downwards, 40–70 cm long, widest at two-thirds portion from base, 15–25 cm wide there; pinnae oblong subtriangular, caudately acuminate at apex, sessile and broadly cuneate at base, up to 4 cm wide on larger fronds; pinnules patent or slightly oblique, round or moderately acute at apex, the base decurrenting to costae forming narrow wings of 0.7 mm broad or so, margin more or less crenulate forming round lobes, the basal pinnules as 2.5 times large as the next ones, lower pinnae gradually narrowing, remote, up to 10 cm apart from the next above; texture herbaceous, light green, setiferous and bearing simple scales except on the upper surface of laminar portion. Veinlets forked (or tri- or multi-partite on larger segments), the apex not reaching the very margin of lobes. Scales on rhizome and stipes oblong subdeltoid with long tails, to 1 cm long, 2.5 mm broad, very rarely hairy at margin, membraneous, light brown, the cells rather small, elongate, the internal cell walls slightly thicker; scales on the axes of fronds so-called setiferous hairs, i. e. the laminar portion of scales extremely reduced to hair-like condition and showing the condition of tufted hairs, very dense, each hairs attaining to 0.4 mm long; hairs rather dense on every part of frond except on upper side of laminar surface, setose, unicellular, straight, 0.3 mm long. Sori dorsal or subterminal on veinlets, naked, 0.8 mm in diameter and dark brownish in matured condition; sporangia setiferous with 1–4 setose hairs with straight or hooked apex of 0.4 mm in length; spores bilateral, tubercular on surface, dark brown.

Terrestrial on humus-rich floor of light forest; rather rare at lower or middle elevation of central Honshu.

Honshu. Pref. Gumma: Tokura, *S. Sakaguchi s. n.* (KYO); Mamba, *T. Yamazaki s. n.* (TI); Kozu-bokujô, *N. Satomi s. n.* (TNS); Akagi-yama, *T. Wakana s. n.* (TNS); Oze, *Ohwi & Tagawa 678* (KYO), *Tagawa 5754* (KYO), *M. Nishida s. n.* (TI), *Kurata 605* (TNS). Pref. Tochigi: Nikkô *H. Sekimoto s. n.* (KYO), Tateno, Yusei-gawa, *Namegata 12440* (TNS). Pref. Saitama: Mt. Bukô-san, *G. Koidzumi s. n.* (KYO), *Hisauchi 525, 1341* (TI). Pref. Toyama: Minase, *T. Otaya s. n.* (KYO). Pref. Yamanashi: Mt. Mitsu-tôge, *Funo 107* (KYO). Pref. Nagano: Mt. Togakushi, *S. Motizuki s. n.* (KYO), *T. Ito 80* (TI), *Faurie 1555* (KYO), *Murata 6340* (KYO), *Hutoh 16377, 16510* (KYO), *Seto 6542* (KYO, TSN); Kitamaki, *Hisauchi 1492* (TI); near Jûmonji Pass, *Hutoh 21850* (KYO); Oomachi,

Namegata 3286 (TNS); Shirakabako, *Oomura 16255* (TNS); Nobeyama, *Oomura 5570* (KYO), *M. Togashi s.n.* (TNS, KYO); Kirigamine, *Yamazaki & Ono s.n.* (TI); Mt. Ontake, *Kodama 4380* (TNS), *4480* (KYO). Pref. Gifu: Hirayu Pass, *Sugimoto 26855* (KYO).

Distribution: endemic so far to the regions cited above.

CHING (1963) reduced this species to *P. levingei*, but our species is distinct from the nominal one in the trichomes repeatedly noted in this paper.

Subgen. *Cyclogramma* (TAGAWA) K. IWATS.

Of eight species enumerated by CHING (1936) and TAGAWA (1938), two, *Thelypteris auriculata* and *T. simulans*, are better united into a single species as shown in the note under the former species. *Thelypteris neo-auriculata* is distinct in having glabrous sporangia, not reduced lower pinnae and glabrous long stipes. This is also very large fern, but we have a variant of *T. auriculata* collected from Assam (*G. Mann s.n.* in US & GH) bearing the pinnae 25 cm or more in length and up to 3 cm in width. The size of plant may thus be fairly variable also in this group of ferns. The seven species belonging to this subgenus may be distinguished as shown in the following key.

A Stipes and lower part of rachis densely scaly with lanceolate, obtuse, brown scales (Sikkim). ..... *T. squamistipes.*

A Stipes hairy but not scaly above the base.

B Lower pairs of pinnae more or less reduced.

C Lower pinnae gradually reduced into auricles, rhizome short, ascending, texture crass herbaceous, opaque, sori subcostal, leaves glabrous except on axes (Sikkim, Taiwan). ..... *T. auriculata.*

C Lowest or basal 2–3 pairs of pinnae shortened but never reduced into auricles, rhizome long creeping, texture herbaceous, green, sori medial, leaves rather densely hirsute on laminar surfaces (China, Taiwan, Japan). ..... *T. omeiensis.*

B Lowest pair of pinna as long as those next above or a little shorter.

C Rhizome creeping, bearing stipes remotely or approximately, leaves sparsely hairy.

D Pinnae less than 10 cm long, 0.8–1.6 cm wide, texture thick herbaceous, opaque (China). ..... *T. flexilis.*

D Pinnae more than 10 cm long, up to 3 cm wide, texture thinner and softer, green (China). ..... *T. chunii.*

C Rhizome short or erect, bearing fasciculate leaves.

D Larger plants, pinnae more than 15 cm long, leaves and stipes rather sparsely hairy, sporangia glabrous (Sikkim). .....*T. neo-auriculata.*

D Smaller plants, pinnae less than 10 cm long, leaves and stipes densely hairy, sporangia setiferous (Sikkim). ..... *T. khasiensis.*

6. **Thelypteris auriculata** (J. SMITH) K. IWATS. Acta Phytotax. Geobot. **19**: 11. 1961.——*Polypodium auriculatum* WALL. ex HOOK. Sp. Fil. IV, 237. 1862, non L.

1753, nec RADDI 1819, nec PRESL 1822. Type: Nepal, *Wallich 314* (Isotypes in US & CAL !).——*Phegopteris auriculata* J. SMITH, Hist. Fil. 233. 1875.——*Cyclogramma auriculata* (J. SMITH) CHING, Acta Phytotax. Sin. **8**: 317. 1963.——*Dryopteris himalayensis* C. CHR. Ind. Fil. Suppl. III, 88. 1934.——*Cyclogramma himalayensis* (C. CHR.) TAGAWA, Acta Phytotax. Geobot. **7**: 55. 1938.——*Lastrea himalayensis* (C. CHR.) COPEL. Gen. Fil. 139. 1947.

Thelypteris subvillosa (MOORE) CHING apud CHING, Bull. Fan Mem. Inst. Biol. **6**: 279. 1936.

Thelypteris simulans CHING, Bull. Fan Mem. Inst. Biol. **6**: 280. 1936. Type: Arisan in Taiwan, *Faurie s. n.*——*Cyclogramma simulans* (CHING) TAGAWA, Acta Phytotax. Geobot. **7**: 53. 1938, **9**: 208. 1940.——*Glaphyropteris simulans* (CHING) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 148. 1939.——*Lastrea simulans* (CHING) COPEL. Gen. Fil. 140. 1947.

Rhizome short, ascending, thick, 6–8 mm or more in diameter, blackish, scaly (or in old portion glabrous). Stipes subapproximate, rather short, bearing the reduced pinnae on the upper portion of stipe 10–15 cm, rather densely scaly at the base, densely hairy throughout. Laminae oblong lanceolate, acute at apex, gradually attenuate downwards, widest at middle portion, (60–) 90–130 cm long, (15–) 20–25 cm wide; rachis like the upper part of stipes, the upper portion of rachis rather distinctly grooved above, the groove not continuous to those of costae; larger pinnae subopposite, 20–30 in pairs, 2.5–4.0 cm apart from each other, lanceolate or linear lanceolate, acuminate at apex, sessile and truncate (or very broadly cuneate) at base, pinnatifid to 4/5 way to costae, lower pinnae gradually reduced into butterfly-shaped accessaries; a prominent aerophore occurring at each base of pinnae up to 5 mm long; segments oblong, oblique, round or obtuse at apex, entire at margin, 5 mm or more in breadth; texture soft papyraceous, hairy throughout. Veins pinnate; veinlets simple, 10 or more in pairs, setiferous, the basal anterior ones running to the callose membrane, the others reaching the very margin of segments. Scales on rhizome and stipes oblong subtriangular, acuminate at apex, deeply cordate at base, entire, dark brown, 5–10 mm long, 1.5–2.0 mm broad at base, both surfaces as well as margin setiferous; hairs on stipes and rachis setose, hooked at apex or straight, pale, unicellular, the longer ones 1.5 mm and the shorter 0.4 mm long or so long; hairs of laminae like the shorter ones on main axes, up to 1 mm long. Sori inframedial, round on punctate, rather prominent receptacles, confluent when fully matured, naked; sporangia setiferous with 1–4 hooked hairs, 0.2 mm long; spores bilateral, reticulate or tubercular, dark brown.

Terrestrial on humus-rich floor of forest usually in moist places; rather rare at middle elevations of Taiwan (provs. Tainan, Takao and Taitô), from where the specimens were fully cited by TAGAWA (1940). This species is also known rather commonly from Southwest China (Yunnan) and Sikkim Himalayan regions; reported from Java (v. A. v. R. Handb. Mal. Ferns 490. 1909, as *Phegopteris auriculata*), but I have examined no specimen wherefrom.

Thelypteris simulans, based on *Faurie s. n.* (May 1914) from Taiwan, is dist-

inguishable from Himalayan *T. auriculata* by crass herbaceous, fragile and opaque fronds densely hispid on both the surfaces. Now, we can safely state that specific segregation is hardly recognizable between the two species, for the Taiwan plants vary to some extent in their texture and hairiness as seen in the Himalayan plants.

Thelypteris flexilis is a species closely related to our species. The nominal species differs from *T. auriculata* in such features as: the lowest pair of pinnae not reduced, patent, the lower pinnae gradually narrowing towards round or cuneate base, the apices of pinnae acuminate to cuspidate, the fronds densely hirsute both on surfaces and on axes, and the smaller size of plants. To those species, *T. squamistipes* and *T. neo-auriculata* are said to be allied, though I have not actually examined the type specimens of them. I will record here the third collection of *T. chunii* from Kweichow: Pinfa, *Cavalerie*, Dr. ROSENSTOCK's Filices Chinensis exsiccatae, no. 49 (GH). One of the duplicates of his exsiccata is *T. flexilis* (US).

7. **Thelypteris omeiensis** (BAKER) CHING, Bull. Fan Mem. Inst. Biol. **6**: 282. 1936.——*Polypodium omeiense* BAKER, Journ. Bot. **1875**. 229. Type: Mt. Omei in Szechuwan, *Faber 1059*.——*Leptogramma omeiensis* (BAKER) TAGAWA, Journ. Jap. Bot. **12**: 748. 1936.——*Cyclogramma omeiensis* (BAKER) TAGAWA, Acta Phytotax. Geobot. **7**: 53. 1938, **9**: 209. 1940.——*Glaphyropteris omeiensis* (BAKER) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 149. 1939.——*Lastrea omeiensis* (BAKER) COPEL. Gen. Fil. 139. 1947; OHWI, Fl. Jap. Pterid. 95. 1957; TAGAWA, Col. Ill. Jap. Pterid. 110, 222. 1959.

Dryopteris izuensis KODAMA in MATSUM. Icon. Pl. Koisikav. II, 7, pl. 88. 1914. Type: Jôren'no-taki Fall in Shizuoka Prefecture, Honshu, *S. Kodama s.n.* (TI !).——*Leptogramma izuensis* (KODAMA) H. ITO, Bot. Mag. Tokyo **49**: 433. 1935.

Dryopteris pseudo-africana MAKINO et OGATA, Journ. Jap. Bot. **4**: 140. 1927; OGATA, Icon. Fil. Jap. I, pl. 23. 1928. Type: Jôren'no-taki Fall.

Leptogramma loveii (HOOK. et GREV.) J. SMITH sensu NAKAI, Bot. Mag. Tokyo **45**: 103. 1931.

Rhizome long creeping on wet sandy ground, rarely branching, 4–5 mm in diameter, sparsely scaly. Stipes 2–5 per 5 cm on rhizome, slightly bulged at base, terete, 20–40 cm long, light brown or greenish, sparsely scaly at base, hairy throughout but sometimes glabrescent. Laminae oblong lanceolate with reduced basal pinnae, acute at apex, 30–60 cm long, 15–20 cm wide; lower pinnae shortly petiolulate, lanceolate, slightly falcate, acuminate at apex, faintly attenuate towards base, upper pinnae straight, sessile and broadly cuneate at base, not narrowing towards base; segments oblique, oblong subdeltoid, round to moderately acute at apex, sinus deep, with callose membrane at base, 1 mm or so in width; texture coarse herbaceous to soft papyraceous, light green or pale blue green in field and sometimes brownish in dried condition, sparsely hairy underneath. Veinlets simple, about 10 in pairs, very sparsely hairy underneath, the basal anterior ones running

to the uppermost portion of callose membrane, the others to the very margin of lobes. Scales on rhizome and at base of stipes sparse, large, soft herbaceous, oblong ovate, acuminate at apex, 6–10 mm long, 3–5 mm broad, hairy at margin, light brown, the cell walls obscure but the internal ones distinct; hairs on stipes and rachis distinctly of two kinds, all unicellular, pale, stiff, the longer straight, 1.5 mm long, the shorter hooked at apex or rarely straight, about 0.2 mm long. Sori medial, round on punctate, rather indistinct receptacles, never fused with the neighbouring ones, about 0.7 mm in matured condition, naked ; sporangia naked or setiferous with 1–3 hooked hairs of the length of 0.1 mm; spores bilateral, echinulate, dark brown.

Rather rare at lower elevations of the warm districts of Japan (Honshu and Kyushu) and at lower or middle elevations of Taiwan; usually in wet places along stream in deep or light shade. This is also known from West China (Szechuwan and Kweichow).

CHING (1936) has noted that this species has the naked sporangia, though almost all the plants bear setiferous sporangia. MAKINO et OGATA distinguished their *D. pseudo-africana* from *D. izuensis* by having the setiferous sporangia, but this distinction is, as in the case of CHING's statement, not worthy of the diagnostic feature for the specific separation. In most cases, the plants of Izu (Shizuoka Prefecture, Honshu) are, in fact, peculiar in having glabrous sporangia in appearance, but it is not so difficult to detect the setose hairs on some sporangia among the sori consisting of glabrous sporangia. The plants in the other localities are quite the same specifically with those from Izu in all the taxonomic features except the setiferous sporangia. Sporangia of *T. neo-auriculata* were noted to be glabrous, but this may be the same as in the case of *T. omeiensis*, for the species of this subgenus seem to have the setiferous sporangia.

Subgen. *Thelypteris*.

Sect. *Metathelypteris* H. ITO.

In East and Southeast Asia, including Malaysia, fourteen species are known. As has been correctly done partly by CHING, ITO and I myself, these species are classified into three groups as follows:

1. Group of *T. gracilescens*, characterized by subglabrous underside of fronds and usually entire segments. To this group belong *T. uraiensis* and *T. singalanensis*.

2. Group of *T. laxa*, an intermediate group between pinnate-bipinnatifid species and those having compound fronds, characterized by the hirsute fronds with generally serrate segments. *Thelypteris flaccida* is a close ally of *T. laxa*, from which fairly distinct are *T. adscendens* of South China and *T. decipiens* of Sikkim. Tripinnatifid *T. hattorii* is a direct relative of *T. laxa*, but an intermediate form between this and the following groups.

3. Group of *T. torresiana*, characterized by tripinnate or more compound construction of fronds. *Thelypteris ogasawarensis* may be a direct derivative of *T. torresiana*, and *T. viridifrons* is a northern variant of that. *Thelypteris multi-*

seta and *T. leucolepis* are Malaysian members hardly distinct from each other. The most huge species is *T. ornata*, which is also known from Taiwan.

Fourteen species have been known in the East and Southeast Asia. They are discriminated from each other in the following key.

A Fronds bipinnatifid or bipinnatisect.
  B Lower pinnae not or a little narrowing towards base, segments entire or nearly so, veins mostly simple.
    C Fronds oblong lanceolate in outline, nearly glabrous underneath, costae hardly hirsute; indusia glabrous. ..... *T. gracilescens.*
    C Fronds subdeltoid in outline, pubescent underneath, costae densely hirsute, indusia pubescent. ..... *T. uraiensis.*
  B Segments subentire or generally serrate; veinlets mostly furcate or subpinnate.
    C Fronds underneath subglabrous, with sparse setose hairs on costae and costules underneath as well as at margin of segments; indusia glandular, not setiferous.
      D Fronds larger, regularly about 50 cm long, 25 cm wide. .... *T. singalanensis.*
      D Fronds smaller, 15–20 cm long, 5–7 cm wide. ..... *T. adscendens.*
    C Fronds underneath more or less setose hairy; indusia setiferous.
      D Fronds deltoid in outline, the basal pinna much the longest. .... *T. decipiens.*
      D Fronds oblong lanceolate in outline, the basal pinna not the longest.
        E Lower pinnae narrowing towards base, fronds underneath downy pubescent; sori supramedial. ..... *T. laxa.*
        E Lower pinnae hardly narrowing towards base; hairs of fronds underneath spreading, fine and needle-like; sori medial. ..... *T. flaccida.*
A Fronds tripinnatifid. ..... *T. hattorii.*
A Fronds tripinnate or more compound.
  B Fronds at most 2 m long, every axis of frond underneath scaly, hairy or nearly glabrous.
    C Rachis and costae underneath hairy or nearly glabrous, never scaly.
      D Laminae yellowish green, pinnules rather close together, narrow (5–15 mm, at most 20 mm wide), the base obliquely broad cuneate, subsessile.
        E Laminae oblong or ovate oblong, pale green underneath, stipes stramineous. ..... *T. torresiana.*
        E Laminae subtriangular, shining and whitish underneath, stipes brilliant. ..... *T. ogasawarensis.*
      D Laminae grass-green, pinnules rather remote, broad (to 30 mm wide), the base truncate and symmetrical, short stalked. ..... *T. viridifrons.*
    C Rachis and costae underneath scaly.
      D Scales of fronds underneath atro-brown, spine-like and patent. .... *T. multiseta.*
      D Scales of fronds underneath pale brown, ribbon-like and patent. .....

..... *T. leucolepis.*

B Fronds usually more than 2 m long, every axis of frond underneath scaly as well as hirsute, the scales attached to protuberances which remain as more or less short prickles. ..... *T. ornata.*

In the regions concerned, eight species including a variety are credited to this section. They have been noted rather minutely in my earlier paper in 1960, and little remains to be said except the matters concerning the nomenclature.

8. **Thelypteris gracilescens** (BLUME) CHING, Bull. Fan Mem. Inst. Biol. **6**: 327. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 137. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 150. 1960.——*Aspidium gracilescens* BLUME, Enum. Pl. Jav. 155. 1828. Type: Java, *Blume.*——*Lastrea gracilescens* (BLUME) MOORE, Ind. Fil. 93. 1858; OHWI, Fl. Jap. Pterid. 99. 1957; TAGAWA, Col. Ill. Jap. Pterid. 112, 221. 1959.——*Metathelypteris gracilescens* (BLUME) CHING, Acta Phytotax. Sin. **8**: 306. 1963.

Dryopteris sublaxa HAYATA, Icon. Pl. Formos. IV, 183. 1914. Type: Arisan in Taiwan, *B. Hayata s. n.* (TI !).

Dryopteris arisanensis ROS. Hedwigia **56**: 340. 1915. Type: Arisan in Taiwan, *Faurie 389* (Isotype in KYO !).

Rhizome short creeping, 3–4 mm in diameter, bearing numerous roots and stipes rather approximately, paleate throughout, especially densely so on young shoots. Stipes close, irregularly placed in appearance, (10–) 17–30 (–50) cm long, about as long as or shorter than the laminae, the base slightly bulged, dark brownish, minute hairy and sparsely paleate, the other parts terete, 0.7–1.5 mm in diameter at middle portion, pale green to stramineous, minutely hirsute throughout. Laminae bipinnate, (15–) 25–35 (–45) cm long, (5–) 7–9 (–12) cm wide, oblong lanceolate to lanceolate, truncate to cordate at base, acuminate or caudately prolonged at apex, dark green to deep blue green, papyraceous to soft papyraceous; rachis similar to the upper part of the stipes, grooved on the upper surface. Pinnae deeply pinnatisect, sessile, oblong lanceolate, lower one or two pairs deflexed and arcuate, narrowing to base, the others except upper ones falcate, truncate and auricled acroscopically and sometimes basiscopically in slight degree at base, caudately acuminate at apex, the largest 4–8 cm long, 1–2 cm wide, upper ones less dissected and gradually merging into indistinct apical portion; costae placed on rachis deflexed at basal one to two pairs, with obtuse (about a right) angles at middle ones and gradually acutely upwards, indistinctly grooved but not continued to those of rachis disturbed by the high ridges along the latter, densely setose hairy on the upper and very sparsely on the under surfaces; segments oblique, elliptical or round oblong, round at apex, decurrented to costae joining to the adjacent ones forming acute sinus, entire but in dry state curled backwards at margin, 3–8 mm long, 1.5–3.5 mm broad, glabrous except on veins; veins pinnate, veinlets simple or very rarely (especially in sterile state) forked, stopped below margin of lobes where dense cilia placed, glabrescent or very rarely hirsute on upper surface. Scales on rhizome subtriangular, broadest at base and long tailed

at apex, less than 1 mm broad, up to 3 mm long including long tail, hard membranous, brown to light brown, glabrous, those at base of stipes like the ones on rhizome though light in colour and narrower in outline; all hairs setose, not coarse, unicellular. Sori apical or subapical on the veinlets, thence biserriate on both sides of the main veins, nearer to the main vein or rather marginal, round, indusiate; indusia round reniform, small, less than 0.8 mm in diameter, glabrescent; sporangia naked; spores bilateral, spiny on surface, pale brown.

Locally fairly common at middle elevations on the island of Yakushima off Kyushu and in Taiwan; terrestrial on humus-rich floor of dense forests in rainy regions.

Distribution: the Philippines and Java to New Guinea through Malaysia. Unknown to continental Asia.

9. **Thelypteris uraiensis** (ROS.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 336. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 138. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 152. 1960.——*Dryopteris uraiensis* Ros. Hedwigia **56**: 341. 1915 (July). Type: Urai in Taiwan, *Faurie 22* (Isotype in KYO !).——*Lastrea uraiensis* (ROS.) COPEL. Gen. Fil. 140. 1947; TAGAWA, Col. Ill. Jap. Pterid. 112, 223. 1959.——*Metathelypteris uraiensis* (ROS.) CHING, Acta Phytotax. Sin. 8: 306. 1963.

Dryopteris hirsutisquama HAYATA, Icon. Pl. Formos. V, 277. 1915 (Nov.). Type: between Tonroku and Rimogan in Taiwan, *T. Ito & Fujii s. n.* (TI !).

Rhizome short, thick, 4 mm or more in diameter, bearing numerous roots and stipes approximately, densely paleate throughout. Stipes very close, approximately placed on the upper surface of rhizome in appearance, (6-) 12-20 (-32) cm long, longer than the laminae, the very base slightly bulged, blackish to dark brownish, paleate and densely hirsute throughout. Laminae bipinnate, (10-) 17-22 (-27) cm long, (5-) 12-15 cm wide at base, subtriangular to long triangular, truncate to broadly cuneate or rarely cordate at base, gradually narrowing upwards to form acuminate or caudately attenuate apex, dark green to deep blue green, papyraceous; rachis similar to the upper portions of stipes, grooved on upper surface; pinnae deeply pinnatisect, sessile, oblong lanceolate, lower one to two pairs falcate or slightly deflexed to arcuate, narrowing towards both base and apex, the middle 5-10 pairs almost straight to slightly falcate, truncate to broadly cuneate and more or less auricled at base, caudately acute to acuminate at less pinnatisect apex, at most 7 cm long, 1.5 cm broad, upper ones less finely dissected and gradually adnate at base to form indistinct apical portion; costae placed on rachis with broad (almost to a right or sometimes rather obtuse) angles at the basal or middle pairs and gradually acuminately upwards, indistinctly grooved but separately from those of rachis with the disturbance of ridges along the latter, densely minutely setose hairy throughout. Segments oblique to straight, oblong to oblong lanceolate, round to moderately acute at apex, decurrented to costae joining to the adjacent to form acute to moderately acute sinus, entire or slightly crenulate at margin, 3-8 mm long, 2-4 mm broad, pubescent with minute, setose hairs; veins pinnate, veinlets

simple or rarely forked, not reaching the margin of lobes, setose hairy. Scales on rhizome elliptical with long attenuate apex, less than 0.8 mm broad, up to 2.5 mm long including long tail, hard membraneous, light brown to pale brown, hairy both on the surfaces and on the margin, those at the base of stipes like rhizome scales but faint in colour and larger in size; all hairs setose, pointed at apex, unicellular. Sori apical or subapical on veinlets, thus biserriate, medial or a little marginal on a lobe, round, indusiate; indusia small, round reniform, pale green, minutely hirsute; sporangia naked; spores bilateral, reticulate, brown.

Rather rare at lower elevation of the island of Yakushima and in Taiwan; terrestrial on damp humus-rich floor of dense forest.

Distribution: after the publication of my earlier paper, I had a chance to examine several Chinese and Assam specimens of this species. They are quite identical with the typical specimens from Taiwan.

10. **Thelypteris laxa** (Fr. et Sav.) Ching, Bull. Fan Mem. Inst. Biol. **6**: 333. 1936; H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 139. 1939, cum f. *glabrescens* et var. *dilatata*; K. Iwats. Acta Phytotax. Geobot. **18**: 153. 1960.——*Aspidium laxum* Fr. et Sav. Enum. Pl. Jap. II, 237, 631. 1879. Type: Yokosuka in Honshu, *Savatier*; Matsum. Ind. Pl. Jap. I, 287. 1904.——*Dryopteris laxa* (Fr. et Sav.) C. Chr. Ind. Fil. 274. 1905; Ogata, Icon. Fil. Jap. IV, pl. 170. 1931.——*Lastrea laxa* (Fr. et Sav.) Copel. Gen. Fil. 139. 1947; Ohwi, Fl. Jap. Pterid. 99. 1957; Tagawa, Col. Ill. Jap. Pterid. 112, 221. 1959.——*Metathelypteris laxa* (Fr. et Sav.) Ching, Acta Phytotax. Sin. **8**: 306. 1963.

Rhizome creeping, 2.5 mm or more in diameter, bearing numerous roots and stipes rather approximately, paleate, minutely hairy throughout. Stipes close together, 7 mm or usually less remote, (7–) 17–30 (–45) cm long, usually shorter but rarely longer than the laminae, the very base slightly bulged, dark brownish to blackish, paleate rather densely and hirsute, the other part terete, 1–2 mm in diameter at midst portion, stramineous or pale green, sometimes coloured with faint purplish tint, minutely hirsute or glabrescent. Laminae bipinnate, usually oblong lanceolate but variable, sometimes lanceolate or ovate subtriangular to ovate oblong, the base broadly cuneate to truncate but sometimes cordate with the deflexed lowest pinnae, the apex caudately acuminate into gradually less dissected apical portion, in typical forms about 30 cm long by 15 cm wide, but variable ranging 13–40 cm long by 4–20 cm wide, yellowish pale green but sometimes less yellowish, in general herbaceous in texture but sometimes soft papyraceous or coarsely membranous; rachis similar to the upper parts of stipe, grooved on the upper surface, usually hirsute in the grooves but sometimes glabrescent on the surface underneath; pinnae deeply to almost completely pinnatisect, sessile, oblong lanceolate to lanceolate, sometimes arcuate, sometimes slightly deflexed in lower pairs, broadest at two-fifths way from the base, gradually narrowing to the base to form cuneate base with reduced basal segments, but sometimes broadly cuneate to truncate and auricled on both the acroscopic and basiscopic sides at base, gradually narrowing towards caudately acuminate to attenuate, less dissected apex,

variable in numbers, size and in form, upper ones gradually less dissected; costae similar to rachis, usually slightly falcate, at broad angles to rachis, indistinctly grooved but the groove not continued to that of rachis, pubescent in every cases; segments oblique, elliptical to oblong, round but sometimes acute at apex, the base coadnate to form wing-like lamina along the both sides of costae, at most 1.7 mm long, 0.7 cm broad, the margin variable ranging from subentire to deeply (up to three-forths way down to costules) incised, not so remote from each other, forming acute or moderately acute sinus; veins pinnate, hirsute, veinlets simple in smaller segments but forked to triparted in larger ones, not reaching the very margin of lobes. Scales oblong lanceolate or subtriangular, broadest near the base, attenuate at apex, 0.5 mm or a little broader, more than 2 mm long, brownish, soft herbaceous to membraneous, densely hirsute; hairs setose, whitish, unicellular and minute. Sori subapical or apical on veinlets, biserriate and rather marginal on segments, round, indusiate; indusia round reniform, not entire at margin, 1 mm or less in diameter, stramineous or sometimes greenish, more or less (densely in usual) hirsute; sporangia naked; spores bilateral, tubercular or reticulate, pale brown.

Terrestrial on rather dry to moist ground in open or lightly shaded places at lower elevations; common in central and southern Honshu, Shikoku and Kyushu. Also known rather rarely from Southern Korea (Isl. Quelpaert), Ryukyu and Taiwan.

Distribution: common in central and southern China.

11. **Thelypteris hattorii** (H. ITO) TAGAWA, Acta Phytotax. Geobot. **5**: 195. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 141. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 154. 1960.——*Dryopteris hattorii* H. ITO, Bot. Mag. Tokyo **49**: 359. 1935. Type: Mt. Yokogura in Shikoku, *S. Hattori s. n.* (TI !). ——*Lastrea hattorii* (H. ITO) TAGAWA, Acta Phytotax. Geobot. **15**: 14. 1955, Col. Ill. Jap. Pterid. 112, 221. 1959; OHWI, Fl. Jap. Pterid. 99. 1957.——*Metathelypteris hattorii* (H. ITO) CHING, Acta Phytotax. Sin. **8**: 306. 1963.

Dryopteris laxa var. *dilatata* KOIDZ. Acta Phytotax. Geobot. **1**: 28. 1932. Type: Mt. Oohira-yama in Kyushu, *Mayebara 756* (Lectotype in KYO !).——*Thelypteris laxa* var. *dilatata* (KOIDZ.) H. ITO ex HONDA, Nom. Pl. Jap. 520. 1939, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 140. 1939, quoad nom. sol.——*Lastrea laxa* var. *dilatata* (KOIDZ.) HONDA, Nom. Pl. Jap. ed. emend. 380. 1957.

Thelypteris nemoralis CHING, Bull. Fan Mem. Inst. Biol. **6**: 338. 1936. Type: Lushan in Kiangsi, *Ching 10127*.

Rhizome oblique, ascending or short creeping, thick, at least 4 mm in diameter, densely hirsute and sparsely paleate. Stipes very close, 16–25 (–40) cm long, about as long as the laminae, the very base slightly bulged, dark brownish, sparsely scaly and densely pubescent, the other part terete, about 2 mm in diameter at middle portion, pale green to stramineous with faint purplish tint, densely hirsute throughout. Laminae tripinnatifid, ovate subtriangular, usually widest at lowest pinnae, broadly cuneate to truncate or rarely cordate at base, acuminate to fairly caudate at apex, (15–) 20–30 (–45) cm long, (13–) 20–30 cm wide at most, yellowish

green to pale blue green, soft papyraceous to herbaceous; rachis like the upper part of stipes, straight or slightly flexuous at midst part, grooved on upper surface; pinnae bipinnatifid, sessile or sometimes very shortly stalked in the lowest pair, oblong lanceolate, round to cuneate at base, acuminate to caudate at the less pinnatisect apex, widest at two-fifths way up from base, the largest ones about 15 cm long, 5-6 cm wide, upper ones less dissected and gradually adnate upwards to form indistinct apical portion; costa like rachis, more or less falcate, at broader angles to the rachis, forming a hairy protuberance at the junction with rachis on the under surface, grooved but the grooves separated from those of rachis with high ridges along the both sides of the latter; pinnules pinnatifid, sessile, oblong, obliquely placed on costae, round to moderately acute at apex, broadly cuneate at base, or adnate to join the adjacent ones to form wings, those near the rachis reduced in size, thus less dissected; costules like costae, placed on this at the angles of more than 70°, almost straight; ultimate segments oblique, elliptical to oblong, round or moderately acute at apex, deeply pinnatifid forming acute sinus between the adjacent segments, entire or hardly crenulate at margin, at most 5 mm long, 3 mm broad, with the space of about 0.5 mm to the adjacent ones, uniformly pubescent underneath; veins pinnate, veinlets simple to forked, not reaching the margin of lobes, hirsute. Scales sparse on rhizome and at the basal part of stipes, subtriangular, broadest at base and long attenuate at apex, more than 1 mm broad, about 3 mm long including long tail, brownish to faint brownish, soft herbaceous, densely hirsute with very minute but setose hairs; all hairs setose, unicellular, not so long. Sori subapical on veinlets, thus marginal on segments, a few (usually one to four) on a segment, round on short receptacles, indusiate; indusia round, about 1 mm on every direction, pale green, herbaceous, densely pubescent with sharp hairs; sporangia naked; spores bilateral, reticulate, brown.

Southern Honshu, Shikoku and Kyushu, rather rare; terrestrial on clayey slope in light shade at lower elevation.

Distribution: I have once considered the eastern Chinese *T. nemoralis* as to be a distinct species allied more closely to *T. torresiana* than to this species. Examining a few Kiangsi specimens, however, there is found no taxonomic discrepancy between these specimens and Japanese *T. hattorii*. Therefore, this species is distributed in Japan and Central China.

12. **Thelypteris torresiana** (GAUD.) ALSTON, Lilloa **30**: 11. 1960.——*Polystichum torresianum* GAUD. in FREYC. Voy. Bot. 333. 1827. Type: Marianne Islands, *Freycient.*——*Lastrea torresiana* (GAUD.) MOORE, Ind. Fil. 106. 1858; WAGNER & GRETHER, B. P. Bishop Mus. Occas. Papers **19** (2): 58. 1948; COPEL. Fern Fl. Phil. II, 331. 1960.——*Macrothelypteris torresiana* (GAUD.) CHING, Acta Phytotax. Sin. **8**: 310. 1963.

Aspidium uliginosum KUNZE, Linnaea **20**: 6. 1947, Bot. Zeit. **6**: 263. 1948. Type: Java.——*Thelypteris uliginosa* (KUNZE) CHING, Bull. Fan Mem. Inst. Biol. **6**: 342. 1936; C. CHR. et TARD. in LECOMTE, Fl. Gén. Indo-Chine **7** (2): 371. 1941; HOLTT.

Fl. Malaya II, 241. 1954; K. IWATS. Acta Phytotax. Geobot. **18**: 156. 1960.

Polypodium tenericaule WALL. ex HOOK. Kew Journ. Bot. **9**: 353. 1857. Type: Assam, *Wallich 335*.——*Lastrea tenericaulis* (WALL. ex HOOK.) MOORE, Ind. Fil. 99. 1858; TAGAWA, Col. Ill. Jap. Pterid. 113, 223. 1959.

Nephrodium setigerum var. *calvatum* BAKER, Journ. Bot. **1875**, 201. Type: Lushan in Kiangsi, *Shearer s. n.*——*Thelypteris uliginosa* var. *calvata* (BAKER) K. IWATS. Acta Phytotax. Geobot. **18**: 158. 1960.

Nephrodium oligophlebium BAKER, Journ. Bot. **1875**, 291. Type: Fongwand shan in Kiangsi, *Querkert s. n.*——*Aspidium oligophlebium* (BAKER) CHRIST in WARBURG, Monsunia I, 81. 1900; MATSUM. Ind. Pl. Jap. I, 288. 1904.——*Dryopteris oligophlebia* (BAKER) C. CHR. Ind. Fil. 280. 1905; H. ITO, Bot. Mag. Tokyo **49**: 364. 1935; OGATA, Icon. Fil. Jap. IV, pl. 173. 1931.——*Thelypteris oligophlebia* (BAKER) CHING, Bull. Fan Mem. Inst. Biol. **6**: 339. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 141. 1939.——*Lastrea oligophlebia* (BAKER) COPEL. Gen. Fil. 139. 1947; OHWI, Fl. Jap. Pterid. 100. 1957; TAGAWA, Col. Ill. Jap. Pterid. 222. 1959.——*Macrothelypteris oligophlebia* (BAKER) CHING, Acta Phytotax. Sin. **8**: 309. 1963.

Dryopteris lasiocarpa HAYATA, Mat. Fl. Formos. 417. 1911. Type: Isl. Kotosho off Taiwan, *Nakahara 994* (TI !).——*Dryopteris oligophlebia* var. *lasiocarpa* (HAYATA) NAKAI, Bot. Mag. Tokyo **34**: 142. 1920; H. ITO, Bot. Mag. Tokyo **49**: 365. 1935.——*Thelypteris oligophlebia* var. *lasiocarpa* (HAYATA) H. ITO, Bot. Mag. Tokyo **52**: 589. 1938, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 144. 1939.——*Lastrea oligophlebia* var. *lasiocarpa* (HAYATA) H. ITO ex MIZUSHIMA, Misc. Rep. Res. Inst. Natur. Res. **38**: 114. 1955; OHWI, Fl. Jap. Pterid. 100. 1957.

Dryopteris elegans KOIDZ. Bot. Mag. Tokyo **38**: 108. 1924. Type: Shiroyama, Kagoshima city in Kyushu, *A. Kimura s. n.* (KYO !).——*Dryopteris oligophlebia* var. *elegans* (KOIDZ.) H. ITO, Bot. Mag. Tokyo **49**: 365. 1935.——*Thelypteris oligophlebia* var. *elegans* (KOIDZ.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 341. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 144. 1939.——*Lastrea oligophlebia* var. *elegans* (KOIDZ.) TAGAWA, Col. Ill. Jap. Pterid. 112, 222. 1959.——*Thelypteris uliginosa* var. *elegans* (KOIDZ.) K. IWATS. Acta Phytotax. Geobot. **18**: 158. 1960.——*Macrothelypteris oligophlebia* var. *elegans* (KOIDZ.) CHING, Acta Phytotax. Sin. **8**: 309. 1963.

Rhizome short, ascending to erect, bearing numerous roots and stipes approximately. Stipes terete, thick, (15–) 40–60 (–100) cm long, the base more or less fleshy, dark brown, densely caespitose, more than 1.5 cm in diameter in larger ones, the other parts glabrescent or sparsely hirsute, stramineous, less shining, gradually narrowing upwards. Fronds ovate oblong to oblong, longer in larger fronds, broadly cuneate at base, acute to acuminate at apex, (30–) 50–100 (–130) cm long, 30–60 (–90) cm wide, tripinnate or quadripinnatifid, yellowish green, herbaceous to soft herbaceous; rachis terete throughout, not grooved, stramineous, gradually narrowing upwards, almost straight, glabrescent or sparsely hairy underneath, densely hirsute on the upper surface; pinnae 15–20 in number, oblong lanceolate, acuminate at apex, broadly cuneate and shortly stalked at base, in larger ones 25 cm long, to

8 cm wide, the upper ones gradually reduced, adnate at base to form indefinite apical part; costae like the upper parts of rachis, densely hirsute on upper surface, sparsely long hairy underneath, placed on rachis with the angles of 50–70°, up to 8 cm apart to each other; pinnules lanceolate, acuminate at apex, the base adnate and decurrent to the costae forming narrow wings along the both sides of costae, up to 10 cm long, 2 cm wide, the upper ones gradually reduced in form towards the acute and sharrowly incised apex of pinnae; costules at angles of 40–60° to rachis, at most 1.5 cm apart to each other, densely minute hairy on upper surface, sparsely long hairy underneath, almost straight; segments sharrowly incised to one-third way down to the main veins at about 45° to costule, round to moderately acute at apex, adnate and decurrented at base; the ultimate lobes oblique, subtriangular, acute at apex, with acute sinuses, entire at margin; veins pinnately divided, veinlets forked to quadriparted in each lobe, not reaching the margin, hairy. Scales only on rhizomes and at the base of stipes, linear lanceolate, attenuate at apex, 1.5 cm long, 3 mm broad, brown to light brown, membranaceous, pubescent on surfaces and at margin, the very base sometimes lignified, leaving minute spinose receptacles on the basal surfaces of stipes; hairs various in density, unicellular to multicellular. Sori dorsal on veinlets, round, usually one to a lobe, nearer to the main veins, indusiate; indusia small, sometimes covered by the numerous sporangia, round reniform, hairy at margin as well as on the dorsal surfaces; sporangia naked; spores bilateral, reticulate, pale brown.

Terrestrial in open places or in light shade at lower elevations of the central and southern Japan, Korea, Ryukyu and Taiwan.

Distribution: Southeast Asia to Australia.

COPELAND (1960) is of opinion that Malaysian *T. setigera* with muricate stipes is the same with this species having the smooth stipe only. I have once mistaken to refer the former species to Himalayan *T. ornata*, but this treatment should be corrected as seen in a few pages further. In 1950 COPELAND noted Japan as a distribution area of *Lastrea leucolepis*; this seems to be resulted from the nomenclatorial confusion around this species. *Thelypteris leucolepis*, known from Malaysian and Polynesian regions, has not yet been collected actually in the regions now under consideration.

In my earlier paper in 1960, I have classified this species, named *T. uliginosa* in that paper, into three varieties. However, two of them may better be regarded here as to be the same, as is shown in my recent paper concerning the thelypteroid trichomes. Var. *elegans* has been distinguished from var. *calvata* by the difference only in the density of setose hairs on laminar parts. We can actually find the setose hairs also on the plants of the latter variety, and can not find any complete discrepancy between those two varieties. Thus, the following two varieties only are here credited to this wide-spread species.

Var. **torresiana**.——*Polystichum torresianum* GAUD. l. c.
Aspidium uliginosum KUNZE, l. c.
Polypodium tenericaulum WALL. ex HOOK. l. c.
Dryopteris lasiocarpa HAYATA, l. c.

Known from the southern edge of Kyushu, the Ryukyus and Taiwan; distributed widely in the tropics of Asia and Australia.

Var. **calvata** (BAKER) K. IWATS. comb. nov.——*Nephrodium setigerum* var. *calvatum* BAKER, l. c.

Nephrodium oligophlebium BAKER, l. c.

Dryopteris elegans KOIDZ. l. c.

Known from the warm temperate regions of Honshu, Shikoku and Kyushu as well as Korea; distributed in the eastern and central China.

13. **Thelypteris ogasawarensis** (NAKAI) H. ITO ex HONDA, Nom. Pl. Jap. 520. 1939, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 144. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 159. 1960.——*Dryopteris ogasawarensis* NAKAI, Bot. Mag. Tokyo **43**: 2. 1929. Type: Isl. Kitaiwô-tô in Bonin, *T. Nakai s. n.*

Rhizome short, oblique, bearing the roots and stipes approximately. Stipes caespitose, usually more than 1 m long, 0.5–1.2 cm in diameter near the base, yellowish brown and brilliant, glabrescent, the base darkish, scaly as well as hairy, prominently fleshy. Laminae triangularly ovate oblong, acute at apex, broad cuneate to truncate at base, tripinnate to quadripinnatifid, 30–80 cm long, 40–70 cm wide, deep yellowish green, paler on the fronds underneath, herbaceous; rachis similar to the upper parts of stipes, upper parts narrowly winged and minutely pubescent on the upper surface; pinnae ovate oblong to oblong lanceolate, acute at apex, broadly cuneate or round at base, petiolate; costae placed on rachis at the angles of 60–75°, slightly falcate or sometimes deflexed, glabrous or hirsute underneath, minutely pubescent on the upper surface, narrowly winged along both sides of upper parts; pinnules subtriangular oblong, broadly cuneate and subsessile at base, gradually narrowing to moderately acute at apex, the upper parts less dissected; costules placed on costae at the angles of 45–60°, pubescent; segments pinnatifid up to a half way down to main veins, round at apex, oblique to costules; ultimate segments round, entire; veins pinnatifid, veinlets simple or forked to triparted in an ultimate lobe, not reaching the very margin, pubescent. Scales only on the rhizomes and at base of stipes, linear or linear lanceolate, long attenuate at apex, 1–3 cm long, at most 3 mm in breadth, soft herbaceous, brown to deep brown, hairy on both the surfaces and at margin; hairs setose, usually long and multicellular. Sori dorsal or subapical on veinlets, one to two in each lobe near the margin, round, indusiate; indusia round reniform, sparsely hairy with long hairs; sporangia with the annuls of 13–15 thickened cells; spores bilateral, sometimes reticulate on surface.

Endemic so far to the Bonins; habitat unknown, but seems to be like that of the preceding species.

BONIN. Isl. Chichi-jima: Asahi-yama, *H. Hattori s. n.* (TI), *Nishimura 489* (TI); Hatsune-yama, *T. Tuyama s. n.* (TI); Ani-shima, *T. Tuyama s. n.* (TI), *Yamamoto s. n.* (TI). Isl. Haha-jima: Kuwanoki-yama, *T. Tuyama s. n.* (TI); Okimura, *T. Nakai s. n.* (TI); Kitamura, *T. Nakai s. n.* (TI); Sekimon, *T. Tuyama s. n.* (TI). Isl. Kitaiwô-tô: sine loco citat, *Isei 19* (TI), *T. Tuyama s. n.* (TI,

KYO). Isl. Minamiiwô-tô: sine loco citat, *T. Tuyama s. n.* (TI).

14. **Thelypteris viridifrons** TAGAWA, Journ. Jap. Bot. **12**: 747. 1936; K. IWATS. Acta Phytotax. Geobot. **18**: 159. 1960.——*Dryopteris elegans* var. *subtripinnata* TAGAWA, Acta Phytotax. Geobot. **2**: 93. 1933. Type: Uji, south of Kyoto in Honshu, *Tagawa 531* (KYO).——*Thelypteris oligophlebia* var. *subtripinnata* (TAGAWA) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 144. 1939.——*Lastrea viridifrons* (TAGAWA) TAGAWA, Acta Phytotax. Geobot. **15**: 14. 1953, Col. Ill. Jap. Pterid. 113, 223. 1959.——*Lastrea oligophlebia* var. *subtripinnata* (TAGAWA) OHWI, Fl. Jap. Pterid. 100. 1957.——*Macrothelypteris viridifrons* (TAGAWA) CHING, Acta Phytotax. Sin. 8: 310. 1963.

Rhizome oblique, ascending. Stipes caespitose, terete, stramineous, (15–) 30–60 (–80) cm long, 0.5–1.5 cm in diameter at base, glabrescent throughout but sparsely scaly on the basal portions, the very base rather fleshy, darkish in colour and sometimes hairy as well as scaly. Laminae ovate oblong to oblong, cuneate to broad cuneate at base, gradually narrowing towards the acute apex, tripinnate to quadripinnatifid, (35–) 50–80 (–100) cm long, (20–) 30–60 (–80) cm wide, viridescent, soft herbaceous, rachis similar to the upper parts of stipe, round and not grooved throughout but in the upper parts narrowly winged, the wing embrace the rachis to form furrows, glabrescent in lower parts but hirsute on the upper parts, especially on the upper surface, almost straight; pinnae many in pairs, 7–15 cm remote in the lower ones, subtriangular oblong to oblong lanceolate, acuminate at apex, truncate at base in larger ones, 40 cm long, 20 cm wide, petiolate, the upper pinnae gradually reduced and adnate to form indefinite apical part; costae placed on rachis at the angles of about 45–60°, round but narrowly winged almost throughout, densely hirsute on the upper surface but glabrescent underneath; pinnules oblong to oblong lanceolate, caudately acuminate at apex, truncate to broad cuneate at base, shortly stalked in larger ones, the larger ones 10 cm long, 3 cm wide; costules winged throughout, pubescent, placed on costae at the angles of 75–90°, placed rather remotely at intervals of 3–5 cm in larger ones; segments pinnatifid up to four-fifths way down to main veins, oblique, oblong, round to moderately acute at apex, broadly cuneate and subsessile at base; ultimate lobes oblique, oblong, round at apex, subentire at margin, pubescent on both surfaces, decurrented base running to the wings of every axis, the sinus narrow, plane, entire and hairy at margin; veins pinnate, veinlets pinnate again in the ultimate lobes, not reaching the margin, setose hairy. Scales only on rhizome and at base of stipes, linear or linear lanceolate, long attenuate at apex, more than 5 mm long but less than 1 mm broad, densely hirsute both on the surfaces and at margin, brown to deep brown, membraneous; hairs setose, those on rachises, costae, and costules of upper surface minute, the others long, usually multicellular. Sori round, dorsal on veinlets, 1–4 in an ultimate lobe, indusiate; indusia round reniform, persistent, greenish or stramineous, hirsute at margin; sporangia naked; spores bilateral, reticulate on surface, pale to yellow brown.

Terrestrial in light shade near villages; fairly common in central and southern

Honshu, and rather rare in southern Kyushu and southern Korea. Endemic so far to the regions cited above, but probably grown in continental China.

15. **Thelypteris ornata** (WALL. ex BEDD.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 346. 1936.——*Polypodium ornatum* WALL. ex BEDD. Ferns S. Ind. t. 171. 1864. Type: India, *Wallich 327* (Isotype in US!).——*Dryopteris ornata* (WALL. ex BEDD) C. CHR. Ind. Fil. 281. 1905.——*Lastrea ornata* (WALL. ex BEDD.) COPEL. Gen. Fil. 139. 1947.——*Macrothelypteris ornata* (WALL. ex BEDD.) CHING, Acta Phytotax. Sin. **8**: 309. 1963.

Thelypteris setigera (BLUME) CHING sensu TAGAWA, Acta Phytotax. Geobot. **8**: 98. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 160. 1960.

Rhizome oblique, thick, with the remainings of the stipe bases, about 15 cm thick. Stipes caespitose, 80–100 cm long, up to 2.5 cm in diameter at base, densely scaly, spinose receptacles of the scale bases remaining on the whole surfaces, stramineous, fairly fleshy and a little dark at the very base. Laminae tripinnate to quadripinnatifid, ovate oblong to subtriangular, acute at apex, subtripinnate at base, 110–130 cm long, about as long as or a little shorter in width, herbaceous or soft papyraceous, yellowish or faintly brownish green; rachis as well as the upper parts of stipes round, spinose, upper extremes very narrowly winged; pinnae lanceolate or oblong lanceolate, gradually narrowing in the upper one-third part toward acuminate apex, truncate at base, petiolate, stalks up to 2.5 cm at the basal pinnae but gradually shortening to reduced upwards, the largest up to 70 cm long and 25 cm wide; costae placed to rachis at the angles of about 60°, slightly bulged at base, sparsely scaly underneath and rather densely hairy on upper surface, narrowly winged on upper parts; pinnules placed on costae at about a right angle, lanceolate, acuminate at apex, truncate at base, in largest ones 15 cm long, 4 cm wide, subsessile; costules prominently winged throughout; segments elongate oblong, round at apex, the base adnate and decurrented to the adjacent to form wings of 0.3–0.5 mm broad on both sides of costules, deeply pinnatifid, up to 1.5 cm long, 5 mm broad, pubescent underneath; lobes oblique, round to acute at apex, incised up to two-thirds way down to the main veins, entire at margin. Veins pinnately divided, veinlets simple, one to a lobe, not reaching the apex of lobes. Scales on stipes linear lanceolate, long attenuate at apex, up to 3 cm long, 3 mm broad at base, hirsute both on the dorsal surface and at the entire margin, rather adpressed or patent, membraneous to soft papyraceous, brownish, the very base darkish, lignified and forming spinose scars which remain the spinosis on the surfaces; scales of rachis or costae underneath smaller but very like in every nature to those on stipes; scales on minor axes smaller and paler in colour; hairs always setose, lacking only on stipes, on rachis underneath and on the upper surface of laminae; hairs on upper surfaces of axes very dense but rather short; hairs of every portion of frond underneath long and setose, multicellular. Sori on dorsal position of veinlets, one to each lobe, rather near to the main veins, round, indusiate; indusia round, small, reniform, hairy at margin, caducous or persistent; sporangia naked; spores bilateral, reticulate or tubercular.

Collected only once in Taiwan; terrestrial at edge of forest at about 500 m in altitude.

Distribution: continental Southeast Asia.

In 1960, I determined the Taiwan plants as a member of Malaysian *T. setigera*, as had been done by TAGAWA. At that time, I misunderstood the large fern *T. setigera* with muricate stipes as being identical with the Himalayan gigantic fern named *T. ornata* but the difference whether the indusia were present or absent. Then I referred *T. ornata* to *T. setigera*, the older name, for the presence of indusia was a common feature to the plants of this group in spite of the occasional misobservation that the plants were exindusiate resulted from the caducous nature of the indusia. However, *T. setigera* is quite distinct from *T. ornata*, and is better reduced to *T. torresiana*. Thus, our Taiwan plants should be identified as *T. ornata*, which is caducously indusiate nevertheless the usual description as being exindusiate.

Sect. *Thelypteris*.

Ten species are credited to this group from the regions now under consideration. Adding to the species enumerated in the key given several pages before, a few Asiatic species belong to this group. *Thelypteris chinensis*, *T. parathelypteris*, *T. hirsutipes* and others are endemic to China and Himalayan regions; *T. viscosa*, *T. pectiniformis*, *T. herbacea* and others are members known in the Malaysian regions. This group may further be splitted into the smaller groups such as:

Group of *T. palustris*: *T. squamulosa*, *T. grisea* and others,

Group of *T. quelpaertensis*: *T. oreopteris* and others,

Group of *T. glanduligera*: *T. angustifrons*, *T. cystopteroides* and others,

Group of *T. japonica*: *T. castanea*, *T. angulariloba*, *T. hirsutipes*, *T. nipponica*, *T. beddomei*, *T. viscosa*, *T. chinensis* and others.

16. **Thelypteris palustris** (SALLISB.) SCHOTT, Gen. Fil. ad t. 10. 1834; CHING, Bull. Fan Mem. Inst. Biol. **6**: 330. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 125. 1939, cum f. *pubescens* (LAWSON) H. ITO et f. *glabra* H. ITO.——*Acrostichum thelypteris* L. Sp. Pl. II, 1071. 1753. Type: Europe.——*Polypodium palustris* SALLISB. Prod. 403. 1796.——*Nephrodium thelypteris* (L.) STEMPEL, Fil. Berol. Syn. 32. 1822; MATSUM. Ind. Pl. Jap. I, 325. 1904.——*Lastrea thelypteris* (L.) BORY, Dict. Class. **9**: 233. 1826; OHWI, Fl. Jap. Pterid. 97. 1957; TAGAWA, Col. Ill. Jap. Pterid. 111, 223. 1959.——*Dryopteris thelypteris* (L.) A. GRAY, Man. Bot. 630. 1848; C. CHR. Ind. Fil. 297. 1905; OGATA, Icon. Fil. Jap. III, pl. 128. 1930.

Rhizome long creeping in marshy places, irregularly branching, rather slender, about 1.5 mm in diameter, glabrescent or sparsely scaly on younger portions, blackish. Stipes more or less remote, 1–3 cm apart from each other, rather slender, terete, blackish and sparsely scaly at base, stramineous or greenish and glabrous upwards. Laminae oblong lanceolate, acute at apex, broadest at about two-thirds way from base, gradually narrowing towards base, the basal pinna patent or deflexed, not prominently reduced, subdimorphic, the fertile fronds much taller and

narrower, with the stipes of 20–35 cm in length and the laminae about as long as the stipes, the sterile fronds with the stipes of 15–25 cm and the laminae of 20–35 cm in length ; fertile pinnae linear lanceolate, gradually narrowing towards acute apex, the base sessile, widest, pinnatisect almost to the costae, about 1 cm in width ; segments oblong subdeltoid, acute to apiculate, entirely covered underneath with seemingly acrostichoid sori in matured condition ; sterile pinnae lanceolate, acute at apex, the base broadest or narrower, very shortly stalked, pinnatisect, about 1.5 cm in breadth, 7–10 cm long, longer than the fertile ones, segments oblique, oblong, acute or moderately acute at apex, subentire or more or less serrate at margin ; texture herbaceous to soft papyraceous, green to pale green or sometimes pale blue green, subglabrous. Veinlets forked, not reticulate, reaching the very margin of lobes. Scales very sparse on rhizome and at base of stipes, oblong subtriangular, very rarely setiferous at margin, about 2.5 mm long, 0.8 mm broad, pale brown, coarse membraneous ; hairs rather sparse on plants, pale, unicellular, not so stiff, 0.3–0.7 mm long ; glandular hairs none. Sori dorsal on veinlets, round on prominent receptacles at midst between main veins and the margin of lobes, large, more than 1 mm in diameter, adhering to the neighbourings to show seemingly acrostichoid condition when matured, indusiate ; indusia round reniform, irregular to fimbriate at margin, hairy at margin and glandular, 0.7 mm in diameter ; spores bilateral, irregularly reticulate or tubercular, dark brown.

Terrestrial on sunny marsh or in wet places usually outside the forests ; common at lower elevations throughout Japan as south as the southernmost edge of Kyushu as well as in Korea, the Kuriles and Saghalien.

Distribution : widely known from the temperate regions of both the hemispheres, except for South America.

South Indian plants of this group bearing scaly costa underneath are delivered by CHING to African *T. squamulosa* characterized by the scaly frond axes, though he has some doubts to his determination. Examining no African plants of the nominal species, I can not decide here whether the South Indian plants are identical with the Africans or not. Regarding the South Indian plants, such discriminative characters enumerated by CHING as the broad ovate or lunate, transparent, light brown scales of the underside of costae and the thicker leaves are distinct and constant. Nevertheless, I can not safely distinguish the South Indian plants specifically from the typical form of *T. palustris*. As I have noted in my earlier paper on the trichomes of these ferns, axes of fronds are always scaly in all the plants of *T. palustris*. Caducous as those scales are, South Indian plants are seemingly distinct from the typical form of this species. These scaly plants are, however, not sufficiently distinguished from the plants belonging to *T. palustris*.

Concerning the infraspecific taxa of this species created by the difference in hairiness, no repetition should be made here. We can not safely distinguish the forms based solely on the difference in the density of hairs. The hairs of this species are not setose but somewhat coarse, though unicellular in the construction.

17. **Thelypteris quelpaertensis** (CHRIST) CHING, Bull. Fan Mem. Inst. Biol.

6: 328. 1936.——*Dryopteris quelpaertensis* CHRIST, Bull. Acad. Géogr. Bot. **1910**, 7. Type: Isl. Quelpaert in Korea, *Taquet 2370*.——*Athyrium quelpaertense* (CHRIST) CHING in C. CHR. Ind. Fil. Suppl. III, 43. 1934.——*Ctenitis quelpaertensis* (CHRIST) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 81. 1939.——*Lastrea quelpaertensis* (CHRIST) COPEL. Gen. Fil. 139. 1947; OHWI, Fl. Jap. Pterid. 96. 1957; TAGAWA, Col. Ill. Jap. Pterid. 111, 222. 1959.

Nephrodium montanum var. *fauriei* CHRIST, Bull. Herb. Boiss. **4**: 671. 1896. Type: Hayachine in Honshu, *Faurie s. n.*; MATSUM. Ind. Pl. Jap. I, 322. 1904.——*Dryopteris oreopteris* var. *fauriei* (CHRIST) MIYABE et KUDO, Tr. Sapporo Nat. Hist. Soc. **6**: 119. 1925; OGATA, Icon. Fil. Jap. V, pl. 228. 1933.——*Dryopteris christiana* KODAMA ex KOIDZ. Bot. Mag. Tokyo **38**: 107. 1924.

Dryopteris yaku-montana MASAMUNE, Journ. Soc. Trop. Agr. Formos. **4**: 76. 1932. Type: Isl. Yakushima off Kyushu, *Masamune s. n.*——*Thelypteris quelpaertensis* var. *yaku-montana* (MASAMUNE) TAGAWA, Acta Phytotax. Geobot. **5**: 196. 1936.——*Ctenitis quelpaertensis* var. *yaku-montana* (MASAMUNE) H. ITO in NAKAI & HONDA, Nova. Fl. Jap. Polypod.-Dryopt. I, 83. 1939.——*Lastrea quelpaertensis* var. *yaku-montana* (MASAMUNE) TAGAWA, Acta Phytotax. Geobot. **15**: 114. 1954; OHWI, Fl. Jap. Pterid. 96. 1957.

Caudex short, ascending, about 1.5 cm or more in thickness. Stipes approximate, several in a tuft, densely scaly throughout, terete, stramineous, to 4 mm in diameter, 20–40 cm long. Laminae oblanceolate, acuminate to acute at apex, widest at about a half to three-forths way from the base, (15–) 50–80 cm long, (5–) 12–25 cm wide, the lower pinnae gradually narrowing, few basal pairs of pinnae being mere butterfly-like auricles, larger pinnae linear subtriangular, deeply pinnatisect almost to the costae, caudately acute at apex, widest at sessile, truncate base, the basal pinnules lengthened; segments oblong, oblique, round to moderately acute at apex, irregularly serrate at margin; texture soft papyraceous, green to dark green, glabrescent; veinlets simple or forked, free from each other, the terminal reaching the very margin of lobes. Scales rather dense on rhizome, stipes, rachis and sparsely so on costae, those on rhizome large, oblong subdeltoid with long tails at apex, to 15 mm long, 5 mm broad, soft herbaceous, light brown, very sparsely hairy at entire margin, scales on higher axes smaller in size but same in pattern; hairs rather sparse on the axes of laminae, pale, unicellular, setose, 0.3–0.4 mm long. Sori round on not so prominent, oblong receptacles, marginal, rather small, 0.8 mm in diameter, indusiate; indusia round reniform, 0.7 mm or so in diameter, entire at margin, membranous, naked; spores bilateral, smooth and minutely echinulate, light green.

Terrestrial on humus-rich floor of light forest at temperate or cold temperate regions of Japan, locally fairly abundant; common at lower elevation of the Kuriles, Hokkaido and northern Honshu, at middle or higher elevations (higher than 1000 m alt.) of central and southern Honshu, Shikoku and southern Korea as well as on the island of Yakushima off Kyushu.

Distribution: Kamtschatka and the Aleutian Islands.

This is the species very closely related to *T. oreopteris* of Europe and North America, from which our species is discriminated by its underside of leaves being

almost eglandular and glabrescent, costae underneath being subglabrous with fibrillose, pale brown scales and very sparse setose hairs, and the pinnae being narrow and thicker. Owing to the scantiness of the setose hairs, CHING (1934) combined this with *Athyrium* and H. ITO (1939) with *Ctenitis*. However, the close alliance of this species with *T. oreopteris* can not be denied even by these authors. There seems to be remained little doubt concerning the subgeneric status of this species. It may correctly be shown that this and *T. oreopteris* are better regarded to have a relationship with *T. palustris* through the intermediates such as *T. squamulosa*.

Dryopteris yaku-montana is a geographically isolated dwarf form found only on the highest area (1500–1800 m alt.) of the island of Yakushima. This is the only locality of this in Kyushu. However, it is well known that the plants become dwarfed at the very summits of the higher mountains, especially on this island. Moreover, there are the plants bearing the fronds of more than 30 cm in length, and such plants have no distinction from the Japanese ones.

18. **Thelypteris angulariloba** CHING, Bull. Fan Mem. Inst. Biol. **6**: 323. 1936. Type: Jao-ping in Kwangtung, *Chun 42644*.——*Lastrea angulariloba* (CHING) TAGAWA, Acta Phytotax. Geobot. **16**: 78, 176. 1956, Col. Ill. Jap. Pterid. 110, 220. 1959. ——*Parathelypteris angulariloba* (CHING) CHING, Acta Phytotax. Sin. 8: 304. 1963.

Thelypteris simozawae TAGAWA, Acta Phytotax. Geobot. **6**: 157. 1937. Type: Tyurei in Taiwan, *Simozawa s. n.* (KYO!); H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 136. 1939.——*Parathelypteris simozawae* (TAGAWA) CHING, Acta Phytotax. Sin. 8: 304. 1963.

Dryopteris hirsutipes (CLARKE) C. CHR. sensu TAGAWA, Acta Phytotax. Geobot. **3**: 28. 1934.——*Thelypteris hirsutipes* (CLARKE) CHING sensu H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 136. 1939.

Caudex short creeping or ascending, bearing approximate stipes near apex, about 0.5 mm thick. Stipes several in numbers, approximate, slightly bulged at base, hairy and dark at base, terete, variously hirsute and stramineous or indistinctly castaneous upwards, 30 cm or so in length, about as long as the laminae. Laminae oblong lanceolate, acuminate at apex, widest at one-fifth way from below, the lowest pinnae patent or deflexed, sterile laminae small, 20 cm or so in length, 8–13 cm wide with strongly deflexed lowest pinnae, fertile laminae tall and large, about 30 cm in length, about as wide as the sterile ones, larger pinnae lanceolate to linear lanceolate, acuminate at apex, broadest at middle, slightly narrowing towards shortly stalked, cordate base, deeply pinnatifid almost to costae, 5–9 cm long, about 1.5 cm wide; segments quadrangular, oblique, obtuse and angular at apex, the margin parallel and entire; texture herbaceous to soft herbaceous, green to dark green or rather yellow green, variously hirsute; veinlets simple, 3–4 in pairs in each lobe, reaching the very margin, the terminal somewhat projecting, hairy on both sides. Scales very sparse on rhizome and at base of stipes, small, oblong subtriangular, acute and tailed at apex, entire at margin, about 1 mm long, 0.3 mm broad, setiferous with unicellular hairs of 0.3 mm in length at margin as well as on both surfaces, bright dark brown, herbaceous; hairs various in density

on every part of plants, setose, simple, straight, white and not transparent, the longer about 1.5 mm long, the shorter 0.3 mm or so in length; glands various in density on the under surface of fronds, light brown, round, sessile. Sori round on oblong receptacles, large, usually more than 1 mm in diameter, subcostular, indusiate; indusia round reniform, large, persistent, soft herbaceous, entire, hirsute; spores bilateral, tubercular, pale brown.

Terrestrial on humus-rich floor of light forest at lower elevation of the southernmost Honshu, Isl. Yakushima and the Ryukyus and Taiwan.

Distribution: South China.

The hairiness of this species is so variable that extreme forms show the difference sufficient to recognize a number of species, though various intermediate forms disturb the practical definition for the sake of taxonomic segregation of such variants. Moreover, the various distinct forms are found in the same locality, and the other characteristics also are very variable independently from the variation in hairiness. Several plants have the subglabrous round indusia and the hairs on costae and veins underneath multicellular composed of 2–5 cells and more than 2 mm in length. In the other plants, indusia are densely pubescent with the hairs of about 2 mm long and the hairs on the axes of the underside of fronds are setose, less than 5 mm in length, and usually unicellular. However, the intermediate forms are not rare, such as: some plants have the pubescent indusia and dense long multicellular hairs; the others are characterized by the subglabrous indusia and dense short unicellular hairs; still others are distinct enough to have only short unicellular hairs on the fertile fronds and long multicellular hairs on the sterile fronds. The length of hairs is not so constant and the unicellular and multicellular hairs are not so distinct from each other. Such variation of hairiness is found only on this species, other thelypteroid ferns being more stable in this characteristics.

Chinese and Sikkim Himalayan *T. hirsutipes* is separated from our plants by CHING with detailed diagnosis. As *T. angulariloba* is variable species as shown above, however, I can set no complete specific line between this and that species. I have examined only a scanty of Chinese specimens, and variation is indistinct among such insufficient materials. On the contrary, Malaysian *T. viscosa* is distinct enough from our species. It may be unnecessary to go further on this discrimination.

Thelypteris simozawae is distinguished from *T. hirsutipes* by the subdimorphic fronds, the laminae being oblong lanceolate and narrowing towards base, the pinnae being less cut and eglandular on under surface of leaves, and by the subcostal sori. These features are, however, those variable in this species, and *T. simozawae* may better be regarded as an extreme variant of *T. angulariloba*.

Among the representative specimens examined, those having glabrous or glandular indusia and long multicellular hairs are:

KYUSHU. Isl. Yakushima: en route from Ambô to Kosugidani, *Iwatsuki 2654* (KYO). RYUKYU. Isl. Okinawa: Kunigami, *Tamaki 296, 720* (KYO), Mt. Yonahadake, *Tagawa & Iwatsuki 4891* (KYO), *Kanashiro 114* (KYO), *Hatusima 18337*

(KAG, US), *Walker et al. 7033* (US), Nakagami, *G. Koidzumi s. n.* (KYO); Isl. Ishigaki-jima: sine loco citat, *G. Koidzumi s. n.* (KYO).

Specimens characterized by pubescent indusia and densely hairy axes of fronds with short unicellular hairs are:

HONSHU. Pref. Wakayama: Wakamiya-jinja, Higashitakaike-chô, *T. Yamamoto s. n.* (KYO); Pref. Mie: between Kotsu and Washige, NE of Owase, *Seto 6514* (KYO). KYUSHU. Isl. Yakushima: Kosugidani, *Yamaguchi 234* (KYO), at foot of Mt. Wariishi, *Tagawa 8339* (KYO), along the Suzunokô, *Tagawa 8259* (KYO), *Kawanabe 5004* (KYO, KAG), along the Tainokô, *Tagawa 7757, 7758, 8353, 8355, 8356, 8357, 8367, 8373, Iwatsuki 2993, Tagawa & Iwatsuki 3244* (KYO). RYUKYU. Isl. Okinawa: Mt. Benoki-yama, *Kanashiro 791* (KYO), *Z. Tashiro s. n.* (KYO), Mt. Yonaha-dake, *Tawada 83* (KYO), *S. Sakaguchi s. n.* (KYO), Mt. Tanyu-dake, *Sonohara et al. 6295* (KYO, US), Sate, *G. Koidzumi s. n.* (KYO), Nakagami, *G. Koidzumi s. n.* (KYO); Isl. Iriomote: Urauchi-gawa, *Walker et al. 6729* (KYO, US).

Representative specimens bearing various intermediate features between the above two extremes are:

RYUKYU. Isl. Amami-Ooshima: Nadai forest, *Iwatsuki 5010* (KYO & others); Isl. Okinawa: Sate, *G. Koidzumi s. n.* (KYO), Nakagami, *G. Koidzumi s. n.* (KYO); Isl. Iriomote: Mt. Goza-dake, *Tagawa & Iwatsuki 4652* (KYO). TAIWAN. Prov. Taihoku: Tyurei, *Simozawa s. n.* (KYO).

19. **Thelypteris castanea** (TAGAWA) CHING, Bull. Fan Mem. Inst. Biol. **6**: 315. 1936.——*Dryopteris castanea* TAGAWA, Acta Phytotax. Geobot. **4**: 132. 1935. Type: Tikusiko, Taihoku Prov. in Taiwan, *Tagawa 616* (KYO !).——*Parathelypteris castanea* (TAGAWA) CHING, Acta Phytotax. Sin. **8**: 304. 1963.

Thelypteris japonica (BAKER) CHING; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 124. 1939, p. p.

Rhizome short creeping or ascending, about 5 mm in diameter. Stipes 2–6 in number, tufted, terete, castaneous, scaly on lower parts, pubescent throughout, about 30 cm long. Laminae oblong subtriangular, acute at apex, truncate at widest base, 20–30 cm long, 15–20 cm wide; pinnae a dozen or more in pairs, the lowest the longest, patent or slightly deflexed, linear lanceolate, caudate at apex, gradually narrowing towards sessile base, deeply pinnatisect almost to costae, 10 cm or more in length, about 1.5 cm in width at most, the other pinnae gradually smaller in size upwards, the basal acroscopic segment sometimes enlarged; segments oblong, oblique, round or moderately acute at apex, 5–8 mm long, about 2.5 mm broad; herbaceous, light green but brownish when dried, pubescent; veinlets simple, 6–8 in pairs, reaching the very margin of lobes, hirsute on both sides. Scales on rhizome and lower portions of stipes, oblong subtriangular, acuminate and long tailed at apex, 5–10 mm long, up to 1.5 mm broad, brilliantly dark brown, soft herbaceous, hairy at margin and on abaxial surface; plants pubescent rather densely, hairs simple, slender, not so stiff, unicellular, pale, usually 0.3–0.5 mm long, glands rather dense on the under surface of laminae, large, dark brownish,

round and sessile. Sori round on rather prominent receptacles, large, submarginal, indusiate; indusia round reniform, entire, hirsute; spores bilateral, reticulate, brown.

Terrestrial on humus-rich floor of mountain forest at lower elevations of the northern part of Taiwan, rather rare.

Distribution: endemic so far to Taiwan.

Independently from each other, TAGAWA (1935) and CHING (1936) considered this species as to be distinct and compared it only with *Dryopteris hirsutipes*, with which this seems to have not so close affinity. Later in 1939, ITO reduced this Taiwan species to *T. japonica* known from Japan and continental China as well as Korea. Really, our Taiwan plants resemble *T. japonica* much more than *T. hirsutipes* or *T. angulariloba*. *Thelypteris castanea* is different from *T. japonica* only in having the densely hirsute leaves: hairs on the costae underneath are very dense, pale, setose, unicellular but up to 1 mm in length, and patent; scales on the base of stipes rather dense, more or less hirsute. The Taiwan plants are natural group constant in every feature, and are distinct from *T. japonica*, though the difference is so slight and very difficult to define in words.

20. **Thelypteris japonica** (BAKER) CHING, Bull. Fan Mem. Inst. Biol. **6**: 312. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 134. 1939.——*Nephrodium japonicum* BAKER, Ann. Bot. **5**: 318. 1891. Type: Nagasaki in Kyushu, *Blamfeld s. n.*——*Aspidium japonicum* (BAKER) MAKINO, Bot. Mag. Tokyo **10**: 110. 1896; MATSUM. Ind. Pl. Jap. I, 287. 1904.——*Dryopteris japonica* (BAKER) C. CHR. Ind. Fil. 272. 1905; OGATA, Icon. Fil. Jap. II, pl. 72. 1929.——*Lastrea japonica* (BAKER) COPEL. Gen. Fil. 139. 1947; OHWI, Fl. Jap. Pterid. 98. 1957; TAGAWA, Col. Ill. Jap. Pterid. 110, 221. 1959.——*Parathelypteris japonica* (BAKER) CHING, Acta Phytotax. Sin. **8**: 304. 1963.

Dryopteris formosa NAKAI, Bot. Mag. Tokyo **45**: 97. 1931, non MAXON 1909. Type: Koryo in Korea, *Nakai 13259* (TI!).——*Dryopteris japonica* var. C. CHR. Ind. Fil. Suppl. III, 86. 1934.

Thelypteris japonica var. *glabrata* CHING, Bull. Fan Mem. Inst. Biol. **6**: 313. 1936. Type: Isl. Quelpaert in Korea, *Faurie 27* partim; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 136. 1939.——*Lastrea japonica* var. *glabrata* (CHRIST) OHWI, Fl. Jap. Pterid. 98. 1957.

Thelypteris japonica f. *viridescens* (MAKINO, nom. subnud.) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 135. 1939.

Thelypteris japonica var. *musashiensis* HIYAMA, Journ. Jap. Bot. **26**: 155. 1951. Type: Bôno'ore-yama in Saitama Prefecture in Honshu, *Hiyama s. n.* (TNS!).——*Lastrea japonica* var. *musashiensis* (HIYAMA) HONDA, Nom. Pl. Jap. ed. emend. 379. 1957; TAGAWA, Col. Ill. Jap. Pterid. 221. 1959.

Rhizome short creeping or subascending, 3 mm or so in diameter, caducously hairy. Stipes not so dense, 1–4 on the apical portion of rhizome, terete, brilliantly dark brown near the base, castaneous on other parts, sparsely scaly and pubescent throughout, 30–50 cm long. Laminae oblong subdeltoid, acute at apex, truncate at widest base, 25–40 cm long, 15–25 cm wide; pinnae more than a dozen in pairs,

the lower ones linear lanceolate, caudately acute at apex, broadest at one-forth way from base, gradually narrowing towards cuneate, sessile base, deeply pinnatisect five-sixths way to costae, patent, upper or middle ones truncate at base, the basal segment sometimes enlarged; segments oblong, patent or slightly oblique, round to moderately acute at apex, to 8 mm long, 3 mm broad; texture herbaceous, green to pale blue green, pubescent; veinlets simple, 6–8 in pairs, reaching the very margin of lobes, setose on both sides. Scales on rhizome and stipes oblong subdeltoid with long tails, about 5 mm long, 1.7 mm broad, soft herbaceous, light brown, glabrous; hairs on every axis of plants and at margin of lobes, as well as on under surface, unicellular, simple, setose, 0.2 mm or so in length; glands on under surface of laminae, dark brown, round, sessile; glandular hairs at margin of indusia, 30μ long. Sori round on elongate receptacles, rather large, submarginal, indusiate; indusia round reniform, about 1 mm in diameter, entire, densely pubescent on surface, glandular hairy at margin; spores bilateral, reticulate, brown.

Terrestrial on humus-rich floor of not so dense mountain forest, rather common at lower elevation throughout Japan and Southern Korea.

Distribution: China.

This seems to be the species rather constant in size and form of the laminae and in hairiness among the species now under consideration. The Korean var. *glabrata* is distinguished from the typical form in Japan by having the narrower and soft herbaceous lobes which are crenate at margin and placed somewhat distantly with wide sinus, by usually more sparse and shorter hairs on the underside of costae, and by having stramineous stipes and glabrous indusia. In Korea, typical variety is not common and var. *glabrata* seems to be growing mixed with that variety, for *Faurie 27* in KYO is doubtlessly var. *japonica* and *Faurie 26* in KYO is var. *glabrata*. I can not note here precisely the variation of this extreme form, but varietal separation may fully be shown by the herbarium specimens.

Concerning the nomenclature of this variety, *Dryopteris formosa* NAKAI non MAXON is the first epithet of this, though this is antidated by *D. formosa* MAXON, 1909. *Dryopteris formosa* NAKAI is, later in 1934, reduced to the variety of *D. japonica*. This reduction is, however, not formally completed. If this is legitimate, this epithet should be used under varietal rank. I selected now the epithet, var. *glabrata*, because this was formally legitimate and beared no obscurity from the nomenclatorial point of view.

Another variety, named var. *musashiensis*, is diagnosed by the stramineous stipes and naked indusia. As for the hairiness of indusia, however, the species belonging to this group are extraordinarily variable: some are densely hirsute only with setose unicellular hairs; some others bear coarse unicellular hairs and glandular hairs; the others have only the glandular hairs or glands; and still others are distinct with completely naked indusia. These various forms occur independently from each other, though typical form bearing castaneous stipes has always setose indusia. Thus, the hairiness of indusia is the character not worthy of the taxonomic recognition. Var. *musashiensis* may better be diagnosed to have stramineous stipes,

occurring the regions just the same with var. *japonica*. Form. *viridescens* is the same plants with var. *musashiensis* though the type specimen is obscure.

The three variety of this species are:

Var. **japonica**.——*Nephrodium japonicum* BAKER, l. c.

Common throughout the regions cited above.

Var. **musashiensis** HIYAMA, l. c.

Thelypteris japonica f. *viridescens* (MAKINO) H. ITO, l. c.

Rather common in the regions cited above. It is not certain whether this distributes to continental China or not.

Var. **glabrata** CHING, l. c.

Dryopteris formosa NAKAI, l. c., non MAXON.

Rare in the southern edge of Korea.

21. **Thelypteris nipponica** (FR. et SAV.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 309. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 132. 1939. ——*Aspidium nipponicum* FR. et SAV. Enum. Pl. Jap. II, 242, 636. 1879. Type: Nippon, *Savatier*; MATSUM. Ind. Pl. Jap. I, 288. 1904.——*Dryopteris nipponica* (FR. et SAV.) C. CHR. Ind. Fil. 279. 1905; KODAMA & MATSUM. Icon. Pl. Koisikav. III, pl. 137. 1916; OGATA, Icon. Fil. Jap. IV, pl. 172. 1931.——*Lastrea nipponica* (FR. et SAV.) COPEL. Gen. Fil. 139. 1947; OHWI, Fl. Jap. Pterid. 98. 1957; TAGAWA, Col. Ill. Jap. Pterid. 110, 222. 1959.——*Parathelypteris nipponica* (FR. et SAV.) CHING, Acta Phytotax. Sin. **8**: 302. 1963.

Dryopteris borealis HARA, Bot. Mag. Tokyo **48**: 695. 1934. Type: Mt. Apoi in Hokkaido, *Hara s. n.* (TI).——*Thelypteris nipponica* var. *borealis* (HARA) HARA, Bot. Mag. Tokyo **52**: 621. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 153. 1939.——*Lastrea nipponica* var. *borealis* (HARA) TAGAWA, Col. Ill. Jap. Pterid. 222. 1959.

Rhizome not so long, thick, 2–3 mm in diameter, black, glabrous or sparsely paleate. Stipes approximate, 15 cm or more long, stramineous, blackish brown at basal portion, glabrous or sparsely hairy with short, white, setose, unicellular hairs, very sparsely paleate. Laminae lanceolate to oblong lanceolate, acute at apex, gradually narrowing towards base, 5–12 cm broad at broadest, apical one-third portion, up to 40 cm long; rachis stramineous, rather densely hirsute, slightly grooved on upper side; larger pinnae linear lanceolate, acuminate at apex, truncate at base, sessile; segments oblong, round at apex, entire at somewhat recurved margin, the lowest acroscopic segments (or basiscopic ones also) enlarged to form auricles, lobed four-fifths way down to costae, sinus very narrow; laminar surface glabrous except for hairy axes, texture herbaceous, pale or yellow green, light brownish in dried condition; veinlets simple, reaching to the very margin of lobes, hairy and glandular with bright brownish, round, sessile glands. Scales oblong subdeltoid, acute at apex, cordate at base, entire at margin, glabrous but rather densely glandular with bright brown, round, sessile glands, up to 5 mm long, 1.5 mm broad at base; hairs on costae underneath dense, usually unicellular (rarely 2–3 celled), soft, the shorter ones (usually 0.3–0.7 mm) spreading but the longer appressed.

Sori round, dorsal on veinlets, medial or costular on lobes, indusiate; indusia covered entirely by sporangia in matured condition, soft herbaceous, entire at margin, sparsely hairy, variously glandular; spores bilateral, reticulate or tubercular, brown.

Terrestrial on open grass fields or in wet places in light forest; at lower or middle elevations of Hokkaido, northern and central Honshu, locally abundant, also in Saghalien, the Kuriles and Korea.

Distribution: central and western China.

Dryopteris borealis is distinguished from the typical form of this species in having the glabrous or glandular indusia. This distinction should better be investigated more precisely in fields. At present, however, I can not distinguish the two forms decidedly among the materials examined.

Besides the variation in hairiness, *T. nipponica* is a very variable species, sometimes being hardly distinguishable from the following species. In some cases, the lower pinnae are not so distinctly reduced, the fronds take the appearance of oblong or broader outline, the segments are broader or narrower and rarely more remotely placed having subacute apices, the sori are submarginal, and the size of plants changes variously bearing the longer or shorter stipes. Chinese plants delivered to this species sometimes take appearance of *T. beddomei*. The distinction may be supported by the knowledge of geographical distribution.

22. **Thelypteris beddomei** (BAKER) CHING, Bull. Fan Mem. Inst. Biol. **6**: 308. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 133. 1939.——*Nephrodium beddomei* BAKER in HOOK. & BAK. Syn. Fil. 267. 1867. Type: Travancore in India, *Beddome.*——*Lastrea beddomei* (BAKER) BEDD. Ferns Br. India Corr. II. 1870, Suppl. 16. 1876; OHWI, Fl. Jap. Pterid. 99. 1957; TAGAWA, Col. Ill. Jap. Pterid. 109, 220. 1959.——*Dryopteris beddomei* (BAKER) O. KTZE. Rev. Gen. Pl. II, 812. 1891; OGATA, Icon. Fil. Jap. IV, pl. 167. 1931; TAGAWA, Acta Phytotax. Geobot. **1**: 306. 1932.——*Parathelypteris beddomei* (BAKER) CHING, Acta Phytotax. Sin. **8**: 302. 1963.

Rhizome long creeping, irregularly branching, 2 mm in diameter, almost naked on older portions, the stipes caespitose on short, ascending branch of rhizome, 10 cm or so in length, stramineous, sparsely scaly. Laminae oblanceolate, acuminate at apex, gradually narrowing towards base, several basal pinnae reduced extremely into merely butterfly-like auricles, rather remote, separated 2 cm or so from each other, 20–50 cm long, 5–8 cm wide, widest at about two-thirds way from the base; larger pinnae oblong subtriangular, caudately acuminate at apex, sessile at broadest base, deeply pinnatisect almost to costae, 3–5 cm long, 6–10 mm wide; segments narrowly oblong, acute to moderately acute at apex, entire but somewhat recurved at margin, 3–4 mm long, about 1 mm broad; texture herbaceous to coarse herbaceous, light green, downy pubescent; veinlets simple, about 5 in pairs in each lobe, reaching the very margin of lobes. Scales on rhizome and stipes oblong subtriangular, 3–5 mm long, 1.5–2 mm broad, brown and obscure, herbaceous, sparsely hairy; hairs on every part of plants, on axes of laminae underneath setose with multicellular

(2-4-celled), pale or whitish hairs 1.5 mm or more in length, short pubescent and glandular on axes and laminar surfaces; glands rather dense on the under surface of laminae, round, sessile but not immersed, brown or whitish. Sori small, round, submarginal, indusiate; indusia reniform, membranous, 0.5 mm in diameter, rather densely glandular; spores bilateral, reticulate, dark brown.

Terrestrial on humus-rich floor or in rather wet places at edge of forest; very rare at lower elevation of South Japan and Korea, and at middle or higher elevations of Taiwan, locally abundant.

Distribution: South India, Ceylon, the Philippines and Java.

Because of the peculiar extension of distribution area into Japan, this species is also variable in our regions, the specific segregation being fairly perplexed from the preceding species, especially concerning the herbarium specimens. The distinction between this and the preceding species is summarized minutely in the key to the species.

I have examined only two sterile specimens from Shizuoka Prefecture. They may belong to this species, but more complete specimen should be examined carefully.

23. **Thelypteris glanduligera** (KUNZE) CHING, Bull. Fan Mem. Inst. Biol. **6**: 320. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 128. 1939.——*Aspidium glanduligerum* KUNZE, Anal. Pterid. 44. 1837. Type: Canton in Kwangtung, *Petersen*.——*Nephrodium glanduligerum* (KUNZE) MAKINO, Bot. Mag. Tokyo **10**: 58. 1896; MATSUM. Ind. Pl. Jap. I, 320. 1904.——*Lastrea glanduligera* (KUNZE) MOORE, Ind. Fil. 93. 1858; OHWI, Fl. Jap. Pterid. 97. 1957; TAGAWA, Col. Ill. Jap. Pterid. 109, 220. 1959.——*Dryopteris gracilescens* ssp. *glanduligera* (KUNZE) C. CHR. Ind. Fil. 268. 1905; OGATA, Icon. Fil. Jap. III, pl. 121. 1930, sub var.——*Dryopteris glanduligera* (KUNZE) CHRIST, Journ. Bot. Frolence **21**: 4, 231. 1908.——*Parathelypteris glanduligera* (KUNZE) CHING, Acta Phytotax. Sin. **8**: 303. 1963.

Dryopteris thelypteris var. *koreana* NAKAI, Bot. Mag. Tokyo **45**: 97. 1931.

Rhizome long creeping, irregularly branching, 2-3 mm in diameter, the older part glabrescent. Stipes usually appoximate, terete, stramineous, (5-) 15-35 cm long, scaly at base, hairy throughout. Laminae lanceolate, acute to acuminate at apex, slightly narrowing towards base, 20-40 cm long, 8-12 cm wide; larger pinnae falcate, deeply pinnatisect almost to costae, linear lanceolate, caudate at apex, broadly cuneate at sessile base, about 3-7 cm long, 0.7-1.2 (-1.5) cm wide, the basal anterior segments elongate; segments narrowly oblong, oblique, acute at apex, entire or crenulate, 3-5 (-7) cm long, 1.2-2.0 (-2.5) mm broad; veinlets 5-7 in pairs, reaching the very margin of segments, setiferous; texture very soft papyraceous to herbaceous, green to yellow green, the laminar surface only glandular. Scales rather sparse on rhizome and at base of stipes, small, oblong subdeltoid, acuminate at apex, 1.0-1.5 mm long, 0.2-0.4 mm broad, herbaceous, brown, sparsely hairy; hairs on every axis and at margin of lobes, setose, pale and transparent, up to 0.7 mm long; glands on under surface of fronds, not so dense, brown, round, sessile and immersed. Sori round on oblong receptacles, submarginal, 0.8 mm in diameter,

indusiate; indusia round reniform, about 0.3 mm in diameter, setiferous; spores bilateral, reticulate, tubercular or minutely echinulate on surface, light brown.

Terrestrial on humus-rich floor of light or more or less deep forests usually at lowar elevations; common throughout Japan south than central Honshu, southern Korea, the Ryukyus and Taiwan.

Distribution: China, Indo-China and North India.

24. **Thelypteris angustifrons** (MIQUEL) CHING, Bull. Fan Mem. Inst. Biol. **6**: 318. 1936.——*Aspidium angustifrons* MIQUEL, Ann. Mus. Bot. Lugd. Bat. **3**: 178. 1867. Type: Nagasaki in Kyushu, *Wichura*.——*Lastrea miqueliana* TAGAWA, Acta Phytotax. Geobot. **15**: 14. 1953, Col. Ill. Jap. Pterid. 109, 221. 1959.——*Parathelypteris angustifrons* (MIQUEL) CHING, Acta Phytotax. Sin. **8**: 302. 1963.

Athyrium cystopteroides var. *elatius* EATON, Proc. Amer. Acad. **4**: 110. 1858. Type: Amami-Guntô, *Wright s. n.* (Isotypes in US & CAL!).

Dryopteris miyagii H. ITO, Bot. Mag. Tokyo **49**: 360. 1935. Type: Isl. Okinawa in Ryukyu, *T. Miyagi s. n.* (TI!).

Dryopteris okinawaensis H. ITO, Bot. Mag. Tokyo **49**: 360. 1935. Type: Isl. Okinawa in Ryukyu, *T. Miyagi s. n.* (TI!).

Dryopteris gracilescens (BLUME) O. KTZE. sensu MAKINO, Journ. Jap. Bot. **6**: 10. 1929; OGATA, Icon. Fil. Jap. III, pl. 120. 1930.

Dryopteris glanduligera var. *hyalostegia* H. ITO, Bot. Mag. Tokyo **49**: 363. 1935, excl. basion.——*Thelypteris glanduligera* var. *hyalostegia* H. ITO, Bot. Mag. Tokyo **52**: 589. 1938, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 130. 1939, excl. basion.——*Lastrea glanduligera* var. *hyalostegia* OHWI, Fl. Jap. Pterid. 97. 1957, excl. basion.

Rhizome short or wide creeping, 1.0–1.8 mm in diameter, irregularly branching. Stipes not so remote or approximate, terete, stramineous with dark brownish base, hirsute throughout, 3–20 cm long. Laminae narrowly oblong subdeltoid to oblong lanceolate, acuminate at apex, (6–) 10–17 (–25) cm long, (2–) 4–7 cm wide, the basal 1–2 pairs of pinnae a little shortened; larger pinnae shortly petiolulate or sessile, oblong to oblong subdeltoid, acute to moderately acute at apex, deeply pinnatisect with 1–3 basal free pinnules, 6–10 mm in width; segments round oblong, oblique, round or moderately acute at apex; veinlets 2–5 pairs in a lobe, reaching the very margin of lobes, setiferous; texture herbaceous, light green, sparsely hirsute. Scales on rhizome small, oblong subtriangular to lanceolate, acuminate and tailed at apex, entire at margin, up to 2 mm long, 0.3 mm broad, dark to bright brown, soft herbaceous, glabrous or sparsely hairy; hairs not so dense on every axis of fronds and at margin of lobes, setose but not so stiff, unicellular, to 0.4 mm long; glands on under surface of laminae, round, brown, not so brilliant, sessile, immersed or not. Sori round on oblong receptacles, submarginal, 0.7 mm in diameter, indusiate; indusia round reniform or rather irregular in form, densely setiferous, about 0.5 mm in diameter; spores bilateral, tubercular, light brown.

Terrestrial on open ground usually along road or on sunny slopes; fairly common throughout central and southern Japan, the Ryukyus and Taiwan.

Distribution: South China.

This is usually regarded as a variety of the preceding species. Variable as this species is, really, we can not separate this definitely from *T. glanduligera*. However, there is troublesome nomenclatorial confusion around this species, and I prefer here to follow CHING to recognize it as a distinct species only for the convenience' sake. These nomenclatorial confusions will be fully discussed under the following species.

Both *D. miyagii* and *D. okinawaensis* were reduced to *T. glanduligera* by their author ITO in 1938. The former is distinguishd from *T. glanduligera* by having the thick rhizome, 2-3 mm in thickness, more deeply cut pinnae bearing a few free basal pinnules, and dense and long hairs on rachis and costae. Comparing with this, the latter is discriminated by having the smaller fronds with the narrower pinnules, and slender and less hairy rachis. In the Ryukyus, in fact, this species is extremely variable and the plants which accord well with the description of the two "species" are not rare at all. However, such extreme forms are bridged with the typical form by successive transitional intermediate forms.

25. **Thelypteris cystopteroides** (EATON) CHING, Bull. Fan Mem. Inst. Biol. **6**: 316. 1936; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 130. 1939.——*Athyrium cystopteroides* EATON, Proc. Amer. Acad. **4**: 110. 1858. Type: Amami-Guntô in Ryukyu, *Wright s. n.* (Isotypes in US & CAL!); MATSUM. Ind. Pl. Jap. I, 293, 386. 1904.——*Dryopteris cystopteroides* (EATON) KODAMA ex TAGAWA, Acta Phytotax. Geobot. **3**: 28. 1934; C. CHR. Ind. Fil. Suppl. III, 84. 1934, p. p.——*Lastrea cystopteroides* (EATON) COPEL. Gen. Fil. 138. 1947; OHWI, Fl. Jap. Pterid. 97. 1957; TAGAWA, Col. Ill. Jap. Pterid. 109, 220. 1959.——*Parathelypteris cystopteroides* (EATON) CHING, Acta Phytotax. Sin. **8**: 302. 1963.

Dryopteris gracilescens var. *abbreviata* KODAMA in MATSUM. Icon. Pl. Koisikav. II, pl. 106. 1914. Lectotype: Isl. Miyajima in Honshu, *Faurie 448* (Isotype in KYO!).

Dryopteris abbreviatipinna MAKINO et OGATA ex MAKINO, Journ. Jap. Bot. **6**: 10. 1929; OGATA, Icon. Fil. Jap. III, pl. 116. 1930.

Rhizome long creeping, bearing the petioles remotely, irregularly branching and usually forming a large colony, 0.4-0.7 (-1.0) mm in diameter, sparsely scaly. Stipes terete, stramineous but darkish brown at scaly basal portion, hairy throughout, 0.2-0.5 mm in diameter at middle portion, (1-) 2-4 (-8) cm in length; fronds oblong or oblong lanceolate, or rarely ovate lanceolate, acute at apex, lower pinnae gradually narrowing downwards, (1.5-) 3-8 (-15) cm long, 0.8-1.2 (-2.0) cm wide, bearing pinnae rather sparsely; rachis slender and fragile, more or less flexuous; pinnae ovate, ovate oblong or oblong subdeltoid, cut into a few (usually up to 4 but rarely to 8) segments, round at apex, broadly cuneate or subtruncate at base, shortly petiolulate or subsessile, the upper ones gradually adnate at base, decurrenting each other to form an indistinct apical part, in general up to 5 (-13) mm long 5 (-10) mm wide, the smaller being not rarely round; segments oblong or ovate oblong, round at apex, almost enitre or dully crenate at margin, very indis-

tinctly petiolulate in larger ones; veinlets simple, reaching the very margin of segments, setose hairy; texture herbaceous or very soft papyraceous, green or pale green, sparsely glandular on the under surface. Scales very sparse on rhizome and at base of petioles, ovate or linear subtriangular, acuminate or attenuate at apex, 0.7–1.2 mm long, 0.4 mm broad at the broadest base, brown, subclathrate in appearance, the margin usually being irregular, setiferous very occasionally, densely glandular but caducous; hairs rather dense on every axis throughout the plants but not or a little hirsute on the laminar surface, unicellular, setose, pale, less than 0.4 mm long. Sori round or oblong, dorsal on veinlets, usually 1–4 on a segment, indusiate; indusia reniform or horseshoe-shape, sometimes elongate along acroscopic side of veinlets, or crescent or linear and completely athyroid in appearance, very densely setiferous and glandular; sporangia naked, with annuls of 12–18 thickened cells; spores bilateral, tubercular or reticulate, light brown.

Terrestrial in sunny places or in light shade usually along road or on smooth slope; rather rare at the southernmost edges of Honshu, Shikoku, Kyushu and throughout the northern and central Ryukyus.

Distribution: endemic so far to the regions cited above.

EATON described *Athyrium cystopteroides* on the basis of the WRIGHT's collection from the northern Ryukyus. I have examined two sheets of *Wright* 1853–56 which are the isosyntypes of this species. The description given by EATON is very insufficient and gives less informations upon the important features of this species. From the description given by him, we can read that the form of the pinnae of his species is "ovato-lanceolatis acutis pinnatipartitis, segmentis (basilaribus nunc liberis) ovatis obtusis ....." These accord, however, with both the preceding and this species. In an isotype specimen in CAL, there are found the three species: the left is *T. glanduligera* and the right lower is this species, *T. cystopteroides*; and the other plants are those called as *D. miyagii*, which is the preceding species. In the other isotype in US, we can found only two fronds without rhizome: the left is *T. glanduligera* and the right is the preceding species. The localities are different in these two specimens and in the original publication. Moreover, EATON described var. *elatius* at the same time basing on the same sheet of specimen. As easily known from the diagnosis given, this variety is a larger form of his species, but there is no conclusive remarks whether this variety is *T. glanduligera* or *T. angustifrons*.

To give an order to such confusion, I prefer to direct the type specimen of *Athyrium cystopteroides* as that representing the specimen which is defined by the description given above, and that of var. *elatius* representing the preceding species. Thus, when the preceding species will be regarded as a variety of *T. glanduligera*, the epithet, *elatius*, should correctly be used in accordance with the principle of rank priority in the international code of nomenclature. Similarly, var. *abbreviatum* is the first name of the plants of this speices in the rank of variety.

Subgen. *Cyclosoriopsis* K. IWATS.

Among a hundred and fifty species belonging to this subgenus, only six are

known in the regions now under consideration.

26. **Thelypteris dentata** (FORSK.) ST. JOHN, Amer. Fern Journ. **26**: 44. 1936.——*Polypodium dentatum* FORSK. Fl. Aegypt. 185. 1775. Type: Aegypt, *Forskal.*——*Cyclosorus dentatus* (FORSK.) CHING, Bull. Fan Mem. Inst. Biol. 8: 206. 1938; TAGAWA, Acta Phytotax. Geobot. **16**: 176. 1956, Col. Ill. Jap. Pterid. 116, 195. 1959; OHWI, Fl. Jap. Pterid. 102. 1957.

Dryopteris oblancifolia TAGAWA, Acta Phytotax. Geobot. **5**: 190. 1936. Type: Urai in Taiwan, *Tagawa 253* (KYO!).——*Cyclosorus oblancifolius* (TAGAWA) TAGAWA, Acta Phytotax. Geobot. **16**: 50. 1955; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 175. 1939.

Caudex erect or very short creeping, thick. Stipes approximate, 2–5 in tuft on a caudex, terete, stramineous, hirsute throughout, rather densely scaly at base, 10–30 cm long. Laminae typically oblong lanceolate, acute to acuminate at apex, widest at middle or a little lower portion, gradually narrowing downwards, 25–40 cm long, 7–15 cm wide; pinnae 10–20 in pairs, rather remote or not, larger ones narrowly oblong to linear subtriangular, caudately acuminate at apex, broadly cuneate to truncate at sessile or very shortly petiolulate base, to 1.5 cm wide, pinnatifid two-fifths to a half way down to costae; lobes round quadrangular, oblique, round obtuse, round or moderately acute at apex, usually 2–3 mm broad; texture soft papyraceous, light green to pale yellow green, both surfaces hirsute rather densely; the basal veinlets uniting with those of opposite groups, the conjugated veinlets running to distinct callose membrane at bottom of sinus between lobes, the second anterior veinlets running to the callose membrane, others reaching the very margin of lobes. Scales on rhizome and at base of stipes linear subtriangular with very long tails, 5–8 mm long, 0.7 mm broad, brown or pale brown, brilliant, soft herbaceous, shortly setiferous at margin; hairs rather dense everywhere on plants, setose, various in size, to 1 mm but usually 0.3–0.6 mm long, unicellular but longer ones bearing occasional septae, hairs on laminar surfaces very short, 0.1 mm or so in length. Sori round on prominent, oblong receptacles, supramedial, indusiate; indusia persistent, round reniform, with entire margin, to 1 mm in diameter, densely setiferous; spores bilateral, tubercular, dark brown.

Terrestrial on dry or humus-rich floor of light forest or more often along road in open places; rather rare in southernmost Japan, rather common in the Ryukyus and in Taiwan.

Distribution: widely known from the tropics throughout the world.

27. **Thelypteris boninensis** (KODAMA ex KOIDZ.) K. IWATS. Acta Phytotax. Geobot. **21**: 41. 1964.——*Dryopteris boninensis* KODAMA ex KOIDZ. Bot. Mag. Tokyo **38**: 109. 1924. Lectotype: Mt. Funaki-yama on Isl. Haha-jime in Bonin, *H. Hattori s. n.* (TI!).

Cyclosorus extensus H. ITO, Bot. Mag. Tokyo **51**: 713. 1937, excl. basyon.

Rhizome ascending or short creeping, thick, bearing the stipes approximately. Stipes stramineous, 60–100 cm long, about 1 cm in diameter near the base. Laminae oblong lanceolate, acute at apex, 100–130 cm or more long, 35–50 cm wide at middle

portion; pinnae more than 30 in pairs, usually basal two pairs distinctly reduced, longest in basal 6–10th pairs, larger ones patent, lobed about three-fourths way down to costae, up to 30 cm long, 2.5 cm wide, linear lanceolate, acuminate at apex, broadly cuneate or subtruncate at base, sessile or very shortly stalked, basal pinnules not or slightly larger than the next ones; lobes oblique, round or moderately acute at apex, subentire, more than 5 mm in breadth; veins 7–10 pairs, only one basal pair regularly uniting with that of the contiguous group, the second anterior one (sometimes the second posterior veinlet as well) run to the callose membrane; rachis very sparsely scaly, rachis, costa and veins of both sides as well as the margin of lamina hairy, laminar surfaces glabrous, the underside glandular with brilliant red, small, rod-shaped, sessile glands. Scales on rhizome rather dense, persistent, linear lanceolate, 15 mm or more in length, about 1.5 mm broad at base, brown, herbaceous, pubescent on both surfaces. Sori medial or submarginal, practically on every veins (sometimes lacking on the basal pairs), round, indusiate; indusia small, up to 0.5 mm in diameter, persistent, densely hairy; spores bilateral, tubercular, dark brown.

Terrestrial on humus-rich floor of light forest; not so rare at lower elevation of the Bonins. Endemic.

28. **Thelypteris parasitica** (L.) K. IWATS. Journ. Jap. Bot. **38**: 315. 1963.——*Polypodium parasiticum* L. Sp. Pl. II, 1990. 1753. Type: Kwangtung, *Osbeck.*——*Aspidium parasiticum* (L.) Sw. Schrad. Journ. Bot. **1800** (2), 35. 1801; MATSUM. Ind. Pl. Jap. I, 384. 1904.——*Dryopteris parasitica* (L.) O. KTZE. Rev. Gen. Pl. II, 811. 1891; OGATA, Icon. Fil. Jap. IV, pl. 174. 1931.——*Cyclosorus parasiticus* (L.) FARW. Amer. Midl. Natur. **12**: 259. 1931; CHING, Bull. Fan Mem. Inst. Biol. **8**: 201. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 176. 1939; OHWI, Fl. Jap. Pterid. 103. 1957; TAGAWA, Col. Ill. Jap. Pterid. 116, 196. 1959.

Dryopteris mollis var. *subglabra* HOSOKAWA, Trans. Nat. Hist. Soc. Formos. **26**: 78. 1936. Type: Dublon on Isl. Truck in Caroline, *Hosokawa 6583.*

Cyclosorus parasiticus f. *boninensis*, f. *latilobus*, f. *pilosissimus* et f. *subglaber* H. ITO, Bot. Mag. Tokyo **51**: 727. 1937, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 178. 1939.

Cyclosorus parasiticus var. *formosanus* CHING, Bull. Fan Mem. Inst. Biol. **8**: 205. 1938. Type: Urai in Taiwan, *Faurie 105.*

Rhizome very wide creeping, irregularly branching, about 4 mm in diameter. Stipes 1–2 cm apart from each other, terete, stramineous or faintly reddish, pubescent, scaly at base, 30–70 cm long. Laminae oblong or oblong lanceolate, acute to acuminate at apex, round at base, up to 80 cm long, 35 cm wide; pinnae 20 or more in pairs, middle ones patent and arcuate, linear lanceolate, attenuate at apex, truncate or cordate at subsessile base, pinnatifid to a half to two-thirds way down to costae, usually 1.5–2.0 cm wide, lower two or three pairs not or a little reduced, deflexed; lobes oblong, oblique, moderately acute to acute at apex, 3 mm or so in breadth; texture soft papyraceous, green or pale green, densely hirsute on both surfaces; the basal pair of veinlets united below the sinus, conjugated veinlets

excurrent to callose membrane, the others reaching the very margin of lobes. Scales on younger parts of rhizome and at base of stipes, rather dense, linear with very long tails, to 1.3 mm long, 0.8 mm broad, brown, opaque, entire, sparsely hairy at margin and on abaxial surfaces; hairs dense throughout plants, setose, pale, transparent, unicellular but occasionally septate in longer ones, to 1.2 mm long. Sori round on round receptacles, medial or supramedial, indusiate; indusia round reniform, entire at margin, persistent, densely hairy; spores bilateral, reticulate, dark brown.

Terrestrial on humus-rich floor of forests in light shade; common in southernmost Japan southwards to Taiwan.

Distribution: tropics of East Asia.

ITO distinguished several formae taking up such characteristics as pubescences, size of fronds, texture and the breadth of pinnae and segments. As repeatedly discussed everywhere, these features are quite variable in the plants of thelypteroid species and are unable to serve as diagnostic characters to separate any taxon.

Var. *formosanus* is discriminated from type variety by an unusually large size. However, the size of this species is not so constant, and larger fronds (stipe 75 cm long, the base 5 mm in diameter, laminae to 80 cm long, middle pinnae about 14 cm long) are found not unusually.

29. **Thelypteris subpubescens** (BLUME) K. IWATS. comb. nov.——*Aspidium subpubescens* BLUME, Enum. Pl. Jav. 149. 1828. Type: Java.——*Cyclosorus subpubescens* (BLUME) CHING, Bull. Fan Mem. Inst. Biol. **8**: 211. 1938; HOLTT. Fl. Malaya II, 273. 1954; TAGAWA, Acta Phytotax. Geobot. **16**: 177. 1956, Col. Ill. Jap. Pterid. 116. 196. 1959; K. IWATS. Acta Phytotax. Geobot. **18**: 116. 1960.——*Cyclosorus parasiticus* var. *subpubescens* (BLUME) C. CHR. et TARD. Not. Syst. **7**: 7. 1938, in LECOMTE, Fl. Gén. Indo-Chine **7** (2): 382. 1941.

Aspidium jaculosum CHRIST, Bull. Herb. Boiss. II, **4**: 615. 1904. Type: Kelung, Taipeh and Kushak in Taiwan, *Faurie 646*, *657* et *840* (Isosyntypes in KYO!).——*Cyclosorus jaculosus* (CHRIST) H. ITO, Bot. Mag. Tokyo **51**: 725. 1937, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 172. 1939.

Rhizome rather wide creeping, 4 mm or more in diameter, scaly. Stipes not remote, terete, stramineous with dark brownish base, 10–20 cm long, scaly at base, hirsute throughout. Laminae oblong oblanceolate, acuminate at apex, the lower pinnae gradually narrowing downwards, 45–75 cm long, 17–30 cm wide; pinnae 10–17 pairs, the lower 2–4 reduced pairs rather remote, to 7 cm from each other, the larger ones linear subtriangular, oblique and straight, long attenuate at apex, broadly cuneate at sessile base, the basal pinnules enlarged, pinnatifid almost to a half way to costae, the apical pinna distinct, large, to 15 cm long; lobes oblong subdeltoid, oblique, round and mucronate or moderately acute at apex, 3.5–4.5 mm broad; texture papyraceous, pale green, pubescent; 2.5 pairs of veinlets usually uniting below the callose sinus, the others running to the very margin of lobes. Scales linear with long tail, up to 5 mm long, 0.6 mm broad, soft herbaceous, brown, opaque, rather densely pubescent at margin and on abaxial surface; hairs rather

variable in density, usually rather dense on axes and at margin of lobes, laminar surfaces subglabrous or very minutely pubescent, hairs all setose, unicellular, pale and transparent. Sori round on punctate receptacles, medial, indusiate; indusia round reniform, to 1.3 mm in diameter, hirsute; spores bilateral, reticulate or tubercular, dark brown.

Terrestrial along road in light forest, at lower elevation; rather rare in southern Kyushu, the Ryukyus and Taiwan.

Distribution: Southeast Asia to Malaysia.

Continental plants of *T. subpubescens* are noted both by CHING (1938) and by HOLTTUM (1954) as having the short, oblique or decumbent, or somewhat creeping rhizome. On the contrary, Japanese and Taiwan plants identified to this species, including the types of *Aspidium jaculosum*, have long creeping rhizome. Excepting this distinction in rhizome structure, however, Japanese and Taiwan plants are quite identical with the continental ones concerning the morphology of the aerial parts of plants. Further investigation is impossible at present, for the most herbarium specimens lack the under ground portions.

Cyclosorus latipinnus of continental southeastern Asia (also in Malaysia, probably) is once combined with *C. subpubescens* by CHRISTENSEN and CHING, but adequately separated from this by HOLTTUM and TARDIEU-BLOT, who have taken up such discriminative features as: much smaller size (having up to 18 pairs of pinnae), less deeply lobed pinnae (lobing about 1/3 way towards the costae), one and a half pairs of veinlets truely anastomosing, and practically glabrous lower surfaces as well as the distinction in their habitat. There are some smaller plants in the Ryukyus and South Japan, but they do not like *C. latipinna*. Besides the features noted by HOLTTUM, some slight differences may be added, such as: in *C. latipinna*, pinnae are rather oblique, forming the angles of less than 60° with rachis, the apices of lobes are round or even obtuse; in the other species, on the contrary, the pinnae patent, forming almost right angles to rachis, the apices of lobes are usually moderately acute to acute.

Tagawa 2739 and *2779* (both from Taiwan) are fairly different from the typical *C. subpubescens*, especially in their pubescence. However, they may not warrant a specific or even varietal separation from this species. It seems better to regard them as the variants of this widespread and rather variable species.

Allied to *T. subpubescens*, there are several species in the East Asiatic regions. Some of them may be distinguished by the characteristics found in the following key.

A A few pairs of lower pinnae reduced to form butterfly-like auricles.
  B Rhizome more or less creeping or suberect; rhizome scales narrow, lanceolate, herbaceous.
    C Large plants; pinnae patent, at about right angles to rachis, more or less hairy on the lower surface.
      D 1.5 pairs of veinlets truely anastomosing.
        E Pinnae lobed 1/3 to 1/2 way towards costae, very sparsely hairy on lower surface.....*T. subpubescens.*

E Pinnae lobed only 1/4 to 1/3 way towards costae, densely pubescent on lower surface, lower pinnae somewhat rhomboid. ..... *T. ensifer.*

D More than 2 pairs of veinlets truely anastomosing. ..... *T. gustavi.*[3)]

C Small plants; pinnae oblique, at acute angles to rachis, almost glabrous on lower surface. ..... *T. latipinna.*

B Rhizome erect, arborescent; rhizome scales round-subtriangular, membranous. ..... *T. papilio.*

A The basal pair of pinnae deflexed, not reduced. ..... *T. namburensis.*

30. **Thelypteris papilio** (HOPE) K. IWATS. comb. nov.——*Nephrodium papilio* HOPE, Journ. Bomb. Nat. Hist. Soc. **12**: 625. 1899. Type: Panjab, *Hope.*——*Cyclosorus papilio* (HOPE) CHING, Bull. Fan Mem. Inst. Biol. **8**: 214. 1938; TARD. ex C. CHR. & TARD. Not. Syst. **7**: 74. 1938; TAGAWA, Acta Phytotax. Geobot. **8**: 170. 1939, **9**: 146. 1940.

Caudex erect, to a half meter tall, to 1 cm in diameter. Stipes caespitose, terete, stramineous with dark brownish base, to 25 cm long, sparsely scaly, hirsute throughout. Laminae oblong lanceolate, acuminate at apex, lower pinnae gradually shorter, 80–110 cm long, 25–35 cm wide; basal 2–5 pairs of pinnae reduced to mere butterfly-like pinnae, to 8 cm apart from each other, the larger pinnae about 25 in pairs, linear subtriangular, long attenuate at apex, widest and broadly cuneate at sessile base, pinnatifid two-fifths to a half way to costae, the basal lobes not or a little enlarged, apical pinnae distinct, to 15 cm long; lobes subdeltoid or subquadriangular, oblique, round or moderately acute at apex, to 5 mm broad; texture papyraceous, pale green, subglabrous on both surfaces; 1.5–2.5 pairs of veinlets uniting below the callose sinus; the others running to the very margin of lobes. Scales oblong subdeltoid, to 5 mm long, 2 mm broad, membranous, appressed, very sparsely hairy at margin; pubescences rather dense on every axis and on laminar surfaces, 50 μ long, setose, pale and transparent, longer hairs very sparse. Sori round on oblong receptacles, medial, indusiate; indusia round reniform, immersed among sporangia in matured condition, to 0.7 mm in diameter, densely pubescent; spores bilateral, tubercular, dark brown.

Terrestrial on humus rich floor of forest at middle elevation of Taiwan, rather rare.

Distribution: Himalayan regions.

This species has been said to be distinguished from *T. subpubescens* only by the difference in the structure of rhizome: rhizome of *T. papilio* is erect and subarborescent, whereas that of the other species is creeping. Adding to this, another prominent diagnostic feature is seen in the rhizome scales, which are round-subtriangular and membranous in *T. papilio* in spite of being narrow lanceolate and herbaceous in *T. subpubescens.*

---

3) CHING (1938) noted that the indusium is glabrous of this species. In an isotype specimen in US, however, pinnae are minutely pubescent on the underside and the indusium is distinctly setiferous.

31. **Thelypteris ensifer** (TAGAWA) K. IWATS. Acta Phytotax. Geobot. **21**: 40. 1964.——*Dryopteris ensifer* TAGAWA, Acta Phytotax. Geobot. **6**: 89. 1937. Type: Kusukusu in Taiwan, *Tagawa 943* (KYO!).

Dryopteris sophoroides f. *ensipinna* HAYATA, Icon. Pl. Formos. IV, 180. 1914. Type: Koshun in Taiwan, *K. Miyake s. n.* (TI!).

Dryopteris latipinna (HOOK.) O. KTZE. sensu HAYATA, Icon. Pl. Formos. VIII, 149. 1918.

Rhizome short creeping, more than 4 mm thick, densely scaly at apex. Stipes near to each other, terete, stramineous, scaly at base, hairy throughout, (15-) 20-35 cm long. Laminae oblong lanceolate, attenuate at apex, not or gradually narrowing downwards, 20-30 cm long, (7-) 15-20 cm wide; lateral pinnae 5-7 in pairs, lanceolate with truncate or slightly subcordate base, attenuate at apex, widest at two-thirds way from base, up to 15 cm long, 2.5 cm wide, sometimes forming rhomboid outline, or becoming narrow less than 1 cm, pinnatifid one-third or a half way to costae; apical pinnae much distinct, large, up to 17 cm long (almost as long as or even longer than the lower lateral pinnae), linear subtriangular, long attenuate; ultimate lobes round subdeltoid, oblique, moderately acute at apex, 3-5 mm broad; texture papyraceous, light blue green, hirsute; 2.5-3.5 pairs of veinlets actually united below or at bottom of callose membrane between lobes, setiferous. Scales linear subtriangular, tailed at apex, about 5 mm long, to 1 mm broad, brown, opaque, soft herbaceous, densely hirsute at margin and on abaxial surface; hairs setose, pale, unicellular, very dense throughout plants, the larger 0.5 mm, the shorter 0.1 mm or so in length, all patent. Sori round on prominent, oblong receptacles, medial to supramedial, indusiate; indusia round reniform, persistent, to 0.8 mm in diameter, very densely setiferous; spores bilateral, reticulate, brown.

Terrestrial on humus-rich floor of dense forest at lower elevation of Taiwan, rare. Endemic.

The lower lateral pinnae of this species have the same appearance as those found in the case of *T. acuminata* var. *kuliangensis*.

Subgen. *Glaphyropteridopsis* (CHING) K. IWATS.

Sect. *Glaphyropteridopsis*.

This and the following sections are as a whole the Asiatic representatives of Sect. *Euglaphyropteris* ITO (1939) or of group 7 and 8 of CHING (1936). CHING divided the members into two groups, chiefly based upon the features whether the sori are indusiate or naked. As noted on the pages under *T. erubescens*, CHING misobserved and noted that *T. rufostraminea*, the closest ally of that species, has naked sori. The presence of indusia should not be the conclusive feature to devide the species group of this series. The two groups differ in some other respects than indusia, for instance the form and size of lower pinnae or the length of rhizome, and the taxonomic separation may be acceptable as done by CHING.

This section is characterized by naked or obsoletely indusiate sori and ample fronds having the lower pinnae not so distinctly reduced. Two other species, *T. rufostraminea* and *T. tonkinensis*, are known to this group, the range of which

extends to Southeast Asia and Malaysia. These three may be distinguished from each other by the features summarized in the following key.

A Sori entirely exindusiate, sporangia glabrous; basal anterior veinlets or sometimes posterior ones also, running into the collose sinus between the adjacent segments.
  B Plant more or less setose hairy at least on rachis and upperside of leaves; sori subcostal, confluent into a costal line at maturity; basal pair of veinlets running obliquely towards sinus. ..... *T. erubescens.*
  B Plant glabrous throughout; sori medial, not confluent; basal pair of veinlets running ascending towards sinus. ..... *T. tonkinensis.*
A Indusia present but obsolete, sporangia setiferous with 3–5 setose hairs; basal pair of veinlets running to the margin a little above the very bottom of sinus. ..... *T. rufostraminea.*

32. **Thelypteris erubescens** (WALL. ex HOOK.) CHING, Bull. Fan Mem. Inst. Biol. **6**: 293. 1936; C. CHR. & TARD. in LECOMTE, Fl. Gén. Indo-Chine **7** (2): 370. 1941; K. IWATS. Acta Phytotax. Geobot. **18**: 13. 1959.——*Polypodium erubescens* WALL. ex HOOK. Sp. Fil. IV, 236. 1862. Type: Nepal, *Wallich 330* (Isotype in US!).——*Glaphyropteris erubescens* (WALL. ex HOOK.) FÉE, Crypt. Vasc. Brésil. **2**: 41. 1872; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 146. 1939. ——*Dryopteris erubescens* (WALL. ex HOOK.) C. CHR. Ind. Fil. 263. 1905; HAYATA, Icon. Pl. Formos. V, 275. 1915.——*Lastrea erubescens* (WALL. ex HOOK.) COPEL. Gen. Fil. 138. 1947, Fern Fl. Phil. II, 329. 1961; TAGAWA, Col. Ill. Jap. Pterid. 111, 220. 1959.——*Glaphyropteridopsis erubescens* (WALL. ex HOOK.) CHING, Acta Phytotax. Sin. **8**: 320. 1963.

Dryopteris reflexa CHING, Bull. Fan Mem. Inst. Biol. **2**: 193. 1931. Type: Mengtze in Yunnan, *Hancock 36* (US!).

Caudex massive, erect, 3–5 cm or more in diameter. Stipes caespitose, to 1 cm in diameter at base, 1 m or more in length, scaly at base, glabrescent, stramineous, polished. Laminae oblong lanceolate, acute at apex, 0.7–1.3 m long, 40–70 cm wide; lower 2–4 pairs a little shortened than the next above, prominently deflexed, the innermost several pinnules reduced to form attenuate base of pinnae; middle larger pinnae about 20 in pairs, about 4 cm from each other, linear, attenuate and tailed at apex, truncate at sessile base, to 35 cm long, 4 cm wide, deeply pinnatifid nine-tenths way to costae, upper pinnae gradually reducing towards apex; distinct aerophore occurring at each base of costae underneath, to 5 mm long, fleshy; segments narrowly oblong, oblique or falcate, acute or moderately acute at apex, entire, up to 2 cm long, 4 mm broad; veinlets 7–15 in pairs, all simple, the basal pair running to the callose membrane, the others reaching the very margin of lobes; texture soft coriaceous, glabrous, grass green to yellow green. Scales membraneous, adpressed to apical portion of rhizome or basal surface of stipes, oblong or round subdeltoid with tails, rather irregular in size and form, brown, sparsely hairy; hairs rather sparse on every axis and at margin of lobes, setose, unicellular. Sori round on punctate receptacles, costular, naked, confluent with adjacent ones in matured

condition; sporangia naked; spores bilateral, reticulate, dark brown.

Terrestrial in wet muddy places of deep forest at middle elevation of Taiwan and at lower elevation on Isl. Yakushima off Kyushu.

Distribution: North India, Southwest China, Tonkin and Laos, and Malaysia.

Distinctness of this large and handsome fern has been recognized by various authors since WALLICH (1828) gave this name to his Nepalian specimen. Various figures and illustrations were given by BEDDOME (1867), HAYATA (1915), ITO (1939, 44), TAGAWA (1959) and others. The plants in our regions are quite identical with the Nepalian type and the other continental specimens.

Thelypteris rufostraminea of South China seems to be the closest ally of *T. erubescens*. The former is separated from the latter by the difference in the lower pinnae being usually not distinctly reflexed nor reduced, more densely setiferous underside of leaves, costular sori consisting of the setiferous sporangia and the presence of small fugaceous indusia[4]. The basal pair of veinlets of *T. rufostraminea* runs to the margin of lobes a little above the very bottom of sinus, though in the other species basal anterior veinlets, or sometimes posterior ones also, run into the callose sinus between the adjacent segments. I have not the chance of examining any specimen of *T. tonkinensis* which is said to be distinct from the above two species in having creeping rhizome, glabrous leaves with free apical pinnae, round sori placed medially and not confluent with each other. Concerning the lower pinnae, CHING (1936) noted that the lower several pairs of pinnae are narrowed towards base, whereas TARDIEU-BLOT (1941) gave the description that the lower pinnae are not reduced; I can not give here a definite information about this.

Sect. *Mesoneuron* (CHING) K. IWATS.

In continental Southeast Asia including the adjacent islands, 16 species are known to this section. They may be subdivided into the following three groups and distinguished from each other by such features as summarized in the key given below.

1. Group of *T. crassifolia*, characterized by a peculiar venation, the posterior basal veinlets springing not from the costules but from the costae, and by petioled and not reduced lower pinnae. The area of this group is Malaysia, three species being known in Malay Peninsula and the adjacent continental regions.

2. Group of *T. ciliata*, a group of small ferns with less finely dissected pinnae, the lower ones being not prominently reduced. Only two species are indigenous to the continental Asia: *T. ciliata* of South China, North India, Indo-China, Burma and Peninsular Malaya, and *T. cana* of India, the latter being less distinct from

[4] CHING (1936, p. 292) notes that *T. rufostraminea* is exindusiate. As noted correctly by CHRIST in his original description, however, this species has small indusia, which are densely hairy at margin and hardly visible under a hand lens being almost covered by the long needlelike hairs of sporangia. I have found these setiferous indusia in all the specimens I have examined. They are: Szechuwan, Mt. Omei, *Fang 2008*, *2610*, *3174* and *3176* (all in US); Nepal, between Narku and Ila, *Polunin et al. 3204* (KYO); this latter is the first record of this species from Nepal.

the former species. *Thelypteris zeylanica* is the species endemic to Ceylon and *T. caudipinna* to Hainan. *Thelypteris calcarata* and others are known in Malaysia and Polynesia.

3. Group of *T. repens*, a different group having reduced lower pinnae. *Thelypteris esquirolii*, a variable species found in Japan and adjacent regions, is an ally of Himalayan *T. repens*, to which related also *T. falciloba* of South China and adjacent regions and *T. ochthodes* of South India. *Thelypteris latipinna* and *T. duclouxii* are hardly distinct from *T. esquirolii*. *Thelypteris xylodes* and *T. tuberculifera* are closely related to each other, and are the members of this group.

A Pinnae long petiolate at least the lower ones; basal posterior veinlets usually springing from costa.
  B Pinnae 2–4 cm wide, incised a half to three-forths way down to costa, segments 5–10 mm wide; posterior basal veinlets springing from costa 1–5 mm apart from base of costule; texture thick and rigidly coriaceous.
    C Pinnae incised three-fourths way to costae, segments to 7 mm broad; sori inframedial. ..... *T. crassifolia.*
    C Pinnae incised a half way to costae, segments to 10 mm broad; sori inframedial. ..... *T. motleyana.*
  B Pinnae about 2 cm wide, deeply incised to a wing to the costae 1–2 mm in width, segments 3–4 mm wide; posterior basal veinlets springing from costae close to base of costule; texture thin. ..... *T. chlamydophora.*
A Pinnae generally sessile or subsessile; texture not so thick; basal veinlets usually springing not from costae.
  B Basal pinnae as long as those next above, or sometimes somewhat shorter.
    C Indusia glabrous.
      D Fronds simply pinnate; pinnae generally below 0.5 cm broad, long attenuate towards base, margin inciso-serrate above the middle. .... *T. zeylanica.*
      D Fronds bipinnatifid; pinnae generally over 1 cm broad, not so attenuate towards base.
        E Segments very oblique, acute at apex; plants small. .... *T. calcarata.*
        E Segments patent, obtuse at apex; plants larger, with the pinnae more than 3 cm broad. ..... *T. latiloba.*
    C Indusia generally more or less hirsute.
      D Pinnae caudate, 8–10 cm long; costae underneath pustulate-puberulous; segments subpatent; indusia with a few hairs..... *T. caudipinna.*
      D Pinnae acute to acuminate; costae underneath with needlelike setose hairs; segments oblique; indusia copiously setose hairy.
        E Middle pinnae usually 4–6 cm long, generally to 1 cm broad above base, incised a half to two-thirds way down to costae; veinlets 3–5 pairs in segments. ..... *T. ciliata.*
        E Pinnae 8–10 cm long, over 1.5 cm broad, pinnatifid nearly down to costae; veinlets 7–8 pairs in segments. ..... *T. cana.*

B Lower pinnae suddenly reduced into prominent aerophores along stipe; costae underneath subglabrous.
C Pinnae more than 25 cm long, 2.5 cm broad. ..... *T. tuberculifera.*
C Pinnae less than 15 cm long, 1.5 cm broad. ..... *T. xylodes.*
B Lower pinnae gradually shortened, a few lowest pairs being butterfly-shaped.
C Pinnae more than 20 cm long, 2 cm broad.
D Sori medial; veins less prominently raised below; texture subcoriaceous. ..... *T. esquirolii.*
D Sori submarginal; veins very prominently raised below; texture coriaceous. ..... *T. duclouxii.*
C Pinnae usually 10–15 cm long, 1–2 cm broad.
D Aerophores at base of lateral pinnae prominent; costae underneath densely persistent hairy, hairs 0.8–1.0 mm long.
E Pinnae deeply incised almost to costae, segments very oblique at about 40° to costae; basal posterior veinlets running to the margin of lobes at a long distance above sinus. ..... *T. falciloba.*
E Pinnae incised about three-fourths to five-sixths way down to costae, segments patent at about 80° to costae; basal posterior veinlets running to the margin of lobes at a short distance above sinus. ..... *T. ochthodes.*
D Aerophores at base of lateral pinnae less prominent; costae underneath minutely pubescent or subglabrous, or hairy with the hairs less than 0.5 mm long.
E Segments oblique, veins forming angles of usually 50–60° with costae; lamina above glabrous except on axes..... *T. esquirolii* var. *glabrata.*
E Segments patent, veins forming angles of usually 70–80° with costae; lamina above shortly setose hairy. ..... *T. repens.*

33. **Thelypteris esquirolii** (CHRIST) CHING, Bull. Fan Mem. Inst. Biol. **6**: 301. 1936.——*Dryopteris esquirolii* CHRIST, Bull. Acad. Géogr. Bot. **1907**, 144. Type: Kwei-yang in Kweichow, *Esquirol 903.*——*Lastrea esquirolii* (CHRIST) COPEL. Gen. Fil. 138. 1947.——*Pseudocyclosorus esquirolii* (CHRIST) CHING, Acta Phytotax. Sin. 8: 324. 1963.

Dryopteris eberhardtii var. *glabrata* CHRIST, Not. Syst. **1**: 37. 1909. Type: Tsoong Shan in Yunnan, *Ducloux 88.*

Thelypteris subochthodes CHING, Bull. Fan Mem. Inst. Biol. **6**: 305. 1936. Type: Tai-mo Shan in Kwangtung, *Tsang 21260* (Isotype in KYO!).——*Lastrea subochthodes* (CHING) TAGAWA, Acta Phytotax. Geobot. **16**: 78. 1956, Col. Ill. Jap. Pterid. 111, 223. 1959; OHWI, Fl. Jap. Pterid. 96. 1957.——*Pseudocyclosorus subochthodes* (CHING) CHING, Acta Phytotax. Sin. 8: 325. 1963.

Nephrodium prolixum (WILLD.) DESV. sensu MATSUM. Ind. Pl. Jap. I, 323. 1904.

Dryopteris ochthodes auct. jap.; OGATA, Icon. Fil. Jap. III, pl. 125. 1930.

Dryopteris ligulata (J. SMITH) O. KTZE. sensu KOIDZ. Bot. Mag. Tokyo **38**: 112. 1924.

Glaphyropteris falciloba H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 147, 1939, excl. basion.

Rhizome short creeping, irregularly branching, very thick, sometimes more than 1 cm in diameter, dark, rather sparsely scaly, bearing wiry roots of up to 1 mm in thickness. Stipes almost contiguous to or a little remote from each other, thick, sometimes up to 1.5 cm in diameter at very base, stramineous or somewhat brownish towards the base, subglabrous and variously scaly at lower portions, rather densely hirsute upwards. Fronds up to 2 m, sometimes still longer, including stipes, 40–60 cm wide, laminae broadly lanceolate, gradually narrowing towards both apice and base; pinnae patent or more usually forming an angle of about 60° with rachis, distinct aerophores present at base of costae, to 5 mm in length; lower pinnae gradually reduced to butterfly-shape and at last to mere aerophores along stipes; middle pinnae the largest, up to 30 cm long, 2.0–3.0 cm wide, linear, gradually narrowing and slightly falcate towards caudately acute apex, truncate and more or less dilated at sessile base, deeply lobed to about five-sixths way to costae, bearing up to 60 pairs of segments; upper pinnae gradually becoming smaller, the apical pinnae not distinct; segments linear, more or less falcate, oblique, usually forming the angles of 50–60° with costae; lobes acute at apex, up to 1.8 cm long, 2.5–3.5 mm broad, the margin subentire or crenulate usually recurved to some extent; the callose membrane somewhat distinct at bottom of sini between adjoining segments; texture subcoriaceous or coriaceous; laminar surfaces almost glabrous, or very sparsely setiferous, on both sides except on veins and at margin, obscurely verrucose on under surface; veinlets simple, usually up to 12 pairs in larger segments, reaching the very margin of lobes, the anterior basal veinlets usually running to the margin of lobes a little above the sinus membrane. Scales usually sparse on rhizome and at basal poriton of stipes, light brown, membranous, ovate subtriangular or somewhat irregular in outline, entire or sometimes uneven at margin, glabrous; hairs rather dense on the upper parts of stipes, rachis, costae, veins, veinlets and at margin of lobes, rather sparse on the underside of leaves, setose and straight, all unicellular, 0.2–1.0 mm long, pale. Sori supramedial, or rarely medial, round, indusiate; indusia persistent, reniform, about 0.7 mm in diameter, entire but more or less undulate at margin, glabrous or rarely setiferous; sporangia glabrous; spores bilateral, irregularly tubercular or echinulate, brown.

Terrestrial in wet places usually along stream in open places or in light shade; common at lower elevation of southern Honshu, Shikoku, Kyushu, southern Korea, the Ryukyus and Taiwan.

Distribution: South China and North India.

The nomenclature of the plants in our regions belonging to this group has long been remained to be uncertain even in the comprehensive work by Ching (1936) who enumerated three species in this group in the regions now under consideration: *T. falciloba*, *T. esquirolii* and *T. subochthodes*. These plants have been regarded to belong to one species by all Japanese taxonomists except only Koidzumi (1924). Really, no specific difference are detected among those plants, though extreme forms are sometimes taking very distinct appearances. The size and hairiness are

highly variable in these plants: the plants in central Japan are usually less than 1 m tall, but those in the Ryukyus and Taiwan are more than 1.5 m tall in full growth; the density of hairs are also the subject of great variation. Thus, the plants in our regions are better to be included in a single variable species, which may be divided into two varieties. The oldest specific epithet corresponding to these plants is *Dryopteris esquirolii* described from Kweichow.

Var. **esquirolii**.——*Dryopteris esquirolii* CHRIST, l. c.

Southernmost edge of Kyushu, the Ryukyus and Taiwan, fairly common.

Thelypteris latiloba and *T. duclouxii* are distinguished from *T. esquirolii* by larger size of their plants. Both of the first two species are represented only by the type specimen, which I have unfortunately had no chance to examine. CHING (1936) enumerated the distinguishing characteristics among them, but as noted on the above paragraphs, *T. esquirolii* is one of the most variable species including various types of variants. Concerning the size of plants, there are found not so rarely the larger variants having the pinnae more than 3 cm in width, the stipe thicker than a small finger, more coriaceous texture of fronds. The broader pinnae have usually the dilated base and glabrous and glossy under surface. *Thelypteris latiloba* is peculiar in having not reduced lower pinnae. In spite of this, the specific distinctness of both *T. latiloba* and *T. duclouxii* is highly disputable.

Another species related to *T. esquirolii* is Himalayan *T. tuberculifera* which is hardly different from *T. xylodes* except the difference in their size. *Thelypteris tuberculifera* is distinguished from *T. esquirolii* by the difference in the lower pinnae suddenly reduced into distinct aerophores, almost glabrous plants except the anterior portions of costae underneath and subcostal position of sori. These two species are distinct to each other, though I can find no specific distinctness between *T. tuberculifera* and *T. xylodes*.

Var. **glabrata** (CHRIST) K. IWATS. comb. nov.——*Dryopteris eberhardtii* var. *glabrata* CHRIST, l. c.

Thelypteris subochthodes CHING, l. c.

Southern Honshu, Shikoku and Kyushu, rather common in northern area of the distribution of this species; also known from Korea (Isl. Quelpaert) and China.

This variety differs from the type variety in no respect other than decidedly smaller size of plants. The segments of var. *glabrata* are usually more oblique and narrower being placed more sparsely and acuminate at apex. Rachis above is not so densely hirsute in this variety as in var. *esquirolii*. One who studies only a few herbarium sheets of specimens may easily recognize them as to be distinct even in the specific rank, though the examination of the numerous living plants in the fields gives no distinct specific discrimination between them.

I have not examined the type specimen of CHRIST's variety, var. *glabrata*, but the sole difference in hairiness is not worthy of taxonomic separation in the thelypteroid ferns. Japanese plants are rarely glabrescent, usually being rather dense pubescences on the axes and fronds underneath. At any rate, CHRIST's epithet given to the abberant form of this variety is correct to our ferns according to the Code of Botanical Nomenclature.

This variety seems to be closely related to *T. repens* of Himalayan regions. Distinctly from our ferns, *T. repens* may be discriminated as to have long creeping rhizome, patent segments placed on costae forming an angle of about 80°, medial sori, and hairy laminar surface. *Thelypteris xylodes* is another species related to ours, but different in such features as the lower pinnae suddenly reduced into distinct aerophores, less deeply incised segments, the sinus being about the depth of two-thirds of the segments, subcostal sori, the costae underneath subglabrous, both the anterior and posterior basal veinlets reaching the margin of leaves a little beyond the callose membrane at the sinus between the segments. Some specimens in our regions sometimes take appearance similar to that of *T. falciloba*, which is, however, very distinct from the variety in question to have very oblique segments, the veins forming an angle of about 40° with costae, medial sori and densely long hairy costae, and the prominent aerophores. Although *T. esquirolii* var. *glabrata* has been combined with *T. falciloba* and *T. ochthodes*, the nominal variety seems to be fairly different from these two and more closely allied to *T. repens*, which bears few discriminative features also from the type variety, var. *esquirolii*.

Sect. *Neocyclosorus* K. IWATS.

34. **Thelypteris taiwanensis** (C. CHR.) K. IWATS. comb. nov.——*Dryopteris taiwanensis* C. CHR. Ind. Fil. 297. 1905; OGATA, Icon. Fil. Jap. IV, pl. 177. 1931; TAGAWA, Acta Phytotax. Geobot. **6**: 157. 1937.——*Aspidium lobulatum* CHRIST, Bull. Herb. Boiss. II, **4**: 614. 1904, non BLUME 1828. Type: Taiwan, *Faurie 642* (Isotype in KYO !).——*Cyclosorus taiwanensis* (C. CHR.) H. ITO, Bot. Mag. Tokyo **51**: 728. 1937; CHING, Bull. Fan Mem. Inst. Biol. **8**: 181. 1938; K. IWATS. Acta Phytotax. Geobot. **18**: 114. 1960.

Dryopteris subhispidula ROS. Hedwigia **56**: 343. 1915. Type: Shakko in Taiwan, *Faurie 12* (Isotype in KYO !).

Cyclosorus heterocarpus (BLUME) TARD. et C. CHR. sensu H. ITO, Bot. Mag. Tokyo **52**: 590. 1938, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 168. 1939.

Caudex massive, erect, more than 5 cm with accumulated roots, scaly at apex. Stipes caespitose, terete, stramineous, dark brownish and slightly bulged at base, sparsely scaly and hirsute throughout, about 50 cm long including portions bearing rudimentary pinnae. Laminae oblong subtriangular, attenuate at apex, truncate at base, 50–80 cm long, to 30 cm wide, subdimorphic; lower several pinnae suddenly and extremely reduced to rudimental accessary; lateral pinnae 30 or more in pairs, about 2.5 cm apart from each other, linear subtriangular, attenuate at apex, broadly cuneate or subtruncate at sessile base with enlarged basal pinnules, pinnatifid to a half way to costae, up to 18 cm long, 1.0–1.5 cm wide, the upper pinnae gradually becoming smaller towards apex; aerophores present at base of costae underneath, fleshy, about 0.5 cm long; lobes oblong with round to moderately acute apex, oblique or falcate; usually lower two pairs of veinlets actually united at or below the sinus membrane, the others reaching the very margin of lobes; texture papyraceous, green to dark green, hirsute. Scales large, oblong subdeltoid with tails,

to 1.5 cm long, 3.5 mm broad, brown, soft herbaceous, hairy at margin and on both surfaces; hairs dense except on laminar surface underneath, pale, setose, unicellular, 0.2 mm or so in length, hairs on upper surface of costae distinct, very dense, up to 1 mm long, stiff, whitish; glands rather dense on laminae, yellow brown, round, sessile but not immersed. Sori round on punctate receptacles, medial or subcostular, to 1 mm in diameter in matured condition, indusiate; indusia round reniform, fugaceous, 0.6 mm in diameter, sparsely hairy; spores bilateral, tubercular or echinulate, dark brown.

Terrestrial in moist places along stream in dense forest; fairly common at lower elevations throughout the Ryukyus and Taiwan.

Distribution: South China (Kwangtung).

This is the species very closely related to *T. heterocarpa*, to which this has often been reduced. *Thelypteris heterocarpa* is subdimorphic, having the sterile fronds with broader pinnae and soft herbaceous texture and the fertile fronds with narrower pinnae and soft papyraceous or herbaceous texure. Contrary to this, *T. taiwanensis* is hardly dimorphic. The base of pinnae is, in this species, as broad as the middle part and large at the acroscopic side, but the pinnae are, in the other species, gradually narrowing towards the truncate base. Hairiness is not so different between these two species.

To the group of these species, we may safely include the Himalayan *T. crinipes*, which is distinct among the genus to have scaly rachis and costae.

Subgen. *Cyclosorus* (LINK) MORTON.

35. **Thelypteris gongylodes** (SCHKUHR) K. IWATS. comb. nov.——*Aspidium goggilodus* SCHKUHR, Krypt. Gew. I, 193. 1809. Type: Jamaica.——*Cyclosorus gongylodus* (SCHKUHR) LINK, Hort. Berol. **2**: 128. 1833; CHING, Bull. Fan Mem. Inst. Biol. 8: 186. 1938; OHWI, Fl. Jap. Pterid. 102. 1957; TAGAWA, Col. Ill. Jap. Pterid. 115, 196. 1959.

Aspidium unitum var. *hirtum* METT. Ann. Mus. Lugd. Bat. I, 8. 1864. Type: Florida, *Johnson.*——*Cyclosorus gongylodus* var. *hirtus* (METT.) FARW. Amer. Midl. Natur. **12**: 259. 1931; CHING, Bull. Fan Mem. Inst. Biol. 8: 187. 1938.

Aspidium unitum var. *glabra* METT. l. c. Type: India, *Griffith.*——*Cyclosorus gongylodus* var. *glaber* (METT.) H. ITO, Bot. Mag. Tokyo **51**: 714. 1937, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 167. 1939; CHING, Bull. Fan Mem. Inst. Biol. 8: 188. 1938.

Cyclosorus gongylodus f. *glaberrimus* et f. *paucipilosus* H. ITO, ll. cc.

Rhizome wide creeping, irregularly branching, 4–6 mm in diameter, blackish, subglabrous. Stipes 1–3 cm apart from each other, terete, brownish with dark base, glabrescent, 20–40 (–80) cm long. Laminae oblong lanceolate, round or moderately acute at apex, 30–50 cm long, 10–20 cm wide; lateral pinnae 20–30 in pairs, oblique or patent, linear lanceolate, acute at apex, round cuneate at base, sessile or shortly petiolulate, up to 15 cm long, 1.5 cm wide, pinnatifid one-forth to one-third way to costae, upper pinnae gradually narrowing towards apex, the apical pinnae distinct but small, like the uppermost lateral one, 3 cm long; ultimate lobes ovate

subdeltoid, apiculate at apex; veinlets 5–8 pairs, simple, lower 1.5 pairs actually uniting at or below the sinus membrane; texture soft coriaceous, deep green, glabrous on laminar surface; scales sparse, oblong subdeltoid, subentire, membranous, sparsely hairy at margin, up to 3 mm long, 1.5 mm broad, brown; hairs rather sparse on axes of fronds and at margin of lobes, setose, pale, unicellular, 0.1–0.3 mm long; glands sparse on laminae underneath, pale brown, round, sessile. Sori round on oblong receptacles, submarginal, confluent to the adjacent in matured condition forming submarginal strands of sori, indusiate; indusia round reniform, more or less fugaceous, 0.4 mm in diameter, densely hairy at margin; spores bilateral, echinulate, brown.

Terrestrial on very wet places or in marsh, usually in sunny places; southern Honshu, southern Shikoku, Kyushu, the Ryukyus and Taiwan, at lower elevations, locally fairly abundant.

Distribution: throughout the tropics of both the worlds.

Both CHING and ITO followed METTENIUS to devide this species into two varieties, var. *hirsutus* and var. *glaber*, discriminating by the pubescence of pinnae. Notwithstanding this agreement in classification, their determinations are contrary to each other. This ignoring contradiction must be caused by the unstability in pubescence of this species. Thus, the division of this species may be superficial basing upon the difference in pubescence.

36. **Thelypteris arida** (DON) MORTON, Amer. Fern Journ. **49**: 113. 1959.——*Aspidium aridum* DON, Prodr. Fl. Nepal. 4. 1825. Type: Nepal, *Wallich.*——*Dryopteris arida* (DON) O. KTZE. Rev. Gen. Pl. II, 812. 1891; HAYATA, Icon. Pl. Formos. VIII, 146. 1918.——*Cyclosorus aridus* (DON) TAGAWA, Acta Phytotax. Geobot. **7**: 78. 1938 (May), **16**: 78. 1956; CHING, Bull. Fan Mem. Inst. Biol. **8**: 194. 1938 (Sept.).

Cyclosorus subaridus TATEWAKI et TAGAWA ex TAGAWA, Acta Phytotax. Geobot. **7**: 77. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 175. 1939. Type: Baibara in Taiwan, *Tatewaki.*

Rhizome wide creeping, about 6 mm in diameter, scaly. Stipes terete, stramineous with dark brownish base, 20 cm or more in length, hairy throughout. Laminae oblong lanceolate, acute at apex, gradually narrowing downwards, 40–80 cm long, 12–25 cm wide at middle portion; lower pairs of lateral pinnae rather abruptly reduced, the lowermost being rudimentary; larger pinnae 20–30 in pairs, linear subtriangular, attenuate at apex, truncate or subcordate at base, up to 13 cm long, 1.5 cm wide, lobed at margin about one-forth way to costae, upper pinnae gradually narrowing towards apex; ultimate lobes ovate subdeltoid, rotundate at apex; veinlets to 10 in pairs, about 5 pairs actually uniting at or below the sinus membrane; texture papyraceous to soft papyraceous, yellow green, hirsute. Scales oblong subtriangular, about 4 mm long, 7 mm broad, brown, brilliant, herbaceous, hairs rather dense, setose or coarse on rachis and stipes, pale, unicellular, the longer 1 mm long, the shorter 0.2 mm or so in length; glands on the underside of laminar axes clavate, sessile, about 0.1 mm long, yellow brown. Sori round on oblong receptacles, medial or supramedial, indusiate; indusia round reniform 0.4 mm in

diameter, sparsely hairy; spores bilateral, tubercular, bright brown.

Terrestrial in moist open grassy places; rather rare, at lower elevation of Taiwan.

Distribution: tropics of Asia.

Cyclosorus subaridus is distinguished from this species by the smaller size of fronds, and by the remote pinnae of narrower outline and more densely pubescent surface. I have not examined the type specimen, but from the description and from the paratype specimens, it may safely be said that such a dwarf form as *C. subaridus* is often seen in every species of the thelypteroid ferns and not separable as to be a distinct species. In this species, too, successive intermediate forms occur frequently.

37. **Thelypteris acuminata** (HOUTT.) MORTON, Amer. Fern Journ. **48**: 139. 1958; K. IWATS. Acta Phytotax. Geobot. **21**: 38. 1964.——*Polypodium acuminatum* HOUTT. Nat. Hist. **14**: 181. 1783. Type: Japan, *Thunberg.*——*Cyclosorus acuminatus* (HOUTT.) NAKAI ex H. ITO, Bot. Mag. Tokyo **51**: 710. 1937, in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 172. 1939; CHING, Bull. Fan Mem. Inst. Biol. 8: 189. 1938; OHWI, Fl. Jap. Pterid. 103. 1957; TAGAWA, Col. Ill. Jap. Pterid. 115, 195. 1959.

Polypodium sophoroides THUNB. Trans. Linn. Soc. **2**: 241. 1794. Type: Japan, *Thunberg.*——*Nephrodium sophoroides* (THUNB.) DESV. Prodr. 256. 1827; MATSUM. Ind. Pl. Jap. I, 324. 1904.——*Dryopteris sophoroides* (THUNB.) O. KTZE. Rev. Gen. Pl. II, 813. 1891; OGATA, Icon. Fil. Jap. IV, pl. 175. 1931.

Aspidium oshimense CHRIST, Bull. Herb. Boiss. II, **1**: 1018. 1901. Type: Amami-Ooshima in Ryukyu, *Faurie 5053* (Isotype in KYO !).

Dryopteris ogatanus KOIDZ. Bot. Mag. Tokyo **39**: 10. 1925. Type: Waguchi, Mishô-chô in Shikoku, *M. Ogata s. n.* (KYO !).

Dryopteris acuminata f. *cristata* TAGAWA, Acta Phytotax. Geobot. **2**: 189. 1933. Type: Kamiakitsu-mura in Honshu, *Nakajima s. n.* (KYO !)

Cyclosorus acuminatus f. *pilosus* H. ITO, Bot. Mag. Tokyo **51**: 712. 1937.

Cyclosorus acuminatus var. *kuliangensis* CHING, Bull. Fan Mem. Inst. Biol. 8: 192. 1938. Type: Kuliang Hills in Fukien, *Norton 1624* (US !).

Cyclosorus yamawakii H. ITO, Journ. Jap. Bot. **27**: 340. 1952. Type: Kaminiroo-mura in Shikoku, *T. Yamawaki s. n.*

Rhizome long creeping, irregularly branching, 3.5–5.0 mm in diameter, scaly. Stipes 2–5 cm apart, terete, stramineous or pale brown with dark base, scaly at base, hirsute or glabrescent, to 40 cm long. Laminae oblong lanceolate, acuminate at apex, usually 40–60 cm long, 15–20 cm wide; lowest pinnae not or a little reduced, deflexed or not, lateral pinnae 15–20 in pairs, linear lanceolate, attenuate at apex, truncate or subcordate at sessile base, the lowest acroscopic pinnules sometimes elongate and deflexed, more or less falcate, 8–15 cm long, 1.0–1.5 cm or more in width, pinnatifid to about a half way towards costae; apical pinnae distinct, 15 cm or more in length; ultimate segments oblong subdeltoid, rotundate to apiculate at apex, entire and recurved at margin; veinlets 7–10 pairs, basal 1.5 pairs actually

uniting at or below sinus membrane; texture papyraceous, grass green, glabrous. Scales oblong subdeltoid, to 5 mm long, 0.6 mm broad, brown, opaque, soft herbaceous, sparsely hairy; hairs on axes of fronds setose, unicellular, about 0.3 mm long. Sori round on punctate receptacles, medial or submarginal, large, confluent with the adjacent in matured condition, indusiate; indusia round reniform, presistent but immersed in sporangia in matured condition, 0.5 mm in diameter, pubescent; spores bilateral, tubercular, dark brown or blackish.

Terrestrial on grass fields along road or in sunny places at lower elevations; common in southern Honshu southwards to Taiwan.

Distribution: South China and Indo-China.

This species is classified into three varieties, all of which are known in our regions:

Var. **acuminata**.——*Polypodium acuminatum* HOUTT. l. c.

Polypodium sophoroides THUNB. l. c.

Aspidium oshimense CHRIST, l. c.

Dryopteris acuminata f. *cristata* TAGAWA, l. c.

Cyclosorus acuminatus f. *pilosus* H. ITO, l. c.

Cyclosorus yamawakii H. ITO, l. c.

Very common in the warmer parts of Japan, Ryukyu, Taiwan; also known in continental South Asia.

Var. **kuliangensis** (CHING) K. IWATS. Acta Phytotax. Geobot. **21**: 40. 1964.——*Cyclosorus acuminatus* var. *kuliangensis* CHING, l. c.

Rather rare in the warmer parts of Japan and southwards; also known in South China.

Var. **ogatana** (KOIDZ.) K. IWATS. Acta Phytotax. Geobot. **21**: 40. 1964.——*Dryopteris ogatana* KOIDZ. l. c.

Known only from two localities in Honshu and Shikoku.

Subgen. *Pneumatopteris* (NAKAI) K. IWATS.

Sect. *Pneumatopteris*.

This group comprises only two species both of which are found in our regions: one is the pantropic *T. truncata* and the other the closely related *T. kotoensis*, endemic to Botel Tobago.

38. **Thelypteris truncata** (POIR.) K. IWATS. Mem. Coll. Sci. Univ. Kyoto, B. **31**: 33. 1964.——*Polypodium truncatum* POIR. Ency. Méth. Bot. **5**: 534. 1804. Type: Brazil.——*Nephrodium truncatum* (POIR.) PRESL, Tent. Pterid. 81. 1836; MATSUM. Ind. Pl. Jap. I, 326. 1904.——*Cyclosorus truncatus* (POIR.) FARW. Amer. Midl. Natur. **12**: 250. 1931; CHING, Bull. Fan Mem. Inst. Biol. **8**: 216. 1938; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 169. 1939.

Dryopteris laevifrons HAYATA, Icon. Pl. Formos. IV, 158. 1914. Type: Kuraru at Koshun in Taiwan, *B. Hayata s. n.* (TI !); TAGAWA, Acta Phytotax. Geobot. **5**: 191. 1936.——*Cyclosorus truncatus* f. *laevifrons* (HAYATA) H. ITO, Bot. Mag. Tokyo **51**: 730. 1937.

Dryopteris kwashotensis HAYATA, Icon. Pl. Formos. V, 278. 1915. Type: Isl.

Kwashoto in Taiwan, *Nakahara s. n.* (TI !).——*Dryopteris laevifrons* var. *kwashotensis* (HAYATA) TAGAWA, Acta Phytotax. Geobot. **5**: 192. 1936.——*Cyclosorus truncatus* f. *kwashotensis* (HAYATA) H. ITO, Bot. Mag. Tokyo **51**: 730. 137.

Dryopteris sublaevifrons TAGAWA, Acta Phytotax. Geobot. **5**: 192. 1936. Type: between Urai and Rimogan in Taiwan, *Tagawa 273* (KYO !).——*Cyclosorus truncatus* f. *sublaevifrons* (TAGAWA) H. ITO, Bot. Mag. Tokyo **51**: 730. 1937.

Caudex erect or ascending, massive, 2 cm or more in diameter, scaly. Stipes caespitose, 3–8 on a plant, terete, stramineous, 50–70 cm long including the portions bearing rudimentary pinnae, scaly at basal portion, hairy throughout. Laminae oblong lanceolate, acute at apex, up to 1 m long, 30 cm or more in width; basal 1–4 pairs abruptly and extremely reduced to mere auricled accessary of 1 cm in length, the larger normal pinnae about 30 in pairs, linear subtriangular, attenuate at apex, broadly cuneate at sessile base, straight, to 25 cm long, 2.5 cm wide, pinnatifid one-third to a half way down to costae, upper pinnae gradually reducing in size towards apex; distinct aerophore provided at each base of pinnae, to 1 cm in length, fleshy; ultimate lobes quadrangular, oblique, obtuse at apex; veinlets 5 or so in pairs, 1.5 basal pairs actually uniting at or below the well developed sinus membrane; texture soft papyraceous, yellow green to pale grass green, glabrous on laminar surfaces. Scales oblong subtriangular with tails, to 4 mm long, 1.5 mm broad, dark brown, opaque, hairy at margin; hairs not so dense on every axis of fronds, pale, setose, unicellular, 0.2–1.0 mm long. Sori round on large capitate receptacles, medial or subcostular, more than 1 mm in diameter, indusia round reniform, persistent, 0.7 mm in diameter, glabrous or sparsely hirsute; spores bilateral, tubercular, pale brown.

Terrestrial in very wet places along stream in forests; at lower elevations of southern Ryukyu and Taiwan.

Distribution: in the tropics throughout the world.

Several names have been published from our regions concerning the plants placed in *T. truncata* or its allies.

Dryopteris laevifrons HAYATA is quite identical with *T. truncata* var. *angustipinna* CHING, having narrower pinnae less than 1.3 cm in width. It seems to be a mere variant form of *T. truncata* and has no difference significant to separate it into distinct species.

Dryopteris kwashotensis is unique in having a hirsute indusia, the other characteristics being quite the same with those of *T. truncata*. Examining numerous Asiatic plants of *T. truncata* in fields and in herbaria, I could not find any trace of hairs on their indusia. On the contrary, Hawaiian specimens belonging to *T. truncata* have the indusia with distinct setose hairs. There is no reliable evidence at present as to the distinctness of these plants. The nomenclatorial conclusion is hard to be given concerning to such a wide spread species.

Dryopteris sublaevifrons is described on the basis of the Taiwan plants, which have no specific difference from *T. truncata*. The Ryukyu plants of this species are, however, distinct in having regularly only 1.5 pairs of veinlets anastomosing. Usually two or more pairs of veinlets are joining the adjacent ones in *T. truncata*.

Cyclosorus truncatus var. *acutiloba* CHING is distinguished from the type variety by the difference in acute or nearly acute segments and rather thin herbaceous leaf texture. The type specimen of this is sterile and somewhat incomplete, and I can not discuss on a taxonomical problems as to such an insufficient materials.

39. **Thelypteris kotoensis** (HAYATA) K. IWATS. Acta Phytotax. Geobot. **21**: 42. 1964.——*Dryopteris kotoensis* HAYATA, Icon. Pl. Formos. V, 279. 1915. Type: Isl. Kotosho off Taiwan, *T. Kawakami & S. Sasaki s. n.* (TI !).——*Cyclosorus truncatus* var. *kotoensis* (HAYATA) H. ITO, Bot. Mag. Tokyo **51**: 729. 1937.

Stipes terete, stramineous with dark brownish base, 70 cm or so in length, scaly at base, hairy. Laminae oblong lanceolate, acute at apex, about 1 m long, 25 cm or more in width; basal pairs of pinnae abruptly and extremely reduced to rudimentary pinnae, the larger pinnae about 25 in pairs, linear subtriangular, gradually narrowing towards attenuate apex, subtruncate at base, about 20 cm long, 2.5 cm wide at base, upper pinnae gradually reducing towards apex; aerophores distinct, one to each base of costae; ultimate lobes quadrangular, oblique, obtuse to acute at apex; veinlets 5 in pairs, 1.5 to 2 pairs actually uniting at or below the sinus membrane; texture soft papyraceous, glabrous on laminar surfaces. Scales linear subtriangular, to 5 mm long, 1.2 mm broad, dark brown, hairy at margin; hairs on every axis of plants setose, unicellular, to 1 mm long; glands rather dense on laminar surfaces underneath, yellow, round, sessile. Sori round on capitate receptacles, medial, indusiate; indusia round reniform, persistent, 0.7 mm in diameter, glabrous; spores bilateral, echinulate, brown.

Endemic to the Island of Kotosho (Botel Tobago); habitat not recorded, known only from the type collection.

Subgen. *Abacopteris* (FÉE) K. IWATS.

40. **Thelypteris simplex** (HOOK.) K. IWATS. comb. nov.——*Meniscium simplex* HOOK. Lond. Journ. Bot. **1**: 294. 1842, Fil. Exot. t. 83. 1857, Sp. Fil. V, 162. 1864. Type: Hongkong, *Hinds s. n.*——*Abacopteris simplex* (HOOK.) CHING, Bull. Fan Mem. Inst. Biol. **8**: 239. 1938; TAGAWA, Acta Phytotax. Geobot. **8**: 171. 1939; K. IWATS. Acta Phytotax. Geobot. **18**: 2. 1959.——*Meniscium triphyllum* var. *simplex* (HOOK.) H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 183. 1939.

Abacopteris simplex var. *trifoliata* CHING, Bull. Fan Mem. Inst. Biol. **10**: 10. 1940. Type: Fukien, Lien-Gong, *Tang Sin Ging 15900*; TAGAWA, Journ. Jap. Bot. **26**: 21. 1951.

Rhizome wide creeping, irregularly branching, about 3 mm in diameter, scaly. Stipes terete, stramineous, scaly at base, hairy, 10–30 cm long. Fronds simple or trifoliate, subdimorphic; fertile laminae on long stipes, lanceolate, acuminate at apex, round, cuneate or subcordate at base, up to 15 cm long, 2.5 cm broad; sterile laminae simple or rarely trifoliate, oblong, round or cordate at base, acuminate at apex, 15–20 cm long, 4–6 cm broad, lateral pinnae if present smaller; venation goniopteroid, excurrent veinlets continuous or separated; texture papyraceous, pale grass green, glabrous and verrucose on laminar surfaces. Scales linear subtri-

angular, 5 mm long, 1 mm broad, soft herbaceous, brown, setiferous at margin and on abaxial surface; hairs rather dense on every axis of fronds, setose, simple, unicellular, straight or hooked at apex, to 0.5 mm long. Sori naked, crescent on conjugated veinlets, often confluent with the neighbouring to form seemingly acrostichoid condition; sporangia setiferous with hooked hairs; spores bilateral, echinulate to reticulate, brown.

Terrestrial on clayey or humus-rich ground along mountain pass or in forests in light shade; rather common throughout the Ryukyus and in Taiwan.

Distribution: South China and Indo-China.

I have noted in 1959 in detail on this species and is not quite assure whether the plants of the Ryukyus identified as this are conspecific with genuine *T. simplex* of Hongkong or not. After that time, I examined cytologically the Ryukyu plants in question. The materials studied were transplanted from the island of Amami-Ooshima and Okinoerabu, both of the northern Ryukyu, to the botanic garden of Kyoto University. These plants, which have been attributed by me to *Abacopteris simplex*, have the chromosomes that show the peculiar moving in meiotic metaphase. Almost all of the two sets of chromosomes are separated regularly to the opposite poles, but a few remain near the equatrial plate. Thus the meiosis of these plants is irregular, as rarely known in the plants growing near the geographical boundary areas of the species concerned. Spores of the Ryukyu *T. simplex* do not germinate in pots even in a green house. These plants may reproduce only vegetatively and, therefore, be considered as a cytological variants of *T. simplex*.

41. **Thelypteris triphylla** (SW.) K. IWATS. comb. nov.——*Meniscium triphyllum* SW. Schrad. Journ. Bot. **1800** (2): 16. 1801, Syn. Fil. 19, 206. 1906. Type: India. ——*Abacopteris triphylla* (SW.) CHING, Bull. Fan Mem. Inst. Biol. **8**: 241. 1938; HOLTT. Fl. Malaya II, 287. 1954; K. IWATS. Acta Phytotax. Geobot. **18**: 5. 1959; TAGAWA, Col. Ill. Jap. Pterid. 117, 173. 1959.——*Cyclosorus triphyllus* (SW.) TARD. Not. Syst. **7**: 77. 1938, in LECOMTE, Fl. Gén. Indo-Chine **7** (2): 386. 1941; OHWI, Fl. Jap. Pterid. 104. 1957.

Meniscium triphyllum var. *parishii* BEDDOME, Ferns Brit. Ind. t. 184. 1866.

Meniscium triphyllum f. *cristatum* K. SATO, Journ. Jap. Bot. **12**: 824. 1936. Type: Isl. Yakushima in Kyushu, *K. Sato s. n.*

Rhizome long creeping, about 3 mm in diameter, persistently scaly. Stipes 1.5–4.0 cm apart from each other, terete, stramineous, scaly at base, hairy throughout, 15–40 cm long (of fertile fronds usually longer). Laminae trifoliate (rarely imparipinnate); apical pinnae oblong lanceolate to lanceolate (narrower in fertile fronds), 10–25 cm long, 2–4 cm broad, acuminate or attenuate at apex, cuneate to round at base; lateral pinnae falcate, oblong, acute to acuminate at apex, round at base, shortly stalked, to 10 cm long, 4 cm broad; texture papyraceous, dark green or blue green on upper surface, paler on under surface, glabrous but verrucose on laminar surface; venation typically goniopteroid, excurrent veinlets uniting or separated. Scales linear, 3 mm or more in length, 0.4 mm broad, bright brown,

opaque, setiferous at margin and on abaxial surface, soft herbaceus; hairs on every axis of fronds, setose, unicellular, straight or hooked at apex, 0.2 mm in length. Sori naked, crescent on conjugated veinlets; sporangia setiferous with hooked hairs; spores bilateral, tubercular, brown.

Terrestrial on humus-rich floor of light or deep forests; fairly common throughout the Ryukyus and Taiwan.

Distribution: from tropical Asia to Australia.

This species is divisible into two distinct varieties.

Var. **triphylla**.——*Meniscium triphyllum* Sw. l. c.

Meniscium triphyllum f. *cristatum* K. Sato, l. c.

Very common in the regions cited above.

Var. **parishii** (Beddome) K. Iwats. comb. nov.——*Meniscium triphyllum* var. *parishii* Beddome, l. c.

Terrestrial on clayey slope of mountains in light shade, at lower elevation of the Ryukyus and in Taiwan; also known in India and Burma to Indo-China, south to Malaya.

42. **Thelypteris liukiuensis** (Christ) K. Iwats. comb. nov.——*Meniscium liukiuense* Christ ex Matsum. Bot. Mag. Tokyo **24**: 240. 1910. Type: Isl. Okinawa in Ryukyu, coll. unknown (Isotype in TI !); H. Ito in Nakai & Honda, Nova Fl. Jap. Polypod.-Dryopt. I, 183. 1939.——*Dryopteris liukiuensis* (Christ) C. Chr. Ind. Fil. Suppl. 34. 1913; Ogata, Icon. Fil. Jap. VII, pl. 313. 1936.——*Abacopteris liukiuensis* (Christ) Tagawa, Acta Phytotax. Geobot. 8: 171. 1939; K. Iwats. Acta Phytotax. Geobot. **18**: 9. 1959.

Abacopteris triphylla var. *simplicifolia* Ching, Bull. Fan Mem. Inst. Biol. 8: 243. 1938. Type: Keelung in Taiwan, *Faurie 214* (Isotype in KYO !).

Dryopteris cuspidata (Blume) Christ sensu Tagawa, Acta Phytotax. Geobot. **1**: 306. 1932.

Abacopteris sampsoni (Baker) Ching, Bull. Fan Mem. Inst. Biol. 8: 244. 1938, p. p.

Rhizome short creeping, to 7 mm in diameter, scaly. Stipes terete, stramineous, scaly at base, hairy throughout, 25–40 cm long. Laminae imparipinnate, oblong lanceolate, 30–50 cm long, 10–20 cm wide ;apical pinnae like lateral ones, lateral pinnae 2–4 in pairs, shortly stalked, often bearing gemmae at base of costae, oblong, cuspidate at apex, broadest at middle portion, gradually narrowing towards cuneate base, margin irregularly crenulate, 7–15 cm long, 1.8–3.0 cm broad, fertile pinnae usually narrower; texture papyraceous, light green to grass green and often red tinted in dried condition, glabrous on laminar surfaces; venation goniopteroid, costules forming an acuter angle with costae, conjugated veinlets usually continuous. Scales oblong subdeltoid, 5 mm long, 1.5 mm broad, brown, coarse herbaceous, subglabrous; hairs very sparse on axes of fronds, simple, unicellular, hooked at apex. Sori naked, crescent on conjugated veinlets, often taking appearance of acrostichoid sori; sporangia naked; spores bilateral, reticulate, brown.

Drooping on rocks or terrestrial by stream in dense forests at lower elevation;

rather common in the Ryukyus and at the northern end of Taiwan.

Distribution: endemic so far to the regions cited above.

Thelypteris liukiuensis, *T. cuspidata*, and *T. sampsoni* are the species which seem to be very closely allied to each other. *Thelypteris liukiuensis* was reduced to a synonym of *T. sampsoni* by CHING (1938), but it was separated as a distinct species by TAGAWA (1939) and others. ITO (1939) once recorded *A. liukiuensis* from the Philippines, but I (1959) excluded the Philippine plants from this species. The Philippine plants of *T. cuspidata* was noted by COPELAND (1960) as being well marked by the shape of the pinnae which was subfalcate and broadest above the middle. *Thelypteris cuspidata* was recorded from Indo-China by CHRISTENSEN & TARDIEU-BLOT (1938, 41), standing on the specimens collected by PÉTEROT in Tonkin and Annam. I examined *Péterot 5402* (US) of Tonkin, and determined it to be *T. sampsoni*. Long creeping rhizome, hairy rhizome scales and others are the features characteristic of the latter species.

Now, the discriminative features of these species are summarized in the following key:

A Rhizome short creeping, bearing the contiguous or approximate stipes; rhizome scales bright brown or blackish, seldom hairy at margin; lateral main veins not so much raised beneath.
  B Upper axil always gemmiferous; veinlets meeting at acute angle; sporangia naked; species endemic to the Ryukyus. ..... *T. liukiuensis.*
  B Upper axil not (?) gemmiferous; veinlets meeting at obtuse angle; sporangia rarely bearing a hooked hair; species in the tropical islands in Southeast Asia. ..... *T. cuspidata.**
A Rhizome long creeping, bearing the stipes remotely; rhizome scales dark brown, densely covered by the hairs; upper axil not gemmiferous; lateral main veins distinct beneath; veinlets meeting at obtuse angle; sporangia bearing one or two hooked hairs; species in the continental Southeast Asia. ..... *T. sampsoni.**

43. **Thelypteris aspera** (PRESL) K. IWATS. comb. nov.——*Goniopteris aspera* PRESL, Tent. Pterid. 183. 1836, based upon *Polypodium asperum* PRESL, Rel. Haenk. **1**: 24. 1825, non L. 1753. Type: Luzon, *Haencke.*——*Abacopteris aspera* (PRESL) CHING, Acta Phytotax. Sin. 8: 332. 1963.——*Dryopteris presliana* CHING in C. CHR, Ind. Fil. Suppl. III, 95. 1934.——*Abacopteris presliana* (CHING) CHING, Bull. Fan Mem. Inst. Biol. 8: 248. 1938.

Abacopteris philippinarum FÉE, Congr. Sci. France X sess. 178. 1843, Gen. Fil. 309. 1852.——*Cyclosorus philippinarum* (FÉE) COPEL. Fern Fl. Phil. II, 372. 1960.

Dryopteris gymnopteridifrons HAYATA, Icon. Pl. Formos. 8: 148. 1919. Type:

---

* **Thelypteris cuspidata** (BLUME) K. IWATS. comb. nov.——*Meniscium cuspidatum* BLUME, Enum. Pl. Jav. 114. 1828.

* **Thelypteris sampsoni** (BAKER) K. IWATS. comb. nov.——*Polypodium sampsoni* BAKER, Ann. Bot. 5: 471. 1891.

Taiwan, Kusukusu, *Soma s. n.* (TI !).——*Abacopteris gymnopteridifrons* (HAYATA) CHING, Bull. Fan Mem. Inst. Biol. **8**: 251. 1938: K. IWATS. Acta Phytotax. Geobot. **18**: 9. 1959.

Meniscium urophyllum H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 184. 1939, excl. basion.

Rhizome long creeping, 5–10 mm in diameter, scaly. Stipes terete, more than 5 mm in diameter at base, scaly at basal portions, glabrescent, usually more than 1 m in length. Laminae imparipinnate, oblong lanceolate, 50–70 (–100) cm long, to 50 cm wide; apical pinnae like lateral ones, lateral pinnae 4–8 in pairs, shortly stalked or sessile, oblong lanceolate, falcate, acute to acuminate at apex, round or subtruncate at base (lower pinnae cuspidate at base), crenate at margin, 20–25 cm long, to 5 cm broad; venation goniopteroid, conjugated veinlets curved, excurrent veinlets usually separated; texture soft papyraceous, grass green, very sparsely hirsute and verrucose on laminar surface underneath. Scales oblong subtriangular, 5–7 mm long, 1.3 mm broad, pale brown, soft herbaceous, hairy at margin; hairs dense on axis of fronds and sparse on laminar surface, setose, unicellular, 0.1–0.5 mm long. Sori round, in a pair on conjugating veinlets, usually confluent in matured condition, indusiate; indusia round reniform, persistent but immersed when matured, 0.3 mm in diameter, setiferous; spores bilateral, tubercular, dark brown.

Terrestrial on clayey or grassy slope in light shade; at lower elevation in Taiwan.

Distribution: tropics of East Asia.

Taiwan plants of the group of *T. urophylla* was distinguished as a distinct species by HAYATA, CHING and I myself under the name of *Dryopteris* (or *Abacopteris*) *gymnopteridifrons*. This is distinguished by CHING from *A. presliana* by the difference in the hairy underside of leaves, setose indusium and sporangium and the round medial sori in two distinctive rows. These features are truely applicable to the Taiwan plants. After the local revision of *Abacopteris* in 1959, I have had the chances to study more specimens of *Abacopteris* from China and the neighbouring regions, and found that the intermediate forms are not rare between the continental plants of this species and the Taiwan plants named *A. gymnopteridifrons*.

The underside of pinnae are not quite glabrous in *T. aspera*, and indusia as well as sporangia of this species are usually hairy to a certain degree. The sori of *T. aspera* are medial or supramedial, round and in two distinct rows.

COPELAND (1960) noted that *Cyclosorus philippinarum* had the laminae naked on surface and sori apparently without indusia. He also enumerated *Cyclosorus urophyllus*, but his treatment is not so clear. HOLTTUM (1954) confined the range of *T. urophylla* to the peninsular Siam, Malaya, Sumatra, Borneo and their neighbouring islands. I have seen no specimen of *T. urophylla* outside the regions cited above. *Thelypteris urophylla* may be discriminated from *T. aspera* by the features summarized in the following key:

A Pinnae round to cuneate at base, subentire or undulate at margin and acuminate at apex; sori indusiate, sporangia with one to three hairs. .....

..... *T. aspera.*

A Pinnae gradually narrowed towards base, undulate or distinctly serrate at margin and caudate at apex; sori naked, sporangia with several hairs. .... *T. urophylla.*

44. **Thelypteris longipetiolata** (K. IWATS.) K. IWATS. comb. nov.——*Abacopteris longipetiolata* K. IWATS, Acta Phytotax. Geobot. **18**: 11. 1959. Type: Tyokakurai in Taiwan, *Tagawa 2593* (KYO !).

Rhizome long creeping, 3–4 mm thick, hairy and sparsely scaly. Stipes 2–5 cm apart from each other, stramineous, beset with short and soft hairs, glabrescent upwards, sparsely scaly near the base, 10–30 cm long. Laminae oblong to ovate-oblong, 15–20 cm long, 9–14 cm wide, imparipinnate with a terminal pinnae much larger than the next below; lateral pinnae 2–4 pairs, oblong to lanceolate, 5–9 cm long, 1.5–2.0 cm wide, acuminate to caudate-acuminate at apex, round to round-cuneate and shortly but distinctly stalked at base, subentire or irregularly crispate-undulate; terminal pinnae oblong-lanceolate, 9–13 cm long, 2.5–4.0 cm wide, caudate-acuminate at apex, truncate to round-truncate and often unequal-sided at base, the margin like those of the lateral pinnae; rachis and costae sparsely beset with short and soft hairs on both sides, the costae straight throughout or slightly falcate toward apex; texture papyraceous. Veins not so conspicuously raised beneath, more or less curved upward; veinlets springing from the veins at a very obtuse angle, meeting regularly in opposite pairs and forming slightly curved cross veinlets, the excurrent veinlets usually free. Scales narrowly deltoid-lanceolate, gradually attenuate toward finely acuminate apex, to about 3.5 mm long and 0.7 mm broad, sparsely hairy on the back and ciliate on margin; hairs on rhizome and fronds short and coarse, usually hooked at apex. Sori confluent into crescent-shaped sori, medial on cross veinlets, exindusiate; sporangia with a hooked hairs, the annulus of about 20 cells.

Known only from the type collection; habitat unknown.

It seems most probable that this species belongs to the group of the red-drying species, such as *Abacopteris rubra* and its allies. These species are characterized by the combination of such features as the exindusiate sori and papyraceous pinnae which turn red or reddish when dried. The species of this group are discriminated from each other by the features shown in the following key:

A Sori arranged in meniscioid condition, or confluent into crescent-shaped sori.
  B Plant smaller, fronds 15–20 cm long excluding stipes; sporangia with hooked hairs; species endemic to Taiwan. .....*T. longipetiolata.*
  B Plant larger, fronds more than 100 cm long excluding stipes; sporangia naked; species endemic to Assam. .....*T. lakhimpurensis.**

A Sori round, distinctly in two rows.
  B Sori medial to supramedial; pinnae not so strongly cuneate at base.

* **Thelypteris lakhimpurensis** (ROS.) K. IWATS. comb. nov.——*Dryopteris lakhimpurensis* ROS. Med. Rijks. Herb. no. 31. 7. 1917.

C Veinlets meeting at acute angle; excurrent veinlets strictly continuous; sporangia naked; species of Polynesia. ..... *T. rubinervis.**

C Veinlets meeting at obtuse angle; excurrent veinlets not regularly continuous.

D Terminal pinnae not especially large and oblanceolate, lateral pinnae round to cuneate at base, acuminate at apex; sporangia naked; species of continental Southeast Asia. ..... *T. rubra.*

D Terminal pinnae large and oblong, lateral pinnae cuneate at base, cuspidate at apex; sporangia with hooked hairs; species of Malaya and Sumatra. ..... *T. rubicunda.**

B Sori strictly costular; pinnae strongly cuneate at base; species endemic to the Philippines. ..... *T. rubida.**

45. **Thelypteris insularis** (K. IWATS.) K. IWATS. comb. nov.——*Abacopteris insularis* K. IWATS. Acta Phytotax. Geobot. **18**: 6. 1959. Type: Okinoerabu in Ryukyu, *Tagawa & Iwatsuki 2248* (KYO !).

Rhizome slender, long creeping, about 4 mm thick, hairy and sparsely scaly. Stipes (1-) 2-4 cm apart from each other. Fronds more or less dimorphic. Sterile fronds: stipes slender, 10-15 cm long; laminae deltoid or ovate-deltoid, pinnae suddenly contracted at apex and then caudately long prolonged into a terminal pinnae, 20-30 cm long, 15-25 cm broad at base, papyraceous in texture; lateral pinnae 4-7 pairs, patent, lanceolate, acuminate, crenate to subentire, round-cuneate to round-truncate on posterior and broad-cuneate to subtruncate and slightly auricled on anterior side of base, the basal 1-2 pairs of pinnae shortly stalked, up to 15 cm long, 2.5 cm broad, the following distinctly shortened, the upper ones sessile, the uppermost ones adnate and merging into basal segments of the terminal pinnae, the upper surface glabrous except the costa, the lower surface sparsely hairy on costa, veins and veinlets; terminal pinnae linear-lanceolate, more deeply so towards base. Veins moderately raised beneath, veinlets 4-6, sometimes to 10, in pairs, springing from the veins at an obtuse angle, meeting in opposite pairs and forming cross veinelts of inverted open V or of long slender S shape, the excurrent veinlets united with the next pair of veinlets above or sometimes free, the venation often irregular in the basal lobes of the terminal pinna. Fertile fronds: much longer than the sterile, stipes 20-60 cm long; lamina deltoid-ovate to ovate-oblong with long terminal pinna, 25-35 cm long, 8-15 cm broad at base; lateral pinnae up to 10 pairs, slightly ascending, to about 15 cm long and 1.4 cm broad, the basal 3-5 pairs short-stalked, the terminal pinna up to 20 cm long and 2 cm broad. Scales scattered on rhizome and the basal part of stipes, brown to fuscous brown, nar-

* **Thelypteris rubicunda** (v. A. v. R.) K. IWATS. comb. nov.——*Phegopteris rubicunda* v. A. v. R. Bull. Jard. Bot. Buit. III, Ser. **2**: 162. 1920.

* **Thelypteris rubida** (J. SMITH) K. IWATS. comb. nov.——*Goniopteris rubida* J. SMITH, Journ. Bot. **3**: 395. 1841.

* **Thelypteris rubinervis** (METT. ex KUHN) K. IWATS. comb. nov.——*Phegopteris rubinervis* METT. ex KUHN, Linnaea **36**: 116. 1869.

rowly deltoid-lanceolate, gradually attenuate towards finely acuminate apex, sparsely hairy on back and ciliated at margin, about 4 mm long, 0.5 mm broad; hairs somewhat dense on all axes, hooked or straight. Sori exindusiate, round and medial on veinlets or confluent into crescent-shaped sori in maturity; sporangia naked, the annuls of about 15 cells; spores loosely plicate-reticulate, brown.

Known only from two collections, the type and:

RYUKYU. Isl. Okinawa: Ufushitsutai, Mt. Genga-yama, Kunigami, on clayey slope along stream in light shade, *T. Amano 7941* (KYO).

This species has been investigated cytologically using the plants separated from the same stock as the holotype specimen was collected, and found to have a quite irregular moving of chromosomes in the meiotic metaphase. Solitary chromosomes are commonly seen outside the spindle fibers and the accessary nucleus is found not so rarely. Spores are perfect in appearance, but never germinate. Thus, the species may enough be estimated to be a hybrid plant. As the parent species, it is easily suggested to be *Thelypteris triphylla* of this subgenus and the species belonging to subgen. *Cyclosoriopsis*, such as *T. parasitica*.

Genus **Meniscium** SCHREBER

This genus comprises a sole species in our regions.

Sect. *Ampelopteris* (KUNZE) K. IWATS.

1. **Meniscium proliferum** (RETZ.) SWARTZ, Syn. Fil. 19, 207. 1806; H. ITO in NAKAI & HONDA, Nova Fl. Jap. Polypod.-Dryopt. I, 185. 1939.——*Hemionitis prolifera* RETZ. Obs. Bot. **6**: 36. 1791. Type: Africa.——*Goniopteris prolifera* (RETZ.) PRESL, Tent. Pterid. 183. 1836; CHING, Bull. Fan Mem. Inst. Biol. **8**: 260. 1938.——*Cyclosorus proliferus* (RETZ.) TARD. ex C. CHR. & TARD. Not. Syst. **7**: 76. 1938 et in LECOMTE, Fl. Gén. Indo-Chine **7** (2): 389. 1941.——*Ampelopteris prolifera* (RETZ.) COPEL. Gen. Fil. 144. 1947 et Fern Fl. Phil. **3**: 377. 1960; HOLTT. Fl. Malaya II, 299. 1954.

Rhizome creeping, 3–5 mm in diameter, sparsely scaly, hairy throughout. Stipes not so remote on rhizome, 3–10 cm long in young plants or 30–50 cm in fully matured plants, terete, hairy throughout. Rechis hairy, proliferous, bearing a tuft of fronds and rooting at several portions of rachis. Laminae impari-pinnate, linear lanceolate, moderately acute at apex, truncate or broadly cuneate at base, with about a dozen pairs of pinnae, the outline sometimes disordered by the proliferous leaves; pinnae shortly stalked, linear lanceolate, moderately acute to acute at apex, truncate at base, incised only one-eighth way down to costae, 4–8 cm long, 1.0–1.5 cm broad; lobes oblique, rectangular, truncate at apex; texture herbaceous, dark oblive-green in dried condition; veins oblique, pinnate, veinlets about 10 pairs, 5–7 pairs uniting with the conjugated ones to form typical goniopteroid venation. Scales only on rhizome and at base of stipes, rather sparse, ovate subtriangular, hairy at margin, brown; hairs unicellular, pale, setose, bifurcate in those on rachis. Sori oblong or linear along conjugated veinlets, naked; sporangia glabrous.

Terrestrial in rather wet places in open places or in light shade at lower

elevations of Taiwan.

TAIWAN. Prov. Shinchiku: Kôkwan-chô, Byôritsu-gun, *Shimada 5138-b* (KYO). Prov. Takao: Chûshô, Rokki-shô, Kizan-gun, *Tagawa 1604* (KYO).

Distribution: tropical and subtropical regions throughout the Old World.