

ASIATIC PTERIDOPHYTA COLLECTED BY JOSEPH F. ROCK 1920-1924

By CARL CHRISTENSEN

INTRODUCTION

Some time ago Dr. William R. Maxon, associate curator of the United States National Herbarium, proposed that we should identify jointly the large number of pteridophyta collected in Siam, Burma, and Yunnan by Joseph F. Rock, and publish a report upon them. There was sent to the Botanical Museum of Copenhagen at the same time an almost complete set of the plants in question. I was just finishing, however, a report upon another large collection of ferns made by Dr. Harry Smith in Szechwan and Chile, and when Doctor Maxon had read this¹ he suggested that I should undertake the work alone, and sent to me all the unicates of the Rock pteridophyta in the United States National Herbarium. Owing to work on the history of Danish botany, which occupied most of my time from 1920 to 1926, I was obliged to postpone study of the Rock ferns; but the historical manuscript was finished in the summer of 1926, and at intervals since that time I have done my best to identify the numerous species represented by the material placed in my hands.

The ferns here discussed were gathered by Mr. Rock during the years 1920 to 1924. A small portion were collected in northern Siam, in a previously unexplored region, and a report upon them forms the second part of the present brochure. The great bulk of the material, however, was collected in the vicinity of the Burma-Yunnan border—northern Burma, and Keng Tung Territory in the Shan States—and in southern Yunnan, mostly on the heavily forested mountain ridges between the Mekong and Salween Rivers. More than a few specimens were collected on the slopes of the Likiang Snow Range, some on Mount Kenyichunpo in southeastern Tibet, a few also in northern Yunnan in the Valley of the Yangtze, and a single specimen from southeastern Szechwan remarkably enough

¹ *Plantae Sinenses: Pteridophyta*. Medd. Bot. Trädg. Göteborg 1: 42-110. *pl.* 16-20. 1924.

belonging to a species (*Asplenium ensiforme*) not previously known from that province.

Nearly all the specimens are complete, often consisting of entire fronds 1.5 to 2 meters long, thus in the case of several large species affording me a knowledge as to size, shape, and proportions that it is difficult to get ordinarily without seeing the plants in the field. Most species of the collection are true forest ferns, among them a good many epiphytes; relatively few alpine species are present. The collection is perhaps the largest made in these regions, at least since Dr. Augustine Henry brought home, 30 years ago, his very rich harvest of plants, which for the first time unveiled to wondering botanists the extraordinarily rich flora of southwestern China. The ferns collected by Henry were determined independently by J. G. Baker at Kew and Dr. H. Christ in Basel, and both these pteridologists based a large number of supposed new species upon this material. No wonder that some of these were described twice, and under different names! It is scarcely excusable, however, that a number of Baker's new species should be published in the Kew Bulletin in 1906, notwithstanding that most of them had already been described by Christ in 1899 and 1900. Still more remarkable is the fact that not a few of these "new" species proposed by Baker in 1906 are based on the same collection numbers and are identical with species described by Baker himself in the Kew Bulletin for 1898. The explanation may be that Kew obtained a set of Henry's plants twice, and that Baker determined the second set without comparing the specimens with those of the first. By the kindness of Dr. A. W. Hill, director of the Royal Botanic Gardens, Kew, I have had on loan, in 1924 and more recently, most of the type specimens of Baker's species, and have thus been able to reduce a very large number of them to synonymy. Baker's descriptions are so short and very often so wrong, and many of them based on such poor specimens, that it is not to be wondered that students have been unable to identify later material with certainty. Thus Doctor Christ has often misapplied Baker's names to specimens that are totally different from the originals.

During the years 1899 to 1910 Christ published a long series of papers on Chinese ferns, and described scores of new species. I have known for a long time that some of these are very weakly characterized, that others had previously been described by Baker, and that Christ himself had not infrequently described the same species twice or even thrice. It must be admitted that Christ had a very sharp eye for distinguishing related forms, and that not a few of his proposed new species will perhaps be regarded as valid by certain modern pteridologists who draw very narrow boundaries for a

“species.” On this point I take a conservative stand. We all know that most of our northern ferns vary considerably in size, cutting, density of pubescence, scales, etc., and I see no reason to suppose that tropical species may not vary to the same extent. Working with Chinese ferns we are on pioneer ground; we seldom have for study more than a few specimens of a given species. It is therefore nearly impossible to know the true range of variation.

On the other hand, it is quite clear to modern botanists that it is wholly unnatural to merge under a single species widely different forms, as is very often done in the Synopsis Filicum and in Clarke's and Beddome's works on the ferns of India. My problem has been to find a golden mean between these extreme points of view, and fortunately we have in the so-called minute characters a means of solving most of these questions. These characters, based for instance on dermal outgrowths (hairs and scales), spores, and hydathodes, must not be misused, of course, as by the late Professor Hieronymus in his latest very long descriptions, where he laid great weight upon the size of the scales and the size and shape of their cells, or when he found the only difference between his new species *Antrophyum henryi* and *A. coriaceum* Wall. to lie in the different length of the terminal cell of the paraphyses. Experience has taught me that scarcely two individuals are fully alike as to such “characters,” and we note also that Hieronymus based a majority of his more recent new species upon a single specimen. I have found it absolutely impossible to identify specimens of *Angiopteris* from his descriptions. Distinctive minute characters that can be described in a way intelligible to everyone are in my opinion of the highest value; but unfortunately they are never mentioned by Baker and rarely by Christ, and a positive identification of the new species proposed by these writers is possible in most cases only when one has at hand for comparison the actual type specimens or, at least, cotypes. As mentioned above, I have had most of the type specimens of Baker's species on loan from Kew, and while in Paris in 1924 I went through Christ's herbarium, then intercalated in the herbarium of Prince Roland Bonaparte, and obtained authentic specimens or fragments of most of the new species. Furthermore, I have had on loan from Berlin the type specimens of the new species described in *Hedwigia* in 1916 by the late G. Brause, and have received also numerous authentic specimens from Prof. E. Rosenstock, Gotha. I have thus found myself in a position to identify with some assurance the ferns of the Rock collection and to carry that work out critically.

The following report is therefore not a bare list of names, inasmuch as I have often added supplementary and critical remarks to earlier descriptions. In my paper on Dr. Harry Smith's ferns

from Szechwan (1924) I published similar remarks on a number of species, and these are not here repeated. As will be seen from the list, I have had to reduce to synonymy a very large number of names, some of which belong to species well known from the Himalaya and clearly described as species or varieties by C. B. Clarke in his *Review of the Ferns of Northern India*.² It appears that Christ rarely consulted this valuable treatise, for several of his supposed new species from Yunnan were known as Himalayan by Clarke. It can not be denied that the fern flora of Yunnan is very rich in endemic species, yet the very large number listed by Matthews³ and by Lévillé⁴ must be considerably reduced. Many of them believed to be endemic are not, several being known also from the eastern Himalaya and Assam and others extending eastward to Japan.

In the first part of the present paper I enumerate all species collected by Mr. Rock in Burma, Yunnan, and southeastern Tibet. Most of them were gathered on both sides of the Burma-Yunnan border, in regions of similar character, and it would be quite unnatural to let the political boundary play any rôle in this list; nevertheless, under each species I have arranged the localities under three headings: Burma, Yunnan, and southeastern Tibet. All numbers collected are cited, but I have not, as a rule, quoted full locality data.

The whole collection contains 293 species. Of these, 275 are found in Burma, Yunnan, and Tibet, 1 in Szechwan, and 60 in Siam.

Besides 6 species here described as new, the following 13 species are recorded for the first time for China: *Alsophila khasyana*, *Dryopteris crinipes*, *D. apiciflora*, *D. sikkimensis*, *Polystichum foeniculaceum*, *Tectaria vasta*, *Leucostegia doreaeformis*, *Humata assamica*, *Athyrium foliolosum*, *Ceterach dalhousiae*, *Pteris heteromorpha*, *P. wallichiana*, *P. dissitifolia*, and *Polypodium wardii*, all but one previously known from British India. Several others now found in Yunnan have been known formerly from Kweichou or Szechwan, e. g. *Drymotaenium*, *Pteris esquirolii*, *Polypodium sikkimense*, *P. rhynchophyllum*, *Campium angustipinnum*, *Polystichum stenophyllum*, and *Asplenium cheilosorum*.

The following species found in Burma seem to be new for the Indian Empire: *Dryopteris lofouensis*, *D. subelata*, *D. hirtisora*, *Polystichum punctiferum*, *Athyrium dissitifolium*, *Diplazium viridissimum*, *Woodwardia japonica*, *Pteris esquirolii*, *Polypodium oligolepidum*, *P. neurodioides*, and *P. sublineare*.

² *Trans. Linn. Soc. II. Bot. 1: 425-611. pl. 49-84. 1880. Often quoted as "Review," only.*

³ *Enumeration of Chinese Ferns. Journ. Linn. Soc. Bot. 39: 339-393. 1911.*

⁴ *Catalogue des Plantes du Yun-Nan. Pp. 1-300. Le Mans, 1916.*

The type specimens of most of the new species are in the Botanical Museum of Copenhagen, cotypes in the United States National Herbarium.

The systematic arrangement of genera is, as a whole, that followed in my *Index Filicum*, which differs considerably from the usage of American fern students. It is not a good one, but I do not wish to change it at present, because in my earlier papers on Chinese ferns the same sequence is followed. I have, however, made a notable exception in the case of the very unnatural group "*Leptochilus*," which is here divided into two genera: *Leptochilus* proper, related to *Polypodium*, and *Campium*, placed in the Dryopterideae. Minor changes will be found here and there. The nomenclature is mainly that of my *Index Filicum*. When no change is made I have refrained from referring to the publications in which the species is named or described, inasmuch as all necessary references are found in the Index; when I deviate from the usage of the Index, the fact is always pointed out. My preferring the name *Tectaria* for *Aspidium* needs no comment, nor the treatment of *Leucostegia* as a genus.

Finally, it is a pleasant duty to thank Doctor Maxon most heartily for his kindness in suggesting that I undertake this work, which has been difficult but by no means tedious, and for his generous interest which led to sending the exceedingly fine set of Mr. Rock's pteridophyta to the Botanical Museum of Copenhagen. To the directors of the Royal Botanic Gardens, Kew, and the Botanical Garden and Museum at Berlin I tender my sincere thanks for their kindness in lending me the type material of many species.

PTERIDOPHYTA FROM BURMA, YUNNAN, AND TIBET

OPHIOGLOSSACEAE

BOTRYCHIUM Swartz

Botrychium lanuginosum Wall.

YUNNAN: West of Talifu, en route to Tengyueh (6665).

MARATTIACEAE

ANGIOPTERIS Hoffm.

Angiopteris caudatifolmis Hieron. *Hedwigia* 61: 278. 1919.

BURMA: Keng Tung Territory, Meh Lui watershed (2323).

YUNNAN: Along the banks of the Meh Kong, near Keng Hung (2554).

SCHIZAEACEAE

LYGODIUM Swartz

Lygodium japonicum (Thunb.) Swartz.

Yunnan-Burma border, near Hsia Sin Gai (7826).

Lygodium flexuosum Swartz.

BURMA: Myawaddi to Kawkereik Hills, Lower Burma (678). Keng Tung Territory: Between Pang Mah Ki Hat and Muang Len (1975); Meh Lui watershed (2279).

YUNNAN: Between Chieng Law and Muang Hun (2381).

No. 678 should be referred perhaps to var. *alta* Clarke.

Lygodium polystachyum Wall.

BURMA: Keng Tung Territory, Muang Len (2017).

GLEICHENIACEAE

DICRANOPTERIS Bernh.

Dicranopteris linearis (Burm.) Underw.

YUNNAN: Between Tengyueh and Lungling (7173).

Another specimen from the same locality (7172) is probably a young sterile branch of the same species. It is of gigantic size, with pinnae 35 cm. long, the segments 7 to 8 cm. long by nearly 1 cm. wide.

HYMENOPHYLLACEAE

HYMENOPHYLLUM J. E. Smith

Hymenophyllum exsertum Wall.

Hymenophyllum delavayi Christ, Bull. Soc. Bot. France 52: 11, 1905. (*Delavay* 3637!)

YUNNAN: Between Tengyueh and Lungling (7216).

Hymenophyllum microsorum v. d. B.

BURMA: Between Sadon and the Yunnan border (7396).

Hymenophyllum australe Willd.

BURMA: Between Sadon and the Yunnan border (7445).

YUNNAN: Between Tengyueh and the Burmese border (7335). Between Kambaiti and Tengyueh (7556).

All the specimens belong to *H. crispatum* Wall., which is kept distinct by Professor Nakai in his recent Key to the Japanese Hymenophyllaceae.⁵ Perhaps he is right, though it is difficult to say precisely how *H. crispatum* may be distinguished from the many other forms grouped under the name *H. australe*.

Hymenophyllum khasianum Baker.

BURMA: Between Sadon and the Yunnan border (7442, 7445a).

YUNNAN: Between Tengyueh and Lungling (7186a).

Identified from the description of *Leptocionium flaccidum* v. d. B. and Clarke's illustration. (Review, pl. 49, f. 2.) The plant illustrated is larger, but the sori are just as in our specimens, with the valves of the indusium long and truncate-obtuse.

Hymenophyllum khasianum is closely related to *H. barbatum* (v. d. B.) Miquel and very likely represents a larger tropical form of that species, which is widely distributed in China and has been described by Baker and Christ under new names. Thus, *H. henryi* Baker, from Hupeh (*Henry* 5457; Kew!), seems to me rather large but typical *H. barbatum*, and *H. omeiense* Christ, from Mount Omei (*Wilson* 5364!), is very nearly identical with it. More different in habit is *H. fastigiosum* Christ, though it may be a form of the same species.

No. 7186a, a single specimen, is referred here with doubt.

TRICHOMANES L.

Trichomanes auriculatum Blume.

YUNNAN: Between Kambaiti and Tengyueh (7532).

CYATHEACEAE

CYATHEA J. E. Smith

Cyathea brunoniana (Wall.) Clarke & Baker.

Alsophila costularis Baker, Kew Bull. Misc. Inf. 1906: 8. 1906.

BURMA: Between Sadon and the Yunnan border; "trunk 25 feet high; crown subhorizontal" (7464).

YUNNAN: Between Tengyueh and the Burmese border (7317).

The indusium is a very shallow cup that soon breaks down, often leaving a patelliform scale only. Thus the species properly belongs to *Hemitelia*, sect. *Amphicosmia*; but it seems to me quite unnatural to separate from *Cyathea* the species of this section, or at least those occurring in the Old World.

The present plant is a very close ally of *C. spinulosa*, differing from it by the hairy costae and costules and the small indusia. The type specimen of *Alsophila costularis* Baker, from Yunnan (*Henry* 13136; Kew!), is exactly identical with Rock's material. Baker overlooked the presence of an indusium.

ALSOPHILA R. Br.

Alsophila glabra (Blume) Hook.

PLATE 13.

BURMA: Keng Tung Territory: Between Muang Len, Pang Kha Luang, and Muang Hpyak (2032. 2041); between Pang Sop Lao and Ban Yang Kha, valley of the Meh Len (2153); Meh Lui watershed (2341).

EXPLANATION OF PLATE 13.—*Alsophila glabra*. Along brook, Meh Lui watershed, Keng Tung Territory, Burma, at 900 meters elevation; *Rock* 2341.

⁵ Bot. Mag. Tokyo 40: 242. 1926.

Here may be mentioned the following critical species of southern China, closely related to *Alsophila glabra*:

Alsophila henryi Baker, Kew Bull. Misc. Inf. 1898: 229. 1898 (Yunnan, *Henry* 11451; Kew!).

Aspidium lamprocaulon Christ, Bull. Acad. Géogr. Bot. 16: 117. 1908 (Szechwan, *Wilson* 5397; Herb. Christ!).

Dryopteris lamprocaulis C. Chr. Ind. Fil. Suppl. 34. 1913.

Alsophila glabra var. *cavaleriana* Christ, Bull. Acad. Géogr. Bot. 20³: 141. 1910. (Kweichou, *Cavalerie* 3385!).

This differs chiefly from *A. glabra* by its broader, much more deeply pinnatifid pinnules and its serrate segments, the veins 7 to 9 jugate, simple or rarely furcate, and it may be no more than a form of that species.

Alsophila glauca (Blume) J. Smith.

BURMA: Keng Tung Territory, Valley of the Meh Len (2097).

Alsophila khasyana Moore.

BURMA: Between Sadon and the Yunnan border (7431).

New to China. Typical.

CIBOTIUM Kaulf.

Cibotium barometz (L.) J. Smith.

PLATE 14

BURMA: Keng Tung Territory: Between Muang Len and Meh Kong (2004); Meh Lui watershed (2298, 2305, 2313); between Keng Hung and Muang Hing (2651).

I do not agree with Christ⁶ in considering *C. assamicum* Hook. distinct from *C. barometz*. It is a larger form with serrate segments, with 5 or 6 pairs of sori to each. No. 2004 is this form; no. 2298 is intermediate between it and the typical plant.

EXPLANATION OF PLATE 14.—*Cibotium barometz*, in forest, Keng Tung Territory, Burma, at 900 to 1,050 meters elevation. A, *Rock* 2298; B, *Rock* 2004, the fronds 3 meters long.

POLYPODIACEAE

DIACALPE Blume

Diacalpe aspidioides Blume.

YUNNAN: Between Tengyueh and the Burmese border (7344). East of Tengyueh (7628, 7694).

BURMA: Between Sadon and the Yunnan border (7481, 7483, 7511).

WOODSIA R. Br.

Woodsia lanosa Hook.

YUNNAN: Eastern slope of Likiang Snow Range (6011).

CYSTOPTERIS Bernh.

Cystopteris setosa Bedd.

YUNNAN: East of Tengyueh, Hsia Ping Ho (7722).

A small form of this interesting species, the systematic position of which appears to me very doubtful; its place in the present genus seems wholly unnatural.

ACROPHORUS Presl

Acrophorus stipellatus (Wall.) Moore.

BURMA: Between Sadon and the Yunnan border (7392, 7441).

YUNNAN: Between Tengyueh and the Burmese border (7353).

⁶ Philippine Journ. Sci. Bot. 2: 117. 1907.

MATTEUCCIA Tod.

Matteuccia orientalis (Hook.) Trev.

YUNNAN: Salween Ridge (6997). Between Kambaiti and Tengyueh 7569).

DRYOPTERIS Adans.

Dryopteris calcarata var. *sericea* (Scott) C. Chr.

Lastrea sericea Scott; Bedd. Ferns Brit. Ind. pl. 308. 1869. Not *Dryopteris sericea* C. Chr. Bot. Gaz. 56: 136. 1913.

Aspidium ciliatum Wall. List, no. 351. 1828 (*nomen*).

Nephrodium calcaratum var. *ciliatum* Baker in Hook. & Baker, Syn. Fil. ed. 2, 494. 1874.

Nephrodium ciliatum Clarke, Trans. Linn. Soc. II. Bot. 1: 514. 1880, not Desv. 1827.

Lastrea calcarata var. β *sericea* Bedd. Handb. Ferns Brit. Ind. 237. 1883.

BURMA: Keng Tung Territory: Valley of the Meh Len (2185); between Pang Hoi Hpi and Peng Sai (2206).

YUNNAN: Between Chieng Law and Muang Hun (2378). Between Keng Hung and Muang Hing (2719).

Although I am tolerably sure that this form is specifically different from genuine *D. calcarata*, I prefer to place it provisionally under that species as a variety, partly because I have a specimen from Annam (*Cadière* 21) that is intermediate between it and the true *D. calcarata*, and partly because no name ascribed to it thus far would be valid specifically. In size, pubescence, and lack of auriculiform pinnae our plant is essentially like *D. calcarata*, but the pinnae are less cut, the lobes less oblique, and the sori closer to the costule. The pinnae are rarely as much as 5 cm. long and 1 cm. broad, and are often obtuse but also sometimes acuminate, the upper basal lobe less elongate.

Dryopteris falciloba (Hook.) C. Chr.

Lastrea falciloba Hook. Journ. Bot. Kew Misc. 9: 337. 1857.

Nephrodium falcilobum Hook. Sp. Fil. 4: 108. 1862; Clarke, Trans. Linn. Soc. II. Bot. 1: 515. 1880.

BURMA: Keng Tung Territory, Valley of the Meh Len (2082).

YUNNAN: Between Keng Hung and Muang Hing (2720). Between Muang Hing and the Szemao hills (2775).

I agree with Clarké in his view that this is specifically different from *D. calcarata* (Blume) Kuntze, to which it was referred as a variety by Beddome (Handbook, p. 237) and other writers. It differs chiefly in its larger size (pinnae up to 15 cm. long and 1.5 cm. wide), the presence of several auriculiform pinnae below the developed ones, and the glabrous indusia.

Dryopteris gracilescens (Blume) Kuntze.

YUNNAN: Kuyung, east of Tengyueh (7693).

Dryopteris flaccida (Blume) Kuntze.

YUNNAN: East of Tengyueh, along trail to Hsiao Ping Ho (7717).

Dryopteris ochthodes (Kunze) C. Chr.

YUNNAN: Ho Mu Shu, near Tengyueh (7853).

Dryopteris xylodes (Kunze) Christ.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2234).

YUNNAN: Between Tengyueh and Lungling (7073, 7143). Between Tengyueh and Bhamo (7836).

A leaf of no. 7143 is 2.25 meters long and 40 cm. wide.

***Dryopteris tuberculifera* C. Chr., sp. nov.**

Rhizome creeping? Stipe solitary, up to 1 meter long, 1 cm. thick, fusco-stramineous, glabrous, with 10 to 15 pairs of small black-brown tubercles (aerophores of abortive pinnae) at distances of about 6 cm., the lowest ones about 10 cm. from the stipe base; blade ovate-lanceolate, 1 meter long (or probably more), membranous, glossy above, nearly glabrous throughout, the costae of the pinnae excepted, these short-strigose above and bearing very few whitish hairs beneath; rachis terete beneath, trisulcate above, stramineous; pinnae numerous, sessile, with a distinct aerophore, 4 to 5 cm. apart, linear-lanceolate, long-acuminate, the middle one about 30 cm. long, the lower ones somewhat abbreviated but not auriculiform, pinnatifid nearly to the costa; segments numerous, with rounded sinuses between, falcate, entire, acute, 15 to 18 mm. long, 4 mm. broad, the basal ones of middle and upper pinnae somewhat elongate, those of the lower pinnae greatly abbreviated, often obsolete; veins in about 15 pairs, very distinct on both sides, all simple, the basal ones running out to the sinus; sori near the costa (the basal ones more remote from it), 10 to 13 on each side, small; indusia reniform, brown, persistent, glabrous; sporangia glabrous.

YUNNAN: In dry sand along stream beyond Muang Hing, March 2-12, 1922 (2731, type). I have the same plant from Sikkim (*Kari* 37).

This large species was no doubt referred by Clarke to his *Nephrodium prolixum* (Review, p. 516), which besides includes *Dryopteris ochthodes* and *D. xylodes*. It seems to me, however, impossible to refer it to either of these species. It is certainly very near *D. xylodes*, agreeing in almost all characters ascribed to that species; I have compared it with typical specimens of *D. xylodes* from the Nilgiri Mountains of southern India, the type locality, with which the Rock specimens so cited fully agree. *Dryopteris tuberculifera* is a much larger fern, dark green and glossy, and essentially glabrous; the rachis is terete below, not quadrangular as in *D. xylodes*; the veins are more prominent and numerous. In general aspect the species recalls *D. erubescens* and *D. braineoides*, but these are exindusiate.

***Dryopteris lofouensis* Christ, Bull. Acad. Géogr. Bot. 20²: 143. 1910.**

BURMA: Keng Tung Territory, Valley of the Meh Len (2141).

YUNNAN: Banks of the Meh Kong, near Keng Hung (2553).

Both specimens match exactly a fragment of the type specimen from Kweichou (*Cavalerie* 3567!); but the upper part of the rachis and the costae beneath are somewhat pubescent by short whitish hairs, and the basal pinnae are similar to the others in no. 2553, though showing a tendency to becoming more compound in no. 2141, as described by Christ.

The species is very intimately related to *D. sylvatica*, but is much smaller, with the subsessile pinnae 20 cm. long by 4 to 5 cm. wide only, in cutting resembling *Tectaria austrosinensis*, mentioned below. It is certainly very near *D. microthecia* (Fée) C. Chr. (*Dryopteris metteniana* Hieron.); and like that species it differs from *D. sylvatica* in its sessile or subsessile pinnae and in bearing the sori generally almost at the tip of the anterior branch of the forked veins. Not having seen an authentic specimen of *D. microthecia* (*Cuming* 13; my specimen of this number is certainly *D. sylvatica* var. *petiolosa* Christ), I dare not identify *D. lofouensis* with it.

Dryopteris syrmatica (Willd.) Kuntze.

Dryopteris cnemidaria Christ, Bull. Acad. Géogr. Bot. 20²: 140. 1910.

BURMA: Keng Tung Territory, Valley of the Meh Len (2140).

Fully identical with Assam specimens collected by Mann, as well with *D. cnemidaria* Christ from Kweichou (*Cavalerie* 3382!). It is a very large form and is perhaps specifically distinct from the Malayan type (*Aspidium spectabile* Blume). The pinnae are up to 10 cm. broad, the segments short-acuminate, not bluntish as in the type.

Dryopteris ornata (Wall.) C. Chr.

BURMA: Mong Khong Ka, between Tengyueh and Bhamo (7842).

A very tall plant, according to Beddome 15 to 20 feet high. The frond examined is 3.5 m. long, the lowest pinnae 50 cm. long by 15 cm. wide.

Dryopteris decursivopinnata (van Hall) Kuntze.

YUNNAN: Between Tengyueh and Lungling, in dense forest (7129). Foot of Salween Ridge, in forest (7594.)

Dryopteris africana (Desv.) C. Chr.

YUNNAN: Between Tengyueh and Lungling (7184).

Dryopteris khasiana C. Chr.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2212).

YUNNAN: Valley of Nam H pang Koh, along stream (2647). Muang Hing region (2732). Between Mehei and Maokai (2914).

In cutting and venation *D. khasiana* very much resembles *D. hirtipes* and its immediate allies, but in spite of free veins its relationship is not with that species but with *D. penangiana* and others having goniopteroid venation. It differs from the subgenus *Eudryopteris* in its dark green color and imparipinnate blades, in the lack of scales above the stipe base, and in having the secondary veins not decurrent below.

Dryopteris parasitica (L.) Kuntze.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2247).

YUNNAN: Between Yu Tan Po and Man Lo (7141).

I am still unable to characterize clearly the many Asiatic forms of this collective species, and must therefore employ here the usual name for the two specimens above cited; they look rather different.

Dryopteris molliuscula (Wall.) C. Chr.

BURMA: Keng Tung Territory, Valley of the Meh Len (2189).

Dryopteris crinipes (Hook.) Kuntze.

BURMA: Keng Tung Territory, Valley of the Meh Len (2089).

YUNNAN: Nam H pang Koh, between Keng Hung and Muang Hing, along bank of stream (2649). Between Mohei and Maokai (2951).

New to China. No. 2089 has the frond more than 2 meters long.

Dryopteris prolifera (Retz.) C. Chr.

BURMA: Keng Tung Territory, Valley of the Meh Len (2115).

Dryopteris subelata (Baker) C. Chr. Ind. Fil. Suppl. 40. 1913.

Nephrodium subelatum Baker, Kew Bull. Misc. Inf. 1906: 11. 1906.

BURMA: Keng Tung Territory, Valley of the Meh Len (2113).

YUNNAN: Between Keng Hung and Muang Hing, along shady stream banks (2573, 2593, 2717).

The only full-grown specimen in the Rock collection (no. 2593) is exactly identical with the type specimen (*Henry* 11809a; Kew!). To Baker's description may be added: Rhizome creeping, with brown pubescent lanceolate scales; blade with several pairs of distant, auriculiform pinnae below and a

rather distinct terminal pinna, this with 1 or 2 short pinnae at base; pinnae about 4 cm. apart, alternate, short-petiolate, truncate at base, acuminate, 15 to 20 cm. long, 3 cm. wide, cut one-third the way to the midrib into falcate, obtuse or subtruncate, distally acutish, dense lobes; texture subcoriaceous; veins simple, 10 to 12 jugate, raised beneath, the lower 4 or 5 pairs united; sori medial, with persistent, coriaceous, short-hairy indusia; rachis with minute, lanceolate scales; upper side of pinnae glabrous, except for the strigose costae, the under side densely downy throughout with very short erect hairs.

This is very probably one of the north Indian forms referred to *Nephrodium pennigerum* by Beddome (Handbook, p. 277). *N. pennigerum* Bedd. was supposed to be the same as the Malayan *Aspidium pennigerum* Blume, which is *Dryopteris megaphylla* (Mett.) C. Chr.; but in the supplement to his Handbook (pp. 73, 74) Beddome refers *A. pennigerum* Blume to his *N. multilineatum* (Wall.), now using the name *pennigerum* for a northeast Indian fern without auricles, which may be the following species.

Now *D. subelata* is certainly very like *D. megaphylla* from Java, but that is thinner in texture and has the veins scarcely raised, the lobes more acute, and the under side hairy on the veins only. These differences are small, it is true, and it is quite possible that *D. subelata* is after all only a form of *D. megaphylla*, to which species Christ¹ referred his specimen of Henry 11809 (as *Aspidium pennigerum* Blume).

***Dryopteris hirtisora* C. Chr., sp. nov.**

In size, habit, cutting, and texture very like *D. subelata*, but differing in the absence of auriculiform pinnae below and in its coarser pubescence, small hirsute evanescent indusia, and villose sporangia.

Rhizome wide-creeping, the stipes distant, 60 to 70 cm. long, without auricles or with a single pair of abbreviated pinnae below; pinnae 20 cm. long, 18 to 25 mm. broad, lobed one-third the way down, with truncate or subacute close lobes, the upper side with scattered needle-like hairs on the veins, the lower side rather densely pubescent with long hairs on the costae and veins and shorter ones on the leaf tissue; rachis without scales, densely short-hirsute; veins about 10-jugate, the 3 lower pairs united, the following 2 running to a hyaline membrane below the sinus; sori medial or slightly inframedial; indusia small, hirsute, the head of the sporangia with 3 to many soft long hairs.

BURMA: Keng Tung Territory, along a mountain trail between Pang Hoi Hpi and Peng Sai (2208, type; 2235).

YUNNAN: Between Keng Hung and Muang Hing (2709).

Also in northern Siam: Upper slopes and summit of Doi Chom Cheng 1511, 1759).

Although *D. hirtisora* closely resembles *D. subelata*, the characters given above seem sufficient for its segregation. As mentioned under *D. subelata*, *Nephrodium pennigerum* Bedd. (Handbook, Suppl. p. 73) may be this species, although neither Clarke nor Beddome mentions the hairy sporangia.

***Dryopteris truncata* (Gaudin) Kuntze.**

BURMA: Keng Tung Territory, between the Siamese border and Pang Mah Ki Hat (1966).

YUNNAN: Banks of the Meh Kong, near Keng Hung (2550). Valley of Nam H pang Koh, between Keng Hung and Nuang Hing (2650).

¹ Bull. Herb. Boiss. 7:17. 1899.

To this species, as generally understood, belong a series of rather different forms which need a thorough revision. The specimens referred here are not closely alike.

Dryopteris moulmeinensis (Bedd.) C. Chr.

BURMA: Keng Tung Territory: Between the Siamese border and Pang Mah Ki Hat (1936, 1958); Valley of the Meh Len (2142).

YUNNAN: Banks of the Meh Kong, near Keng Hung (2526). Between Keng Hung and Muang Hing (2596). Between Tengyueh and Lungling (7093).

Variable in density of pubescence, in number and direction of veins, and in size. No. 2526 is a very large glabrescent form, the whole leaf 1.7 meters long, with 15 pairs of pinnae, these 30 to 35 cm. long and 4.5 cm. wide.

Dryopteris urophylla (Wall.) C. Chr.

YUNNAN: Along the Meh Kong, near Keng Hung; on rocks in river bed (2552).

Dryopteris cuspidata (Blume) Christ, Philippine Journ. Sci. Bot. 2: 205. 1907.

Meniscium cuspidatum Blume, Enum. Pl. Jav. 114. 1828.

BURMA: Keng Tung Territory, Valley of the Meh Len, between Muang Hpyak and Pang Sop Lao (2136).

Well marked by the exindusiate, often confluent sori, otherwise very near *D. urophylla*.

Subgenus EUDRYOPTERIS

Dryopteris hirtipes (Blume) Kuntze.

After examination of a fair number of specimens I feel compelled to refer to this species several forms described from northern India and China as species, thus agreeing with Clarke and Beddome. I have failed to find stable characters by which they may be distinguished with certainty; scarcely two specimens are exactly identical as to scales, degree of cutting, and venation. I shall try to characterize briefly some of these forms.

f. *typica* (*Aspidium hirtipes* Blume).

Pinnae mostly short-stalked, 2 to 2.5 cm. broad, not close, incised rather deeply (incisures 5 mm. deep or more), with oblique crenate lobes, these having the anterior edge rounded, the posterior one straight and often with 1 or 2 short teeth at the outer distal corner; stipe, rachis, and costae beneath rather sparsely crinite by reddish-brown or blackish, entire or very sparsely fimbriate scales.

Malaya, Ceylon, southern India, Siam.

Dryopteris hirtipes var. *atrata* (Wall.) C. Chr.

Aspidium atratum Wall.; Kunze, Linnaea 24: 279. 1851 (in part?).

Pinnae mostly sessile, not close, 2 cm. broad or less, the obliquely truncate base diverging from the rachis; margins serrulate (incisures only 2 to 3 mm. deep), the lobes broader than long, truncate and often slightly emarginate, with a distal tooth; scales of stipe and rachis mostly very dense, linear, black or blackish, sometimes distinctly fimbriate, those of the costae beneath often reddish.

Common in Indian Himalaya, also in southern China (e. g. Kweichou, *Cavalerie* 2847).

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2207).

YUNNAN: Between Tengyueh and the Burmese border (7336, 7338).

A form of this variety, described as *Aspidium pycnopteroides* Christ,⁵ occurs in western Szechwan (*Wilson* 5401! *H. Smith* 2066, 2103!). It differs from typical *atrata* chiefly in the broader, light brown scales of the rachis.

⁵ Bull. Acad. Géogr. Bot. 16: 116. 1906.

Dryopteris hirtipes var. **stenolepis** (Baker) C. Chr.

Polypodium (Goniopteris) *stenolepis* Baker, Kew Bull. Misc. Inf. 1898: 231. 1898.

Aspidium yunnanense Christ, Bull. Herb. Boiss. 6: 965. 1898.

Nephrodium gamblei Hope, Journ. Bombay Nat. Hist. Soc. 12: 533. pl. 7. 1899.

Dryopteris gamblei C. Chr. Ind. Fil. 267. 1905.

Dryopteris stenolepis C. Chr. Ind. Fil. 294. 1905.

Very like var. *atrata*, with the stipe and rachis densely crinite with nearly black linear scales, but tolerably well marked by the narrower (1 to 1.5 cm. broad), numerous, and densely placed pinnae, these strictly sessile, with the truncate base closely parallel to the rachis and sometimes overlapping it; stipe bases and apex of the strong erect rhizome covered with a dense mass of large ovate-lanceolate scales, these fuscous in some specimens, in others light brown and glossy, those of the stipe above its base always nearly black.

This is the commonest form in Yunnan. I have little doubt that the Himalayan *Nephrodium gamblei* Hope is identical with *Polypodium stenolepis* Baker, and Hope himself (?) has noted their identity on the type sheet of the latter (Henry 9038; Kew!), which Baker referred to the subgenus *Goniopteris* of *Polypodium*, although the veins are free.

YUNNAN: Between Tengyueh and Lungling (7214, 7220). East of Tengyueh (7854).

BURMA: Kambaiti Valley (7507).

A form of this variety with the pinnae lobed halfway down to the midrib is *Aspidium lunanense* Christ⁹ (Henry 10584!). Also the Japanese *Dryopteris dickinsii* (Franch. & Sav.) C. Chr. seems to be a form of *D. hirtipes* closely allied to the plant described as *A. pycnopteroides* Christ, mentioned above.

Intimately related to *D. hirtipes* is *Dryopteris thibetica* (Franch.) C. Chr., with which *Nephrodium microlepis* Baker, from Yunnan (Henry 13154; Kew!), is almost identical. It differs from all forms of *hirtipes* in the reddish, crisped, linear scales of the rachis, in having the pinnae incised midway to the midrib into triangular-oblong, subobtuse, subdentate lobes with cartilaginous teeth (the middle segments often a little enlarged), and in having the midveins of the lobes curved backward more strongly at base. In cutting, *Nephrodium microlepis* is exactly like the type from Mupin (leg. David!), but the venation is slightly different, the edges are less cartilaginous, and the sori are closer to the midrib.

I may mention here also *Dryopteris peregrina* C. Chr.,¹⁰ which I had formerly supposed to be a near relative of *D. thibetica*. It was described from a sterile specimen collected in Kiu Kiang, by Shearer. An examination of the type specimen at Kew has shown, however, that it is only a sterile leaf of *Matteuccia orientalis*.

Dryopteris clarkei (Baker) Kuntze.

BURMA: Between Sadon and the Yunnan border, altitude 2,700 meters (7405).

Blade long-attenuate below, in general aspect very similar to the form mentioned by me recently¹¹ under the name *D. filix-mas* subsp. *fibrillosa* (Clarke) C. Chr., which I now consider a distinct species. *Dryopteris clarkei* is more closely related to *D. apiciflora*, however, than to the form just mentioned, and is especially well marked by the rectangular truncate segments, these

⁹ Bull. Herb. Boiss. 6: 966. 1898.

¹⁰ Ind. Fil. 284. 1905 (*Nephrodium regulare* Baker, Journ. Bot. Brit. & For. 13: 200. 1875).

¹¹ Medd. Bot. Trädg. Göteborg 1: 57-59. 1924.

not toothed, but bordered by a rather broad hyaline margin, and not fibrillose beneath; costa above straight, very slightly or not at all furrowed. The species is illustrated rather well by Beddome (Ferns Brit. Ind. Suppl. pl. 371).

***Dryopteris apiciflora* (Wall.) Kuntze.**

YUNNAN: East of Tengyueh, in dense forest; altitude 2,400 meters (7603).

In size, color, and scaly stipe and rachis the present plant is scarcely different from *D. paleacea*, yet I consider it a distinct species. It is fully bipinnate; secondary pinnules not so close as in *D. paleacea*, adnate and short-decurrent at the posterior base, excised at the anterior one; margins entire or repand, the apex truncate or a little attenuated, crenately dentate, not sharply serrate as in *D. paleacea*; sori mostly confined to the outer third of the pinnules; indusia peltate, with a very low sinus; costae above straight, very narrowly sulcate or not, rather fibrillose with rufous scales.

This species has recently been found in Formosa, but is new to China.

***Dryopteris paleacea* (Swartz) C. Chr. Amer. Fern Journ. 1: 94. 1911.**

Aspidium paleaceum Swartz, Syn. Fil. 52. 1806 (type from Andes); D. Don. Prodr. Fl. Nepal. 4. 1825 (type from Himalaya).

Dryopteris flix-mas * *A. paleaceum* Swartz and * *A. patentissimum* Wall.; C. Chr. Ind. Fil. 265. 1905, with synonyms (*Nephrodium flix-mas* var. *fibrillosa* Clarke excepted).

YUNNAN: West of Talifu, Shia Shiu Chi, altitude 2,400 meters (6896). From Pingpo to Tengyueh, Salween Ridge (7009). Between Tengyueh and the Burmese border (7354).

BURMA: Between Sadon and the Yunnan border (7506).

I have formerly considered the American *Aspidium paleaceum* Swartz (*A. parallelogrammum* Kunze) and the Himalayan *A. paleaceum* Don (*A. patentissimum* Wall.) specifically different, but a close comparison of the very complete specimens gathered by Mr. Rock with equally beautiful specimens received in recent years from America has shown me that it is impossible to find one stable character by which they can be distinguished. On the other hand, this tropical species can not be united at all naturally with our northern *D. flix-mas*. Although a much larger fern—the leaves are sometimes as much as 1.5 meters long—it is less incised, with very uniform closely placed secondary segments, these broadly adnate and widened at both sides of the base, the parallel edges entire, the truncate apex sharply serrate. The mature indusia are biscuteloid,¹² i. e. cleft into two equal halves, exactly as in the American form. The stipe and rachis are very densely paleaceous, with patent lanceolate-linear, reddish brown or (rarely) blackish scales; the costae are flexuose above and broadly sulcate, the furrow with raised pale edges and deciduous hairlike fibrils.

Under this species I recognize provisionally the following variety:

***Dryopteris paleacea* var. *hasiana* (Clarke) C. Chr.**

Nephrodium flix-mas var. *hasiana* Clarke, Trans. Linn. Soc. II. Bot. 1: 519. pl. 69, f. 1. 1880.

YUNNAN: Between Tengyueh and the Burmese border (7285). Between Kambalti and Tengyueh near Tako (7540).

SOUTHEASTERN TIBET: Mount Kenyichunpo (11628, doubtful).

Differs from the typical form of the species in its lesser size, in having the blade not narrowed below, in the hairlike, nearly black fibrils of the

¹² Fée, Gen. Fil. pl. 23 B, f. 1.

stipe and rachis, in its segments being more oblique, short-acute, and sharply toothed both at the tip and below it, and in its smaller sori. It is probably a valid species, near *D. odontoloma*.

Dryopteris odontoloma (Moore) C. Chr. Medd. Bot. Trädg. Göteborg 1: 59. 1924.

Dryopteris flix-mas **Lastrea odontoloma* Moore; C. Chr. Ind. Fil. 265. 1905, with synonymy.

Dryopteris juxtaposita Christ, Bull. Acad. Géogr. Bot. 17: 138. 1907.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 2,700 meters elevation (3607, 3812, 5996).

Dryopteris chrysocoma (Christ) C. Chr. Ind. Fil. 257. 1905.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,000 meters elevation (5611). Summit of Shwell-Salween Ridge, east of Tengyueh, in dense forest (7726).

This is likely a high-alpine, scaly, glandulose-pubescent form of *D. cochleata*.

Dryopteris cochleata (D. Don) C. Chr. Ind. Fil. 258. 1905.

BURMA: Keng Tung Territory: Dry plains, between Pang Hoi Hpi and Peng Sai (2245); Meh Lui watershed (2285).

YUNNAN: Between Tengyueh and the Burmese border (7279). East of Tengyueh (7679). Between Tengyueh and Bhamo (7828).

Often decidedly dimorphic, the fertile pinnules much contracted.

Chinese specimens which I refer here have been named, by Merrill, *D. heleopteroides* Christ, a species from Luzon, unknown to me. May it be the same as *D. cochleata*?

Dryopteris sublacera Christ, Not. Syst. Lecomte 1: 43. 1909; C. Chr. Medd. Bot. Trädg. Göteborg 1: 60. 1924.

Dryopteris blepharolepis C. Chr. in Lévillé, Cat. Pl. Yun-Nan 103. 1916.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,150 meters elevation, in gulch, under *Abies* (5889).

Dryopteris fructuosa (Christ) C. Chr. Ind. Fil. 267. 1905; Med. Bot. Trädg. Göteborg 1: 61. 1924.

Aspidium varium var. *fructuosum* Christ, Bull. Herb. Boiss. 6: 967. 1898.

Aspidium fructuosum Christ, Bull. Soc. Bot. France 52: Mém. 1: 38. 1905.

Dryopteris basisora Christ, Not. Syst. Lecomte 1: 44. 1909.

Dryopteris cavalerii Lévillé; C. Chr. in Lévillé, Cat. Pl. Yun-Nan 104. 1916.

Dryopteris adenorachis C. Chr. Ind. Fil. Suppl. Prél. 1913-1916, 13. 1917.

YUNNAN: West of Talifu, en route to Youngchang and Tengyueh (6649, 6921, 7033a). East of Tengyueh (7612, 7733, 7862).

This species varies considerably in degree of cutting. The largest specimens have the pinnules deeply pinnatifid, whereas others (e. g., nos. 6649 and 7033a) are bipinnate only, with subentire, oblong, obtuse, subhastate pinnules, thus in cutting scarcely different from *D. sublacera*. The latter species differs, however, in its lanceolate (not deltoid) blades and in its distinctly fimbriate rachis scales. I suppose that the *Nephrodium rigidum* of Clarke and Beddome is this species.

Dryopteris marginata (Wall.) Christ, Philippine Journ. Sci. Bot. 2: 212. 1907.

Dryopteris flix-mas **Aspidium marginatum* Wall.; C. Chr. Ind. Fil. 265. 1905, with synonyms.

BURMA: Between Sadon and the Yunnan border (7504).

YUNNAN: Between Hsiaó Chai and summit of Shwell-Salween ridge, in forest, at 2,100 meters elevation (7620).

Dryopteris barbiger (Moore) Kuntze.

YUNNAN: Alpine heights of the Likiang Snow Range, altitude about 3,900 meters (4968). Among undergrowth in *Acer* forest, mountains above Tsaku and Tsehchung, altitude 3,300 meters (11604).

Dryopteris erythrosora (D. C. Eaton) Kuntze.

YUNNAN: Between Szeamo and Puerhfu (2852).

According to description, *D. subtriangularis* (Hope) C. Chr. seems to be a form of this species. It is best known by the bullate scales of the costae beneath.

Dryopteris sparsa (D. Don) Kuntze.

YUNNAN: Between Keng Hung and Muang Hing (2721).

BURMA: Between Sadon and the Yunnan border (7503).

Dryopteris sikkimensis (Bedd.) Kuntze.

YUNNAN: East of Tengyueh, Shweli-Salween watershed, in dense forest; altitude 2,400 meters (7597, 7601).

This beautiful fern was hitherto known from Sikkim only. The stipe and lower part of the rachis of no. 7597 are atropurpureous, as in *D. splendens*.

Subgenus POLYSTICHOPSIS

Dryopteris speciosa (D. Don) C. Chr. Medd. Bot. Trädg. Göteborg 1: 63. 1924.

Polystichum speciosum J. Smith; C. Chr. Ind. Fil. 587. 1906, with synonymy

YUNNAN: Between Tengyueh and the Burmese border (7371).

The plant here cited represents a less divided form of the species, with broad pinnules.

Dryopteris speciosa var. *assamica* (Kuhn) C. Chr.

Aspidium assamicum Kuhn, Linnaea 36: 108. 1869.

BURMA: Keng Tung Territory, Valley of the Meh Len (2186).

A larger and more divided plant, which I identify from Kuhn's description. It is bipinnate-pinnatifid, the lower pinnae 30 cm. long and equal-sided, the pinnules 4 cm. long, and very unequal at base.

Dryopteris aristata (Forst.) Kuntze.

Polystichum aristatum Presl; C. Chr. Ind. Fil. 578. 1906, with direct synonyms (most, if not all, varieties excluded).

YUNNAN: Between Keng Hung and Muang Hing (2718).

Dryopteris carvifolia (Kunze) C. Chr. Medd. Bot. Trädg. Göteborg 1: 64. 1924.

Polystichum carvifolium C. Chr. Ind. Fil. 580. 1906 (excl. syn. *A. conifolium* Wall.).

YUNNAN: Between Muang Hun and Muang Hai (2411).

See the comments under the following species.

Dryopteris henryi (Christ) C. Chr.

Polystichum henryi Christ, Not. Syst. Lecomte 1: 36. 1909.

Aspidium conifolium Wall. 1828 (nomen); Kunze, Linnaea 24: 293. 1851, not Presl, 1822.

Polystichum carvifolium C. Chr. Ind. Fil. 580. 1906, in part.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Pang Sai (2233).

YUNNAN: Between Tengyueh and the Burmese border (7337).

I agree with Christ that this is so distinct a form that it must be considered specifically different from *D. carvifolia*. In sorting out the rather numerous specimens in the Botanical Museum of Copenhagen sent a century ago from our countryman, N. Wallich, to Professor Hornemann I find that they evidently

belong to two different forms, and that only one is named *A. conifolium* Wall., i. e., the name received from Wallich. Furthermore, I find that Kunze in 1851 clearly pointed out the differences between these same two forms, which were described by him as *A. carvifolium* Kunze and *A. conifolium* Wall. (loc. cit. 292-293). Mettenius, in his paper on *Aspidium* and *Phegopteris*, made *conifolium* a variety of *carvifolium*; but later on both were either referred to *A. aristatum* as much-divided varieties, e. g. by Clarke (Review, p. 511), or were merged together into one species, *conifolium* (e. g., Beddome, Handbook, p. 230). Beddome's character, "sori large or small," seems clearly to show that he knew both forms. As indicated above, I regard them without question as specifically different, and shall here point out some of their distinguishing characters.

Dryopteris carvifolia is smaller than the other, coriaceous and shining, pale green beneath, and three to four times pinnate; sori with rather large, persistent, subreniform, pale brown indusia; scales of stipe many, of rachis few, all narrowly lanceolate and distinctly toothed. *Dryopteris henryi* is a much larger species, the blades thin, nearly herbaceous, scarcely paler below, and four to five times pinnate with basal pinnae 40 cm. long or more; sori smaller, with the less persistent brown indusia nearly always abraded in herbarium specimens; scales of stipe many, of rachis almost none, entire. There are, besides, other differences—for example, in the shape of the ultimate segments and teeth. In habit *Dryopteris henryi* is not unlike *D. effusa* (Swartz) Urban, of tropical America.

Dryopteris fargesii (Christ) C. Chr. var.?

PLATE 15

YUNNAN: West of the Mekong, from Pingpo to Tengyueh (7029). East of Tengyueh (7645).

The present specimens apparently differ from the form described by Christ (*Farges* 299!) in lacking scales on the rachis and costules beneath, but a close examination shows that a few minute scales actually occur on the costules; in *D. fargesii* more numerous, distinctly bullate scales are found. It is highly probable that this decomposed fern of southern China is a form of the Japanese *D. miqueliana* (Franch. & Sav.) C. Chr. In size, cutting, and texture it fully agrees with that species, differing chiefly in the fewer scales of stipe and rachis, in its light green color, and in having not only the costules but also the costae of the pinnae hirsute above; in the type, ovate-bullate scales are found on the costules beneath, just as in *D. fargesii*.

I am inclined to believe, therefore, that *D. fargesii* (typical) is a slightly different form of *D. miqueliana*, and that the specimens under examination, with which others from Yunnan (*Cavalerie* 4726 in part) fully agree, represent a less scaly variety of the same species. *Dryopteris miqueliana* and *D. fargesii* belong to a small group of decomposed plants, including, for example, *D. diffracta* (Baker) C. Chr., which can not be placed very naturally under any of the subgenera characterized in my papers on the American species of *Dryopteris*.

EXPLANATION OF PLATE 15.—*Dryopteris fargesii*, from region east of Tengyueh, Yunnan, Rock 7645. Second pinna from base of blade. Two-thirds natural size.

POLYSTICHUM Roth

Polystichum deltodon (Baker) Diels.

YUNNAN: Ta Ho Shan, western slopes of the Likiang Snow Range, at 3,600 to 3,900 meters elevation (4238).

Polystichum stenophyllum Christ.

PLATE 16

YUNNAN: Lachiming Valley; altitude 2,400 meters; on shady banks in bamboo forest (8627).

EXPLANATION OF PLATE 16.—*Polystichum stenophyllum*; Rock 8627. Two-fifths natural size.

Polystichum obliquum (D. Don) Moore.

YUNNAN: Lower eastern slope of the Likiang Snow Range, at 2,700 meters altitude, in a limestone cave (3606).

Polystichum nepalense (Spreng.) C. Chr.

YUNNAN: Tsangshan Range, at 2,700 meters elevation, in a cave (3159). East of Tengyueh (7606, 7616).

Most distinct in the peculiar teeth and scales of the underside. The typical form is pinnate, with broad, falcate, short-acuminate pinnae that are distinctly auricled at the upper base, the margins white-callose and slightly serrate with irregular, straw-colored, broad teeth, which are not pungent. The under side is rather densely dotted on the veins with minute appressed scales, these nearly circular at base, often pale, and with a long-cuspidate reddish apex. The rachis is rather sparsely clothed with smaller cuspidate scales and with a number of large, ovate, light brown ones, the latter generally placed at the base of the pinnae and along the very long stipe.

Aspidium manmeiense Christ,¹³ is, according to Christ himself, a form of this species with the auricle of the lower pinnae free. It thus connects the type with the following variety:

Polystichum nepalense var. *subbipinnatum* C. Chr., var. nov.

YUNNAN: East of Tengyueh, between Hsiao Chai and the summit of the Shweli-Salween ridge, altitude 2,400 meters, on shaded mossy rocks (7605).

Pinnae deeply pinnatifid, with 4 or 5 ovate segments on each side below the broad serrate apex, the upper basal one large and free in the lower pinnae.

In cutting the new variety resembles very closely certain forms of *P. lobatum*, but the white teeth and the scales of the underside are exactly as in typical *P. nepalense* and prove that it is a more divided form of that species.

GROUP OF POLYSTICHUM SQUARROSUM

To this small group belongs an unbroken series of forms varying from simply pinnate to bipinnate. The group is exceedingly well marked by the hard, very coriaceous texture and glossy surfaces; by the thickened margins, which bear a few strong spines; by the fact that the rhizome and rachis, and usually also the underside, are densely beset with reddish scales, those of the rhizome and stipe very large and leaving characteristic transverse, linear, black or reddish scars (less distinct in the small forms), those of the underside consisting of a small central portion with 1 to 5 very long, reddish, hairlike, tortuous or crisped fibrils. The latter scales are, indeed, sometimes so numerous at first that the underside appears woolly, but in old fronds they are generally abraded. The scales of the rachis and costae beneath are of different sizes, varying from hairlike to lanceolate; they are generally reddish, though rarely (in some forms of *P. neolobatum*) blackish. The sori are, as a rule, nearer the midrib than the edge.

Taken as a whole, the group is easily distinguishable from others; but it is more difficult to delimit the few species comprising it, since they are almost completely connected by intermediates. Nevertheless I think it is possible to recognize the following species:

¹³ Bull. Herb. Boiss. 6: 965. 1898 (*Henry* 10097).

Polystichum stimulans Presl, Tent. Pter. 83. 1836.

Aspidium stimulans Kunze; Mett. Abh. Senckenb. Ges. Frankfurt 2: 327. 1858.

Aspidium ilicifolium D. Don, Prodr. Fl. Nepal. 3. 1825.

Polystichum ilicifolium Moore, Ind. Fil. 94. 1858, not Fée, 1852.

YUNNAN: Tsangshan Range, altitude 2,700 meters, in a cave (3159a). Eastern slopes of the Likiang Snow Range (3688).

This is the smallest form, with blades 2.5 to 5 cm. broad (rarely more), generally somewhat narrowed downward, simply pinnate to pinnate-pinnatifid, the large scales shortly erose-fimbriate or dentate. The least divided form is typical *P. stimulans*, from the Himalaya. It is simply pinnate, the pinnae triangular, rather remote, 1 to 1.5 cm. long, with a pungent lobe on each side of the base (the upper one the larger and sometimes nearly free) and above these often 1 or 2 shorter lobes; veins obscure; linear scars on stipe few or none.

Similar simply pinnate forms from southern China were described as *P. ilicifolium* var. *delavayi* Christ;¹⁴ they differ a little in their more crowded pinnae, and are transitional to the following species.

Polystichum acanthophyllum (Franch.) Bedd.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,300 to 4,200 meters elevation (3435, 3814).

Larger than the preceding. Blades 20 to 25 cm. long, 4 to 5 cm. wide, narrowed below, the pinnae imbricate, deeply pinnatifid, with 4 or 5 ovate segments, each with 3 or 4 pungent or mucronate teeth, the upper basal one larger and often quite free; veins distinct beneath; linear scars on stipes many.

The typical form of this species looks very distinct, but is possibly no more than a large state of *P. stimulans*. On the other hand the form named by Christ *P. acanthophyllum* var. *indicum*¹⁵ and illustrated by Hope¹⁶ connects the type with *P. squarrosum*; it is subbipinnate, with nonimbricate pinnae, these with 5 or 6 segments which have pungent tips but are generally without lateral teeth, the lower 2 or 3 free. This form could as well be considered a narrow state of *P. squarrosum*.

Polystichum cyclolobum C. Chr. in Lévillé, Cat. Pl. Yun-Nan 111. 1916.

YUNNAN (*Maire* 122).

Differs from *P. acanthophyllum*, which it equals in size, by the lamina being broadest at base and tapering gradually thence toward the apex, by the long-fimbriate scales, and by the short-ovate or nearly circular segments or pinnules, which are pungent at the tip only, rarely with a single tooth on the distal edge. It may be a small form of the following:

Polystichum neo-lobatum Nakai, Bot. Mag. Tokyo 39: 118. 1925.

Polystichum lobatum var. *chinense* Christ, Nuov. Giorn. Bot. Ital. n. ser. 4: 92. 1897.

Polystichum squarrosum var. *chinense* C. Chr. Medd. Bot. Trädg. Göteborg 1: 69. 1924.

YUNNAN: High plateau, between Talifu and Likiang, in a rocky gorge (3300).

In size and cutting greatly resembling typical *P. lobatum*, but much more coriaceous. Blades 10 to 12 cm. broad, subbipinnate; pinnae not imbricate, often rather distant, short-acuminate, pinnate in the lower half; pinnules ovate-acuminate, very close, the larger with 1 to 3 lateral pungent teeth, the upper

¹⁴ Mém. Soc. Bot. France 1: 31. 1905.

¹⁵ Mém. Soc. Bot. France 1: 31. 1905.

¹⁶ Journ. Bombay Nat. Hist. Soc. 14: pl. 29.

basal one enlarged, sublobate; narrow scales of stipe and rachis often dark colored, the larger ones of the stipe erose-dentate, leaving distinct linear, raised scars when falling.

Polystichum squarrosum (D. Don) Fée.

Polystichum lobatum var. 4. C. Chr. Ind. Fil. 583. 1906, with synonyms.

The largest form of the group: Blades fully bipinnate; pinnae often 10 to 12 cm. long, with numerous free pinnules, these resembling the pinnae of *P. stimulanans*, strongly auricled at distal base, lateral teeth 1 to 3 or often none; stipe and rachis quite hidden by reddish scales, those of the stipe very large, erose-dentate or sometimes entire, those of the rachis crisped, hairlike from a broad, lacerate base.

Himalaya.

Polystichum discretum (D. Don) Diels.

Polystichum lobatum var. 3. C. Chr. Ind. Fil. 583. 1906, with synonyms (excl.

Aspidium polyblepharon Roem.).

Polystichum aculeatum var. *setulosa* Rosenst. Repert. Sp. Nov. Fedde 13: 141. 1914.

YUNNAN: Between Hsia Chai and summit of Shweli-Salween Ridge, along water course in dense forest, altitude 2,400 meters (7602).

A most distinct species: Blades rather coriaceous, nearly 1 meter long, lanceolate, somewhat narrowed below, fully bipinnate; pinnae close, 1 to 1.5 cm. broad, very regularly pinnate; pinnules uniform, narrowly rhombic-oblong, almost entire, with 6 to 8 very long spinescent teeth; both surfaces with long red hairlike fibrils, these protuding far beyond the margins; sori small, infra-medial; stipe and rachis densely scaly, the scales partly hairlike, partly very large, ovate, thin, and reddish, or some of the stipe scales nearly black.

GROUP OF POLYSTICHUM ACULEATUM

This group, which includes *P. aculeatum*, *P. lobatum*, *P. braunii*, and other species adopted in my Index, is represented from the Himalaya eastward, as in other mountainous regions of the globe, by a large number of more or less distinct forms or species. Clarke and Beddome referred them all to a single species, *P. aculeatum*, but this treatment is unsatisfactory. In recent times Christ and other pteridologists have described a number of species and varieties from this region, some of which seem to me distinct; but certain of these have probably been described before and the nomenclature is, therefore, very complicated. Mr. Rock has gathered a fair number of specimens belonging to this group, and I shall try therefore to give a short review of the forms occurring in Yunnan and adjacent regions as represented in the present collection and in my own herbarium.

Polystichum moupinense (Franch.) Bedd.

YUNNAN: Alpine eastern slopes of the Likiang Snow Range, at 4,650 meters elevation (6115).

Polystichum yunnanense Christ. Not. Syst. Lecomte 1: 34. 1909.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 2,700 meters elevation (4289). West of Talifu; altitude 2,250 meters (6856). Valley of Meng Ka (7369). East of Tengyueh, Shweli-Salween ridge (7623, 7728).

BURMA: Between Sadon and the Yunnan border (7521).

In texture, cutting, and size this species resembles the typical European *P. setiferum* (Forsk.) Woynar (*Aspidium angulare* Kit., or "*Polystichum aculeatum*" of my Index Filicum), and could rather naturally be regarded as a geographical race of it. The most important differential characters are:

Rhizome scales very large, ovate-acuminate, glossy, almost black, with broader or narrower, scariose, light brown, entire margins; stipe and rachis with large, light brown, entire or sparsely fimbriate scales and numerous narrow fibrils, the latter reddish-brown or sometimes dark brown, long, hairlike, flexuose, sparsely fimbriate, their broad base appressed and fimbriate; similar scales on costae and costules beneath. Blade not or very slightly attenuate downward, the basal pair of pinnae often reflexed; pinnules more or less deeply serrate, the teeth dense, long-aristate. Blade fertile from base to apex, or the upper part sterile.

This species is common in the Himalaya and was referred by Clarke to his "*aculeatum*" type, which also includes forms that are scarcely distinguishable from *P. setiferum*. His variety *semifertilis* (Review, p. 509) is, according to scale characters, a large form of *P. yunnanense* with the upper third of the frond sterile, the rest densely fertile, with confluent sori. Other forms of *P. yunnanense* are:

***Polystichum yunnanense* var. *fargesii* (Christ) C. Chr.**

Polystichum aculeatum var. *fargesii* Christ, Mém. Soc. Bot. France 1: 29. 1905.

Stipe and lower part of rachis with glossy, nearly black scales (with light brown fimbriate margins) intermixed with narrower reddish-brown scales and fibrils.

YUNNAN; Szechwan (*H. Smith* 2385, 4922); Kweichow (*Cavalerie*).

***Polystichum yunnanense* var. *submuticum* C. Chr., var. nov.**

Scales as in the type; blade rather coriaceous, suddenly contracted upward into a pinnate apex, the lower 2 or 3 pairs of pinnae sterile (unlike var. *semifertilis* Clarke); margins of pinnules often subentire, or slightly serrate with acute teeth, the apex and basal auricle short-aristate only.

YUNNAN: Top of Salween Ridge, altitude 2,400 meters, in forest (7033, 7035, 7737).

***Polystichum* sp.**

YUNNAN: Between Tengyueh and the Burmese border, beyond Hpun Kan (7331).

A very large form with fronds (including stipe) 1.5 m. long and 45 cm. broad, in scale characters not essentially different from *P. yunnanense*; pinnules 2.5 cm. long, deeply serrately lobed and strongly auricled, the basal upper ones greatly elongate; sori costular.

I prefer to let this form remain unnamed, although it seems distinct enough. It stands in the same relation to *P. yunnanense* as the south European var. *hastulatum* (Tenore) to typical *P. setiferum*.

***Polystichum biaristatum* (Blume) Moore.**

Polystichum aculeatum var. 30, C. Chr. Ind. Fil. 577. 1906.

BURMA: Keng Tung Territory: Bank of the Meh Len (2116, 2117); Meh Lui watershed (2309).

YUNNAN: Along Nam Ho (2476). Bank of Nam Meh (2713). Between Szemao and Puerhfu (2853). Between Tengyueh and Lungling (7099, 7138, 7171?). East of Tengyueh (7695, 7856).

This is the most common "*aculeatum*" form in the region of Assam, Upper Burma, and Yunnan. Clarke (Review, p. 510) has identified it with the Javanese *Aspidium biaristatum* Blume. As it agrees excellently with the description of that species in Van Alderwerelt van Rosenburgh's "Handbook" of Malayan ferns and with a form from Java described as *P. aculeatum* var. *eurylodum* Rosenstock,¹⁷ which presumably is precisely *A. biaristatum*, I prefer to use that specific name.

¹⁷ Repert. Sp. Nov. Fedde 8: 164. 1910.

The form under examination is a much larger fern than *P. yunnanense*, with which it has the large, glossy, black, scariose-edged rhizome scales in common; but the scales of the stipe and rachis are different, larger ones being few or none and the narrow hairlike fibrils generally black with a broad, light brown, thin, appressed base (soon abraded). Other characters are: Blade green, not reddish, subcoriaceous or papyraceous, the rachis often gemmiferous somewhat below the apex; pinnules numerous, often 2 cm. long or more, 5 to 7 mm. wide, trapezoid-oblong, often falcate, short-auricled at the distal base; margins subentire or dentate, the teeth shortly aristate or merely acute, the apex aristate; sori as a rule supramedial, lower pinnae most often sterile.

No. 7171 is referred here with doubt. In size and cutting the two specimens examined resemble very closely *P. nepalense* var. *subbipinnatum*, but the rachis is gemmiferous and the teeth and scales are widely different from that. The specimens are sterile, and I think they are young, less cut plants of *P. biaristatum*.

Polystichum punctiferum C. Chr., sp. nov.

PLATE 17

Rhizome stout, oblique. Stipe strong, 45 cm. long, stramineous, at base densely clothed with large, glossy brown, concolorous, ovate, entire scales, upward with dense but easily abraded small ovate hair-pointed rufous ones. Blade about 50 cm. long, 25 cm. broad below the middle, broadly lanceolate, coriaceous, distinctly reddish when dried (especially above), bipinnate; rachis rather densely paleaceous with rufous lanceolate entire scales; pinnae about 15 pairs, alternate, the lower ones short-petiolate, lanceolate, finely acuminate, the basal ones equal to the others or slightly shorter; largest pinnae 15 cm. long by 3 cm. wide, pinnate nearly to the serrate apex; pinnules not contiguous, oblique, short petiolate or sessile, cuneate at the lower base, truncate and auriculate-lobate above, thence serrately lobed and attenuate toward the acute apex, the lobes numerous, close, oblique, with short-aristate or merely acute teeth; veins subpinnate in the lower (larger) lobes, furcate in the upper teeth, terminating well within the edge, the tips marked on the upper side of the blade by very distinct, brown, clavate or oblong hydathodes sunk in a little groove; sori medial or slightly inframedial; indusia small, deciduous, peltate, glabrous. Upper surface of the blade naked and glabrous throughout, the underside with numerous reddish-yellow hairlike fibrils on the costae and veins.

BURMA: Between Sadon and the Yunnan border, in forest, near Kambaiti (7522, type).

YUNNAN: Between Tengyueh and the Burmese border (7342).

This is a puzzling fern, very much resembling *P. biaristatum* in size and cutting, but nevertheless a most distinct new species, especially well marked by the obviously thickened tips of the veins. This feature is not found in any other species of *Polystichum* known to me, though it does occur in certain species of *Eudryopteris*, for example in *D. sparsa* and form of *D. erythrosora*, which also resemble the present plant in color. Nevertheless, the subaristate teeth and peltate indusia make it desirable to place the new species in *Polystichum*.

EXPLANATION OF PLATE 17.—*Polystichum punctiferum*. The type specimen, *Rock* 7522. About one-half natural size.

Polystichum (?) *foeniculaceum* (Hook.) J. Smith.

YUNNAN: East of Tengyueh, in shade, on moss-covered banks; altitude 2,400 meters (7604).

A very beautiful fern, of doubtful systematic position. It is, however, more natural to place it under *Polystichum* than under *Diacalpe*, as proposed by Clarke. In a rather young specimen from the Himalaya the red indusia are seen to be peltate but fixed excentrically; when forced back by the sporangia the indusium seems attached laterally to the receptacle, and appears as a scale, entire or cleft, on the distal side of the receptacle, as in the beautiful specimens from Yunnan. In this state the indusia do not at all resemble those of *Polystichum*, and the natural place of the species is scarcely here but rather in a genus of its own.

The species is new to China.

CYRTOMIUM Presl

Cyrtomium caryotideum (Wall.) Presl.

Polystichum falcatum **Aspidium caryotideum* Wall.; C. Chr. Ind. Fil. 581. 1906.

NORTHWESTERN YUNNAN: Mountains of Londjre. Mekong-Salween watershed (8902). Mountains above Tsehchung, along the Meh Kong (11599).

Cyrtomium hookerianum (Presl) C. Chr. Amer. Fern Journ. 20: 44. 1930.

Lastrea hookeriana Presl, Tent. Pter. 77, 1836.

Aspidium caducum Wall.; Hook. & Grev. Icon. Fil. 2: pl. 171. 1829. Not H. B. K. 1815.

YUNNAN: Between Tengyueh and the Burmese border, in mossy forest, near Hpunkan (7341, 7357).

TECTARIA Cav.

Tectaria vasta (Blume) Copel.

BURMA: Keng Tung Territory: Between the Siamese border and Pang Mah Ki Hat (1938, 1957); Valley of the Meh Len (2132, 2139).

YUNNAN: Along the banks of the Meh Kong, near Keng Hung (2517a).

In several of these specimens scaly buds are found in the axils of the rachis and costules. The species is new to China.

Tectaria decurrens (Presl) Copel.

YUNNAN: Banks of the Meh Kong, near Keng Hung (2517).

Tectaria polymorpha (Wall.) Copel.

BURMA: Keng Tung Territory: Between the Siamese border, Ban Meh Huak, and Pang Mah Ki Hat (1954); Valley of the Meh Len (2084, 2090, 2093, 2094, 2130, 2182, 2187); Meh Lui watershed (2283).

YUNNAN: Between Keng Hung and Muang Hing (2571, 2572, 2575, 2576, 2597, 2598, 2637, 2638).

As the name indicates, this is a very variable species and the specimens referred here look very different. Some from the Meh Len Valley (nos. 2084, 2090, 2094, 2130), which I consider to be young fertile plants, have the leaves either entire with a deeply cordate base, or trilobate with a pair of smaller basal lobes; these agree very well with the type of *Nephrodium morsci* Baker¹⁸ from Kwangsi (Kew!). Some of the specimens from Yunnan have a distinctly creeping rhizome, glabrous costae, and the basal pinnae not forked, thus much resembling *Aspidium heterocarpum* Bedd. (Handbook, p. 219), but none of them have buds in the axils.

Tectaria variolosa (Wall.) C. Chr.

Aspidium variolosum Wall.; Hook. Sp. Fil. 4: 51. 1862.

YUNNAN: Between Chieng Law and Muang Hun (2372).

Further synonymy is given in the Index Filicum (p. 97).

¹⁸ Kew Bull. Misc. Inf. 1906: 11. 1906.

Tectaria fuscipes (Wall.) C. Chr.

Aspidium fuscipes Wall. List, no. 361. 1828, in part; Bedd. Ferns Brit. Ind. 15. pl. 366. 1876.

Nephrodium membranifolium Hook. Sp. Fil. 4: 131. pl. 261. 1862; Clarke, Trans. Linn. Soc. II. Bot. 1: 534. pl. 75. 1880. Not *N. membranifolium* Presl, 1825, which is *Dryopteris dissecta* (Forst.) Kuntze.

Aspidium subsageniaceum Christ, Bull. Acad. Géogr. Bot. 16: 240. 1906.

Dryopteris subsageniacea C. Chr. Ind. Fil. Suppl. 40. 1913.

BURMA: Between the Siamese border, Bam Meh Huak, and Pang Mah Ki Hat (1952, 1953).

YUNNAN: Along the banks of the Meh Kong, near Keng Hung (2551).

A reduced form of the group of *T. cicutaria*. Pinnae pinnatifid only, the lower segments of the basal ones generally elongate; veins of the upper pinnae free, with a forked vein running out from the costa midway between two costules, those of the lower (larger) pinnae partly anastomosing and forming costal areoles.

Aspidium subsageniaceum Christ is the normal condition of the species, and the same form occurs in Annam (*Cadiere* 94, 126). The latter material was named by Christ *Aspidium obscurum*,¹⁹ identifying it with *Phegopteris obscura* Fée, which is closely related to *Dryopteris sagenioides* and perhaps a variety of it.

Closely related to *T. fuscipes* is *Tectaria austrosinensis* (Christ) C. Chr.,²⁰ from Kweichou (*Cavalerie* 2637; *Esquirol* 2237, 3733). The venation is essentially the same, although arching veins are rare; but this is a much larger species, with the distant pinnae 20 cm. long or more, 3 to 4 cm. broad, and incised two-thirds the way to the midrib into oblong-rounded repand lobes 8 mm. broad; basal pinnae not at all compound, rather a little reduced. Superficially *T. austrosinensis* closely resembles *Dryopteris lofouensis* in habit, but the pubescence (rusty intestiniform hairs on the costae above), scales, venation, and the pluriserial sori in the lobes show clearly that it belongs to the section *Pleocnemia* of *Tectaria*.

OLEANDRA Cav.

Oleandra cumingii var. *longipes* Hook. Sp. Fil. 4: 158. 1860.

BURMA: Keng Tung Territory: Ridge between Muang Len and Meh Kong (2026, 2026a).

A well-marked variety or, as I suspect, a valid species; stipes scattered, up to 20 cm. long, articulated at the middle, like the underside and indusia downy; rhizome scales entire or slightly villose-fimbriate; lamina cuneate at base, short-decurrent.

EGENOLFIA Schott

In 1904 I published a short paper on the American species of *Leptochilus*, Sect. *Bolbitis*,²¹ wherein I used the name *Leptochilus* Kaulf. for the group of acrostichoid ferns generally called *Gymnopteris*. This usage was adopted in my *Index Filicum* also, and has since been followed by nearly all pteridologists. Aware of its heterogeneity, I divided the genus in four sections or subgenera (*Ind. Fil.* p. xxvi): *Euleptochilus*, *Anapausia*, *Bolbitis*, and *Lomagramma*, and, following Diels, placed it in the tribe Aspidieae. The last section, *Lomagramma*, was subsequently (*Ind. Fil. Suppl.* p. 49) separated from *Leptochilus*

¹⁹ Journ. de Bot. 19: 62. 1905.

²⁰ *Dryopteris austrosinensis* Christ, Bull. Acad. Géogr. Bot. 17: 145. 1907.

²¹ Bot. Tidsskr. 26: 283-297.

as a genus; the other three have until now remained in *Leptochilus*, although it must be evident to everyone that these three sections are only remotely related. This was shown by Eva Schumann,²³ who, after a comprehensive study of the comparative morphology of the group, came to the conclusion that, "Die Leptochilen mit geteilter Blattspreite sind von *Dryopteris* subgenus *Meniscium* abzuleiten, die mit ungeteilter Blattspreite wahrscheinlich von *Polypodium*-Arten" (p. 258). With this view Prof. F. O. Bower has agreed in his fundamental Studies in the Phylogeny of the Filicales,²⁴ and it is certainly correct, at least as to the second point. The species with simple fronds (*Leptochilus*, in the proper sense) are intimately related to certain species of *Polypodium* (for example, *P. ovatum*), and I now use the name *Leptochilus* for these species only and place this genus in the tribe Polypodieae.

The species with more or less divided leaves are less intimately related and the contention that they are derivatives of *Meniscium* is only partly true, though the proper place of all seems to be in the tribe Dryopterideae (Aspidieae). My opinion is that the section *Anapausia*, the type species of which is the tropical American *L. alienus*, is derived from *Tectaria*, and it is possible also that certain Asiatic species, such as *L. diversifolius*, have their nearest relatives among the species of *Tectaria*.

The remaining group, known variously as *Poikilopteris* Eschweiler (1827), *Bolbitis* Schott (1834), *Poecilopteris* Presl (1836), *Cyrtogonium* J. Smith (1842), *Heteroneuron* Fée (1845), and *Gymnopteris* Beddome and others, includes a number of tropical species which are rather uniform as to most characters, though scarcely congeneric. In a recent paper²⁵ Copeland has given an elaborate review of all oriental species of this group, for which he has preferred the generic name *Campium* Prsl. I am inclined to consider the American species (*Poecilopteris* Presl, or *Bolbitis* Schott) generically different from the oriental ones and can therefore agree with Copeland in preferring the name *Campium* for the latter; but on the other hand I can not follow him in including in *Campium* the section *Dendroglossa* and some, or all, of the simple-fronded species of his section *Heteroneuron*, which in my opinion are polypodioid ferns with acrostichoid sori, while the pinnate species of *Heteroneuron* are acrostichoid derivatives from the Dryopterideae. *Campium*, thus confined, is closely related to *Egenolfia* Schott (1834).

The genus *Egenolfia* was based on *Acrostichum appendiculatum* Willd. and was later united with *Polybotrya*, as in my Index Filicum. *Polybotrya* is, however, in its wider sense a most unnatural group of ferns, including species related to *Polystichum*, different subgenera of *Dryopteris* (e. g. *Otentis* and *Polystichopsis*), and other dryopteroid ferns. *Egenolfia* is now shown to be so closely related to certain Asiatic species of *Campium* that I am rather inclined to place the species of both in a single genus, which thus could be divided into two sections: *Egenolfia* with free veins, and *Campium* with anastomosing veins. For the present, however, I maintain the two genera.

Egenolfia appendiculata var. *subintegra* (Bedd.) C. Chr.

Polybotrya appendiculata var. *subintegra* Bedd. Handb. Ferns Brit. Ind. 427. 1883.

BURMA: Forests southeast of Mawlaik, Upper Chindwin District (823).

²³ Die Acrosticheen und ihre Stellung im System der Farne. Flora 108: 201-260. 1915.

²⁴ See especially, Ann. Bot. 31: 1-39. 1917.

²⁵ *Leptochilus* and genera confused with it. Philippine Journ. Sci. Bot. 37: 333-416. 32 plates. 1928.

The specimens agree excellently with Beddome's short description and figure ²⁶ of this variety, and probably represent a distinct species. The sterile blades are often elongate and gemmiferous at apex; the fertile pinnae are torulose.

Egenolfia helferiana (Kunze) C. Chr.

Polybotrya helferiana Kunze, Farrnkr. 2: 35. pl. 114. 1848.

LOWER BURMA: Oktada, Martaban Hills, Kalama Range (759).

Apparently a distinct species. The bipinnate fertile leaf, with very small, distant, beadlike pinnules, resembles that of *Psomiocarpa apiifolia* (Kunze) Presl.

CAMPIUM Presl

Campium sinense (Baker) C. Chr.

Acrostichum sinense Baker, Kew Bull. Misc. Inf. 1906: 14. 1906.

Polybotrya sinensis C. Chr. Ind. Fil. Suppl. 57. 1913.

Egenolfia sinensis Maxon, Proc. Biol. Soc. Washington 36: 173. 1923.

YUNNAN: Between Keng Hung and Muang Hing, along river banks (2636, 2657). Between Mohei and Maokai (2913).

This is closely related to the following species and especially to *C. cuspidatum* (Presl) Copel.,²⁰ resembling the latter in its dark green color and deeply lobed pinnae, differing in simpler venation and truncate base of the pinnae. The sterile leaves terminate often in a gemmiferous tail, and the lower basal segments of the basal pinnae are often prolonged as in some forms of *Egenolfia appendiculata*. The pinnae are broader and generally shorter than in *C. angustipinnum* and are incised nearly midway to the costa, with broad, oblique, obtuse, close, faintly repand lobes, with a distinct tooth in the narrow sinuses; these teeth, which often are double, were not observed by Baker ("setis inter lobos haud productis"), although they are very distinct in the type specimen (Henry 12494; Kew!). In this specimen all the veins are free, as they are in *Rock* 2657; in *Rock* 2913 one finds, however, here and there an arching vein between two costules which forms a low costal areole, and in *Rock* 2636 these areoles are normally rather high and not essentially different from those of *C. angustipinnum*. From the arching veins one or, more often, two veins run to the sinus, often free but not infrequently anastomosing with the basal lateral veins from the costules, the other veins always free, simple or forked. In such cases the venation is not materially different from that of *C. angustipinnum*; it is more simple because the pinnae are deeply lobed. It is without question that the specimens mentioned belong to the same species, which thus shows partly the characters ascribed to *Egenolfia*; and as mentioned before, it is very probable that *Egenolfia* and *Campium* should be united.

The fertile piannae are entire or crenate, rather obtuse, 3 to 4 cm. long, 6 to 7 mm. wide.

Campium angustipinnum (Hayata) Copel. Philippine Journ. Sci. Bot. 37: 381. 1928.

YUNNAN: Between Keng Hung and Muang Hing, in dense forest, along brooks (2427).

This is the common Himalayan form called *Gymnopteris contaminans* by Beddome (Handb. Ferns Brit. Ind. 435) and in part *Leptochilus virens* of the Index Filicum. The nomenclature of this and related species is greatly confused. Although I am not quite sure that Copeland is right in his choice of names, I prefer here to use the name adopted by him for this most distinct species, excellently described by him.

²⁶ Ferns Brit. Ind. pl. 111 (left hand top figure). 1865.

²⁰ *Nephrodium cuspidatum* Presl, Rel. Haenk. 1: 31. 1825.

NEPHROLEPIS Schott

Nephrolepis cordifolia (L.) Presl.

YUNNAN: Between Kambaiti and Tengyueh (7702).

HUMATA Cav.

Humata repens (L. f.) Diels.

YUNNAN: Between Tengyueh and Lungling (7182).

Humata assamica (Bedd.) Diels.

YUNNAN: between Tengyueh and the Burmese border (7312). Between Kambaiti and Tengyueh (7580).

Beddome's illustration (Ferns Brit. Ind. *pl.* 94) agrees very well with the present specimens and I think my identification is right. In no description, however, is there mentioned the presence of 2 to 6 large ovate scales that occur on the lower part of the costae beneath.

This species, which is new to China, is very near *H. griffithiana*, mainly differing from that in the narrow, deltoid, short-stalked blades and in the scale character mentioned. The fronds are somewhat dimorphic in our specimens; the largest sterile blade is 21 cm. long, 7 cm. broad at base, and of rather thin texture; the largest fertile one is 15 cm. long by 4.5 cm. wide, short-stalked, and coriaceous. The rhizome and its scales and the shape of the ultimate segments and the indusia are very nearly the same as in *H. griffithiana*.

Humata griffithiana (Hook.) C. Chr.

Davallia griffithiana Hook. Sp. Fil. 1: 168. *pl.* 49, B. 1846; C. Chr. Ind. Fil. 210. 1905, with syn.

Davallia (*Humata*) *platylepis* Baker, Kew Bull. Misc. Inf. 1898: 229. 1898.

Davallia (*Eudavallia*) *henryana* Baker, Kew Bull. Misc. Inf. 1906: 8. 1906.

YUNNAN: Between Muang Hun and Muang Hai, epiphytic, in dry forest (2437).

I venture to transfer *Davallia griffithiana* Hook. to the genus *Humata*, with which it agrees much better in scales, texture, and indusia than with *Davallia*. The indusia of the typical form are shortly attached at the edges, though otherwise leucostegioid in shape; but if one prefers to hold *Humata* and *Leucostegia* as separate genera, the species must belong to the former.

Our specimen from Yunnan agrees exactly with the two species described by Baker on the same collection number (*Henry* 10082, Herb. Kew). I have seen both type specimens, and they belong undoubtedly to the same species, although Baker referred them to two different subgenera of *Davallia*. All these specimens from Yunnan differ a little from typical *D. griffithiana* in having the indusia wholly free at the sides. At first I had referred *Rock* 2437 to *Humata tyermanii* Moore and perhaps rightly so, though I am inclined to regard this also as a form of *H. griffithiana*.

LEUCOSTEGIA Presl

Leucostegia immersa (Wall.) Presl.

YUNNAN: Between Tengyueh and Lungling (7240). East of Tengyueh (7618).

Leucostegia pulchra (D. Don) Moore.

YUNNAN: Western slopes of the Likiang Snow Range, near Gan Hoi Tze, altitude about 3,000 meters; wet mossy bank of brook (4156).

A form approaching the next species.

Leucostegia pseudocystopteris (Kunze) Bedd. Ferns Brit. Ind. Suppl. 4. 1876.

Davallia pseudocystopteris Kunze, Bot. Zeit. 8: 68. 1850.

Davallia anthamantica Christ, Mém. Soc. Bot. France 1: 65. 1905.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,000 to 3,900 meters elevation (4460, 5985, 6054).

Leucostegia perdurans (Christ) Hieron. Hedwigia 62: 12. 1920.

Davallia perdurans Christ, Bull. Herb. Boiss. 6: 976. 1898.

YUNNAN: Salween Ridge, east of Tengyueh, altitude 2,400 meters (7732).

Leucostegia clarkei (Baker) C. Chr.

Davallia clarkei Baker in Hook. & Baker, Syn. Fil. ed. 2, 91. 1874; C. Chr. Ind. Fil. 208. 1905.

Davallia dareaeformis Levinge; Clarke, Trans. Linn. Soc. II. Bot. 1: 443. 1880, in part.

Leucostegia clarkei var. *faberiana* C. Chr.

Davallia clarkei var. *faberiana* C. Chr. Medd. Bot. Trädg. Göteborg 1: 73. 1924.

YUNNAN: West of the Mekong, from Pingpo to Tengyueh (7047). Salween Ridge, east of Tengyueh, altitude 2,400 meters (7720).

BURMA: Between Sadon and Yunnan border, epiphytic in dense forest, at 2,100 meters elevation (7418).

A most handsome fern, very finely cut, of a golden-brown color, and delicate in texture. It is perhaps specifically different from the genuine *L. clarkei*, being much larger, the pinnae sometimes 30 cm. long. The blade is broadly deltoid, the rachises with large scattered scales beneath as in *L. perdurans*.

Leucostegia dareaeformis (Hook.) Bedd.

Polypodium dareaeforme Hook. Second Cent. Ferns pl. 24. 1860; C. Chr. Ind. Fil. 521. 1906.

YUNNAN: Salween Ridge, west of the Mekong, en route from Pingpo to Tengyueh, at 2,400 meters elevation (7046).

I have little doubt that this species is an exindusiate *Leucostegia*. Clarke was wrong in uniting it with *L. clarkei*, from which it differs in its much narrower rhizome scales and in having rachises castaneous below, yellowish green above.

New to China.

DAVALLIA J. E. Smith

Davallia bullata Wall.

YUNNAN: Between Tengyueh and Lungling (7154).

MICROLEPIA Presl

Microlepia marginata var. *calvescens* (Hook.) C. Chr.

Davallia calvescens Wall.; Hook. Sp. Fil. 1: 172. pl. 48, B. 1846.

BURMA: Keng Tung Territory, valley of the Meh Len (2180, 2190).

YUNNAN: Between Chieng Law and Muang Hun (2377).

Microlepia platyphylla (D. Don) J. Smith.

BURMA: Keng Tung Territory: Valley of the Meh Len (2129); between Pang Hoi Hpi and Peng Sai (2232).

Microlepia kurzii (Clarke) Bedd.

BURMA: Keng Tung Territory: Valley of the Meh Len (2083); Meh Lui watershed (2311).

Microlepia strigosa (Thunb.) Presl.

YUNNAN: Between Tengyueh and the Burmese border (7315, 7316). Shwell-Salween watershed, east of Tengyueh, altitude 2,100 to 2,400 meters (7857).

Microlepia pilosula (Wall.) Presl.

YUNNAN: Between Tengyueh and the Burmese border (7349). Salween Ridge, east of Tengyueh, altitude 2,400 meters (7734).

Not found in Matthew's list.

Microlepia trapeziformis (Roxb.) Kuhn.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2230).

YUNNAN: Between Tengyueh and Lungling (7142).

Microlepia trapeziformis var. *rhomboidea* (Wall.) C. Chr.

Davallia rhomboidea Wall.; Kunze, Bot. Zeit. 8: 158. 1850.

YUNNAN: Valley of the Meh Len (2086).

Microlepia hirta (Kaulf.) Presl.²⁷

BURMA: Keng Tung Territory: Valley of the Meh Len (2088); Meh Lui watershed (2317).

DENNSTAEDTIA Bernh.**Dennstaedtia scabra** (Wall.) Moore.

YUNNAN: Between Tengyueh and Lungling (7190).

ODONTOSORIA (Presl) Fée**Odontosoria chinensis** (L.) J. Smith.

BURMA: Keng Tung Territory, valley of the Meh Len (2078, 2152).

YUNNAN: East of Tengyueh, along the Kuyung trail (7698).

MONACHOSORUM Kunze**Monachosorum subdigitatum** (Blume) Kuhn.

BURMA: Between Sadon and the Yunnan border (7404, 7511a).

YUNNAN: Salween Ridge, east of Tengyueh, at 2,400 meters elevation, in dense forest; terrestrial (7635).

The plant described as *Monachosorum henryi* Christ is to me a form of this species.

LINDSAYA Dry.**Lindsaya cultrata** (Willd.) Swartz.

YUNNAN: Between Tengyueh and Lungling (7189); between Kambaiti and Tengyueh, along banks of the Tako (7539).

Lindsaya malabarica (Bedd.) Baker.

Schizoloma malabaricum Bedd. Ferns Brit. Ind. pl. 268. 1868.

Schizoloma lobata var. *malabarica* Bedd. Handb. Ferns Brit. Ind. 79. 1883.

LOWER BURMA: Oktada, Martaban Hills, Kalama Range (750).

The specimen agrees closely with Beddome's description and plate, and I do not hesitate to consider it a distinct species, differing from *L. decomposita* Willd. (*Schizoloma lobata* Bedd.) by the long, slender, simply pinnate leaves, with the veins free, as a rule, but occasionally anastomosing.

This species has hitherto been known from southern India only.

²⁷I use for this species the common name *M. hirta*, although it is probable that the original *M. hirta* of Kaulfuss, from the Hawaiian Islands, is another species. The nomenclature of these large *Microlepias* is very confused and my material is too insufficient for positive delimitation of the species. The "*Microlepia hirta*" of southern China and India is perhaps not distinct from *M. speluncae*, as supposed by Beddome.

ATHYRIUM Roth

Athyrium dissitifolium (Baker) C. Chr.

PLATE 18

Polypodium dissitifolium Baker, Kew Bull. Misc. Inf. 1895: 54. 1895.*Polypodium apicidens* Baker, Kew Bull. Misc. Inf. 1895: 54. 1895.*Phegopteris incrassata* Christ, Bull. Herb. Boiss. 6: 963. 1898.*Dryopteris apicidens* C. Chr. Ind. Fil. 252. 1905.*Dryopteris dissitifolia* C. Chr. Ind. Fil. 262. 1905.*Dryopteris incrassata* C. Chr. Ind. Fil. 272. 1905.

BURMA: Keng Tung Territory, between Pang Hoi Hpi and Peng Sai (2231).

YUNNAN: Between Keng Hung and Muang Hing, at 1,000 to 1,500 meters altitude; dry slopes (2666, 2691). Between Tengyueh and Lungling (7219).

This species has been known to me for many years as *Dryopteris incrassata* (Henry 11548!). I have now, on loan from Kew, for comparison, the type specimens (Hancock 45, 87) of the two species which were described, side by side and in nearly the same words, by Baker in 1895, and I find that there is hardly the slightest difference between them. Both are fully identical with *D. incrassata*, and I must therefore fall back upon Baker's first name, *dissitifolium*. Both Baker and Christ placed their new species in *Phegopteris*, but I have for a long time regarded the reference of this plant to the phegopteroid group in *Dryopteris* as highly problematical and now feel sure that it is really a species of *Athyrium*, although it is difficult to point out substantial reasons for this view. The absolutely exindusiate sori are, however, not always round, but are often elongate; the costae above are deeply channelled, the furrow quite glabrous, with sharp raised edges, as in most species of *Athyrium*, yet lacking the projecting spines found in several species of that genus; the linear-lanceolate scales of the stipe base and the venation agree much better with *Athyrium* than with any species of *Dryopteris*. Within the genus *Athyrium* the species is a most distinct one. The following notes, supplementary to the descriptions given by Baker and Christ, may be useful:

Rhizome erect, like the stipe bases clothed with linear-lanceolate, subulate, reddish-brown scales, the plant otherwise perfectly glabrous; stipe very slender, 15 to 25 cm. long, stramineous; blade lanceolate, not or slightly narrowed at base, coriaceous, gray-green, 30 to 40 cm. long, 15 cm. broad, but often much smaller; pinnae distant, often 3 cm. apart, short-stalked or nearly sessile, about 1 cm. broad, often falcate, deeply pinnatifid, terminating in a long serrate apex; segments oblong, sharply dentate outward with deltoid teeth, the thickened margins generally revolute; veins 4 to 6 jugate, simple, often thick, running into the teeth and reaching the thick margin; sori suprasedial, often near the margin; spores with a low crest.

A bipinnate form of this species was found near Yunnan-fu by Cavalerie (Herb. C. Chr.).

Athyrium dissitifolium seems to be a common species in southern Yunnan and adjacent regions, being found also near Canton, and it is rather remarkable that it is not mentioned by the writers on Indian ferns. It is scarcely the same as Clarke's *A. drepanopterum* var. *kulhaitense* Atkins. (Review, p. 494), which is similarly exindusiate. Related to our species apparently is *A. rupicola* (Hope) C. Chr., but that is distinctly indusiate.

EXPLANATION OF PLATE 18.—*Athyrium dissitifolium*. The type specimen, Hancock 45, from Yunnan, in the Kew Herbarium. Two-fifths natural size.

Athyrium acrostichoides (Swartz) Diels, sens lat.

YUNNAN: Between Tengyueh and the Burmese border (7346). Kuyung, east of Tengyueh (7696).

The numerous Asiatic forms related to the North American *A. acrostichoides*, several of which Christ has dealt with as full species, are greatly in need of a critical revision.

***Athyrium nephrodioides* (Baker) Christ.**

YUNNAN: Eastern slopes of the Likiang Snow Range, at about 3,150 meters elevation (5879, 5898).

The specimens agree closely with the type specimen from Ichang (*Henry* 1858; Kew!), but are less scaly; in the type the costae are furnished with rather numerous light brown, lanceolate scales beneath, whereas in our specimens they are almost scaleless.

The species is so near *A. fallaciosum* Milde that it may be doubted if it really is distinct. It differs chiefly in having the blade very long-attenuate below and in its longer sharply serrate segments.

***Athyrium supraspinescens* C. Chr., sp. nov.**

PLATE 19

Rhizome short, erect, clothed at apex with firm, lanceolate-acuminate, fuscous scales. Stipes few, slender, 10 to 20 cm. long, somewhat scaly at the blackish base, upward stramineous and glabrous, trisulcate above. Blade generally shorter than the stipe, narrowly ovate or subdeltoid-acuminate, 8 to 12 cm. long, 4 to 6 cm. broad, firmly herbaceous, pinnate-pinnatifid; pinnae close, 12 to 15 pairs, alternate, sessile (or the lowest short-petiolate), 2 to 3 cm. long, 6 to 10 mm. broad at base, thence tapering rather gradually to the short-acuminate but rather obtuse apex, unequal at base (cuneate at the lower side, truncate and subauriculate at the upper), incised about two-thirds the distance to the midrib, the basal ones not reduced; segments rectangular, rounded-truncate at apex, repand, crenate or obtusely toothed, the upper basal one generally somewhat elongate; veins about 4 on each side, simple, ascending, the lower ones reaching the margin above the sinus; sori large, oval or nearly round, situated on the lower part of the veins but at maturity nearly reaching from costule to margin, 1 to 3 to each segment, or in the smaller pinnae generally 1, then forming two confluent rows close to the midrib of the pinna; indusia small, evanescent, short, oblong, brown, convex (hippocrepiform shape not observed); spores bean-shaped, perfectly smooth. Upper part of rachis, costae, and costules above with long fleshy spines just below the base of the veins; entire blade without scales or hairs, but both surfaces (especially the upper) beset with glistening sessile glands.

YUNNAN: Top of Salween ridge, east of Tengyueh; altitude about 2,400 meters; November, 1922 (7721, type).

This small species can be compared only with *A. falcatum* Bedd., which it resembles in size and cutting; but the blade is not reduced below, and in the very prominent long spines on the costules above and in glandulosity it is very different from all other small species of *Athyrium* known to me.

EXPLANATION OF PLATE 19.—*Athyrium supraspinescens*. The type specimen, *Rock* 7721. About one-half natural size.

***Athyrium macrocarpum* (Blume) Bedd.**

Athyrium anisopteron Christ, Bull. Herb. Boiss. 6: 962. 1898; Bull. Acad. Géogr. Bot. 17: 133. 1907.

BURMA: Near Kambaiti (7484).

YUNNAN: Salween Ridge, east of Tengyueh, altitude 2,400 meters; in forest (7007, 7723, 7725).

After long consideration I have arrived at the opinion that *A. anisopteron* Christ is a small, less cut form of *A. macrocarpum* and very likely the same

as var. *atkinsoni* Clarke²⁸ although its type looks rather different from the large forms of the species, owing to the obtuse and obtusely toothed or crenate segments. The four specimens of the Rock collection show, however, very instructive transitions between the two extremes. The largest frond of no. 7484 is, in size and division, typical *A. macrocarpum*, but in its obtuse segments it is quite like *A. anisopteron*; no. 7725 might be considered a large form of *A. anisopteron*; no. 7723, from the same locality and identical with 7007, is *A. anisopteron* as to size and division, but in the more sharply toothed segments it is like *A. macrocarpum*. The spores of all these forms with large sori are furnished with high reticulate crests and are very unlike those of *A. nigripes* and its allies.

Athyrium wardii (Hook.) Makino.

Asplenium sinense Baker, Kew Bull. Misc. Inf. 1906: 9. 1906.

Athyrium sinense C. Chr. Ind. Fil. Suppl. 15. 1913, not Rupr. 1845.

? *Athyrium mengtzeense* Hieron. Hedwigia 59: 319. 1917.

YUNNAN: Top of Salween Ridge, altitude 2,400 meters; in mossy forest (7005, 7006, 7034). East of Tengyueh (7731).

The proper identification of these specimens is difficult. No doubt they belong to *A. wardii* var. *elongatum* Christ,²⁹ which differs a little from genuine *A. wardii* in its ovate-lanceolate (not deltoid) blades. Here belongs also the type specimen of *A. sinense* Baker (*Henry* 10101; Kew!). The latter "species" was renamed *Athyrium mengtzeense* by Hieronymus, but the cotype (*Henry* 11101) at Berlin is rather different from the Kew specimen, being less incised, with oblong and obtusely toothed nonauriculate pinnules; it may, nevertheless, be a form of the same species.

I must confess, however, that I can not see clearly how this species as here interpreted may be separated with certainty from *A. nigripes* (Blume) Moore or, more correctly, from the north Indian *Athyrium*s referred by all authors to that species. The best characters of *A. wardii* var. *elongatum* appear to be: Blade not deltoid but ovate in outline, the basal pair of pinnae shorter than the following; pinnules subentire, but commonly sharply dentate (almost spinulose) at the apex, auriculate or not at the anterior base, the anterior margin sometimes sublobate; basal pinnules of lowest pinnae generally much reduced; costae beneath shortly glandulose-pubescent. To *A. nigripes* I should refer specimens with a deltoid blade, with the segments about equally lobate on each side, with less sharp teeth, the costae glabrous beneath. I fear, however, that none of these characters hold good. English botanists have, no doubt, referred north Indian forms corresponding to *A. wardii* as here characterized to *A. nigripes*, and perhaps rightly so. In both species the short oblong or linear sori form two rows close to the midrib of the pinnules.

Very closely related to *A. wardii* and, I think, a variety of it may be mentioned *Athyrium roseum* Christ (*Henry* 9918!), with which *A. violascens* Diels (*Rosthorn* 1752!) is identical; it differs in its light green leaf tissue and its rose or violet colored, glabrous costae.

Another related form is *Athyrium otophorum* (Miquel) Rosenst.,³⁰ from Japan, from which I can not distinguish *Athyrium muticum* Christ³¹ from Kweichou (*Cavalerie* 2741, 3722). It differs chiefly in its chartaceous texture, brown color, and less incised, closer, and decurrent pinnules.

²⁸ Hook. & Baker, Syn. Fil. ed. 2, 489. 1874.

²⁹ Mém. Soc. Bot. France 1: 49. 1905.

³⁰ *Asplenium otophorum* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 175. 1867.

³¹ Bull. Acad. Géogr. Bot. 17: 147. 1907.

Athyrium strigillosum Moore, in Lowe, Ferns Brit. Exot. 5: pl. 36. 1858.

Asplenium strigillosum Lowe, loc. cit.

Athyrium clarkei Bedd. Ferns Brit. Ind. Suppl. 11, pl. 360. 1876.

Asplenium clarkei Atkinson; Clarke, Trans. Linn. Soc. II. Bot. 1: 489. 1880.

Asplenium tenuifrons Wall. List, no. 206. 1828, in part (*nomen nudum*);

Hope, Journ. Bombay Nat. Hist. Soc. 14: 120. pl. 22. 1902.

Athyrium petiolosum Christ, Bull. Acad. Géogr. Bot. 17: 134. 1907.

YUNNAN: Between Tengyueh and the Burmese border (7330). East of Tengyueh (7621, 7852).

BURMA: Between Sadon and the Yunnan border (7420); doubtful.

The oldest name of this species is perhaps *Asplenium gracile* Don; but the short description given by D. Don²² is insufficient and fits equally several other species of *Athyrium* from the Himalaya. Hope followed Clarke (Review, p. 489) in uniting *A. tenuifrons* Wall. and *A. clarkei*; but he preferred to use the former name, which, however, had always been a *nomen nudum*. Thus, the name *Athyrium clarkei* should be taken up, unless, as I believe, Moore's *A. strigillosum* is just this species. The illustration and especially the figure of a pinna given by Lowe agree closely with *A. clarkei*, as does also the description, the gemmiferous rachis only not being mentioned; however, the larger form (*A. tenuifrons*) is often without buds.

I can not agree with Beddome in referring both *A. clarkei* and *A. tenuifrons* to *A. nigripes* as varieties. *Athyrium strigillosum* as here interpreted differs from that species in its smaller and narrower blades, which are of thin texture, often considerably narrowed below, and frequently viviparous by buds on the rachis, and in the presence of numerous callose spines not only on the costae but also on the costules above.

The two forms of *A. strigillosum* may be distinguished as follows: (1) *Athyrium clarkei*. Blade narrow, attenuate below, nearly always gemmiferous; pinnae sessile; (2) *Athyrium tenuifrons* Wall. Blade broader, slightly narrowed below, rarely gemmiferous; pinnae short-petiolate. *Athyrium petiolosum* Christ (*Ducloux* 50!) is about intermediate between these two forms; it is not gemmiferous, and the pinnae are somewhat longer-stipitate. Also, *A. viviparum* Christ,²³ from Kweichou, seems to be a form of this species and perhaps the same as *Athyrium clarkei* var. *membranacea* Rosenst.²⁴

Athyrium setiferum C. Chr. Ind. Fil. 146. 1905 (?).

Asplenium tenellum Hope, Journ. Bombay Nat. Hist. Soc. 12: 529. pl. 4. 1899, not Roxb. 1816.

BURMA: Between Sadon and the Yunnan border, in forest near Kambaitl (7518, 7520).

As to essential characters the specimens agree rather well with Hope's description and illustration, but less so with specimens gathered by Hope himself. The dark green blade is not reduced below; it is larger (25 by 15 cm.), and the indusia are evanescent, the confluent rounded sori forming two compact rows close to the midrib. The costae and costules bear several weak reddish spines above.

In cutting the present species resembles *A. filix-femina*, but in its stalked pinnae and the presence of spines above it comes nearer to *A. nigripes*.

Athyrium nigripes (Blume) Moore.

BURMA: Between Sadon and the Yunnan border (7519).

²² Prodr. Fl. Nepal. 8. 1825.

²³ Bull. Acad. Géogr. Bot. 20³: 13. 1910.

²⁴ Repert. Sp. Nov. Fedde 13: 124. 1913.

Athyrium mackinnoni (Hope) C. Chr. Ind. Fil. 143. 1905.

Asplenium mackinnoni Hope, Journ. Bot. Brit. & For. 34: 124. 1896; Journ. Bombay Nat. Hist. Soc. 14: 122. pl. 23. 1902.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,000 meters elevation (4321).

The specimen is identical with another from Yunnan (*E. Maire*, Herb. C. Chr.) and agrees very well with Hope's description and figure quoted.

This species differs from *A. nigripes* in having most of the indusia hippocrepiform and in its light green lower surfaces.

Athyrium drepanopterum (Kunze) A. Br.

YUNNAN: Between Man Lo and Lungling (7183). Shweli Valley east of Tengyueh (7673). On lava flows near Tengyueh (7709). East of Tengyueh (7893, 7895). Near Tengyueh (7956).

BURMA: Between Sadon and the Yunnan border (7476).

Athyrium drepanopterum var. *funebre* Christ, Not. Syst. Lecomte 1: 46. 1909.

YUNNAN: Salween Ridge, west of the Mekong (7063). Shweli Valley, between Tengyueh and Lungling (7178).

BURMA: Between Sadon and the Yunnan border (7477).

Blades 10 to 15 cm. long, 3 to 5 cm. wide at base.

This is a much reduced but fully fertile form that resembles very closely *A. macrocarpum*, from which it may be distinguished by its coriaceous texture and smaller, deciduous, nonhippocrepiform indusia.

Athyrium filix-femina (L.) Roth, var.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 4,500 meters elevation (5931).

One of the many so-called varieties of this species from the Himalaya and southern China. It is about intermediate between Clarke's var. *retusa* and var. *flabellata*.

Athyrium foliolosum (Wall.) Moore.

YUNNAN: Salween Ridge, east of Tengyueh, altitude 2,400 meters; in forest (7598, 7613).

I identify these specimens according to Beddome's description (Handb. Suppl., p. 38). In no. 7613 the upper basal pinnules are very much enlarged, just as described by Beddome; less so in no. 7598, which on the whole is less divided.

Athyrium atkinsoni Bedd. Ferns Brit. Ind. Suppl. 11. pl. 359. 1876.

Asplenium atkinsoni Clarke, Trans. Linn. Soc. II. Bot. 1: 487. pl. 57. (var. *andersoni*). 1880.

Asplenium lastreoides Baker, Journ. Bot. Brit. & For. 26: 227. 1888.

Athyrium lastreoides Diels in Engl. & Prantl, Pflanzenfam. 1⁴: 224. 1899.

? *Davallia athyriifolia* Baker, Ann. Bot. 5: 200. 1891.

Athyrium monticola Rosenst. Repert. Sp. Nov. Fedde 13: 23. 1913.

Cystopteris grandis C. Chr. in Lévillé, Cat. Pl. Yun-Nan 100. 1916.

YUNNAN: Eastern slopes of the Likiang Snow Range, at about 3,150 meters elevation (5890, 5890a).

This widespread Chinese species is best known as *Athyrium lastreoides*, of which *Cystopteris grandis* C. Chr. is a direct synonym; but it agrees perfectly with Clarke's illustration of his *Asplenium atkinsoni* var. *andersoni* and is no doubt the same plant. Clarke remarks that Beddome's original illustration of *A. atkinsoni* probably represents a small, less cut leaf of the same species, and I think he is right; *Athyrium monticola* Rosenst. is a similar reduced form.

Beddome (Handb. Suppl., p. 37) has referred both Clarke's var. *andersoni* and *A. lastreoides* to *A. fimbriatum*. I do not understand this, since Beddome himself (Handbook, p. 172) described *A. fimbriatum* as having the ultimate pinnules auricled at the superior base, while in the present species they are equal sided at base. The indusia are very small and short, cystopteroid or leucostegioid; still it is not, on this account, excusable that I should have described the plant as a species of *Cystopteris* or that Baker should place it in *Davallia*, subgenus *Leucostegia*.

Athyrium sp.

YUNNAN: Eastern slopes of the Likiang Snow Range (5894).

A large, bipinnate-pinnatifid form, with basal pinnae 30 cm. long, which I must leave unnamed. We have in our bundle of *Athyrium umbrosum* a similar specimen collected in Nepal by Wallich, but it is certainly widely different from the genuine *A. umbrosum*. The very thick epigaeous caudex (10 cm. long) is evidently like that of *Asplenium bellum* Clarke, but the somewhat unequal-sided pinnules do not agree with Clarke's illustration (Review, pl. 63, f. 2.).

DIPLAZIUM Swartz

Diplazium lobbianum (Hook.) Moore.

Asplenium pinnatifido-pinnatum Hook. Sp. Fil. 3: 238. 1860.

Diplazium pinnatifido-pinnatum Moore, Ind. Fil. 331. 1861.

BURMA: Keng Tung Territory, between the Siamese border and Pang Mah Ki Hat (1937).

This is apparently a very rare species in these regions; Clarke and Beddome had only the material gathered by Griffith in Mishmee a century ago. The present specimens seem to prove that Clarke was right in referring Griffith's plants (*A. pinnatifido-pinnatum*) to the Malayan *D. lobbianum*; they agree very closely with the original illustration of the latter.³⁵ The blades have 11 pairs of free pinnae below the pinnatifid apex and are dark green above, pale green beneath; the stipes are tufted upon a short erect rhizome.

Diplazium japonicum (Thunb.) Bedd.?

YUNNAN: Between Tengyueh and the Burmese border (7339).

A critical plant, very much resembling some of the forms of *Athyrium acrostichoides*, but some of the sori are diplazioloid.

GROUP OF DIPLAZIUM DILATATUM

The following species of *Diplazium* belong to a group of intimately related large forms, which are exceedingly difficult to deal with systematically. Although Baker, Beddome, and other conservative English writers recognize only four or five north Indian species of this alliance, Christ has described as new a score of species, several of which can not be regarded as valid. I have tried now to arrange in a key all the forms known to me from southern China and the Himalaya, but the result is not satisfactory and it is perhaps impossible to draw definite lines between really good species, if such exist; the same is true of the corresponding tropical American group centering in *D. expansum* and *D. ambiguum*. In minute characters most forms are nearly alike, and species distinctions must, therefore, be based upon the degree of division; but that character is not a good one, since these large plants vary greatly in cutting, as may be observed in cultivated plants, in which young fronds often are simply pinnate, older ones bipinnate or even triplinnate.

³⁵ Hook. Second Cent. Ferns pl. 17. 1860.

More stable characters are found, I think in the shape of the ultimate segments and the length of the sori, and in details of venation.

Veins partly united (2 or 3 lower pairs).....*D. esculentum* (p. 305).

Veins all free.

Rachis asperous.....*D. sikkimense* (p. 304).

Rachis smooth.

Stipe and rachis with many blackish lanceolate scales.

D. squamigerum (Mett.) Christ.

Stipe and rachis naked or nearly so.

Blade pinnate-pinnatifid or bipinnate-subpinnatifid; ultimate segments broad, oblique or falcate, more or less acute; sori long, the basal anterior one often much curved or crescent-shaped.

Blade pinnate-pinnatifid.....*D. veitchii* (p. 302).

Blade bipinnate-subpinnatifid.....*D. dilatatum* (p. 302).

Blade bipinnate-pinnatifid or tripinnate-pinnatifid.

Blade tripinnate-pinnatifid.....*D. orientale* (p. 304).

Blade bipinnate-pinnatifid; sori mostly short.

Blades relatively small, subtripinnate; basal posterior tertiary segments or pinnules broad, deeply lobed.

D. leptophyllum (p. 303).

Blades larger, bipinnate-pinnatifid; basal posterior tertiary segments like the others.

Pinnules incised about halfway; segments broad, square (5 mm. long and broad), slightly toothed; sori short, often exindusiate.

D. flaccidum (p. 304).

Pinnules incised two-thirds down, or more; segments longer than broad.

Segments oblong, slightly oblique, truncate, toothed; sori short.

D. polypodioides (p. 304).

Segments longer, oblique or falcate, toothed at the tip only; sori longer.....*D. viridissimum* (p. 304).

Several other species of this group occur in eastern China and Japan, for example, *D. virescens* Kunze and *D. taquetii* C. Chr. Christ has referred specimens from southern China to the former, but I believe they belong to *D. viridissimum*.

Diplazium veitchii Christ, Bull. Acad. Géogr. Bot. 16: 125. 1906. PLATE 20

YUNNAN: Between Tengyueh and the Burmese border (7267, 7268).

These specimens differ from the type, *Wilson* 5357! (5375?), in the pinnae being incised halfway or more into broad, falcate, finely serrate lobes, with 6 or 7 simple or rarely forked veins, but otherwise they fully agree. It is highly probable that this species is a simply pinnate form of *D. dilatatum* and not essentially different from *Asplenium latifolium* var. *japonicum* Clarke (Review, p. 503.) A very similar form is *D. cavalerii* Christ (*Cavalerie* 49, 375, 7102), from Kweichou; and *D. veitchii* should perhaps be referred to it. It has narrower pinnae, with about 4 simple, distant, blackish green veins and a flexuose midrib.

EXPLANATION OF PLATE 20.—*Diplazium veitchii*; *Rock* 7267. Two-fifths natural size.

Diplazium dilatatum Blume.

Diplazium maximum C. Chr. Ind. Fil. 235. 1905, in part. Not *Asplenium maximum* D. Don, 1825.

Asplenium latifolium D. Don, Prodr. Fl. Nepal. 8. 1825.

The nomenclature of this species and *D. polypodioides* Blume is very confused. In 1825 David Don described briefly in his Prodr. Fl. Nepal the two species

Asplenium latifolium and *A. maximum*, both gathered in Nepal by Wallich; and in 1828 Blume also briefly described, from Java, *Diplazium dilatatum* and *D. polypodioides*, which are presumably the same as Don's two species. But I fear that my treatment of these species in the Index Filicum is wholly unsatisfactory. My error arose from Clarke's and Beddome's merging of Baker's *A. maximum* and *A. latifolium* (Syn. Fil. 239) into one species, *D. latifolium*; I chose, therefore, the name *maximum*, inasmuch as the name *latifolium* was preoccupied (Bory, 1803), overlooking the fact that Clarke (Review, p. 503) was of the opinion that *A. maximum* D. Don is the same as *D. polypodioides*. Having now carefully gone through Don's descriptions I feel sure that Clarke was right; *A. latifolium* ("foliolis incisi-crenatis") is *D. dilatatum* Blume, and the description of *A. maximum* ("foliolls alte pinnatifidis, soris nervo contiguis") fits very well *D. polypodioides* Blume, but also *D. sikkimense* (Clarke) and *Asplenium diversifolium* Wall., though certainly not the large fern called *D. latifolium* by most writers.

In the Botanical Museum at Copenhagen are found two forms from Nepal that were received from Wallich under the names *Asplenium polymorphum* Wall. and *A. diversifolium* Wall.; the former is *D. polypodioides*, the latter a variety of *D. dilatatum*. It is impossible to say which of these two forms corresponds to *A. maximum* D. Don; therefore I prefer to drop this name. To *D. dilatatum* I refer specimens with bipinnate blades and the secondary pinnules subentire to incised one-third to halfway down into broad, oblique, often falcate, acute segments; the sori are generally long, especially the basal anterior one, which often is much curved or even crescent-shaped. Delimited thus the species includes two forms or, perhaps, species:

(1) *latifolium* (D. Don). Dark green, firm, the pinnules incised one-third the distance to the midrib, or less; midribs of pinnae straight, not curved at base.

BURMA: Keng Tung Territory: Between Muang Len and Muang Hpyak (2036); Valley of the Meh Len (2184). Between Sadon and the Yunnan border (7443).

YUNNAN: East of Tengyueh (7858).

(2) *diversifolium* (Wall.). Light green, pinnules remote, incised halfway or two-thirds the distance to the midrib into very oblique segments with toothed tips; midribs strongly curved backward at base.

BURMA: Keng Tung Territory, Valley of the Meh Len (2134).

Asplenium torrentium Clarke is likely the same, Clarke's illustrations agreeing closely with our authentic specimen of *diversifolium*.

Here belongs also *Gymnogramme gigantea* Baker, from Hupeh (*Henry* 6517; Kew!). It is not exindusiate, as supposed by Baker, for traces of indusia are to be found. The pinnules are cut about two-thirds the distance to the midrib.

Closely related to *Gymnogramme gigantea* and considered by me a form of *D. dilatatum* is *Diplazium calogramma* Christ,²⁸ from Yunnan (*Henry* 11526!; not 1125, as quoted by Christ). Its pinnules are very deeply cut, the segments 1 to 1.5 cm. long and 5 mm. broad, the sori long and very regular.

Diplazium leptophyllum (Baker) Christ, Bull. Acad. Géogr. Bot. 11: 245. 1902.

Asplenium leptophyllum Baker, Kew Bull. Misc. Inf. 1906: 10. 1906.

YUNNAN: Between Keng Hung and Muang Hing (2577).

Very much like a small thin-leaved *D. polypodioides*, nearly tripinnate below, with the posterior basal tertiary segments in the larger pinnules broader than the others and deeply lobed, a character not seen in any form of *D. polypodi-*

²⁸ Not. Syst. Lecomte 1: 45. 1909; *Diplazium polypodioides* var. *henryi* Christ, Bull. Acad. Géogr. Bot. 16: 127. 1906.

oides; color dark green; sori short, with distinct indusia. The present specimen agrees very well with the type (*Henry* 13106; Kew!).

The name *leptophyllum* is actually not valid, but I have not assigned a new one, because it seems probable that this plant may prove to be a form of *D. squamigerum*.

Diplazium flaccidum Christ, Bull. Acad. Géogr. Bot. 16: 125. 1906.

Diplazium frondosum Christ, Not. Syst. Lecomte 1: 46. 1909.

SZECHWAN: Mount Omei (*Faber! Wilson* 5347!).

KWEICHOW: Pinfa (*Cavalerie* 2845, 7250!).

Christ identified this species with *Asplenium frondosum* Wall. (*Asplenium latifolium* var. *frondosa* Clarke (Review, p. 503), but no species has been described under this name.

Diplazium flaccidum is intermediate between *D. dilatatum* and *D. polypodioides*. The blades are dark green, with short, often exindusiate sori (like the latter), but are less incised, with close, square, truncate, scarcely oblique segments, these 5 mm. long and broad, slightly toothed, and often somewhat emarginate at the outer edge.

Diplazium polypodioides Blume.

Asplenium maximum D. Don. (See above under *D. dilatatum*.)

BURMA: Between Sadon and the Yunnan border, near Changtifang (7434).

YUNNAN: Between Tengyueh and Lungling near Man Lo (7140). East of Tengyueh, along Hsiao Ping Ho (7724).

The typical form of this species looks very distinct in its regularly and deeply pinnatifid, mostly sessile, dark green pinnules, with oblong, truncate-dentate, close, slightly oblique segments, and short sori; but some forms run into the next species. Mr. Rock's no. 7140 is such a large form, with the indusia almost perfectly obsolete.

Diplazium polypodioides var. *vestitum* Clarke.

YUNNAN: Dense forest, east of Tengyueh; altitude 2,400 meters (7611).

Rachises rather paleaceous but smooth; sori very short, about as in *D. sikkimense*.

Diplazium viridissimum Christ, Not. Syst. Lecomte 1: 45. 1909.

BURMA: Keng Tung Territory, Valley of the Meh Len (2131).

The specimen agrees perfectly with the type (*Ducloux* 106!). It is a very large plant, with pinnae up to 50 cm. long, dark green, and is very like a large form of *D. polypodioides*. In its longer sori, which are nearly exindusiate, its more distant and distinctly petiolate pinnules, and its oblique, often falcate segments, these toothed at the apex only, this species approaches the more divided forms of *D. dilatatum*.

Diplazium orientale Rosenst. Repert. Sp. Nov. Fedde 13: 128. 1913.

KWEICHOW: *Cavalerie* 2774! 3720!

Tertiary pinnules free or connected by a narrow wing, 2 to 2.5 cm. long, 5 mm. broad, deeply pinnatifid; sori filling the whole pinnule when mature.

Judging from the illustration, *Asplenium succulentum* Clarke²⁷ is very near this species and is perhaps the same.

Diplazium sikkimense (Clarke) C. Chr.

Asplenium sikkimense Clarke, Trans. Linn. Soc. II. Bot. 1: 500. pl. 65, f. 1. 1880.

BURMA: Keng Tung Territory, Valley of the Meh Len (2183).

This is a very characteristic fern, by its rough rachises closely related to the Malayan *D. asperum* Blume, and Beddome was possibly correct in refer-

²⁷ Trans. Linn. Soc. II. Bot. 1: 502. pl. 64, f. 4. 1880.

ring it to that species, from which it differs chiefly by its extremely short sori, placed close to the midrib; they are rarely more than 1 mm. long, the indusia persistent, red, vaulted, some of the lower ones diplazioid. In general aspect and cutting it resembles large forms of *D. polypodioides*. According to Mr. Rock the trunk is small and erect.

Diplazium esculentum (Retz.) Swartz.

BURMA: Keng Tung Territory, Valley of the Meh Len (2114, 2143, 2144).

ASPLENIUM L.

Asplenium nidus L.

BURMA: Beyond Sadon, near the Yunnan border (7467).

Asplenium nidus var. *phyllitidis* (D. Don) Bedd.

BURMA: Keng Tung Territory, Valley of the Meh Len (2181).

Asplenium ensiforme Wall.

BURMA: Changtifang, near the Yunnan border (7397).

YUNNAN: Between Tengyueh and the Burmese border (7311, 7355, 7380). Between Kambaiti and Tengyueh (7554). Mountains above Tseku and Tseh-chung, Salween Valley, altitude 2,850 meters (11508).

SZECHWAN: Mill Kingdom, Waerh Dja Mountains (6472).

Asplenium trichomanes L.

SOUTHEASTERN TIBET: Near Champutong, Salween Valley; altitude 2,700 meters (11528).

Asplenium normale D. Don.

YUNNAN: West of the Mekong, Salween ridge (7028). East of Tengyueh, forest of Kao Tien (7874).

A small epiphytic form from Kambaiti, Burma (7508), with pinnae 7 to 8 mm. long and only 3 mm. broad, is referred to var. *minus*. It possibly represents *A. monanthemoides* Roxb.

Asplenium unilaterale Lam.

BURMA: Between the Siamese border and Pang Mah Ki Hat (1947a).

Asplenium unilaterale var. *rahaense* (Yabe) Hayata, Journ. Coll. Sci. Univ. Tokyo 30: 438. 1911.

BURMA: Between the Siamese border and Pang Mah Ki Hat (1947).

YUNNAN: Between Tengyueh and Lungling (7089).

A very large form of *A. unilaterale*, with pinnae 6 cm. long and 1 to 1.5 cm. broad. It is very similar to *A. obscurum* Blume, but the stipe and rachis are castaneous as in the type.

Asplenium cheilosorum Kunze.

YUNNAN: Between Tengyueh and Lungling, on rocks (7218).

BURMA: Between Sadon and the Yunnan border; terrestrial, in dense forest (7425).

Asplenium planicaule Wall.

YUNNAN: West of the Mekong, from Pingpo to Tengyueh (7010). Between Tengyueh and Lungling (7121). Between Tengyueh and the Burmese border (7348, 7360). Between Kambaiti and Tengyueh (7559). East of Tengyueh (7855).

BURMA: Between Sadon and the Yunnan border (7417).

Very variable in size and in depth of incisures, but I find no real intermediates between this species and *A. laciniatum* Don, with which Clarke and Beddome united it. In this the stipe and lower half of the rachis are castaneous beneath, green above; in *A. laciniatum*, green throughout. Also, the stipe of the latter

is much more scaly and the blade different in cutting, as well shown by Hooker's illustrations of the two species. Recently Hieronymus³⁸ has pointed out differences in the structure of the scales. On the other hand, *A. planicaule* seems to run gradually into the following species.

Asplenium crinicaule Hance.

Asplenium polytrichum Christ, Bull. Acad. Géogr. Bot. 20¹: 172. 1909.

YUNNAN: Between Keng Hung and Muang Hing (2712).

This differs from *A. planicaule* mainly in its larger size, less incised pinnules, and rather densely crinite rachis.

Asplenium laciniatum D. Don.

BURMA: Between Sadon and the Yunnan border (7422, 7517).

Asplenium yunnanense Franch.

YUNNAN: Eastern slopes of the L'kiang Snow Range, in limestone crevices; altitude 2,700 meters (4878, 6001).

Asplenium bullatum Wall.; Mett. Abh. Senckenb. Ges. Frankfurt 3: 150. 1859.

Asplenium grandifrons Christ, Bull. Herb. Boiss. 7: 9. 1899.

Asplenium latecuneatum Christ, Bull. Acad. Géogr. Bot. 20¹: 171. 1909.

Asplenium cavalerianum Christ, Bull. Acad. Géogr. Bot. 20¹: 173. 1909.

YUNNAN: Between Tengyueh and the Burmese border (7370). Environs of Tengyueh (7955).

Hieronymus³⁹ has shown that the Himalayan fern referred by Hooker, Clarke, Beddome, and others to *Asplenium bulbiferum* is well distinguished from the type of that species from New Zealand, and further that *A. cavalerianum* Christ, from Kweichou (*Cavalerie* 2846!), belongs to the same form, first described by Mettenius as *A. bullatum* Wall. *Asplenium cavalerianum* is, however, also identical with *A. grandifrons* Christ (*Henry* 11521! in Herb. Christ) and with several sheets of Wallich's original collection in Copenhagen. *Asplenium latecuneatum* Christ was also based on *Cavalerie* 2846; it differs from the type by being less divided (bipinnatifid only), but otherwise is identical. The degree of division is a poor specific character in *Asplenium*, especially in the *bulbiferum* group; one of Wallich's specimens from Nepal belongs to the same form.

Asplenium bullatum seems to be widely distributed through southern China; it was recently (1926) found in the province of Fukien, near Foochow (*Herb. Fukien Christian University* 5790).

CETERACH Lam. & DC.

Ceterach dalhousiae (Hook.) C. Chr.

YUNNAN: East of Tengyueh, between Hsiao Chai and summit of Shwell-Salween ridge; altitude 2,700 meters (7595).

New to China.

BLECHNUM L.

Blechnum orientale L.

BURMA: Keng Tung Territory, Valley of the Meh Len (2076).

YUNNAN: Between Tengyueh and Lungling (7234).

PRAINEA J. Smith

Prainea insignis Hook.

BURMA: Keng Teng Territory, ridge between Muang Len and Meh Kong river-basin; common (2028).

³⁸ Hedwigia 61: 33. 1919.

³⁹ Hedwigia 61: 4. 1919.

WOODWARDIA J. E. Smith

Woodwardia japonica (L.) J. E. Smith.

BURMA: Keng Tung Territory, ridge between Muang Len and the Meh Kong (2006).

New to Burma.

Woodwardia radicans var. *unigemmata* Makino, Jap. Journ. Bot. 2: 7. 1918.

Woodwardia unigemmata Nakai, Bot. Mag. Tokyo 39: 103. 1925.

YUNNAN: Between Hsiao Chai and summit of Shweli-Salween ridge (7627). East of Tengyueh (7879).

In his recent key to the species of this genus, Nakai considers this common fern of southern China specifically different from *W. radicans*. My material does not justify this segregation.

CONIOGRAMME Fée

Coniogramme fraxinea (D. Don) Diels.

YUNNAN: Between Muang Hun and Muang Hai (2401).

Coniogramme intermedia Hieron, Hedwigia 57: 301. 1916.

YUNNAN: Between Tengyueh and the Burmese border (7340). Eastern slopes of the Likiang Snow Range, at 3,450 meters elevation (7757).

Coniogramme spinulosa (Christ) Hieron, Hedwigia 57: 311. 1916.

SOUTHEASTERN TIBET: Forests of Doyan Longba, altitude 3,000 meters (11627).

Coniogramme procera (Wall.) Fée.

YUNNAN: Between Tengyueh and the Burmese border (7328).

The four species of *Coniogramme* here listed would all fall under *C. fraxinea*, regarding that species in the usual broad sense. The several new species proposed by Hieronymus in 1916 are chiefly characterized by the hydathodes and their distance from the teeth. Several of these will appear, I think, to be founded upon too weak characters, but others of them are certainly valid, for example, *C. spinulosa*.

GYMNOPTERIS Bernh.

Gymnopteris vestita (Wall.) Underw.

YUNNAN: Eastern slopes of the Likiang Snow Range (6495).

NOTHOLAENA R. Br.

Notholaena delavayi (Baker) C. Chr.

Gymnogramme delavayi Baker, Ann. Bot. 5: 484. 1891.

Gymnopteris delavayi Underw. Bull. Torrey Club 29: 627. 1902.

Notholaena bureauii Christ, Mém. Soc. Bot. France 1: 59. 1905.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,150 meters elevation (4099, 5896).

As to all characters except simple pinnae this is so much like *N. marantae* that I am almost convinced it should be regarded as a simply pinnate form of that species. In no. 4099 some of the pinnae have a distinct auricle at the upper base, quite like a pinnule of *N. marantae*. Owing to the slight width of the pinnae (3 to 4 mm.), the broad sorus lines reach almost from the edge to the midrib.

Notholaena marantae (L.) R. Br.

YUNNAN: Western slopes of the Likiang Snow Range, near Ganhaitze, at about 3,000 meters altitude (4155).

Mettenius demonstrated⁴⁰ that the sporangia in this species are not confined to the thickened tips of the veins, but are borne also on their outer part, the sori thus becoming subgymnogrammoid. He therefore transferred the species to *Gymnogramme*. The two Chinese species, *N. delavayi* and *N. marantae*, show clearly this gymnogrammoid extension of the sori. The question then arises as to whether both these species should be placed under *Gymnopteris* or under *Notholaena*. *Gymnopteris* is, however, a composite genus, and it is not certain that the hairy species such as *G. rufa* (the type of the genus) and *G. vestita* are really congeneric with the scaly species, e. g. *G. delavayi* and *G. muelleri*. If two genera are here represented, the scaly species, among them *N. marantae*, should be referred to *Notholaena* as above, assuming *N. marantae* to be the generic type. In this case the species with true marginal sori hitherto referred to *Notholaena* could naturally be placed under *Cheilanthes*, following Mettenius. It is not certain, however, that *Acrostichum marantae* L. should be adopted as the type of *Notholaena*.

CHEILANTHES Swartz

Cheilanthes albofusca Baker.

Cheilanthes mairei Brause, Hedwigia 54: 202. pl. 4, D. 1914.

YUNNAN: Likiang Snow Range, at 2,700 meters elevation (4879, 5998).

Cheilanthes taliensis Christ.

Cheilanthes henryi Christ, Bull. Acad. Géogr. Bot. 16: 133. 1906.

Cheilanthes bonatiana Brause, Hedwigia 54: 203. pl. 4, E. 1914.

YUNNAN: Likiang Snow Range, at 2,700 to 3,450 meters elevation (6000, 6047).

Cheilanthes farinosa (Kaulf.) Forsk.

YUNNAN: Eastern slopes of the Likiang Snow Range (3561, 6012). Between Tengyueh and Bhamo (7830).

BURMA: Between Sadon and the Yunnan border, forest of Kambaiti (7492).

Cheilanthes farinosa var. *dalhousiae* (Hook.) Clarke, Trans. Linn. Soc. II, Bot. 1: 457. pl. 51. 1880.

YUNNAN: Eastern slopes of the Likiang Snow Range (6496).

I agree with Clarke in considering this a nonfarinose form of *C. farinosa*.

Cheilanthes subrufa Baker, Kew Bull. Misc. Inf. 1906: 8. 1906.

Cheilanthes leveillei Christ, Bull. Acad. Géogr. Bot. 17: 149. 1907.

YUNNAN: Likiang Snow Range, at 2,700 meters altitude (5999).

A problematical species, very likely a variety of *C. rufa* Don. The type specimen (*Henry* 11831; Kew!) looks rather different from that species in its broadly deltoid blade, but other specimens from Yunnan (*Henry* 9080) and Kweichou (*Cavalerie* 1803), with which *Rock* 5999 fully agrees, have less deltoid and narrow blades, and *Cheilanthes leveillei* Christ is a form with lanceolate blade narrowed below, just as in *C. rufa*. Otherwise, all the specimens quite agree as to vestiture and in the greenish white or pale yellowish farina of the under side. However, the indusia are closer, larger, and more definitely lacerate-fimbriate than in *C. rufa*, and the large lanceolate scales of the rhizome and lower part of the stipe are castaneous, with broad hyaline margins.

⁴⁰ Fil. Hort. Lips. 43. 1856.

Cheilanthes albomarginata Clarke is evidently very closely related to *C. subrufa*, and is perhaps the same. It was found in Yunnan by Hancock (no. 15). Very likely *C. dubia* Hope is this species, also.

Cheilanthes subvillosa Hook. Sp. Fil. 2: 87. pl. 98, B. 1852.

Cheilanthes yunnanensis Brause, Hedwigia 54: 204. pl. 4. 1914.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,150 meters altitude (5891).

This species, rare in the Himalaya, seems to be common in Yunnan. I have specimens from Yunnan, collected by Maire, Ducloux, and Siméon Ten, and others from southern Szechwan (*H. Smith* 2010) which agree perfectly with Hooker's illustration and with the more accurate description of Clarke (Review, p. 456). Brause was of the opinion that his new species differs from *C. subvillosa* in scale characters, but in my rather numerous specimens the scales vary considerably in color, from castaneous to pale. Mr. Rock's no. 5891 would fall within Brause's var. *dilatata* of *C. yunnanensis*; it is a very large form, the blades 25 cm. long by 15 cm. wide.

Christ confounded this species with *C. patula* Baker, a widely different plant. All the specimens in his herbarium under that name belong to *C. subvillosa*.

HYPOLEPIS Bernh.

Hypolepis punctata (Thunb.) Mett.

BURMA: Keng Tung Territory, Meh Lui watershed, between Muang Mah and the Yunnan border (2337).

ONYCHIUM Kaulf.

Onychium japonicum var. *lucidum* (D. Don) Christ.

YUNNAN: Between Keng Hung and Muang Hing (2699). Between Tengyueh and Bhamo (7835).

Onychium siliculosum (Desv.) C. Chr.

BURMA: Keng Tung Territory, Valley of the Meh Len (2073, 2150).

YUNNAN: Between Tengyueh and Bhamo (7827, 7827a).

CRYPTOGRAMMA R. Br.

Cryptogramma brunoniana R. Br.

YUNNAN: Mountains above Tseku and Tsehchung, altitude 3,300 meters (11606).

PLAGIOGYRIA (Kunze) Mett.

Plagiogyria henryi Christ.

PLATE 21

Lomaria decurrens Baker, Kew Bull. Misc. Inf. 1906: 9. 1906.

YUNNAN: Between Kambaiti and Tengyueh (7571). East of Tengyueh, near Kuyung (7699).

A very distinct plant, of thin texture, with the lower 5 or 6 pinnae reduced to roundish toothed auricles. It is closely related to *P. stenoptera* (Hance) Diels,⁴¹ with one pair of auriculiform pinnae only, to which I refer *P. tenuifolia* Copel.⁴² and *Lomaria matthewii* Christ as a variety having the basal pinnae less reduced. Further material will perhaps show that *P. tenuifolia* Copel. and *P. henryi* Christ are the extreme forms of a single species that varies as to degree of reduction of the lower pinnae.

EXPLANATION OF PLATE 21.—*Plagiogyria henryi*; Rock 7699. Two-fifths natural size.

⁴¹ See Hook. Icon. Pl. pl. 1644.

⁴² Philippine Journ. Sci. Bot. 3: 281. 1908.

Plagiogyria glauca (Blume) Mett.

YUNNAN: Tsangshan Range near summit; altitude 3,000 meters (3151). Between Tengyueh and the Burmese border (7389). East of Tengyueh (7659). Salween Valley, border of Tsarong, Tibet (11496).

Plagiogyria glauca var. *virescens* C. Chr., var. nov.

YUNNAN: West of the Mekong, from Pingpo to Tengyueh (7068). Summit of Hsueh Shan Ting, east of Tengyueh (7644, type).

Differs from the typical form in the direction of *P. pycnophylla* by the pale green or even brownish green, not whitish glaucous leaves.

Plagiogyria euphlexia (Kunze) Mett.

YUNNAN: Between Kambaiti and Tengyueh (7572).

ADIANTUM L.

Adiantum philippense L.

Adiantum lunulatum Burm. Fl. Ind. 235. 1768.

YUNNAN: West of Talifu, en route to Tengyueh (6628).

Adiantum caudatum L.

BURMA: Keng Tung Territory, Meh Lui watershed (2329).

Adiantum edgeworthii Hook.

YUNNAN: Environs of Tengyueh (7970).

Adiantum edentulum Christ, Mém. Soc. Bot. France 1: 63. 1905.

YUNNAN: Eastern slopes of the Likiang Snow Range, at about 3,300 meters altitude (5677, 6010).

This species is intermediate between *A. capillus veneris* and *A. venustum*, and is very probably the same as *A. wattii* Baker. *Adiantum delavayi* Christ (loc. cit.) is scarcely different. The character, "sori orbicular-reniform or long and straight" is not a constant one. The present specimens show both kinds on fronds from the same rhizome.

Adiantum davidi Franch.

YUNNAN: Between Likiang and Youngpei (5154). Between Likiang and Tsilikiang (8513).

Adiantum davidi var. *prattii* (Baker) C. Chr. Medd. Bot. Trädg. Göteborg 1: 94. 1924.

Adiantum prattii Baker, Journ. Linn. Soc. 29: 321. 1892.

SOUTHEASTERN TIBET: Champutong; altitude 2,700 meters (11527).

Adiantum pedatum var. *glaucinum* Christ, Bull. Herb. Boiss. 6: 957. 1898.

Adiantum myriosorum Baker, Kew Bull. Misc. Inf. 1898: 230. 1898.

SOUTHEASTERN TIBET: Forests of Doyan Longba (11629).

PTERIS L.

Pteris vittata L.

YUNNAN: Slopes of Moting Shan, northeast of Yangtze-Mekong watershed (10343).

Pteris pellucida Presl.

BURMA: Keng Tung Territory: Between Pang Hoi Hpi and Peng Sai (2246); Meh Lui watershed (2282).

Pteris esquirolii Christ, Not. Syst. Lecomte 1: 50. 1909.

BURMA: Keng Tung Territory, Valley of the Meh Len (2188).

YUNNAN: Between Mohei and Maokai, watershed of the Black River (Paplenho) (2912).

Identified from the original description. Near *P. pellucida*, but extremely dimorphic; pinnae of the sterile frond 3.5 cm. broad with sharply serrated tips, and of the fertile one 1 cm. broad or less.

***Pteris heteromorpha* Fée.**

YUNNAN: Between Chieng Law and Muang Hun (2364).

New to China. Apparently a rare and little known species, allied to *P. cretica*, with most of the distant, long, linear pinnae entire or auriculate at the upper base, the lower ones often pinnatifid at base. The specimens at hand correspond closely to Beddome's illustration (Ferns Brit. Ind. pl. 89.).

***Pteris cretica* L.**

YUNNAN: Between Mohei and Maokai, watershed of the Black River (2996). Top of Salween ridge (7037). Between Tengyueh and Man Lo (7147). Forest beyond Shwell, east of Tengyueh (7589).

***Pteris dactylina* Hook.**

Pteris henryi Christ, Bull. Herb. Boiss. 6: 957. 1898.

YUNNAN: Eastern slopes of the Likiang Snow Range (3659, 4854, 4880).

No. 4854 is typical *P. dactylina*; the other specimens would be referred to *P. henryi* Christ (*Henry* 9911!), a larger form with the rachis prolonged and a pair of lateral pinnae above the basal furcate ones. I can not, however, consider this form even a variety.

***Pteris ensiformis* Burm.**

BURMA: Keng Tung Territory, between Muang Len and Muang Hpyak (2031).

***Pteris semipinnata* L.**

YUNNAN: Between Tengyueh and the Burmese border (7343).

***Pteris dissitifolia* Baker.**

YUNNAN: Between Chieng Law and Muang Hun (2369).

The specimen is identical with the type at Kew (*Balansa* 1790!). This species is very like a large form of *P. semipinnata* L., with the lower two pairs of pinnae equally pinnate on each side; stipe and rachises purplish. New to China.

***Pteris decrescens* Christ, Bull. Acad. Géogr. Bot. 16: 244. 1906.**

YUNNAN: Salween Ridge, east of Tengyueh, altitude 2,400 meters (7716).

The specimen agrees with authentic material from Kweichou (*Cavalerie* 2038, 3761!) and Kwantung (*Matthew*!) in the unforked basal pinnae, but differs in its obtuse segments and in not having the pinnae long-caudate. The determination is, therefore, uncertain.

***Pteris quadriaurita* Retz.**

YUNNAN: Between Tengyueh and Lungling (7087).

***Pteris* sp.**

YUNNAN: Puerhfu to Mohei (2867).

The material, which is scanty, belongs to the group of *P. quadriaurita*, but I have not succeeded in identifying it with any of the species described by Hieronymus.

***Pteris aspericaulis* Wall.; Hieron. Hedwigia 55: 348. 1914.**

YUNNAN: East of Tengyueh (7880).

***Pteris aspericaulis* var. *roseo-lilacina* (Hieron.). C. Chr.**

Pteris roseo-lilacina Hieron. Hedwigia 55: 350. 1914.

YUNNAN: West of Talifu, en route to Tengyueh, near Tu Kwe San Temple (6652). Between Tengyueh and the Burmese border (7269).

Although *Pteris roseo-lilacina* was described from an incomplete sterile frond (*Henry* 13222), I have no doubt that Mr. Rock's specimens belong to this form, which is well marked by the beautifully wine-colored rachises. I can not, however, regard this character as of specific importance, especially inasmuch as genuine *P. aspericaulis* to some extent shows the same coloration.

***Pteris excelsa* Gaud.**

YUNNAN: Between Tengyueh and the Burmese border (7345).

I can not find any difference between the Asiatic form and the Hawaiian type.

***Pteris longipinnula* var. *hirtula* C. Chr., var. nov.**

BURMA: Keng Tung Territory, valley of the Meh Len (2133, type; U. S. Nat. Herb. 1,211,373). Also no. 2091 from the same locality.

Differs from the typical form of the species in having the costae and midribs of the segments short-pubescent beneath, and in the rounded-obtuse sterile tips of the segments, these not mucronate.

***Pteris biaurita* L.**

YUNNAN: Between Kao Tien and Tengyueh, on lava flows (7710).

***Pteris biaurita* var. *intermittens* C. Chr., var. nov.**

YUNNAN: Between Keng Hung and Muang Hing (2578).

Pinnae 15 cm. long, 2 cm. wide, incised about two-thirds, with obtuse falcate segments. Basal veins both furcate, the branches of the anterior one bending toward each other near the sinus, the posterior one springing from the costa of the pinnae far from the base of the midrib of the segment, forked from the base; in upper pinnae the basal veins free, in lower ones the opposed branches frequently united by a cross-vein, a short veinlet sometimes running thence toward the sinus.

A critical form with the venation partly that of *P. quadriaurita*, partly of *P. biaurita*.

***Pteris longipes* D. Don.**

BURMA: Keng Tung Territory, Valley of the Meh Len (2179).

***Pteris wallichiana* Agardh.**

YUNNAN: Between Tengyueh and Lungling (7237). Between Tengyueh and the Burmese border (7368). Between Kambaiti and Tengyueh (7565).

HISTIOPTERIS (Agardh) J. Smith***Histiopteris incisa* (Thunb.) J. Smith.**

YUNNAN: Between Tengyueh and the Burmese border (7321).

PTERIDIUM Gleditsch***Pteridium aquilinum* (L.) Kuhn.**

YUNNAN: Between Mohei and Maokai, watershed of the Black River (2906).

VITTARIA J. E. Smith***Vittaria sikkimensis* Kuhn.**

BURMA: Between Sadon and the Chinese border (7419).

***Vittaria caricina* Christ.**

BURMA: Between Sadon and the Yunnan border (7395).

YUNNAN: Ridge forest east of Tengyueh; altitude 2,400 meters (7636).

This is the *Vittaria lineata* of most writers on Indian and Chinese ferns, and it is difficult to see how it may be distinguished from the true *V. lineata* of tropical America. The present specimens (35 cm. long, 2 mm. broad), are larger than the type of *V. caricina* Christ (*Cavalerie* 679!), but otherwise not different. In appearance it resembles *Drymotaenium*, but may be at once distinguished from this by the pyriform paraphyses, less rigid texture, and fresh green color.

Vittaria flexuosa Fée, Mém. Foug. 3: 16. 1851-52.

Vittaria japonica Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 169. 1867.

Vittaria filipes Christ, Bull. Acad. Géogr. Bot. 17: 150. 1907.

YUNNAN: Between Tengyueh and Lungling (7224).

Vittaria doniana Mett.; Hieron. Hedwigia 57: 204. 1915.

BURMA: Between Sadon and the Yunnan border (7423, 7496).

Vittaria doniana var. *angusta* Hieron. Hedwigia 57: 205. 1915.

BURMA: Between Sadon and the Yunnan border (7398).

Vittaria doniana is very closely allied to *V. scolopendrina* (Bory) Thwaites; but it may be distinct from the true form of this species, which is from the Mascarene Islands. Evidently it is a very rare fern, apparently found only twice before in the eastern Himalaya by Griffith and Hooker & Thompson. Rather remarkably Clarke did not mention these finds in his Review, where *V. scolopendrina* is altogether omitted. Beddome (Handbook, p. 408) cites *V. scolopendrina* from the Himalaya, Sikkim, Assam, and Bhotan, presumably meaning the present species.

ANTROPHYUM Kaulf.

Antrophyum henryi Hieron. Hedwigia 57: 208. 1915.

YUNNAN: Between Lungling and Hsiangta (7235).

I have little doubt that this is a small form of *A. coriaceum*, with the narrowly oblanceolate fronds 1 cm. broad or less. In all essential characters (scales, plicate frond, taeniform paraphyses, reticulate sori, etc.) it fully agrees with that species, and as to the size also with some specimens of Wallich's original collection of *A. coriaceum* in the Copenhagen Herbarium. Provisionally, I prefer to maintain this small form as a species, because the boundaries between some of the Asiatic species are as yet not clear.

Antrophyum henryi is based upon *Henry* 11517A, in the Berlin Herbarium. I have not seen the actual type, but specimens of the same number in Christ's herbarium, which are identical with *Rock* 7235, were referred by Christ to *A. stenophyllum* Baker (*Henry* 9607; Kew!), which is figured by Benedict.⁴⁴ After a comparison between *Henry* 11517A and 9607 I am inclined to consider them two different species. *Antrophyum stenophyllum* differs from *A. henryi* in its linear-lanceolate (not oblanceolate) blades, with the sori generally forming two long vittarioid lines; but sometimes the sori show a tendency to become reticulate, as seen in Benedict's figure; further, the upper side is not plicate, and there is a rather distinct midrib in the lower third of the frond. In *A. henryi*, on the other hand, there is no midrib at all, and the sori form 4 or 5 anastomosing rows. The rhizome scales and paraphyses are very similar in both species.

Antrophyum stenophyllum is evidently the same as *A. reticulatum* var. *parvula* Clarke (Review, p. 573), but scarcely *A. parvulum* Blume, and most probably it is not specifically different from *A. vittarioides* Baker, from Tonkin (*Balansa* 1921; Kew!). This, as to scales, size, midrib, and two long sorus lines, is very nearly the same as *A. stenophyllum*, but the paraphyses are narrower and the sori show no tendency to become reticulate, though portions of a second parallel line occasionally occur.

Antrophyum vittarioides is said by Van Alderwerelt van Rosenburgh⁴⁴ to occur in Borneo, but the plant illustrated by him is at least not typical, having

⁴⁴ Bull. Torrey Club 39: pl. 7, f. 1-2. 1911.

⁴⁴ Bull. Jard. Bot. Buitenzorg II. 11: 2. pl. 2. 1913.

the sorus lines much closer to the edge than in the type. The same writer has described⁴⁶ a var. *major* of *A. vittarioides*, collected in Sumatra by Dr. C. G. Matthew, who kindly has presented me with a cotype specimen. This form is specifically different from *A. vittarioides* in its hair-pointed rhizome scales, in having the midrib evanescent a little above the base, and the sorus lines very near to the edge; the frond is entirely vittarioid in general aspect, but the hairlike paraphyses and tetrahedral spores are those of *Antrophyum*.

Summarizing the above remarks, I believe (1) *A. henryi* to be a small form of *A. coriaceum*, (2) *A. stenophyllum* to be a form of *A. vittarioides*, and (3) the Malayan plants to represent a third, undescribed species.

***Antrophyum coriaceum* (D. Don) Wall.**

YUNNAN: Between Muang Hun and Muang Hai (2403). Banks of the Meh Kong, near Keng Hung (2522).

A large form of this species, the blades 20 cm. long by 3 cm. broad, very much resembling *A. reticulatum*, but distinctly plicate above.

Antrophyum reticulatum is recorded from Yunnan by Christ,⁴⁶ but the specimens probably belong to *A. coriaceum*.

***Antrophyum obovatum* Baker, Kew Bull. Misc. Inf. 1898: 233. 1898.**

Antrophyum petiolatum Baker, Kew Bull. Misc. Inf. 1906: 14. 1906.

BURMA: Between Sadon and the Yunnan border (7501).

The present specimens are small, exactly like one plant of Henry 9153B, the type of *A. petiolatum* Baker (Kew!). *Antrophyum obovatum* Baker (Henry 9153A; Kew!) is somewhat larger, the blade up to 10 cm. broad, but is otherwise identical with the former. In Christ's herbarium Henry 9153A is exactly the same as 9153B at Kew, and there remains no doubt that here again Baker described the same plant twice.

Antrophyum obovatum comes near to *A. latifolium* Blume, but seems to be a distinct species. It differs in having the blade, especially of smaller leaves, rather long-cuneate at base and attenuate into the thick fleshy stipe, not abruptly rounded as in *A. latifolium*; the sori are very slightly immersed and the paraphyses capitate with a large subglobose end-cell, while the paraphyses of *A. latifolium* are clavate with a lengthened end-cell. *Antrophyum latifolium* is said by Clarke (Review, p. 573) to be frequent in the eastern Himalaya, but it is very probable that this north Indian "*A. latifolium*" is *A. obovatum*.

DRYMOTAENIUM Makino

***Drymotaenium miyoshianum* Makino.**

YUNNAN: Mountain forest above Tseku, at 3,000 meters elevation (10057).

LEMMAPHYLLUM Presl.

***Lemmaphyllum carnosum* (Wall.) Presl, Epim. Bot. 158. 1849.**

Drymoglossum carnosum J. Smith in Hook. Gen. Fil. pl. 78, A. 1841.

YUNNAN: Between Tengyueh and the Burmese border (7367). East of Tengyueh (7622, 7957a).

I have recently discussed elsewhere this and related species, as indicated under *Polypodium neurodioides* (p. 318).

⁴⁶ Op. cit. 16: 56. 1914.

⁴⁶ Bull. Herb. Boiss. 1: 3. 1899.

POLYPODIUM L.

Subgenus EUPOLYPODIUM

Polypodium sikkimense Hieron.

YUNNAN: East of Tengyueh, in dense forest, at 2,400 meters elevation (7613a).

Polypodium subfalcatum Blume.

Polypodium sinicum Christ, Bull. Herb. Boiss. 7: 3. 1899.

Polypodium convolutum Baker, Kew Bull. Misc. Inf. 1906: 12. 1906.

Polypodium trichophyllum Baker, loc. cit. 13.

BURMA: Between Sadon and the Yunnan border, epiphytic in mossy forest, at 2,700 meters elevation (7400).

The specimens agree closely with plants collected in Assam by G. Mann, which Beddome, Clarke, and others refer to *P. subfalcatum* Blume, probably with correctness, although the Javanese type differs slightly in its less dense pubescence of long brown hairs. *Polypodium sinicum* Christ and *P. convolutum* Baker are exactly identical, being based upon the same collection number (Henry 10186; Kew! Herb. Christ!); *P. trichophyllum* Baker, also from the forests of Mengtze (Hancock 153; Kew!) is the same, only the fronds are longer (up to 30 cm.), with the pinnae more distant. The specimens of the Rock collection differ a little from these in their relatively long stipes (3 to 4 cm.).

Subgenus GONIOPHLEBIUM

Polypodium manmeiense Christ, Bull. Herb. Boiss. 6: 870. 1898.

Polypodium scalare Christ, Mém. Soc. Bot. France 1: 14. 1905.

Polypodium pseudodimidiatum Christ, Mém. Soc. Bot. France 1: 14. 1905.

Polypodium simulans Baker, Kew Bull. Misc. Inf. 1906: 13. 1906.

YUNNAN: Between Tengyueh and Lungling (7241). Near Ngaza, west of Likiang (10558). Litiping Range, east of Weihsi (11559).

This is no doubt a free-veined *Goniophlebium*, in general aspect very like some forms of *P. vulgare*. On the other hand it comes very near *P. microrrhizoma* Clarke, but the blades are narrower and the rachis is stramineous beneath. These and certain other Asiatic species of *Goniophlebium* afford a strong basis for my opinion that our common *P. vulgare* is a free-veined *Goniophlebium*, and not closely related to any group of the subgenus *Eupolypodium*.

Polypodium microrrhizoma Clarke.

YUNNAN: Eastern slopes of the Likiang Snow Range (5892, 6498).

In this species the veins are as a rule free, but occasionally they anastomose, forming goniophlebioid areoles. It is a larger fern than *P. manmeiense*, and well marked by the rachis being castaneous beneath.

Polypodium lachnopus Wall.

YUNNAN: Mount Schwemenkan, northwest of the Likiang Snow Range, at 2,100 meters elevation (9789).

Polypodium amoenum Wall.

Polypodium yunnanense Franch. Bull. Soc. Bot. France 32: 29. 1885.

Polypodium bonatianum Brause, Hedwigia 54: 207. pl. 4, L. 1914.

Polypodium amoenum var. *pilosa* Rosenst. Repert. Sp. Nov. Fedde 13: 134. 1914.

YUNNAN: Salween watershed, en route from Pingpo to Youngchang and Tengyueh; epiphytic (7003, 7036, 7065). Between Tengyueh and Lungling (7152, 7153, 7180). Hsiao Ping Ho, east of Tengyueh (7719).

BURMA: Between Sadon and the Yunnan border (7455).

The most common Chinese form of this species is rather densely and softly glandulose-pubescent throughout and has been described as a distinct species by Franchet and by Brause, as a variety by Rosenstock. The beautiful series of specimens gathered by Mr. Rock shows, however, that this hairy form can not be separated from the more glabrous Himalayan type; the density of pubescence is due very largely to age.

Polypodium argutum Wall.

Polypodium mengtzeense Christ, Bull. Herb. Boiss. 6: 869. 1898.

Polypodium aspersum Baker, Kew Bull. Misc. Inf. 1898: 231. 1898.

BURMA: Between Sadon and the Yunnan border (7500).

In an examination of the type specimens of the species described in the same year by both Christ and Baker (*Henry* 9054) I have tried in vain to find real differences between their plant and specimens of undoubted *P. argutum* from Himalaya, among the latter a cotype in the Copenhagen Herbarium. The original specimen of *P. aspersum* Baker, at Kew, is evidently somewhat abnormal, with irregular venation and irregularly scattered sori. The two or three uppermost pairs of pinnae are confluent at base with the terminal pinna, as is often the case in typical *P. argutum*, for example, in our specimen from Wallich. In the Rock material all the pinnae bear an auricle at the lower base; in the lowest pinnae it is much prolonged, like a secondary pinna.

Subgenus PLEOPELTIS

The numerous Chinese forms of this subgenus (here regarded in the sense of my *Index Filicum*), with simple fronds, have been very differently identified by authors. The prevailing confusion was, however, greatly reduced by H. Takeda, who published in 1915 a revision⁴⁷ of these species. Having examined the type specimens of most of the species described by Baker and by Christ, and having compared them with the large series collected by Cavalerie, Esquirol, H. Smith, and now more recently by Mr. Rock, I find Takeda's delimitation of the species very satisfactory on the whole. In the following list I refer, therefore, repeatedly to his paper, noting where I have a different view and giving supplementary remarks where needed.

Polypodium lineare Thunb.; Takeda, Notes Bot. Gard. Edinburgh 8: 268. 1915 (excl. var. *loriforme*).

f. *thunbergiana* (Kaulf.) Takeda, loc. cit.

YUNNAN: Western slopes of the Likiang Snow Range, on rocks (5400).

BURMA: Between Sadon and the Yunnan border, on trees (7421).

f. *thunbergiana* (Kaulf.) Takeda, loc. cit.

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,150 meters elevation, on rocks (3387). Western slopes of the same range, at 3,300 meters elevation (4157).

f. *caudato-attenuata* Takeda, op. cit. 269?

BURMA: Between Sadon and the Yunnan border (7509).

YUNNAN: West of Talifu (6870). Identification doubtful.

Polypodium oligolepidum Baker (Takeda, op. cit. 276).

Polypodium trabeculatum Copel. Philippine Journ. Sci. Bot. 3: 283. 1908.

BURMA: Between Sadon and the Yunnan border; epiphytic (7494, 7498).

This species differs from *P. lineare* chiefly in its rhizome scales, which are lanceolate-acuminate and ciliate, with a dark brown central stripe and light

⁴⁷ Notes Bot. Gard. Edinburgh 8: 265-312.

brown edges; the stipe is very short (not almost black, as stated by Takeda); the lamina is broader and shorter than in *P. lineare*, the upper side distinctly nigro-punctate, the under side with numerous ovate-cuspidate small scales; the sori are large, globose, situated near the midrib, and even at maturity are partly covered with peltate scales.

I have compared specimens from the type collection of *P. trabeculatum* Copel. from Kwantung, received from Dr. C. G. Matthew, with the meager type from Kiu-kiang, at Kew, and find them identical. Other typical specimens from Kweichou (*Cavalerie* 1579) were received from Professor Rosenstock under the name *P. lineare* var. *heterolepis* Rosenst., but evidently they do not belong to that variety, which was described by Rosenstock on specimens from Sikkim and is referred by me to *P. loriforme* (see below).

The Burmese specimens gathered by Rock are not typical, being intermediate between *P. oligolepidum* and *P. lineare*. They resemble the former in scale structure and general aspect, but the sori are about medial and the lower surfaces (the sori excepted) naked.

Polypodium loriforme Wall. List, no. 271. 1828; Mett. Abh. Senckenb. Ges. Frankfurt 2: 92. pl. 1, f. 50. 1857.

Polypodium subimmersum Baker, Kew Bull. Misc. Inf. 1895: 55. 1895; Takeda, op. cit. 275.

Polypodium xiphopteris Baker, Kew Bull. Misc. Inf. 1906: 13. 1906.

Polypodium mengtzeanum Baker, Kew Bull. Misc. Inf. 1906: 14. 1906 (*vide* Takeda).

Polypodium lineare var. *loriforme* Takeda, op. cit. 272.

YUNNAN: En route from Pingpo to Tengyueh (7020). Between Tengyueh and the Burmese border (7303).

Although Takeda refers Wallich's *P. loriforme* to *P. lineare* as a variety, he nevertheless maintains *P. subimmersum* Baker as a species. I have compared a specimen from Wallich's type collection (Herb. Copenhagen) with authentic specimens of *P. subimmersum* and find them nearly identical, except that *P. subimmersum* (which is the same as *P. xiphopteris* Baker) has the margins of the blade slightly sinuate, with a sorus near each sinus. Rock's specimens, above cited, are typical *P. loriforme*.

Polypodium loriforme seems to me abundantly different from *P. lineare*. The fronds are longer (up to 40 cm.), 1 cm. broad or a little more, and very gradually narrowed downward into a short stipe (2 to 5 cm. long); the blades are generally wrinkled longitudinally in a dried state, the margins narrowly revolute. The lower surfaces are naked or bear occasionally a few minute, ovate, clathrate scales in the lower part near the costa. The sori are intramarginal, linear when young, and covered with peltate scales, with age globose and devoid of scales, slightly immersed, always much more distant than in *P. lineare*.

The rhizome scales resemble those of *P. lineare*, but in reality are quite different. They are ovate-acuminate, nearly black, and coarsely clathrate; all cells nearly isodiametrical, with clear lumina and strong black walls; margins short-dentate from the protruding cross-walls of the marginal cells, not long-ciliate as in *P. lineare*.

To this species I refer a series of somewhat different forms, distinguished from the typical form by their narrow, long-acuminate blades, which are only 5 to 8 mm. broad. Further material will prove, I think, that these narrow-leaved forms belong to different species.

Polypodium loriforme f. *angustifrons* (Takeda) C. Chr.

Polypodium subimmersum f. *angustifrons* Takeda, op. cit. 276.

YUNNAN: Shweli-Salween watershed east of Tengyueh, altitude 2,400 meters; epiphytic (7599).

SOUTHEASTERN TIBET: Forests of Doyan Longba, altitude 3,000 meters (11630).

This form differs from the type in its narrow leaves only. Closely related to it and differing only in having the sori medial or even inframedial are the following two collections:

YUNNAN: Between Tengyueh and the Burmese border (7306).

SOUTHEASTERN TIBET: Mount Kenyichunpo, Champutong (11519).

Polypodium loriforme var. *steniste* (Clarke) C. Chr.

Polypodium lineare var. *steniste* Clarke, Trans. Linn. Soc. II. Bot. 1: 559. 1880.

Polypodium subintegrum Baker, Kew Bull. Misc. Inf. 1898: 231. 1898, not Baker, 1877.

Polypodium oblongisorum C. Chr. Ind. Fil. 549. 1906.

Specimens of the type collection of *P. subintegrum* Baker (*Henry* 9194; Kew! Herb. Christ!) differ from narrow forms of *P. loriforme* only in the sori protruding beyond the margin; and since Clarke describes his var. *steniste* as "Fronds 11 by 1/6 in.; sori large, appearing as projections on the margin," and as Takeda (loc. cit. 273) places *steniste* as a form of *P. loriforme*, I have no doubt that *P. subintegrum* Baker is the same.

Polypodium loriforme var. *heterolepis* (Rosenst.) C. Chr.

Polypodium lineare var. *heterolepis* Rosenst. Repert. Sp. Nov. Fedde 12: 247. 1913.

A variety with large, medial, globose or oblong sori, which touch the costa as well as margin. It differs from the former varieties by its discoloured rhizome scales, which have a distinct dark central stripe and bright brown edges.

YUNNAN: Between Tengyueh and Lungling (7168). Below Kuyung (7558).

Polypodium neurodioides C. Chr., nom. nov.⁴⁸

Neurodium sinense Christ, Bull. Herb. Boiss. 6: 880. 1898. Not *Polypodium sinense* Christ, 1905.

Paltonium sinense C. Chr. Ind. Fil. 477. 1906.

Lemmaphyllum sinense C. Chr. Dansk Bot. Arkiv 6¹: 51. 1929.

For a long time I have had serious doubts whether this species, one of the marvels ascribed by Christ to the Chinese fern flora, really belonged to the genus *Paltonium*, which otherwise was known as exclusively American. The specimens gathered by Mr. Rock and now under examination have shown it to be so closely related to the species of the group of *Polypodium lineare* that it must naturally be placed here. The truly lanceolate-acuminate frond of the type specimen resembles in size, shape, and texture some of the forms of

⁴⁸In my recently published review of the "drymoglossoid" genera (Dansk Bot. Arkiv 6¹: 1-93. pl. 1-13. 1929), worked out after my manuscript of the present paper was sent to Doctor Maxon, I have made *Polypodium neurodioides* a member of the genus *Lemmaphyllum*, as *L. sinense* (Christ) C. Chr., citing it as an unpublished name. Inasmuch as this species may be placed in *Polypodium* quite as naturally as in *Lemmaphyllum*, I prefer to let the present treatment stand unchanged, as originally written.

P. lineare, but the sori form two continuous or intermittent narrow lines from the middle of the blade nearly to the apex, 1 to 2 mm. within the margins; when young they are covered with peltate scales, as in other species of this group. The underside of the blade is sparsely furnished with ovate-acuminate, toothed, clathrate scales along the lower part of the costa. The hidden venation is that of this group. The scales of the creeping rhizome are ovate, broadly acuminate, fuscous, dark brown at the center, the edges bright brown, ciliate, much resembling those of *P. oligolepidum* or of *P. loriforme* var. *heterolepis*.

The species is a variable one, and I distinguished the following four forms:

1. (Typical). Blade lanceolate, 1 to 1.5 cm. broad below the middle; sorus lines continuous or nearly so.

YUNNAN: *Henry* 10434, 13072. Between Tengyueh and the Burmese border; epiphytic (*Rock* 7385).

BURMA: Between Sadon and the Yunnan border (*Rock* 7488).

2. Blades typical in shape, but the sori polypodioid, globose or somewhat oblong. Distinguished from *P. lineare* principally by its discolored rhizome scales and its broader, lanceolate blades.

YUNNAN: Between Tengyueh and Lungling, on trees (7113).

3. Blades narrower, 5 to 8 mm. broad, of a more linear type, in outline closely resembling the narrow forms described under *P. loriforme*; sorus lines continuous.

YUNNAN: *Mengtze* (*Henry* 11518A; *Herb. Christ*).

4. Similar to the last, but sorus lines interrupted into many oblong or linear sori (sometimes 1 to 1.5 cm. long); resembling closely *P. loriforme* var. *heterolepis* also in scale structure, differing from it chiefly by its linear, often confluent sori.

NORTHWESTERN YUNNAN: Alpine regions of Silo, above Tseku and Tsehchung (8727).

Polypodium excavatum Bory (*Takeda*, op. cit. 279).

YUNNAN: Eastern slopes of the Likiang Snow Range, at 3,300 meters elevation (5887; f. *bicolor* *Takeda*). West of Talifu, Mount Yu Hua Ko (6677; f. *concolor* *Takeda*).

Polypodium macrosphaerum Baker, *Kew Bull. Misc. Inf.* 1895: 55. 1895.

Polypodium asterolepis Baker, *Journ. Bot. Brit. & For.* 26: 230. 1888; *Takeda*, op. cit. 283. Not *P. astrolepis* Liebm. 1849.

Polypodium aspidiolepis Baker, *Ann. Bot.* 5: 474. 1891. (err. typ.).

Polypodium intramarginale Baker; *Christ, Bull. Herb. Boiss.* II. 3: 509. 1903; *Baker, Kew Bull. Misc. Inf.* 1906: 13. 1906.

YUNNAN: West of Talifu (6869). Between Tengyueh and Lungling; epiphytic (7103, 7225). Between Tengyueh and the Burmese border (7283). Between Kambaiti and Tengyueh (7538).

SOUTHEASTERN TIBET: Salween watershed below Shundsongla, altitude 3,000 meters (11631).

This is a variable species, especially as to size, but is easily recognized by the obtuse scales of the rhizome. The underside and young sori are covered with many peltate scales; the large globose sori are generally near the margin, but in some specimens they are medial. Specimens from Shensi (*Purdom* 95) reported⁴⁹ by me as *P. oligolepidum* may now be referred here, although they are somewhat different.

⁴⁹ *Bot. Gaz.* 56: 332. 1913.

Polypodium sublineare Baker (Takeda, op. cit. 276).

PLATE 22

BURMA: Between Sadon and the Yunnan border; epiphytic, in dense forest (7424, 7502).

The Rock specimens agree closely with the type from Yunnan (*Henry* 9062A; Kew!): Rhizome scales blackish brown, ovate-acuminate, with very large, uniform, thick-walled cells; margins distantly short-ciliate, not freely long-ciliate as in *P. lineare*.

This is a much larger species than *P. lineare*; the subfasciculate coriaceous fronds are nearly sessile, 3 to 5 cm. broad at the middle, and bear no scales on the surfaces. The large sori are exactly medial and confined to the upper half of the blade, and according to Takeda have peltate scales when young. In habit the plant is much more like *P. excavatum* than *P. lineare*, but the texture is much thicker and the scales are entirely different. The distinctions between this species and the very similar *P. sordidum* are noted under that species.

EXPLANATION OF PLATE 22.—*Polypodium sublineare*. The type specimens, *Henry* 9062A, from Yunnan, in the Kew Herbarium. Two-fifths natural size.

Polypodium sordidum C. Chr., sp. nov.

Rhizome rather short-creeping, firm, blackish, about 3 mm. thick, with a mass of fibrous roots, the younger parts clothed with black, lanceolate-acuminate, sparingly short-toothed scales, the lumina of the cells very small and narrow, here and there brownish and forming irregular brown stripes (especially in the center), the scales often being nearly opaque. Fronds approximate, sometimes 5 or 6 within a space of 3 cm., articulate to short cylindrical pseudopodia from the rhizome; stipes 7 to 15 cm. long, greenish-stramineous, sulcate above, glabrous; blades entire, lanceolate, 25 to 35 cm. long, 2.5 to 4 cm. broad below the middle, cuneate and short-decurrent at base, acuminate at apex, coriaceous, grayish green, paler beneath, perfectly glabrous, the midrib below with a few deciduous, black, ovate, acute scales; veins hidden; sori uniserial in the upper half of the lamina, supramedial, globose, large (about 4 mm. in diameter), superficial, provided with black, lacerate, clathrate scales and filiform paraphyses.

YUNNAN: Between Man Lo and Lungling, in forest, on mossy banks (7160; type). Banks of the Taho, near Kambaiti, on mossy boulders (7537).

A large species, habitally resembling *P. sublineare* and *P. macrosphaerum*, differing from both by its black nearly opaque rhizome scales, and from *P. sublineare* moreover in its relatively long stipes and suprasedial sori.

Polypodium subrostratum C. Chr.

YUNNAN: Kin Tung Chai, between Keng Hung and Muang Hing; climbing on tree trunks in stream bed (2690).

BURMA: Between Sadon and the Yunnan border, on boulders (7493).

Polypodium rhynchophyllum Hook.

BURMA: Between Sadon and the Yunnan border, Valley of Kambaiti (7513).

YUNNAN: Between Kambaiti and Tengyueh (7535, 7557).

Polypodium chrysotrichum C. Chr., sp. nov.

PLATE 23

Rhizome creeping on tree trunks, filiform, 1 mm. thick, ramose, whitish-pruinose, paleaceous at first; scales small, brown, peltate, narrowed from a broad ovate sublacerate base into an entire hairlike tip (2 to 3 mm. long). Fronds scattered, conform, the stipes very slender, glabrous, 1 to 3 cm. long (rarely 4 to 5 cm.). Sterile blades ovate-oblong, entire, the larger ones 5 to 7 cm. long, 2 to 2.5 cm. broad, at base rounded and often subcordate, acuminate at apex, the tip short-caudate. Fertile blades similar in shape but smaller,

3 to 4 cm. long by 8 to 10 mm. broad, subcoriaceous, light green above, glaucescent or grayish green beneath, entire (the edges cartilaginous, narrowly revolute), glabrous above, beneath bearing rather numerous, extremely small, glandular, club-shaped, appressed hairs, these consisting of 2 or 3 clear cells (forming a shaft) and 1 much larger, terminal, golden-yellow cell (fig. e); lateral veins about 10 pairs, 6 to 8 mm. apart, lightly flexuous, diverging from the slender costa at an angle of 70° , distinct nearly to the margin, connected by 3 or 4 transverse flexuous veins, these cross veins giving rise to 1 or 2 simple or furcate, recurved veinlets with clavate tips, free, or sometimes united with each other or with the next cross vein; transverse veins of fertile blades commonly connivent at the middle and there connected by a soriferous veinlet (fig. c); sori borne in a single row on each side of the costa, exactly round, rather large (2.5 to 3 mm.), often confined to the lower half of the blade, never extending to the tip; sporangia with 2 to 4 stiff septate hairs, these borne from the upper lateral cells of the sporangium (not from the annulus), protruding above the sporangia (figs. f, g).

YUNNAN: Salween Valley, east of Tengyueh, altitude 2,400 meters; climbing on tree trunks (7656, type).

This new species is a most interesting and distinct one. In general habit and in size it is intermediate between *P. rhynchophyllum* and *P. griffithianum*, resembling the latter in texture and color, the former in size and venation. Aside from the position of the sori in the lower part of the blade, it differs from both these species, however, in the peculiar microscopical glandular hairs of its underside and in its pilose sporangia; in the latter characters it is abundantly different from all other species of this group known to me.

EXPLANATION OF PLATE 23.—*Polypodium chrysotrichum*. The type specimen, Rock 7656. a, Three fronds, attached to rhizome (natural size); b, venation of sterile blade (enlarged); c, venation of fertile blade, the limits of the sori faintly indicated (enlarged); d, rhizome scale (much enlarged); e, glandular hair from underside of blade (greatly enlarged); f, g, sporangia (greatly magnified).

Polypodium griffithianum Hook.

Polypodium majoense C. Chr. in Lévillé, Cat. Pl. Yun-Nan 108. 1916.

YUNNAN: Route from Pingpo to Youngchang and Tengyueh; epiphytic (7045, 7067). Between Tengyueh and the Burmese border; epiphytic on forest trees (7305). Between Kambaiti and Tengyueh; epiphytic (7555). East of Tengyueh, Salween ridge; epiphytic (7715).

BURMA: Between Sadon and the Yunnan border; epiphytic (7528).

Polypodium normale D. Don (Takeda, op. cit. 286).

YUNNAN: Between Tengyueh and Lungling; epiphytic (7150). Between Tengyueh and the Burmese border; epiphytic (7358).

BURMA: Between Sadon and the Yunnan border; epiphytic (7510).

Polypodium hymenodes Kunze, *Linnaea* 23: 279, 319. 1850; Takeda, op. cit. 287.

YUNNAN: Between Tengyueh and the Burmese border; epiphytic (7366).

Polypodium superficiale Blume.

Polypodium nigrocinctum Christ, Bull. Herb. Boiss. 6: 874. 1898.

YUNNAN: Between Tengyueh and the Burmese border; epiphytic (7270, 7359). East of Tengyueh (7714).

BURMA: Between Sadon and the Yunnan border (7497).

Polypodium membranaceum D. Don.

YUNNAN: Near Talifu, in the Yangpi Range (6281). Between Tengyueh and Lungling (7100, 7137). Near Ngaza, west of Likiang (10559).

BURMA: Between Sadon and the Yunnan border (7478).

***Polypodium punctatum* L.**

BURMA: Keng Tung Territory, Valley of the Meh Len; epiphytic (2138).

YUNNAN: Between Chieng Law and Muang Hun; epiphytic (2368).

***Polypodium dactylinum* Christ.**

YUNNAN: Mountains above Tseku and Tsehchung, at an elevation of 3,300 meters (11593).

This species has been referred by Takeda (op. cit. 300) to *P. hastatum* Thunb., but it seems to me well characterized by its glaucous, coriaceous, pedately divided blades, with 5 to 7 lobes. The beautiful specimens collected by Mr. Rock agree excellently with the type specimens in Christ's herbarium, although somewhat smaller. The characteristic distant notches in the thickened margins, seen in all forms of the variable *P. hastatum*, are very indistinct in our specimens.

***Polypodium veitchii* Baker (Takeda, op. cit. 296, with synonymy).**

YUNNAN: Eastern slopes of the Likiang Snow Range (5893, 6040, 6048).

I follow Takeda in referring *Polypodium glaucopsis* Franch., from Yunnan, and *P. shensiense* Christ, from Shensi, to the Japanese *P. veitchii*. This is a variable species as to texture, number, shape, and serrature of the segments, as well as to structure of the rhizome scales. The scales may be concolorous and nearly entire; but more commonly they are brown or blackish in the center, with the margins pilose-ciliate. The number of lateral segments varies between 1 and 5 pairs; commonly they are very obtuse, but sometimes acute; the lowest pair are generally excised at the lower base, making the whole blade cordate with a broad open basal sinus, but sometimes they are broadly adnate and short-decurrent. The margins of the form occurring in Yunnan (*P. glaucopsis* Franch.) are distinctly serrulate and often with distinct cuspidate teeth (especially toward the apex), like those of *P. malacodon* Hook., though much shorter. In reality, the specimens gathered by Mr. Rock seem to show that there is not to be found any reliable difference between the Himalayan *P. malacodon* and *P. veitchii* f. *glaucopsis*. See also under the next species.

***Polypodium crenato-pinnatum* Clarke (Takeda, op. cit. 297).**

YUNNAN: Saba, eastern slopes of the Likiang Snow Range; altitude 3,150 meters (6123).

The specimens agree closely with the type of *Polypodium pseudo-serratum* Christ, which was correctly reduced by Takeda to a form of *P. crenato-pinnatum*. They differ from *P. veitchii* by their darker, firm, nearly entire rhizome scales and by their acute or acuminate segments, which are more or less crenate-lobate or even irregularly pinnatifid; but I have serious doubt whether these characters are constant, and am inclined to think that there is no important difference between this species and *P. veitchii*.

***Polypodium cyrtolobum* Clarke (Takeda, op. cit. 298).**

YUNNAN: Western slopes of the Likiang Snow Range, near Ganhaitze; altitude 3,000 meters (4137).

Polypodium trisectum Baker, Kew Bull. Misc. Inf. 1898: 232. 1898; Takeda, op. cit. 295.

Polypodium podobasis Christ, Bull. Acad. Géogr. Bot. 11: 215. 1902 (Henry 13121!).

YUNNAN: Between Tengyueh and Lungling (7179, 7181, 7186).

Very closely allied to *P. oxylobum*, from which it is best distinguished by the underside, especially the costae, being minutely glandulose-pubescent. Well developed fronds bear two patent or rather ascending basal lobes, these as a rule much shorter than the central one; but in smaller plants (e. g., 7181) the fronds may be entire or with one or two short basal auricles only. The

rhizome scales resemble those of *P. oxylobum*; they are fulvous, lanceolate-acuminate, and lanose-ciliate.

Polypodium oxylobum Wall. (Takeda, op. cit. 299).

YUNNAN: West of Talifu, en route to Tengyueh (6664). Salween Ridge, en route from Pingpo to Tengyueh (7066). Between Tengyueh and Lungling (7169).

Polypodium ebenipes Hook. (Takeda, op. cit. 300).

YUNNAN: West of Talifu, en route to Tengyueh; altitude 2,400 meters (6678).

A form of this species approaching *P. oxylobum*, from which it differs in its reflexed basal pinnae and slightly serrulate margins. The blade is cordate at base, with a very narrow sinus. The rhizome scales are lanose-ciliate, as in the type. The rhizome is much more strongly glauco-pruinose than in *P. oxylobum*.

Polypodium euryphyllum C. Chr.

BURMA: Keng Tung Territory, Valley of the Meh Len, in dense shade (2135).

Polypodium tatsienense Franch. & Bur.

YUNNAN: West of the Mekong, en route from Pingpo to Tengyueh, on moist bank (7060, 7061).

Identified from Christ's description. The rhizome is creeping and is covered with patent, brown, hair-pointed, short-dentate scales; in no. 7061 there are 1 or 2 pairs of lateral pinnae below the larger terminal one, but in no. 7060 the blade is simple, quite like the terminal pinna of no. 7061. The upper surface is white-dotted with secernated lime; the undulate margins are bordered by a narrow cartilaginous membrane, as in *P. wallichianum*; and the sori and texture are as in that species.

It is possible that *P. tatsienense* is in reality a small form of *P. wallichianum* and perhaps the same as *P. juglandifolium* var. *pauper* Clarke.

Polypodium wallichianum Spreng.

YUNNAN: Between Mohei and Maokai (2954). Between Tengyueh and Lungling (7155). Between Tengyueh and the Burmese border (7304).

Polypodium wallichianum var. *tenuicauda* Hook.

SOUTHEASTERN TIBET: Salween Valley, near Champutong; altitude 2,700 meters; on moss-covered boulders in stream bed (11510).

Polypodium leiorhizon Wall.

YUNNAN: Between Muang Hai and Keng Hung, on rocks, in forest (2473, 2515). Between Tengyueh and Lungling (7139, 7139a). Fifteen li east of Tengyueh, on boulders (7875, 7878).

Polypodium lehmanni Mett.

YUNNAN: En route from Pingpo to Tengyueh (7064).

Polypodium lehmanni var. *mairei* (Brause) C. Chr.

Polypodium mairei Brause, *Hedwigia* 54: 208. pl. 4, M. 1914.

YUNNAN: West of Talifu, en route to Tengyueh (6655, 6675, 6920).

Differs from the type in its more numerous pinnae (6 to 11 pairs), these broadly lanceolate or subelliptic, with often crenate, distinctly cartilaginous margins, the sori frequently confluent, thus approaching *P. himalayense*.

Polypodium wardii Clarke, *Journ. Linn. Soc.* 25: 99. pl. 43. 1889.

YUNNAN: Between Tengyueh and Lungling (7257). Summit of Shweli-Salween watershed, east of Tengyueh (7729).

This very beautiful species can not be united naturally with *P. himalayense*, as by Beddome (*Handb. Suppl.* p. 98), since it differs in its sori being uniserial between the main veins and its perfectly glabrous surfaces and glabrous

sporangia. Clarke failed to mention the color of the leaf; in our specimens the blades are very beautifully glaucous beneath and bordered with broad hyaline margins; otherwise they agree closely with Clarke's description and figure.

The species is new to China.

Subgenus SELLIGUEA

The validity of *Selliguea* as a genus is subject to great controversy among pteridologists. The gymnogrammoid sori may justify the segregation of this group from the subgenus *Pleopeltis* of *Polypodium*; but in most species, specimens with polypodioid sori are found and these may often be difficult to distinguish from *Polypodium* by any other character. So long as we maintain *Polypodium* in the wide sense now generally accepted, it seems best to me to place *Selliguea* under *Polypodium* as a subgenus.

In recent years a considerable number of species have been described from southern China, Annam, Tonkin, and Malaya. Most of these from central east Asia belong to the narrower subgroup of the well-known *Polypodium ellipticum*, with pinnate or occasionally simple fronds, or to that of *P. digitatum* Baker, with digitate or pedatifid fronds. To the latter should probably be referred most of the very weakly characterized Annamese species described by Christ.

In Mr. Rock's collection only two forms of this subgenus are found, both belonging to *P. ellipticum*, using the name in its wide sense. This collective species includes several apparently distinct forms, the delimitation of which is scarcely possible without extensive material. It seems advisable, therefore, to refer the specimens at hand provisionally to that species.

Polypodium ellipticum Thunb.

Gymnogramme pentaphylla Baker, Kew Bull. Misc. Inf. 1898: 233. 1898.

YUNNAN: Between Tengyueh and the Burmese border (7329).

This is nearly typical, with 6 pairs of lateral pinnae, the lower ones free and petiolate; rachis winged above only; margins entire or nearly so.

Gymnogramme pentaphylla Baker is a very similar form, with only two pairs of broad pinnae and a larger terminal one. It was described from a poorly fertile specimen (*Henry* 9033; Kew!), but another specimen in Herb. Christ (*Henry* 9033A!) is evidently quite the same, with sori nearly reaching the costa.

Polypodium ellipticum var. *undulato-repandum* C. Chr. Bull. Acad. Géogr. Bot. 22: 141. 1913.

YUNNAN: Between Keng Hung and Muang Hing (2643).

Differs from the last in its broad wing, which extends throughout the rachis to the upper part of the stipe. It thus resembles another variety of *P. ellipticum* illustrated by Hooker and Greville (*pl. 6*) as *Grammitis decurrens* Wall., but differs by its dark color and irregularly repand-crenate margins.

I have little doubt that *Polypodium cavaleriei* Rosenst.⁶⁰ is a form of this with entire or slightly lobed leaves.

LOXOGRAMME (Blume) Presl

Loxogramme salicifolia Makino, Bot. Mag. Tokyo 19: 138. 1905.

Gymnogramme salicifolia Makino, Phan. Pter. Jap. Icon. *pl. 34*. 1899.

Polypodium makinoi C. Chr. Ind. Fil. 543. 1906.

Loxogramme duclouxii Christ, Bull. Acad. Géogr. Bot. 17: 140. 1907.

⁶⁰ Repert. Sp. Nov. Fedde 13: 134. 1914.

Polypodium succulentum C. Chr. Ind. Fil. Suppl. 63. 1913.

Loxogramme fauriei Copel. Philippine Journ. Sci. Bot. 11: 45. pl. 3, f. 12. 1916.

Loxogramme makinoi C. Chr. Ind. Fil. Suppl. Prél. 22. 1917.

YUNNAN: Between Tengyueh and Lungling (7259). Between Kambaiti and Tengyueh (7543).

The large amount of material now available from central and eastern Asia proves that the larger forms usually but incorrectly called *Loxogramme lanceolata* and in recent years segregated under several names by Makino, Christ, and Copeland, all belong to one species, which is intermediate between *L. involuta* (D. Don) Presl and *L. lanceolata* (Swartz) Presl. From the former, taken in the sense of Copeland, this differs in its slender costa, and from the latter, an African species, in its divergent sori. The name here chosen applies undoubtedly to this species, but I suspect that the oldest name actually is *Grammitis involuta* Don,⁶¹ and that Copeland's application of this to the form from southern India originally described as *Grammitis scolopendrina* Bory (*Polypodium scolopendrinum* C. Chr.) is incorrect.

Loxogramme duclouxii Christ differs from the normal form only in having the sori confined to the upper third of the blade.

LEPTOCHILUS Kaulf.

As mentioned above, this genus must be restricted to those Asiatic species having entire fronds with "venatio Anaxeti." In his recent paper on *Leptochilus*, quoted above (p. 291), Copeland refers to *Leptochilus* two species only, *L. axillaris* Kaulf. (the type species) and *L. platyphyllus*, placing the other species of so-called *Leptochilus* in the genus *Campium*, sect. *Heteroneuron*. This treatment seems to me an unnatural one, and I have no doubt that the following species and its immediate allies are more closely related to *L. axillaris* than to the pinnate species of *Heteroneuron*. They are polypodioid ferns, and, as a matter of fact, some of them resemble so closely certain species of *Polypodium* (e. g. *P. ovatum* and *P. zippelii*) that one is tempted to consider them acrostichoid states of *Polypodium* species. It appears, as mentioned below, that such a species as *L. decurrens* occasionally bears rudimentary polypodioid sori on its broad fronds, but it remains unproven that contracted fertile fronds are found in the same individual.

Leptochilus decurrens Blume.

YUNNAN: Between Huang Hun and Muang Hai (2420). Between Keng Hung and Muang Hing (2722). Beyond Muang Hing (2725). Between Mohei and Maokai (2911).

Very variable; in no. 2420 the stalk of the sterile leaf is 25 cm. long, in no. 2722 it measures 2 to 5 cm. The former resembles so closely *Polypodium ovatum* Wall. that it is scarcely possible to distinguish their sterile fronds.

To this species I refer also, with doubt, the two following specimens:

BURMA: Keng Tung Territory, Valley of the Meh Len; very rare (2137, 2170).

In both these specimens very small, polypodioid, apparently rudimentary sori occur on the broad leaves, and contracted linear fertile leaves are absent. Thus the specimens seem to belong to *Polypodium*, but they can not be referred to any known species of that genus. In its long-decurrent nearly exstipitate frond no. 2137 very much resembles *Polypodium zippelii* Blume, but I do not believe it can be that species, the veins being too distinct. In no. 2170 the veins

⁶¹ Prodr. Fl. Nepal. 14. 1825.

are still more elevated and the stipe is longer, the frond closely resembling *P. ensatum* Thunb. in habit.

It is very probable that these two specimens belong to a distinct species, or perhaps two, but I prefer to let them remain in *L. decurrens* for the present, inasmuch as Beddome (Handbook, p. 429) mentions forms of *L. decurrens* from southern India which have polypodioid sori, and which in their long-decurrent blades and straight main veins seem to correspond to *Rock* 2137.

CYCLOPHORUS Desv.

Cyclophorus beddomeanus (Giesenh.) C. Chr.

YUNNAN: Man Lo, between Tengyueh and Lungling; epiphytic (7161). Between Kambaiti and Tengyueh (7703).

Cyclophorus drakeanus (Franch.) C. Chr.

SOUTHEASTERN TIBET: Forests of Doyan Longba, Salween-Irawadi watershed, at 3,000 meters elevation (11653).

In my 1924 paper above quoted I wrongly reduced *C. drakeanus* (Franch.) C. Chr. and *C. inaequalis* (Christ) C. Chr. to synonyms of *C. sheareri*; the present specimens belong to *C. inaequalis*.

Cyclophorus flocculosus (D. Don) C. Chr.

BURMA: Between Sadon and the Yunnan border at Changtifang and Kambaiti; epiphytic (7462, 7490).

Cyclophorus gralla (Giesenh.) C. Chr.

YUNNAN: Weinsi, north to Kangpu, Mekong Valley (11580).

The specimens are considerably larger than the type (*Henry* 9061A), the fronds (stipe included) being 25 to 35 cm. long and 3 to 3.5 cm. broad, the stellate hairs of the under side with shorter branches, resembling those of *C. flocculosus*. The rhizome scales are, however, like those of the type (dark brown or nearly black, with bright, short-toothed margins), and the blade is very long and very gradually decurrent. I think my identification is, therefore, correct.

Cyclophorus pekinensis C. Chr.

YUNNAN: Between Tengyueh and Lungling (7146). East of Tengyueh (7881).

Cyclophorus sticticus (Kunze) C. Chr.

YUNNAN: West of Talifu, en route to Tengyueh (6646). Between Tengyueh and Lungling (7228, 7253). Between Tengyueh and the Burmese border (7313). Between Kambaiti and Tengyueh (7544). Yangtze Valley, near Pei Fing Chiang (11535).

Cyclophorus nudus (Giesenh.) C. Chr.

BURMA: Between Tengyueh and Bhamo (7825, 7847).

Cyclophorus heteractis (Mett.) C. Chr.

BURMA: Between Sadon and the Yunnan border at Changtifang and Kambaiti; epiphytic (7491, 7491a, 7499).

Cyclophorus lingua (Thunb.) Desv.

YUNNAN: Between Kambaiti and Tengyueh (7546).

DRYNARIA (Bory) J. Smith

Drynaria delavayi Christ.

YUNNAN: Eastern slopes of the Likiang Snow Range (4290, 6175). East of Likiang, region of Tungshan (10534).

I am inclined to consider this species a smaller form of *D. propinqua*.

Drynaria propinqua (Wall.) J. Smith.

YUNNAN: Between Tengyueh and Lungling (7097, 7102, 7122).

Drynaria sparsisora (Desv.) Moore.

YUNNAN: Between Muang Hai and Keng Hung (2513). Between Muang Hing and Szemao (2756).

Drynaria coronans (Wall.) J. Smith.

Drynaria esquirolii C. Chr. Bull. Acad. Géogr. Bot. 22: 139. 1913.

BURMA: Between Muang Len and Muang Hpyak (2033).

If the genus *Drynaria* is to be maintained it seems to me quite unnatural to place in *Polypodium* such species as *P. coronans* and *P. heracleum* as has been done by Diels.

ELAPHOGLOSSUM Schott

Elaphoglossum conforme (Swartz) Schott.

Acrostichum marginatum Wall. List, no. 17. 1828 (nomen nudum); Fée, Mém. Foug. 2: 31. 1845.

Elaphoglossum fusco-punctatum Christ, Bull. Herb. Bolss. 6: 867. 1899.

YUNNAN: Salween Ridge, west of the Mekong; epiphytic (7063a, 7685, 7727).

It is possible that further material would show this Himalayan and southern Chinese form (*A. marginatum* Wall.) specifically distinct from the true South African *E. conforme*; still some of the specimens examined come very near to the typical form. *Elaphoglossum fusco-punctatum* Christ (*Henry* 9158!) has the blades rather obtuse at both ends, but otherwise not different; the scales of the blade are sometimes nearly entire, but often stellately fimbriate.

Elaphoglossum yunnanense (Baker) C. Chr.

Acrostichum yunnanense Baker, Kew Bull. Misc. Inf. 1898: 233. 1898.

YUNNAN: Between Kambaiti and Tengyueh, on rocks near the Taho (7534).

The specimen agrees fully with the type (*Henry* 10310; Herb. Christ!), which Christ in his monograph of the genus says is not unlike *E. petiolatum* (Swartz) Urban. I do not understand this. The plant resembles, it is true, that species in general habit, but it differs widely in the blade being rather densely scaly, with small long-fimbriate scales on both sides (those of the upper side soon abraded) and along the costa beneath, here densely chaffy with reddish fimbriate scales.

MARSILEACEAE

MARSILEA L.

Marsilea minuta L.

YUNNAN: Puerhfu to Mohei (2871).

The specimen is sterile, and the identification therefore doubtful.

EQUISETACEAE

EQUISETUM L.

Equisetum arvense L.

YUNNAN: Between Muang Hing and Szemao (2730).

Equisetum ramosissimum Desf. ?

YUNNAN: Along the banks of the Meh Kong, near Keng Hung (2529).

LYCOPODIACEAE

LYCOPODIUM L.

Lycopodium serratum Thunb.

YUNNAN: Woods of Kao Tien, east of Tengyueh (7868).

Lycopodium casuarinoides Spring.

YUNNAN: West of Mekong, en route to Tengyueh (7055). Between Tengyueh and Lungling (7252). East of Tengyueh (7885).

Lycopodium complanatum L.

YUNNAN: Tsangshan Range, west of Talifu (6362). West of Talifu, en route to Tengyueh (6854). Near Tengyueh (7947).

SOUTHEASTERN TIBET: Region of Champutong (10202).

Lycopodium clavatum L.

YUNNAN: Tsangshan Range, west of Talifu (6371). Hsueh Shan Ting, east of Tengyueh (7637).

SOUTHEASTERN TIBET: Slopes of Champutong Mountain (10189).

Lycopodium cernuum L.

BURMA: Valley of the Meh Len (2077).

Lycopodium hamiltonii Spring.

BURMA: Between Sadon and the Yunnan border (7526).

YUNNAN: Between Tengyueh and the Burmese border (7282).

SELAGINELLACEAE

SELAGINELLA Beauv.

Selaginella involvens Spring.

YUNNAN: Eastern slopes of the Likiang Snow Range (3838).

Selaginella willdenovii (Desv.) Baker.

BURMA: Keng Tung Territory, between Muang Len and Muang Hpyak (2064).

Selaginella doederleinii Hieron.

YUNNAN: East of Tengyueh (7689); det. O. Schmidt.

Selaginella inaequalifolia (Hook. & Grev.) Spring.

BURMA: Keng Tung Territory: Between the Siamese border and Pang Mah Ki Hat (1941); Valley of the Meh Len (2125); det. O. Schmidt.

Selaginella biformis A. Br.

BURMA: Keng Tung Territory, between Muang Len and Muang Hpyak (2038); det. O. Schmidt.

PTERIDOPHYTA FROM NORTHERN SIAM

The collection contains 60 species, nearly all from the mountainous region between Salween and Mekong and adjoining eastern Burma (Keng Tung Territory). Most of the specimens were collected on the summit of Doi Chom Cheng, in the Doi Sootep Mountain Range, at an altitude of 1,500 to 1,650 meters, others in the Doi Chang Mountains. The fern flora of these mountains, as it appears from the following list, resembles very much that of Burma and southern Yunnan, and not a few species from these regions are now recorded for Siam. The tropical Malayan element is, however, somewhat more prominent, and it seems that the genus *Platycerium* here reaches its northern limit.

MARATTIACEAE

Angiopteris helferiana Presl.

Between Meh Soi and Hue San (1848, 1851).

Angiopteris sp.

Doi Chom Cheng (1510). A single sterile specimen.

SCHIZAEACEAE

Lygodium flexuosum Swartz.

Between Ta Kaw and Meh Soi (1674). Between Ban Tong Ha and Ta Kaio (1703). Lower slopes of Doi Chang Mountain, in rain forest (1731, 1734, 1740). Between Ban Hue Bong and the border (1913).

A form with simple pinnules, approaching *L. salicifolium* Presl, was collected on Doi Chom Cheng (191).

Lygodium flexuosum Swartz, var.?

Along the Meh Ping at Soop Chem (557).

A single specimen, different from all forms of *L. flexuosum* known to me; intermediate between that species and *L. scandens*, much resembling the American *L. polymorphum* (Cav.) H. B. K. It differs from *L. scandens* in its straight secondary rachis with only 2 or 3 pairs of tertiary pinnules, these palmately deeply divided into 3 to 5 lobes, the central one the largest, 2 to 4 cm. long; the secondary rachises are winged nearly to the base, as are the petioles of the ultimate segments; fertile pinnules generally less divided and smaller, but nearly always with two broad basal lateral lobes; ribs of the pinnules prominent and slightly hairy, the leaf otherwise glabrous; texture thin.

Lygodium polystachyum Wall.

Between Meh Soi and Hue San (1846, 1852).

Lygodium japonicum Swartz.

Along the Meh Ping at Doi Noi (504). Lad Bua Kao, near Korat (1527).

Lygodium scandens Swartz.

Between Ban Du and Ban Meh Ki (1860).

GLEICHENIACEAE

Dicranopteris linearis (Burm.) Underw.

Upper slopes of Doi Chang Mountain (1756).

HYMENOPHYLLACEAE

Hymenophyllum exsertum Wall.

PLATE 24

Summit of Doi Chom Cheng (1517). Upper slopes of Doi Chang Mountain (1757).

EXPLANATION OF PLATE 24.—*Hymenophyllum exsertum*, covering a tree trunk at summit of Doi Chang, Slam, altitude 1,625 meters; *Rock* 1757.

Trichomanes bipunctatum var. *latealatum* (v. d. B.) Clarke.

Summit of Doi Chom Cheng (1518, 1521).

Among the many forms of this species described by Van den Bosch as species, the specimens agree best with his *Didymoglossum latealatum*. This may be distinct; but, so far as my experience goes, the essential character "spurious veins few or many, long or short, with or without an intramarginal one" is more individual than specific. In the present specimens an intramarginal spurious vein is wanting, but many shorter and longer ones are present in the leaf tissue.

POLYPODIACEAE

Dryopteris procurrens (Mett.) Kuntze.

Nephrodium molle var. *aurea* Clarke, Trans. Linn. Soc. II. Bot. 1: 533. 1880.

Dryopteris cylindrothrix Rosenst. Repert. Sp. Nov. Fedde 12: 246. 1913.

On the Wieng Papao plain; stream bed of the Meh Lao (1652).

The specimen is densely glandular beneath with cylindrical hairs, besides longer whitish ones, just as described by Beddome (Handb. Suppl. 67) and Rosenstock. I do not know whether this is the typical form of the species.

Dryopteris pteroides (Retz.) Kuntze.

Rain forests of the lower slopes of Doi Chang Mountain (1716).

Dryopteris hirtisora C. Chr.

Doi Chom Cheng (1511, 1759).

See above (p. 277).

Dryopteris moulemeinensis (Bedd.) C. Chr.

At Pang Kia, headwaters of Meh Lao; altitude 900 meters (1594).

Dryopteris sagenioides (Mett.) Kuntze.

Between Ban Du and Ban Meh Ki (1874).

Dryopteris hirtipes (Blume) Kuntze.

Summit of Doi Chom Cheng (234, 1512).

Polystichum setiferum (Forsk.) Woyнар?

Valley of Hue Me Pan (444, 445).

A form intermediate between *Polystichum yunnanense* Christ and *P. biaristatum* Bl., but the scanty specimens are insufficient for positive identification. In no. 444 the leaf is gemmiferous just below the apex.

Tectaria polymorpha (Wall.) Copel.

Trail from Raheng to Peng Ma Kham Pom (1524). Between Meh Sol and Hue San (1855).

Tectaria rockii C. Chr., sp. nov.

Rhizome not seen. Stipe about 80 cm. long, 5 mm. thick, brownish-stramineous, deeply sulcate above, minutely glandulose-puberulous, bearing at the base a few dark-brown lanceolate scales. Blade broadly deltoid, about 50 cm. long, herbaceous, dark green, bipinnate at base; basal pinnae much the largest, 35 cm. long or more, stalked (5 cm.), basispic, with a pair of free pinnules, the lower one of these about 20 cm. long and 3 to 3.5 cm. broad, petiolate (1 cm.), acuminate, crenate-lobate (the lobes triangular and rounded outward, scarcely 1 cm. long), the upper pinnules similar but smaller and merely undulate-crenate; terminal portion of the basal pinna 5 cm. distant from the free pinnules, about 25 cm. long, not decurrent at base, deltoid, in the lower half deeply lobed with 5 or 6 deltoid acuminate segments on each side (the lower ones about 10 cm. long, 2 cm. broad at base), the apical portion 3 cm. broad, undivided, short-lobate, finally undulate-crenate; second pair of pinnae 20 cm. distant from the basal pair, short-stalked (1.5 cm.), about 25 cm. long, 4 cm. broad at base, cut like the terminal portion of the basal pinnae; third pair of pinnae 10 cm. distant from the second, nearly sessile, about 20 cm. long, 4 cm. broad, cut like the lower pinnule of the basal pinnae; terminal portion of the blade about 25 cm. long, cuneate at base, in cutting similar to the terminal portion of the basal pinnae, but the lower segments larger; rachises and larger veins like the stipe, brownish, glossy, minutely glandulose-puberulous beneath; veins anastomosing, forming distinct irregular areoles with or without included free veinlets; sori confined to the ultimate lobes, leaving a broad sterile belt at the middle of the pinnae or pinnules, rather irregularly placed on the netted veins, but in the smaller lobes situated as a rule in a row at either side of the midrib; indusia reniform, brown, persistent, glabrous. Leaf tissue glabrous on both sides.

Western Siam: Between Palut and Nam Dip, on the trail from Raheng to Mesawt, December 17, 18, 1920 (668).

I venture to describe this fern as new, although it is impossible, I think, to be quite sure that it has not previously been published. Very probably, however, it is the plant illustrated by Beddome (Ferns Brit. Ind. *pl.* 48) under the name *Sagenia subtriphyllo*; but if so, I can not agree with him. *Tectaria subtriphyllo* (Hook. & Arn.) Copel., from eastern China, is much smaller and much more pubescent, and usually has one pair of lateral pinnae only. *T. rockii* comes near some forms of *T. coadunata* (Wall.) C. Chr.,² but it is less cut and less hairy. A closely allied species is *Tectaria longicruris* (Christ) C. Chr. (*Sagenia longicruris* Christ), from Kweichou (*Oavalerie* 191D, 3559; *Esquirol* 2252), but that differs in its atropurpureous or ebenous rachises and partly confluent sori.

Tectaria leuzeana (Gaud.) Copel.

Between Meh Soi and Hue San (1849). Between Ban Du and Ban Meh Ki (1873).

The species is here regarded in its broad sense.

Campium costatum (Wall.) Presl.

Leptochilus costatus C. Chr. Bot. Tidsskr. 32: 344. 1916.

Valley of the Hue Me Pan (229). Summit of Doi Chom Cheng (1503).

Nephrolepis biserrata (Swartz) Schott.

Between Ban Du and Ban Meh Ki (1875).

Leucostegia immersa (Wall.) Presl.

Summit of Doi Chom Cheng (194).

² *Aspidium coadunatum* Wall. List, no. 377. 1828; Hook. & Grev. Icon. Fil. 2: *pl.* 202. 1831.

Leucostegia pulchra (D. Don) Moore.

PLATE 25

Summit of Doi Chom Cheng (359, 361, 362).

EXPLANATION OF PLATE 25.—*Leucostegia pulchra*; Rock 362, climbing high in the trunk of a forest tree.

Leucostegia dareaeformis (Hook.) Bedd.

Summit of Doi Chom Cheng (364, 365, 367).

Microlepia hirta (Kaulf.) Presl.

Between Meh Soi and Hue San (1847).

Microlepia speluncae (L.) Moore.

Trail from Raheng to Pang Ma Kham Pom (1523).

Athyrium dissitifolium (Baker) C. Chr.

Summit of Doi Chom Cheng (368, 369). Valley of the Hue Me Pan (440).

See above (p. 296).

Diplazium siamense C. Chr., sp. nov.

PLATE 26

Rhizome (incomplete) suberect, densely paleaceous at apex, the scales castaneous, lanceolate, entire. Fronds several, fasciculate, nearly 1 meter long, the stipes up to 50 cm. long, 3 to 4 mm. thick, fuscous and scaly at base, gray-greenish upward with a few scattering deciduous scales, trisulcate above, glabrous; blade broadly ovate or subdeltoid, about 40 cm. long, subcoriaceous, glabrous, dark green above, pale beneath, pinnate (the pinnae pinnatifid), with a rather distinct terminal pinnatifid pinna; free pinnae in 5 or 6 pairs (above these commonly 1 or 2 shorter ones adnate to the rachis), alternate, about 6 cm. apart, long-petiolate (2 to 2.5 cm. in the lower ones), oblong-lanceolate, 20 cm. long, 3.5 to 4 cm. broad, equally short-cuneate at base, incised one-half to two-thirds the distance to the midrib, the apex acuminate, serrate; lobes falcate, 1.2 to 1.5 cm. long, 8 to 9 mm. wide, obtusely rounded, short-serrate; veins in about 8 pairs, mostly forked at the middle, the basal ones always simple, much curved and ascending to the sinus; sori very narrow, not touching the costa, reaching about halfway to the edge; indusia narrow, entire, a few of the lower ones diplazioid.

Summit of Doi Chom Cheng, altitude 1,500 to 1,650 meters, Nov. 1-6, 1920 (438; 1507, type).

Diplazium siamense differs from all related species known to me by its conspicuously long-stalked, few, and broad pinnae. In cutting it most resembles *D. veitchii*, but the color and texture are different and the blade is not gradually, but rather abruptly, narrowed at the pinnatifid apex.

EXPLANATION OF PLATE 26.—*Diplazium siamense*. The type specimen, Rock 1507. About one-half natural size.

Asplenium nidus L.

Between Ban Du and Ban Meh Ki (1871).

Asplenium ensiforme Wall.

Summit of Doi Chom Cheng (350, 1500, 1509).

Asplenium planicaule Wall.

Summit of Doi Chom Cheng (461).

Asplenium rockii C. Chr., sp. nov.

PLATE 27

Rhizome short-creeping, with numerous black-brown, clathrate, lanceolate, acuminate scales. Fronds several, fasciculate, suberect, 14 to 17 cm. long; stipes 2 to 3 cm. long, like the rachis crinite by numerous narrow, lanceolate, hair-pointed, fimbriate, black-brown scales; blade lanceolate, acuminate, 12 to 15 cm. long, 2.5 to 3 cm. broad at middle, evenly narrowed both ways, sub-

coriaceous, light green, nearly bipinnate; pinnae 15 to 20 pairs, alternate, the largest 1.5 cm. long, short-petiolate, truncate at upper base, cuneate below, pinnately cut to a very narrow costal wing into 3 or 4 pairs of pinnules, the apex rather obtuse, once or twice cleft; pinnules or segments often 4 at the upper, 3 at the lower side of the pinna, the upper basal one the largest, 5 cm. long, cuneate-spatulate, deeply incised, with about 4 obtuse lobes, the other pinnules equally cuneate, with 2 or 3 short obtuse lobes or teeth at the outer edge; costae and larger veins with scattered scales beneath similar to those of the rachis but smaller, suddenly contracted from a lighter, broad, fimbriate base into a long hairlike point; margins revolute; veins indistinct; sori 1 or 2 in each segment, nearly covering it; indusia oblong, grayish, entire.

Summit of Doi Chom Cheng (348, type; U. S. Nat. Herb. no. 1,211,193; also *Rock* 1520, from the same locality.

This small species seems abundantly distinct from all species known from these regions. It is evidently related to the Javanese *A. stereophyllum* Kunze, resembling it in texture and cutting; but that species is much larger, with much longer stipe, and without the peculiar dense scales of stipe, rachis, and costae, which form the most prominent character of our new species. The description is drawn from the largest specimen (no. 348); the other (no. 1520) is much smaller: blade 4 to 5 cm. long, 1 cm. broad; stipe nearly wanting.

EXPLANATION OF PLATE 27.—*Asplenium rockii*. The type specimen, *Rock* 348. Natural size.

Blechnum orientale L.

Trail from Raheng to Pang Ma Kham Pom (1525).

Brainea insignis Hook.

PLATE 28

Summit of Doi Chom Cheng (354).

EXPLANATION OF PLATE 28.—*Brainea insignis*. Summit of Doi Chom Cheng, *Rock* 354.

Doryopteris ludens (Wall.) J. Smith.

Lad Bua Kao, near Korat (503).

Pteris pellucida D. Don.

Trail from Pang Ma Khan Pom to Palut, near Raheng (653).

Pteris biaurita L.

At Pang Kia, headwaters of the Meh Lao (1593).

Pteris wallichiana Agardh.

Summit of Doi Chom Cheng (1506).

Pteridium aquilinum (L.) Kuhn.

Rain forests on the lower slopes of Doi Chang Mountain (1716a, 1720).

Vittaria flexuosa Fée.

Summit of Doi Chom Cheng (351) Upper slopes of Doi Chang Mountain, Chiangmai Province (1760).

Polypodium amoenum Wall.

Doi Chom Cheng (151a, 237, 355, 357, 370a).

Polypodium argutum Wall.

Summit of Doi Chom Cheng (151, 370, 449, 455).

All the specimens cited belong to a form which approaches *P. subauriculatum* Blume in having most of the pinnae cordate at base. This is identical with some of the forms referred by Christ to his *P. mengtzeense*, but differs from the type in having only the uppermost pair of pinnae confluent with the terminal pinna.

***Polypodium lineare* Thunb.?**

Summit of Doi Chom Cheng (358).

A variety or perhaps a distinct species, the rhizome scales nearly black, with very narrow cells and bright brown, sparsely ciliate margins.

***Polypodium excavatum* Bory.**

Summit of Doi Chom Cheng (150, 356, 1505). Valley of the Hue Me Pan, Doi Sootep Mountain Range (450, 454).

***Polypodium rhynchophyllum* Hook.**

Summit of Doi Chom Cheng (250, 352, 1502).

***Polypodium membranaceum* D. Don.**

Summit of Doi Chom Cheng (239, 1504).

***Polypodium lehmanni* Mett.**

Summit of Doi Chom Cheng, altitude 1,650 meters (360, 363, 1514). Valley of the Hue Me Pan (446).

Some of these specimens, e. g. no. 360, match exactly a sketch of the type specimen by Mettenius in the Berlin Herbarium. The number of lateral pinnae varies from 4 to 7 pairs.

***Polypodium oosphaerum* C. Chr., sp. nov.**

PLATE 29

Rhizome wide-creeping, 6 to 8 mm. thick, densely covered with peltate, imbricate, ovate-acute, entire, sordid-brown scales, these nearly concolorous, the central cell-walls somewhat darker than the rest, most of the cells rectangular, with straight walls, those bordering the edges smaller, irregular, with flexuose walls (about as in *P. excavatum*). Fronds at distances of 2 to 3 cm., the stipes very short, rarely 1 cm. long; blade simple, entire, broadly lanceolate, 40 cm. long, 5 to 6 cm. broad below the middle, thence gradually attenuate to the subacute curved apex, less narrowed downward, about 2 cm. broad at extreme base, here rotund-truncate; leaf tissue light-green, thinly papyraceous, glabrous, the upper side densely fusco-punctate from the hydathodes of the free veinlets; costa yellowish-brown, raised below and there furnished with a few ovate-lanceolate, deciduous scales; primary lateral veins very fine, but distinct two-thirds of the way to the edge, very oblique, 1.5 to 2 cm. apart, the included network of veins very fine but distinctly seen in the dried frond, the areoles with many free veinlets; sori confined to the upper half of the blade, borne in a single row at either side, medial, obliquely elliptic, 6 mm. long, 4 mm. broad, yellowish brown, without peltate scales, but with numerous paraphyses among the sporangia.

Summit of Doi Chom Cheng, Doi Sootep Mountain Range, altitude 1,500 to 1,650 meters, November 1 to 6, 1920 (236, type; U. S. Nat. Herb. no. 1,211,188); also no. 1515, with identical data.

A near ally of *P. excavatum* Bory, differing in its larger and, particularly, its broader frond, which is not decurrent at the very short stipe, in its thin oblique veins, and its large elliptic sori.

EXPLANATION OF PLATE 29.—*Polypodium oosphaerum*. The type specimen, *Rock* 236. Two-fifths natural size.

***Polypodium hastatum* Thunb.**

Summit of Doi Chom Cheng (182).

A small form with two horizontal basal lobes.

***Polypodium oxylobum* Wall.**

Summit of Doi Chom Cheng (195).

***Drynaria propinqua* (Wall.) J. Smith.**

Summit of Doi Chom Cheng (368)

Drynaria quercifolia (L.) J. Smith.

Along the Meh Ping at Doi Noi (512).

Cyclophorus heteractis (Mett.) C. Chr. var. *minor* C. Chr., var. nov.

Summit of Doi Chom Cheng (349, 1508).

Much smaller than the typical form of the species: Stipe 3 cm. long; blade 5 to 6 cm. long, 1.5 cm. broad; in scale characters not different; color bright reddish brown. Probably a local race.

Elaphoglossum conforme (Swartz) Schott.

Summit of Doi Chom Cheng (353, 1516). Upper slopes of Doi Chang Mountain (1768).

The specimens are not typical, differing by the short stipes of the sterile leaves margined almost to the base. See previous entry (p. 327).

Elaphoglossum yunnanense (Baker) C. Chr.

Summit of Doi Chom Cheng (249).

Platycterium wallichii Hook.

Trail from Raheng to Pang Ma Kham Pom (1526).

Platycterium grande J. Smith.

Between Ban Hue Bong and the Burmese border (1922).

LYCOPODIACEAE

Lycopodium hamiltonii Spring.

Summit of Doi Chom Cheng (451).

SELAGINELLACEAE

Selaginella fulcrata (Ham.) Spring.

Along the Meh Ping at Soop Chem (480, 525); det. O. Schmidt.

Selaginella willdenovii (Desv.) Baker.

Between Ban Du and Ban Meh Ki (1863); det. O. Schmidt.

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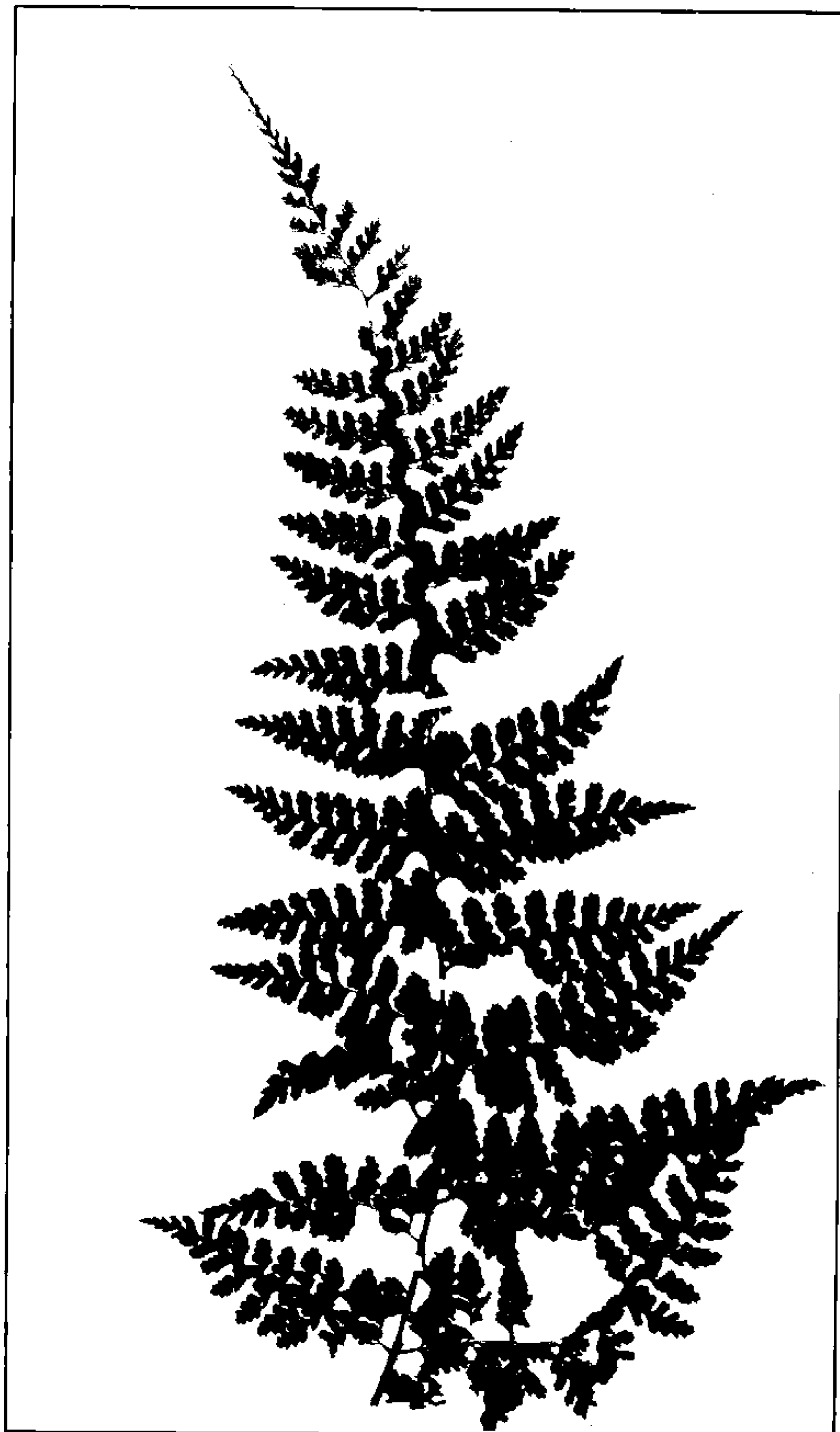
ALSOPHILA GLABRA (BLUME) HOOK.



A. CIBOTIUM BAROMETZ (L.) J. SMITH



B. CIBOTIUM BAROMETZ (L.) J. SMITH



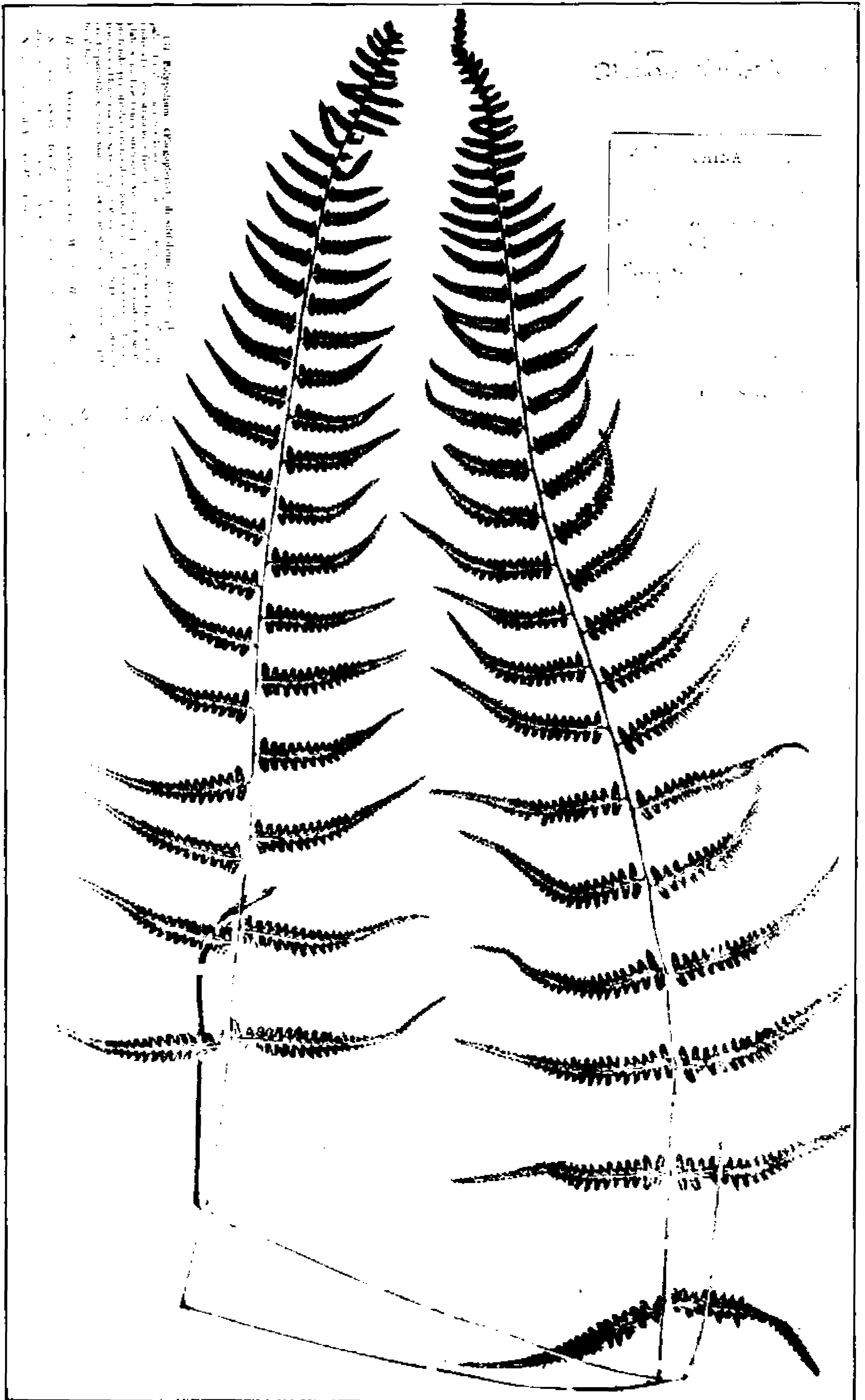
DRYOPTERIS FARGESII (CHRIST) C. CHR.



POLYSTICHUM STENOPHYLLUM CHRIST



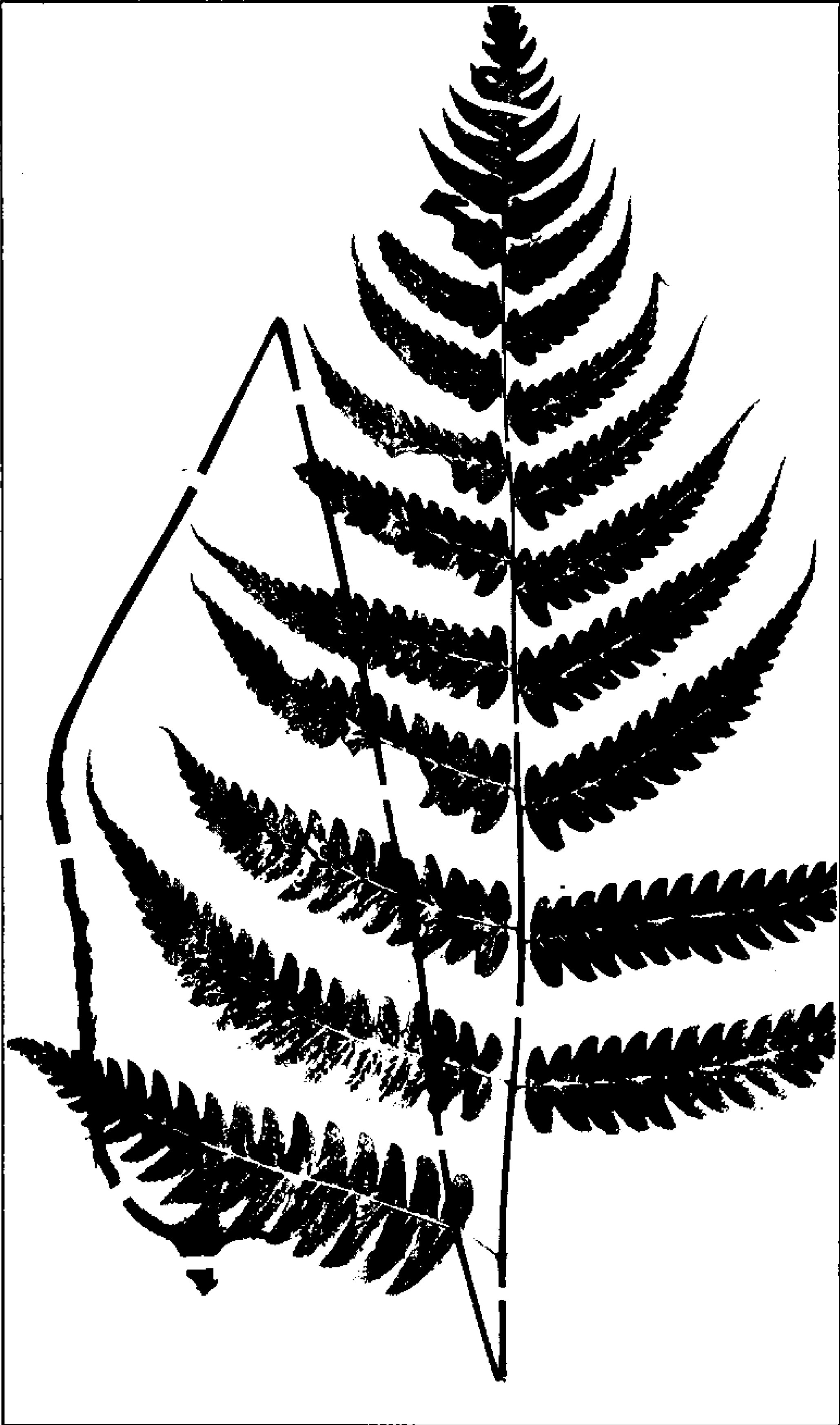
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ATHYRIUM DISSITIFOLIUM (BAKER) C. CHR.



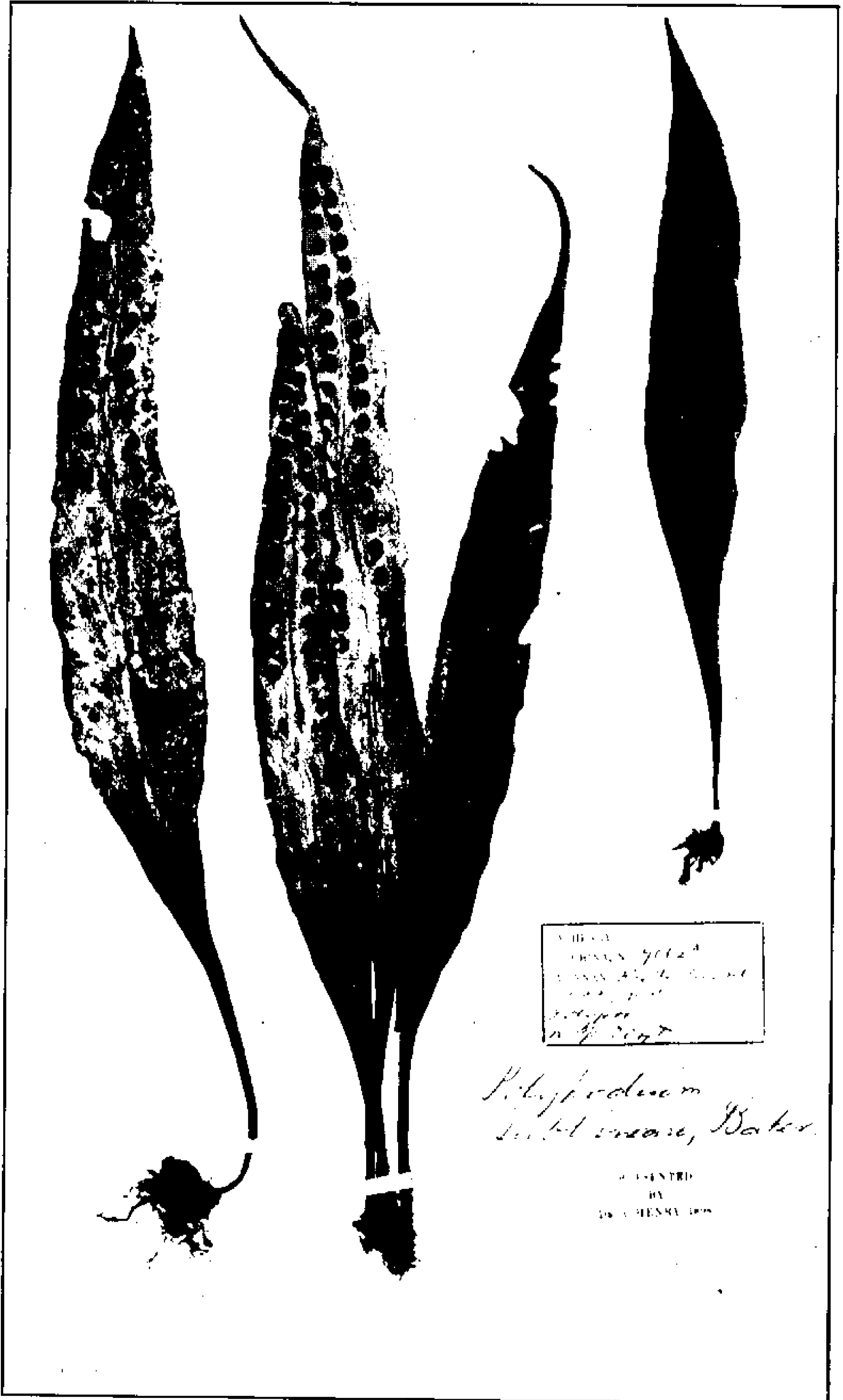
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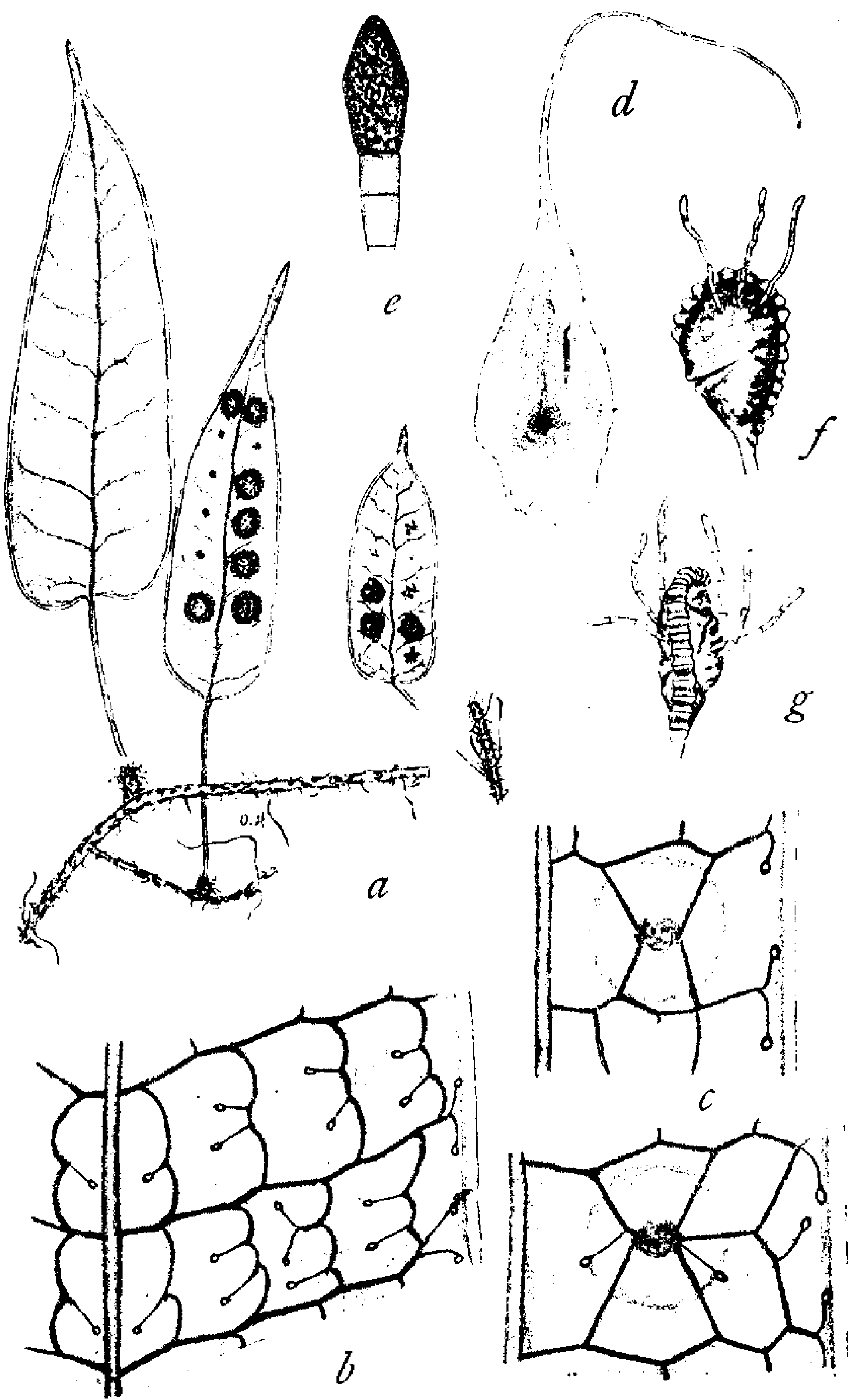
DIPLAZIUM VEITCHII CHRIST



PLAGIOGYRIA HENRYI CHRIST



POLYPODIUM SUBLINEARE BAKER



POLYPODIUM CHRYSOTRICHUM C. CHR.



HYMENOPHYLLUM EXSERTUM WALL



LEUCOSTEGIA PULCHRA (D. DON) MOORE



DIPLAZIUM SIAMENSE C. CHR.



ASPENIUM ROCKII C. CHR.



BRAINEA INSIGNIS HOOK.



POLYPODIUM OOSPHAERUM C. CHR.