

STUDIES OF TROPICAL AMERICAN FERNS—NO. 6.

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INTRODUCTION.

The present number of this series¹ is devoted mainly to a consideration of three groups of *Polypodium* whose species have for the most part been greatly misunderstood. The positive identification of many of the species depends largely upon a set of characters which until recent years have received scant attention, namely, the points of distinction afforded by the scales of the rhizome, or of the lamina, or of both. The rhizome scales are, for example, of especial importance in the group of *Polypodium trichomanoides*, as shown hereafter; and as studies of other groups within this genus have progressed, it has become more and more clear that in the scales or paleæ of the rhizome are to be found in general the most definite, constant, and readily available characters of all for the distinction of closely allied species. In some groups, as in that of *P. trichomanoides*, the very existence of these characters would pass unsuspected in a casual examination because of the general similarity of the plants in gross morphology; and the confusion which long prevailed among the species of this particular group is in fact traceable largely to this circumstance.

Besides the structural differences just mentioned, and correlated with them, there are peculiarities of habit, of venation and outline, and of several trichome structures of the frond which, under the former and more general method of study, passed as individual or regional variations but which evidently are to be regarded as important substantiating characters. These may appear among related species in various combinations. In preparing keys primarily for the identification of species emphasis must, therefore, be placed now upon one set of characters, now upon another, preference naturally being given to those which may be made out readily; but any synoptical treatment which pretends to completeness will certainly take account of scale structure in some detail. No further explanation need be offered for the frequent use and mention of relatively minute characters of this sort.

¹ Contr. U. S. Nat. Herb. 10: 473-508. pls. 55, 56. March 30, 1908. Ibid. 13: 1-43. pls. 1-9. June 30, 1909. Ibid. 16: 25-62. pls. 18-34. June 19, 1912. Ibid. 17: 133-177. pls. 1-10. June 20, 1913. Ibid. 17: 391-425. pls. 11-23. January 21, 1914.

POLYPODIUM TRICHOMANOIDES AND ITS AMERICAN ALLIES.

The name *Polypodium trichomanoides*, given by Swartz in 1788 to a common plant of the Blue Mountains of Jamaica, was often applied very loosely by later writers and, although various related forms were described as valid species from time to time, the characters of these were not well understood, and there was little attempt to correlate them until the appearance in 1905 of an excellent paper by Hieronymus upon several groups of *Polypodium*.¹ To this author is due the credit of establishing the relationship and distinctive characters of a majority of the species in the group, as defined by him, and of demonstrating the usefulness and value of the minute but obvious structural differences of the rhizome scales. These characters, which are constant, can mostly be made out by means of a hand lens, although for greater accuracy and for the sake of repeated observation it is far preferable to preserve the scales as permanent microscopic mounts.

In the present paper, which is to a certain extent supplementary to that of Hieronymus, the group of *P. trichomanoides* is somewhat enlarged in scope, and several of Jenman's species which were overlooked or omitted by Hieronymus are also included, as well as others which have since been described by Christ, Rosenstock, Hieronymus, and the writer. Brief critical notes upon these are given in the following pages.

Strictly delimited, the group should include only those species which have the general facies and particularly the long-setose vestiture of *P. trichomanoides*, the principal characters of the plants being a smallish ascending or erect rhizome, with fulvous to reddish brown, ciliate or toothed rhizome scales, the few fronds mostly 3 to 15 cm. long, short-stipitate, slender, the lamina linear to narrowly linear-lanceolate, pinnately lobed to pinnatisect, the lobes or segments with a simple or once-forked vein, and invariably monosorous,² both the stipe and the lamina (especially upon the under side) being clothed with numerous long, spreading, stiffish, reddish hairs. Thus defined, the group would not include *P. micropteris*, *P. limula*, *P. hartii*, and *P. nutatum*, which have entire rhizome scales and fronds at most subsetulose, never long-setose. It would also exclude *P. grisebachii*, *P. perpusillum*, *P. mitchellae*, *P. shaferi*, *P. schenckii*, and *P. organense*, plants whose fronds range from subglabrous to pubescent, but are never long-setose with reddish hairs. All of these, however, have the small stature and monosorous lobes or segments of *P. trichomanoides* and its more immediate relatives and may therefore be included in this group. The first four mentioned above

¹ Hedwigia 44: 78-105. 1905.

² See, however, under *P. blepharolepis* (page 556).

might with some justice be added to the group of *P. myosuroides*, treated in a former paper,¹ which they resemble in their rhizome scales, simple veins, and elongate sori. The whole series of species is of unusual interest from the fact that the individual unit characters (which are stated at length in the key) are variously combined in the different species. The points of specific difference are exact rather than comparative and so, with one or two exceptions noted in the text, the status of the species is fairly certain. Several of the species—e. g., *P. cookii*, *P. williamsii*, *P. basiattenuatum*, *P. trichomanoides*, *P. serricula*, and *P. setulosum*—have bifurcate or branched glandular hairs upon one or both sides of the lamina, the terminal cells being enlarged and more or less clavate. No examples of this structure in other families are known to the writer.

KEY TO THE SPECIES.

Veins of all the segments simple.

Scales of the rhizome not ciliate.

Lamina slightly pubescent, or, if subsetulose the hairs mostly short, brittle, or caducous.

Segments minute, very oblique, long-decurrent..... 1. *P. micropteris*.

Segments larger, spreading, not long-decurrent.

Scales of the rhizome 0.6 to 1 mm. long, elongate-deltoid to ovate, acuminate to acutish, attached far above their base, the outermost 1 or 2 rows of cells minute and relatively thin-walled..... 2. *P. limula*.

Scales of the rhizome 1 to 3 mm. long, lance-linear to lance-oblong, attached at or near their base, not bordered by conspicuously smaller cells.

Segments narrowly oblong; scales mostly 8 to 12 cells broad, clathrate, the cells subquadrate to broadly oblong..... 3. *P. hartii*.

Segments deltoid-oblong; scales 13 to 20 cells broad, the cells mostly elongate-hexagonal, much smaller..... 4. *P. nutatum*.

Lamina conspicuously bristly-setose, the hairs long and persistent.

Plants of coarse aspect, the stipe 0.5 mm. thick; lamina merely pinnatifid, the segments coarse and rather broadly joined..... 5. *P. cookii*.

¹ Contr. U. S. Nat. Herb. 17: 398-406. pls. 11, 12. 1913.

- Plants very delicate, the stipe 0.1 mm. thick; lamina subpinnate throughout, the segments narrowed at the base, obscurely joined..... 6. *P. williamsii*.
- Scales of the rhizome freely long-ciliate..... 7. *P. caucanum*.
- Veins of the fertile (and sometimes also the sterile) segments forked; or, in nos. 9 and 15, the fertile spur commonly obsolete.
- Lamina nearly glabrous to pubescent, never long-setose with stiff reddish hairs.
- Scales of the rhizome entire; partition cell walls very thin.
- Leaf tissue delicate, translucent; scales 0.6 to 1.3 mm. long..... 8. *P. grisebachii*.
- Leaf tissue coriaceous, opaque; scales mostly 1.5 to 2 mm. long..... 9. *P. perpusillum*.
- Scales of the rhizome whitish-ciliate; partition cell walls strongly dark-sclerotic.
- Sporangia long-setose.
- Fronds 4 to 8 cm. long, delicately herbaceous; lobes 15 to 30 pairs..... 10. *P. mitchellae*.
- Fronds 1.5 to 3.5 mm. long, spongiose-herbaceous; lobes 5 to 12 pairs, shorter, broader 11. *P. shaferei*.
- Sporangia not setose.
- Fronds 2 to 5 (rarely 8) cm. long; lamina 3 to 4 mm. broad, pinnatifid about three-fourths the distance to the rachis, the segments small, porrect, close, acutish..... 12. *P. schenckii*.
- Fronds 8 to 20 cm. long; lamina 4 to 9 mm. broad, very obliquely lobed about half way to the rachis, the lobes large and rounded..... 13. *P. organense*.
- Lamina invariably reddish-setose, the hairs usually very long.
- Scales of the rhizome with occasional irregular teeth, these 1 to 3 cells broad.
- Fertile branch of vein usually long-produced; segments narrow, usually subdistant in drying, distinctly gibbous..... 14. *P. trichomanoides*.
- Fertile branch of vein short or (in no. 15) commonly obsolete, the sorus then sessile; segments broader, closer, never gibbous.
- Segments obliquely triangular or deltoid-oblong..... 15. *P. serricula*.
- Segments oblong, rounded at the apex.
- Lamina delicately herbaceous, copiously long-setose; vein of fertile segments distinctly geniculate..... 16. *P. basiattenuatum*.
- Lamina more or less spongiose, sparingly setose, the hairs shorter; vein of fertile segments arcuate, decurved..... 17. *P. sherringii*.

Scales of the rhizome with bristle-like cilia.

Lamina pinnately lobed about halfway to the rachis..... 18. *P. andinum*.

Lamina pinnatifid to subpinnatisect.

Vein of the fertile segments forked at or very near its middle.

Rhizome stout, the scales linear, 1.5 to 3 mm. long; lamina up to 15 cm. long, pinnatifid, the segments joined by a broadish wing..... 19. *P. truncicola*.

Rhizome small, the scales lance-oblong, 1 mm. long or less; lamina not exceeding 8 cm., subpinnatisect.

Segments more than their width apart, oblique, long-decurrent, freely setose, the hairs up to 1 mm. long.. 20. *P. nanum*.

Segments less than their width apart, spreading, not decurrent, less strongly setose, the hairs much shorter..... 21. *P. daguense*.

Vein of the fertile segments forked distinctly below its middle, commonly in the basal fourth.

Cilia of the rhizome scales hyaline.... 22. *P. hyalinum*.

Cilia of the rhizome scales reddish brown.

Segments very oblique, long-decurrent; rhizome scales minute, with few cilia..... 23. *P. setulosum*.

Segments spreading; scales much larger, freely ciliate.

Soriferous veinlet of fertile segments at least half as long as the sterile; segments distinctly joined..... 24. *P. nimbatum*.

Soriferous veinlet of fertile segments one-third to one-fifth as long as the sterile; segments scarcely or not at all joined.

Lamina conspicuously setose beneath, especially among the sporangia; annulus 15 or 16-celled..... 25. *P. blepharodes*.

Lamina scantily setose beneath, the hairs shorter and more slender; annulus 13 or 14-celled..... 26. *P. taenifolium*.

1. *Polypodium micropteris* C. Chr. Ind. Fil. 545. 1906.*Xiphopteris setosa* Kaulf. Enum. Fil. 275. 1824.*Grammitis setosa* Presl, Tent. Pter. 208. 1836, not Blume, 1828.*Polypodium setosum* Mett. Abh. Senckenb. Ges. Frankfurt 2: 33. 1856, not Thunb. 1784, Först. 1786, nor Presl, 1836.

TYPE LOCALITY: Brazil.

DISTRIBUTION: Apparently confined to Brazil.

ILLUSTRATION: Raddi, Pl. Bras. pl. 22 bis. f. 3, 3a (as *Grammitis myosuroides*.)

The above synonymy shows the change of name made by Christensen to have been necessary for this species, which was redescribed by Hieronymus¹ under the previously accepted name *Polypodium setosum* Mett. Most of the material cited by the latter has been seen in fragments kindly forwarded to the writer by Dr. I. Urban. In addition there has been available a single specimen in the Underwood Fern Herbarium.

2. *Polypodium limula* Christ, Bull. Soc. Bot. Genève II. 1: 218. 1909.

PLATE 32.

TYPE LOCALITY: Marais de la Palma, Costa Rica, altitude 1,500 meters (*Pittier* 708).

DISTRIBUTION: Mountains of Panama and Costa Rica, at 700 to 1,650 meters altitude; reported also from Guatemala.

This species, which is the continental analogue of *P. hartii*, is related closely only to that species and *P. nutatum*.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Mossy trunks of trees, La Palma, alt. 1,450 to 1,550 meters, *Tonduz* 12595; *Maxon* 367, 476, 406 in part. La Guaba, San Isidro, *Jiménez* 271. Cañas Gordas, alt. 1,100 meters, *Pittier* 10976. Forests of Tablazo, *Pittier* 7948 in part. Without locality, *Wercklé*. Helechaes de General, valley of Diquís, alt. 700 meters, *Pittier* 12060.

PANAMA: Humid forest along the upper Caldera River, near Camp I, Holcomb's trail, above El Boquete, Chiriquí, alt. 1,450 to 1,650 meters, *Maxon* 5721. Above Penonomé, *Williams* 454.

EXPLANATION OF PLATE 32.—Specimens of a cotype collection, *Pittier* 12595 (U. S. Nat. Herb. no. 366022). Natural size.3. *Polypodium hartii* Jenman, Journ. Bot. Brit. & For. 24: 272. 1886. PLATE 33.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and the Lesser Antilles, ascending to 1,800 meters.

A well marked species, to be compared only with *P. limula* and *P. nutatum*. There is, as Hieronymus has noted,² a wide variation in its scales, some of which measure a full 3 mm. in length.

The following specimens are in the U. S. National Herbarium:

GRENADA: Without locality, *Sherring* 156 in part.

GUADELOUPE: "Epiphyte, assez rare. Chemin des Bains-Jaunes à la savane à Mulets. Savane aux Ananas. Morne Pavillon (Trois-Rivieres). Alt. 700-1,080 meters. 1897. 1899." *Duss* 4372, 4145.

DOMINICA: Trois Pitons, *Lloyd* 797.EXPLANATION OF PLATE 33.—Two collections of *Polypodium hartii*: a, part of a Grenada specimen, *Sherring* 156 in part, received from Kew; b, Guadeloupe specimens, *Duss* "4372, 4145" (U. S. Nat. Herb. no. 524164). Both natural size.¹ *Hedwigia* 44: 91, 92. 1905.² *Op. cit.* 95.



POLYPODIUM LIMULA CHRIST.



POLYPODIUM HARTII BAKER.



POLYPODIUM WILLIAMSII MAXON.

4. *Polypodium nutatum* Jenman, Journ. Bot. Brit. & For. 24: 272. 1886.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Mountains of Jamaica and St. Vincent, ascending to 1,800 meters.

This species, the type specimens of which are presumably at Kew, is represented in the Jenman herbarium at New York by several specimens from St. Vincent (where, according to a note in Jenman's hand, it is "common above 2,000 ft. altitude") and a frond from Jamaica. These agree perfectly among themselves and with the description, the largest specimen being twice the height of *P. hartii* or *P. limula*. From these *P. nutatum* is readily distinguished by the key characters.

5. *Polypodium cookii* Underw. & Maxon, Contr. U. S. Nat. Herb. 17: 408. 1913.

TYPE LOCALITY: Near the Finca Sepacuité, Alta Verapaz, Guatemala (*Cook & Griggs* 80).

DISTRIBUTION: KNOWN only from the original specimens.

A distinct and singular species, to be compared only with the next.

6. *Polypodium williamsii* Maxon, sp. nov.

PLATE 34.

Plants small and slender, subfasciculate, erect. Rhizome minute, 2 to 3 mm. long, 1 mm. or less in diameter, oblique, freely radice, conspicuously paleaceous at the apex; scales numerous, tufted, spreading, yellowish brown in mass, oblong to ovate-oblong, 1 to 1.5 mm. long, 0.35 to 0.66 mm. broad, gland-tipped at the acutish or abruptly short-acuminate apex, entire, pale yellowish by transmitted light, the cells mostly oblong to quadrate, with thin walls; fronds 3 to 8, ascending, fasciculate, 2.5 to 5 cm. long; stipe 3 to 6 mm. long, 0.1 mm. in diameter, pale brown, bearing numerous short, deciduous, 3 or 4-celled branched glandular hairs; lamina linear, 2 to 4.5 cm. long, 3 to 6 mm. broad, scarcely narrowed at the base, slightly so at the apex, subpinnate throughout, both surfaces scantily long-setose, the hairs stiff, reddish brown, 1 to 1.6 mm. long; segments monosorous, 8 to 20 pairs, alternate (with a similar or slightly smaller terminal segment), oblique, subdistant, mostly inequilateral, broadly elliptical to rounded-obovate, entire (or, if shallowly notched above, often narrowly rhombic-ovate), usually narrower at the base, adnate, slightly decurrent, all faintly joined, the slender rachis greenish above, brownish and elevated beneath, distinctly flexuous throughout; veins of both the sterile and fertile segments simple, nearly straight, extending half or two-thirds the distance to the apex, ending in an elliptical hydathode; sori small, round, inframedial upon the segment, medial upon the vein, the receptacle minute, punctiform; sporangia glabrous, the annulus 15-celled. Leaf tissue delicately herbaceous, translucent, sparingly glandular beneath like the stipe.

Type in the U. S. National Herbarium, no. 700301, collected near Apolo, Bolivia, altitude about 1,500 meters, on rocks, July 7, 1902, by R. S. Williams (no. 1167).

Distributed as *Polypodium nanum* Fée, which it resembles in general appearance, but from which it departs widely in its entire rhizome scales and simple veins. The only American species of the *trichomanoides* group agreeing with *P. williamsii* in having entire rhizome scales, a long-setose lamina, and simple veins is the foregoing *P. cookii*, recently described from Guatemala; but that is a much coarser plant, with stipe 0.5 mm. in diameter, lamina merely pinnatifid, segments close and rather broadly joined, and sori larger, nearly basal, and confluent at maturity, the resemblance to *P. williamsii* being very remote.

EXPLANATION OF PLATE 34.—The type specimens. Natural size.

7. *Polypodium caucanum* Hieron. Bot. Jahrb. Engler 34: 503. 1904.

TYPE LOCALITY: Trunks of trees in humid forests near the Rio Dagua, Province of Cauca, Colombia, altitude 2,300 meters (*Lehmann* 3257).

DISTRIBUTION: Nicaragua, Panama, Colombia, British Guiana, and Ecuador; ascending to 2,300 meters.

This species and *Polypodium cookii* are the only long-setose allies of *P. trichomanoides* in America which have the veins wholly simple. In *P. caucanum* the veins are merely arcuate, the small sorus being borne at a point a little less than half the distance from the base; in *P. cookii* they are geniculate at the sorus. The leaf tissue of both plants is rigidly herbaceo-coriaceous.

The following specimens are in the U. S. National Herbarium:

NICARAGUA: Without locality, *Wright*.

PANAMA: Humid forests of the upper Caldera watershed, between Camp I and the Divide, Holcomb's trail, above El Boquete, Chiriquí, alt. 1,650 to 1,925 meters, *Maxon* 5657.

BRITISH GUIANA: Upper slope of Mount Roraima, *in Thurn* 178. "Old Path," Mount Roraima, *in Thurn* 348.

8. *Polypodium grisebachii* Underw. in C. Chr. Ind. Fil. 531. 1906.

Polypodium exiguum Griseb. Fl. Brit. W. Ind. 701. 1864, not Heward, 1838, nor Fée, 1869.

TYPE LOCALITY: Summit of Blue Mountains, Jamaica, on trees (*Purdie*).

DISTRIBUTION: Higher peaks of the Blue Mountains, Jamaica, at 1,800 to 2,220 meters elevation; also in Martinique and Guadeloupe.

There is little to add to Hieronymus's excellent descriptive notes upon this species (which was wrongly taken up by him under the invalid name *Polypodium exiguum* Griseb.), except that the rhizome scales are not invariably ovate, but range to oblong-ovate or even linear-oblong. In Jamaica it occurs only upon the highest peaks and usually grows closely entangled in the deep mossy covering of forest trees.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Summit of Blue Mountain Peak, alt. 2,220 meters, *Maxon* 1512 (= *Underwood* 2580). Monkey Hill (above New Haven Gap), alt. 1,800 meters, *Maxon* 2751. Sir Johns Peak, alt. 1,850 meters, *Underwood* 3191. Locality not stated, *Hart* 74.

MARTINIQUE: Sommet de la Calabasse, etc., *Duss* 1655.

9. *Polypodium perpusillum* Maxon, Contr. U. S. Nat. Herb. 17: 409. 1913.

TYPE LOCALITY: Serra de Caraça, Minas Gerais, Brazil (*Ule*).

DISTRIBUTION: Known only from the original specimens.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 13. A.

At its place of publication this species was compared with *P. grisebachii*, which is perhaps its nearest relative, neither species being really of very close alliance to *P. trichomanoides*. *Polypodium perpusillum* is somewhat anomalous in its venation. Some fronds have most of both the fertile and the sterile veins simple, the receptacle of the sorus being evident as a slight protuberance about midway upon the upper side of the vein; others, which presumably represent a more mature state of the species, have some of both the fertile and the sterile veins forked. The species may, therefore, be placed here, rather than with *P. hartii*, *P. limula*, and *P. nutatum*, species which it does not at all resemble habitually.

10. *Polypodium mitchellae* Baker in Hemsl. Biol. Centr. Amer. Bot. 3: 664. 1885.

TYPE LOCALITY: Orange Walk, British Honduras (*Mrs. Mitchell*).

DISTRIBUTION: British Honduras, eastern Guatemala, and Nicaragua, ascending to 450 meters. Reported also from Costa Rica.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 14.

Polypodium mitchellae is most nearly related to *P. shaferi*, of Cuba, with which it was compared at the place of publication of the latter. The scale characters there given for it are, however, far from correct, having been taken from immature and broken scales. An examination of perfect material shows the scales of mature plants to be elongate-lanceolate to lance-ovate or sometimes broadly ovate, long-acuminate or usually attenuate, 1 to 1.7 mm. long, 0.36 to 0.63 mm. broad (excluding the long, divergent cilia). In form and dimensions, therefore, they approach those of *P. shaferi*, but their structure is different, the cells being broader and more irregular, with much thinner partition walls and much larger lumina. The two species are otherwise readily distinguishable by the characters previously pointed out.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Trunks of forest trees near Secanquim, Alta Verapaz, alt. 450 meters, *Maxon & Hay* 3195, 3213.

11. *Polypodium shaferi* Maxon, Contr. U. S. Nat. Herb. 17: 410. 1913.

TYPE LOCALITY: Near Camp La Gloria, south of Sierra Moa, Oriente, Cuba, among moss on roots and rocks (*Shafer* 8071).

DISTRIBUTION: Known only from the original specimens.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 13. B.

The position of *P. shaferi*, and especially its relationship to the last preceding species, were fully discussed at its place of publication.

12. *Polypodium schenckii* Hieron. Hedwigia 44: 87. 1905.

TYPE LOCALITY: Serra do Mar, near Joinville, Province of Santa Catharina, Brazil (*Schenck* 1243).

DISTRIBUTION: Known only from Brazil.

As previously noted¹ *Polypodium schenckii* belongs undoubtedly to the group of *P. trichomanoides* rather than to that of "*P. serrulatum*" (*P. duale*), in which it was placed by Hieronymus.

In addition to the material listed by Hieronymus the following specimens have been studied:

BRAZIL: Joinville, State of Santa Catharina, alt. 1,000 meters, *Schmalz* (Rosenstock, no. 139). Without locality, *Glaziou* 7491. Caldas, Minas Geraës, *Regnell* III. 1462 * (received as *P. peruvianum*).

13. *Polypodium organense* (Gardn.) Mett. Abh. Senckenb. Ges. Frankfurt 2: 39. 1857.

Grammitis organensis Gardn. in Hook. Icon. Pl. 6: pl. 509. 1843.

TYPE LOCALITY: Ravine near the summit of the Organ Mountains, Brazil (*Gardner* 5913).

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Hook. Icon. Pl. 6: pl. 509; Fée, Crypt. Vasc. Brés. 1: pl. 78. f. 1.

A comparison of the scales of *P. organense* with those of *P. schenckii* suggests a much closer relationship between these two species than their pronounced differences in leaf form would indicate. The scales of *P. schenckii* have been described by Hieronymus. Those of *P. organense* are longer, broader, and similarly whitish-ciliate; the cells are arranged in 7 to 11 rows and the partition walls are much thicker, the lumen often obsolete.

¹ Contr. U. S. Nat. Herb. 17: 406, 410. 1913.

The following specimen, received from Copenhagen, is in the U. S. National Herbarium:

BRAZIL: Without locality, *Glaziou* 3573.

14. *Polypodium trichomanoides* Swartz, Prodr. Veg. Ind. Occ. 131. 1788.

PLATE 35.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and eastern Guatemala, ascending to 2,200 meters. Ascribed also to British Guiana and Guadeloupe, probably in error.

ILLUSTRATION: Schkuhr, Krypt. Gewüchs. 1: pl. 10.

In his treatment of this group, already mentioned, Hieronymus has described at length the peculiar rhizome scales of *P. trichomanoides*, and has shown very clearly their diagnostic value as a means of distinguishing this from those related species which have ciliate rhizome scales. In so doing, however, he has made the mistake of including in *P. trichomanoides* a Lesser Antilles form, described as *P. serricula* Fée, which seems to be a distinct species, and has wholly overlooked Jenman's *P. basiattenuatum* and *P. sherringii* from Jamaica. The scales of all four are too nearly alike to afford good distinctive characters, it is true. Still, the species may be distinguished easily by differences in the venation, cutting, texture, and vestiture of the fronds.

The general characters of *P. trichomanoides* will be evident from the illustration of a typical Jamaican plant in plate 35 and from Jenman's excellent description.¹ Aside from the stout rhizomes and the stiffly erect or shuttlecock habit of the very numerous rigid fronds, the most conspicuous and constant character lies in the strongly gibbous upper margin of the segments. Rarely is this condition lacking, and then only in certain fronds of immature plants or in the smaller fronds of mature individuals. The gibbous form of the segments is directly associated with the production of a slender elongate fertile branch. The sorus is borne distinctly below the tip of this branch, and the tips of both veinlets are invariably evident as hydathodes upon the upper surface.

Polypodium trichomanoides is readily distinguishable from *P. basiattenuatum* and *P. sherringii*. It is more easily confused with *P. serricula* Fée, a Lesser Antilles species merged with it by Hieronymus, as discussed below.

The following specimens of *P. trichomanoides* are in the U. S. National Herbarium:

JAMAICA: Vicinity of New Haven Gap, alt. 1,650 meters, on mossy trunks and branches of forest trees, *Maxon* 2626, 2627, 2687. Slopes of Monkey Hill (above New Haven Gap), alt. about 1,800 meters, *Maxon* 2745, 2752. Sir Johns Peak, alt. about 1,900 meters, *Underwood* 3175, 3196. Upper slopes of John Crow Peak, alt. 1,650 to 1,800 meters, *Maxon* 1348; *Clute* 78. Without precise locality, *Hart* 190, 258.

GUATEMALA: Near Coban, Alta Verapaz, alt. 1,350 meters, *von Türckheim* II. 2383.

EXPLANATION OF PLATE 35.—Medium-sized Jamaica specimens of *Polypodium trichomanoides* (*Maxon* 2687, U. S. Nat. Herb. no. 520663). Natural size.

15. *Polypodium serricula* Fée, Gen. Fil. 238. 1852.

TYPE LOCALITY: Guadeloupe.

DISTRIBUTION: Guadeloupe, Martinique, and Dominica, at 700 to 1,250 meters elevation.

ILLUSTRATION: Fée, Mém. Foug. 6: pl. 7. f. 1.

Polypodium serricula was described in 1852 from Guadeloupe specimens collected by L'Herminier and Perrottet and was figured by Fée two years later,

¹ Bull. Bot. Dept. Jamaica II. 4: 114. 1897.



POLYPODIUM TRICHOMANOIDES SWARTZ.



POLYPODIUM BASIATTENUATUM JENMAN.

only the original specimens being again cited. The illustration accords perfectly with several Lesser Antilles specimens at hand which show this to be a distinct species. Of these specimens one is in the U. S. National Herbarium (no. 692056); it is from Guadeloupe, Duss "4084, 4085, 4086," and came associated under this collective number with four individuals of *P. taenifolium*, the label reading "*P. trichomanoides* Sw." The other numbers, all in the Underwood Herbarium of the New York Botanical Garden, are as follows:

GUADELOUPE: Duss 4371 in part (the other element is *P. taenifolium*).

Duss "4084, 4085, 4086" in part (mixed with *P. hartii* and *P. taenifolium*). Several fragmentary specimens collected by L'Herminier (no. 106), presumably type material, and with them two fronds of *P. hartii* and two of *P. taenifolium*.

MARTINIQUE: Duss 1654 in greater part (excellent specimens, with one plant of *P. taenifolium*). Duss 1654b (two sheets, one of which is in part *P. hartii*).

DOMINICA: Laudat, Lloyd 121 in small part (the other specimens mostly *P. hartii*). Mount Diablotin, Lloyd 874. Mount Diablotin, alt. 900 meters, Lloyd 897.

From these specimens a complete description has been written for the North American Flora. Though manifestly of close alliance to *P. trichomanoides*, to which it is reduced by Hieronymus,¹ *P. serricula* has excellent characters for its recognition, differing not only in the shape of its segments but also in its fewer setæ, its less rigid, thinner, and more translucent leaf tissue (*P. trichomanoides* having rigid, thick, herbaceous, and nearly opaque leaf tissue), and in its venation. In a few specimens the fertile vein branch is extended a short distance beyond the sorus and ends in a noticeable hydathode; but in most others the fertile spur of the vein is hardly visible, being in fact so short that the sorus is actually sessile upon the upper side of the main vein and chiefly overlies it, and a hydathode is usually not developed. The nongibbous, more or less triangular segments and the characteristic aspect of the plant alone ordinarily distinguish it from *P. trichomanoides*, however, for it agrees indifferently only with those few young or small fronds of the latter in which the gibbous form of the segments has not yet been developed.

16. *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica II. 4: 114. 1897. PLATE 36.

TYPE LOCALITY: Blue Mountains, Jamaica.

DISTRIBUTION: Known only from the Blue Mountains of Jamaica, altitude 1,500 to 2,220 meters.

Following his description of this species, Jenman comments upon it as follows:

Common above 5,000 ft. altitude on the branches of trees; a much softer plant than any of its allies, from which it is further distinguished by its weaker habit, characteristically attenuated base of the fronds, the oblong broadly rounded, unlobed segments, lying obliquely side by side so close that the base of each is not expanded; the longer, softer, surface-hairs, which glisten in sunlight with a beautiful reddish fulvous hue, and the usually larger sori. Hitherto ascribed to the mainland *P. truncicola* Klotzsch, a stiffly erect species with deltoid segments set horizontally, like the teeth of a saw, but possessing the same beautiful, soft, silky vestiture.

¹Among other specimens cited by Hieronymus under *P. trichomanoides* are two from Guadeloupe, both determined by Mettenius as *P. serricula*, and a British Guiana specimen collected by Schomburgk, which has not been seen by the writer.

As may be noted from the key, however, the relationship of *P. basiattenuatum* with *P. truncicola* is not a very close one, the rhizome scales of the former entirely lacking the bristle-like cilia characteristic of *P. truncicola*. The latter is also in every respect a much coarser plant. *Polypodium basiattenuatum* grows in association with *P. trichomanoides*, but the two may be distinguished at a glance.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Summit of Blue Mountain Peak, alt. 2,000 to 2,200 meters, on mossy trunks and branches of trees, *Maxon* 1475, 1511, 1515; *Underwood* 1452, 1462. Slopes of Monkey Hill (above New Haven Gap), alt. 1,800 meters, *Maxon* 2573. Summit of Sir Johns Peak, alt. about 1,900 meters, *Underwood* 3188. Without locality, *Hart* 69.

EXPLANATION OF PLATE 36.—Characteristic specimens of *Polypodium basiattenuatum* (*Underwood* 1462, U. S. Nat. Herb. no. 521277). Natural size.

17. *Polypodium sherringii* Baker, Journ. Bot. Brit. & For. 20: 326. 1882.

TYPE LOCALITY: Newton district, Port Royal Mountains, Jamaica (*Sherring*).

DISTRIBUTION: Port Royal Mountains, Jamaica, altitude 1,200 to 1,500 meters.

The actual type of this species, which is at Kew, has not been seen by the writer, but there are photographs in the U. S. National Herbarium, the Underwood Herbarium, and the Herbarium of the Department of Agriculture at Hope Gardens, near Kingston, Jamaica, as well as an incomplete specimen in the Underwood Herbarium, presumably of the type collection,¹ from which a fairly complete description has been drawn for the North American Flora. It appears that this species is a close ally of *P. basiattenuatum*, from which it may be separated by the characters given in the key.

Jenman, who also has redescribed² *P. sherringii*, writes of its relationship, as follows:

Rare at 4,000–5,000 ft. altitude in the Port Royal Mountains in the Newton district on boughs of forest trees. This resembles *basiattenuatum* in the entire rounded lobes, decurrent and dwindling at the base of the fronds, but is more densely tufted, with short stiff coriaceous fronds, which are much less ciliate. The fronds are erect or erecto-spreading and are so stiff that in course of time the pagina decays, leaving the rigid black midribs standing mixed with the growing fronds. The rootstock in the specimen before me forms an upright tuft of matted fibres nearly finger thick.

18. *Polypodium andinum* Hook. Second Cent. Ferns pl. 6. 1860.

TYPE LOCALITY: Banks of the Rio Hondacha, Andes of Peru (*Jameson* 780).

DISTRIBUTION: Mountains of Ecuador, Peru, Colombia, and Costa Rica, ascending to at least 2,000 meters.

ILLUSTRATION: Hook. loc. cit.

The present species, which is clearly a member of the *trichomanoides* group, was well described and figured by Hooker. The scales are minute (0.75 to 1 mm. long), linear-deltoid from a rounded base, here 5 to 8 cells broad, the cells mostly oblong, thin-walled, translucent, pale rusty. The cilia are distinctly reddish brown and mostly longer than the width of the scale.

The following specimens, agreeing closely with Hooker's plate, are in the U. S. National Herbarium:

COSTA RICA: Near La Palma, alt. 1,450 to 1,550 meters, on trunk of a small forest tree, *Maxon* 392. Same locality, *Tonduz* 12648.

¹An accompanying note in Dr. Underwood's hand reads as follows: "Mr. Sherring says specimen photographed was afterwards divided in three parts: One here [Jenman herbarium], one at Kew, and the balance with himself.—L. M. U., 1903."

²Bull. Bot. Dept. Jamaica II. 4: 113. 1897.

19. Polypodium truncicola Klotzsch, *Linnaea* 20: 374. 1847.

TYPE LOCALITY: Tovar, Venezuela (*Moritz* 252).

DISTRIBUTION: Venezuela to Ecuador. Ascribed also to Guatemala, probably in error.

Of this species, which is tolerably well known from its redescription by Mettenius and others, the following specimens are in the U. S. National Herbarium:

VENEZUELA: Mérida or Tovar, *Moritz* 333. Without locality, *Fendler* 211.

20. Polypodium nanum Fée, *Gen. Fil.* 238. 1852.

Polypodium exiguum Fée, *Crypt. Vasc. Brés.* 1: 89. 1869, not Heward, 1838, nor Griseb. 1864.

Polypodium blanchetii C. Chr. *Bot. Tidsskr.* 25: 78. 1902.

TYPE LOCALITY: French Guiana (*Leprieur*).

DISTRIBUTION: French Guiana, British Guiana, and Brazil.

ILLUSTRATION: Fée, *Crypt. Vasc. Brés.* 1: *pl. 37. f. 1* (as *P. exiguum* Fée).

In his recent paper upon this group Hieronymus¹ has referred to this species specimens of five different collections, two of which (*Malme* 1696 and *Glaziou* 15753) are represented in the U. S. National Herbarium. A study of these and of several of *Leprieur*'s French Guiana plants, also in the National Herbarium, shows all to belong to a single species, as stated by Hieronymus.

Of the two other collections (not seen) one (*Schwacke* 5001) was determined by Christ as *P. exiguum* Fée, a "species" described and figured by Fée from a plant from Bahia (*Blanchet* 8). Hieronymus regards this as distinct from *P. nanum* and Christ's determination, therefore, as an error; but there is little to support such a view. The *Leprieur* specimens at hand are exactly similar to Fée's figure, save in the one particular of lacking the long stipes shown in that illustration; and it is probable that the specimen figured was either atypical or imperfect, or both. Moreover, Christensen in substituting the new name *P. blanchetii* for the *P. exiguum* of Fée has cited two of *Glaziou*'s Brazilian plants (10177 and 15753), the latter of which is included by Hieronymus under *P. nanum*. An example of this number in the National Herbarium, received from Copenhagen under Christensen's determination as *P. blanchetii* C. Chr., agrees very well with the *Leprieur* plants and serves to indicate that whatever *Blanchet*'s no. 8 (the type of *P. blanchetii*) may be, *P. blanchetii* as understood by Christensen is conspecific with *P. nanum*. *Glaziou*'s 10177 has not been seen by the writer nor, apparently, by Hieronymus.

The specimens mentioned as being in the U. S. National Herbarium are:

FRENCH GUIANA: Summo arborum muscis intermixtum in sylvis humidis, Oyapok superius, June, 1833, *Leprieur* (as *Polypodium trichomanoides*).

BRAZIL: Serra da Chapada, Matto Grosso, June 18, 1894, *Malme* 1696. Without exact locality, *Glaziou* 15753.

There are excellent British Guiana specimens of this species in the Underwood Herbarium, collected by Jenman in the region of the higher Demerara River.

21. Polypodium daguense Hieron. *Bot. Jahrb. Engler* 34: 504. 1904.

TYPE LOCALITY: Dense maritime forest near the Río Dagua, Province of Cauca, Colombia (*Lehmann* 1951).

DISTRIBUTION: Known only from the type collection.

The present species was described by Hieronymus previous to his revision of this group in 1905. It is distinguished easily from *P. nanum* by the characters stated in the key, and from *P. taenifolium*, its nearest relative, by the lesser size of all its leafy parts, by its shorter setæ, and by having the veins of the fertile segments forked toward the middle rather than near the base.

¹ *Hedwigia* 44: 102, 103. 1905.

22. *Polypodium hyalinum* Maxon, Contr. U. S. Nat. Herb. 17: 406. 1913.

TYPE LOCALITY: Upper forested slopes of the Volcán de Barba, Costa Rica (*Pittier* 1928).

DISTRIBUTION: Known only from the original collection.

This species was fully compared with its allies at the original place of publication.

23. *Polypodium setulosum* Rosenst. Repert. Nov. Sp. Fedde 10: 277. 1912.

TYPE LOCALITY: El General, Costa Rica, altitude 656 meters.

DISTRIBUTION: Known only from Costa Rica.

The type of *P. setulosum*, collected by Tonduz, is Jiménez's no. 214, of which there are three fronds in the National Herbarium. The species is adequately described except as to venation. The veins of the sterile segments are either simple or forked below the middle, the proximal branch oblique and decidedly longer than in related species. The veins of the fertile segments are invariably forked, the very oblique proximal branch being fertile near its base and almost equaling the distal branch. Minute branched glandular hairs, similar to those of *P. trichomanoides*, *P. serricula*, and *P. basiattenuatum*, are borne sparingly upon the under surface of the leaf.

The following additional specimen, which is larger and not altogether typical in venation, is referred provisionally to this species:

COSTA RICA: San Cristóbal, *Wercklé* (ex herb. Jiménez).

24. *Polypodium nimbatum* Jenman, Journ. Bot. Brit. & For. 24: 271. 1886.

PLATE 37.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Mountains of Jamaica and Cuba, at 1,020 to 1,500 meters altitude; rare.

A small species with stout rhizomes and numerous densely tufted, short, narrow fronds, somewhat suggesting a reduced state of *P. truncicola*, from which it differs widely in venation and position of sori. Although grouped with *P. taenifolium* and *P. blepharodes* in the artificial key it has only a remote relationship to these species.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Without definite locality, the collector's name not stated (ex herb. Dept. Agric. Jamaica; determined by Jenman as *P. nimbatum*). Rose Hill, W. *Harris*, March 12, 1895 (determined by Jenman as *P. nimbatum*). Hardware Gap, July 30, 1907, *Fisher* 157.

CUBA: Without precise locality, *Wright* 1049 (fragments from specimens in the Gray Herbarium). Jiguarito Mountain, Sierra Maestra, alt. 1,020 meters, September 18, 1906, *Taylor* 540.

EXPLANATION OF PLATE 37.—Specimens of *Polypodium nimbatum*: A, one of five Jamaican specimens (probably the type collection) marked *Polypodium nimbatum* by Jenman, received from Herbarium of the Department of Agriculture, Jamaica; B, *Wright's* no. 1049, from Cuba, in the Gray Herbarium. Both natural size.

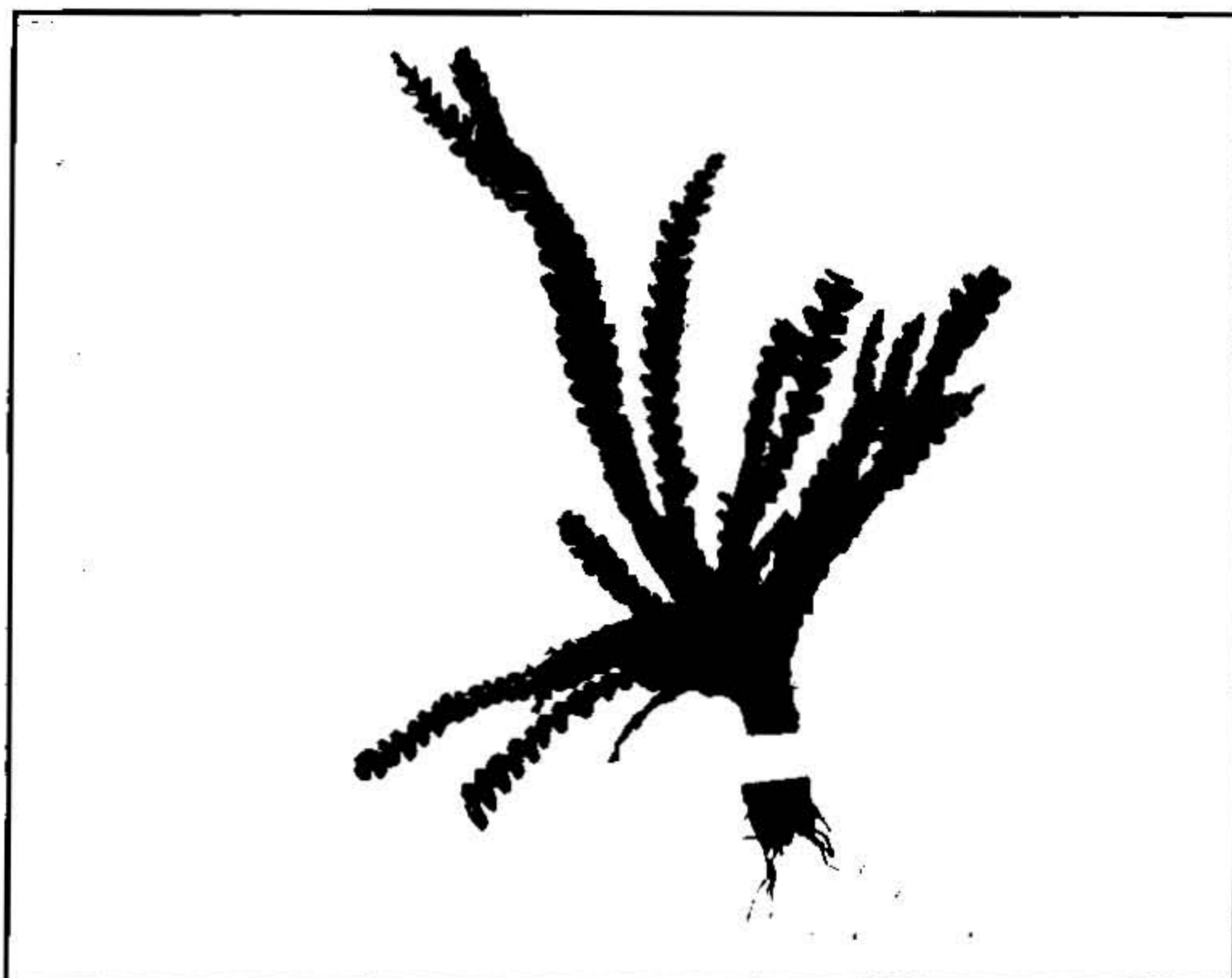
25. *Polypodium blepharodes* Maxon, Contr. U. S. Nat. Herb. 17: 407. 1913.

TYPE LOCALITY: Vicinity of La Palma, Costa Rica, altitude 1,450 to 1,550 meters, on tree stump at border of forest (*Maxon* 406).

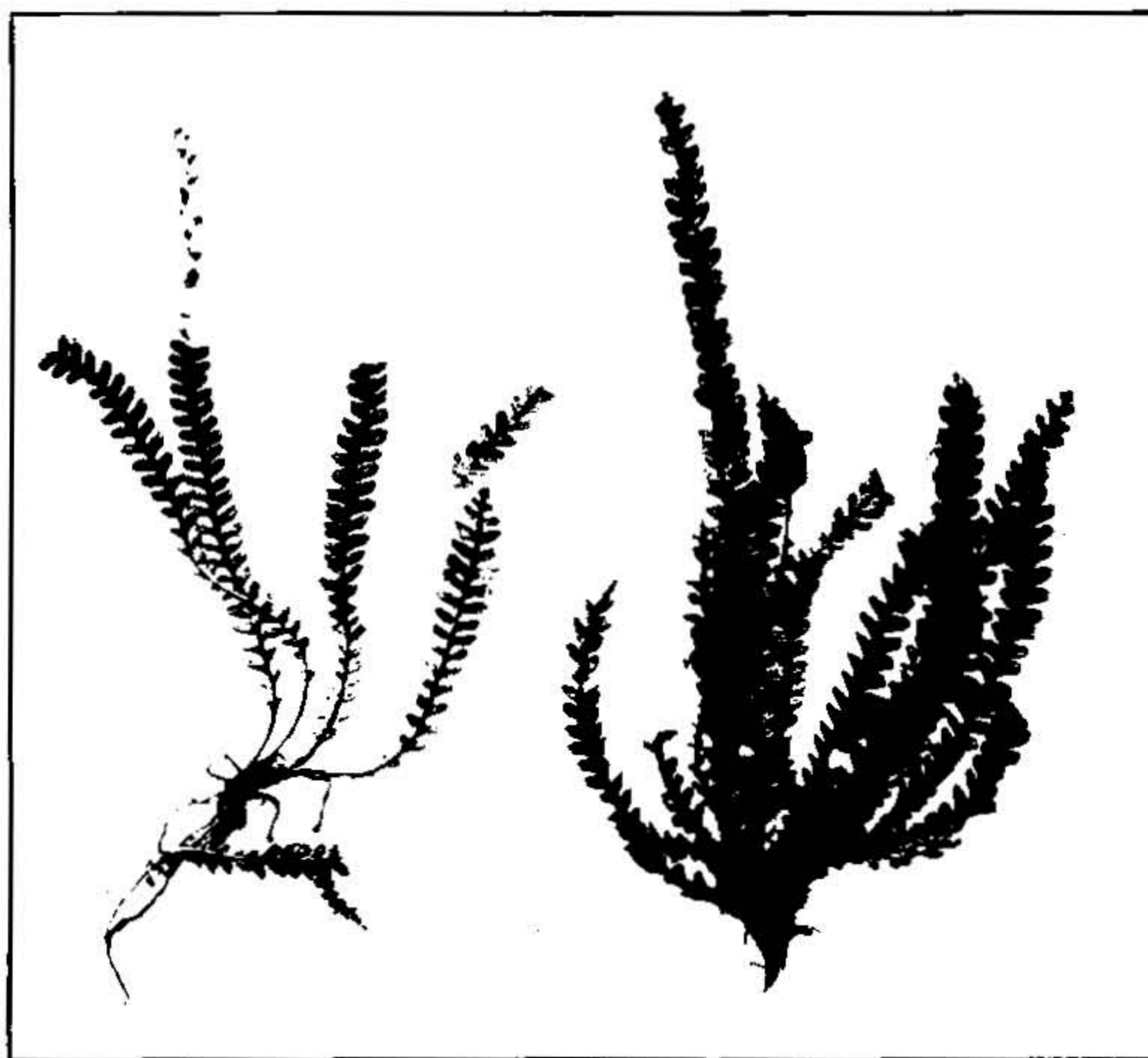
DISTRIBUTION: Mountains of Panama, Costa Rica, and eastern Guatemala, ascending to 1,650 meters.

The relationship of *P. blepharodes* has previously been treated, with citation of the numerous specimens in the U. S. National Herbarium. The following additional collections may be listed:

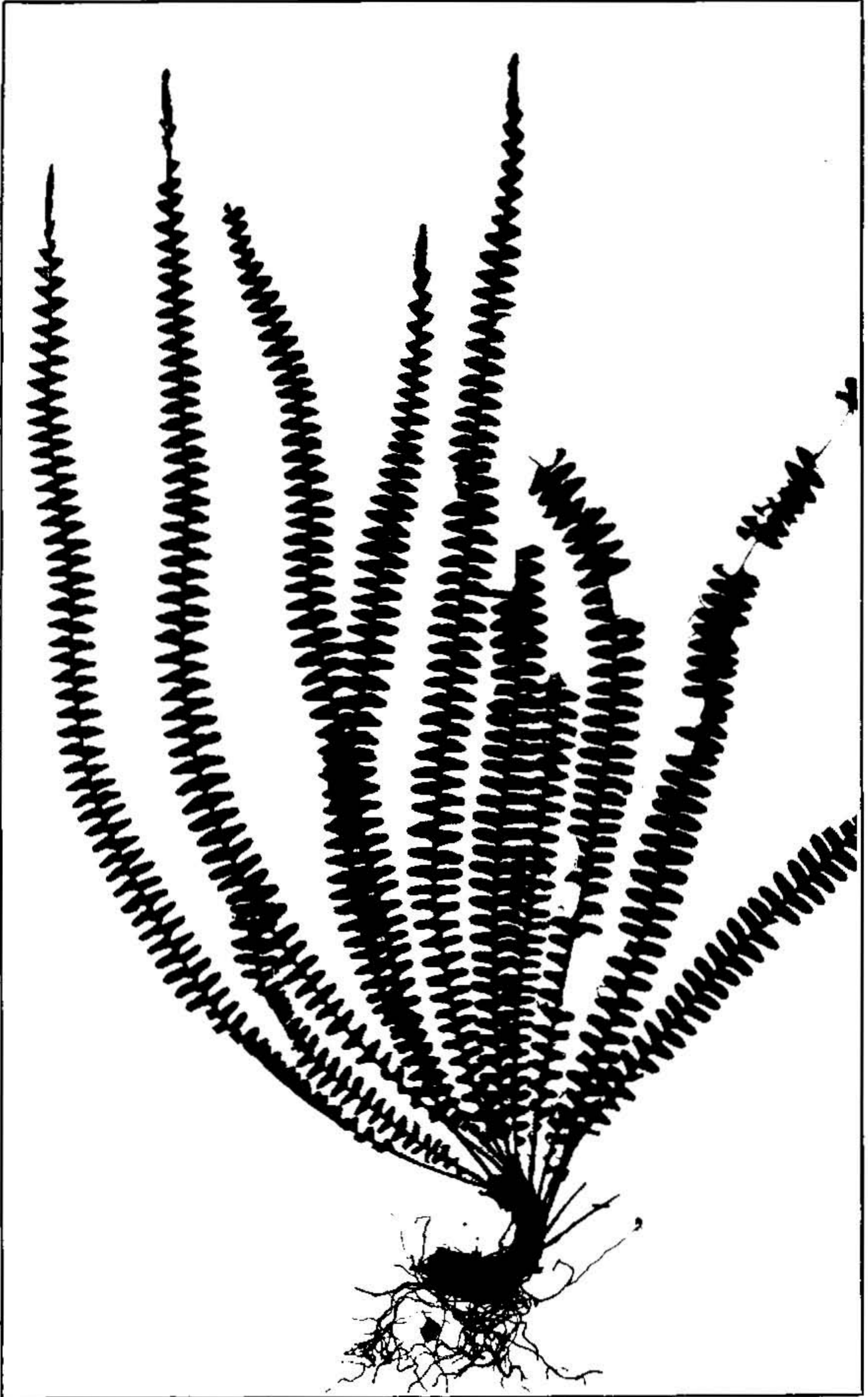
COSTA RICA: Trail from San Ramón to Esparta, alt. 1,200 to 1,400 meters, *Brénes* 14214. Santiago, near San Ramón, alt. 1,200 to 1,300 meters, *Brénes* 14212.



A. POLYPODIUM NIMBATUM JENMAN.



B. POLYPODIUM NIMBATUM JENMAN.



POLYPODIUM TAENIFOLIUM JENMAN.

PANAMA: Cerro Vaca, eastern Chiriquí, alt. 900 to 1,136 meters, *Pittier* 5371. Eastern slope of Mount Pirre, Province of Panama, alt. 1,350 meters, *Goldman* 1972. Cana and vicinity, alt. 1,650 meters, *Williams* 892. Above Penonomé, *Williams* 452.

26. *Polypodium taenifolium* Jenman, Bull. Bot. Dept. Jamaica II. 4: 114. 1897.

PLATE 38.

Polypodium sintenisii Hieron. Hedwigia 44: 101. 1905.

TYPE LOCALITY: Near Mount Moses, Jamaica, altitude 600 to 900 meters (*Syme*).

DISTRIBUTION: Jamaica, Porto Rico, Grenada, Montserrat, Martinique, Guadeloupe, and Trinidad; ascending to about 1,100 meters.

Jenman's description of *P. taenifolium* and the more elaborate description of *P. sintenisii* by Hieronymus agree very well, and a comparison of a specimen of the former¹ with typical material of *P. sintenisii* from Porto Rico, collected by Sintenis and others, leaves absolutely no doubt as to their identity. Unfortunately, *P. taenifolium* is exceedingly rare in Jamaica, so that the species is known chiefly from specimens collected in Porto Rico and the Lesser Antilles.

Of the Porto Rican specimens listed by Hieronymus under *P. sintenisii* only one (*Sintenis* 1796) is at hand, this according perfectly with the other specimens from Porto Rico cited below. Hieronymus studied Guadeloupe and Grenada collections also, of which only the latter (*Sherring* 156, in part) is represented in the National Herbarium. This last, which is more freely fertile than any of the Porto Rican plants seen, has the fertile segments narrowly triangular and lightly gibbous, their shape being directly dependent upon the pronounced fertility of the fronds. So also, in Duss's very fertile Martinique and Guadeloupe specimens (listed below) the fertile pinnæ are rather strongly gibbous and the fertile vein-branches are accordingly much longer than in less fertile specimens, even attaining a length of one-third that of the distal branch, rather than one-fifth, as in Porto Rican specimens; they are also more oblique. Hieronymus's description must, therefore, be amended in this particular. The differences in venation are, perhaps, not wholly accounted for on the score of fertility, and it is possible that the Lesser Antilles plants represent a phase which with more abundant material will be found to represent a distinct species.

The following specimens are in the U. S. National Herbarium:

PORTO RICO: Sierra de Luquillo, in monte Jiménez, *Sintenis* 1796. Luquillo Mountains, *Wilson* 179; *Hioram* 342. Sierra de Naguabo, *Hess* 315; *Shafer* 2250.

MARTINIQUE: *Duss* 1654 in part.

GADELOUPE: *Duss* 4084, 4085, 4086.

GRENADA: Without locality, *Sherring* 156 in part.

MONTSERRAT: Chaners Mountain, alt. 900 meters, *Shafer* 291.

There are also four excellent sheets of Trinidad specimens of this species in the Underwood Herbarium, New York Botanical Garden, three being numbered, respectively, 24, 202, and 6434, of the Trinidad Botanic Gardens Herbarium series.

EXPLANATION OF PLATE 38.—A medium-sized Porto Rico specimen of *Polypodium taenifolium* (*Hess* 315, U. S. Nat. Herb. no. 756055).

¹This specimen is in the herbarium of the Department of Agriculture of Jamaica, Hope Gardens, near Kingston, Jamaica. It is marked in Jenman's handwriting as *P. taenifolium* and almost certainly is a part of the type.

DOUBTFUL OR EXCLUDED SPECIES.

1. POLYPODIUM ANTIOQUIANUM Baker, Journ. Bot. Brit. & For. 19: 205. 1881.

This species, founded upon specimens collected from among mosses on forest trees, Antioquia, Colombia, altitude 1,500 meters (*Kalbreyer* 1703) and apparently represented in herbaria only by Kalbreyer's specimens, was wholly unknown to Hieronymus, who was inclined from description to regard it as a near relative of *P. trichomanoides*. An examination of a portion of the type (lent from Kew) shows, however, that it is not of the *trichomanoides* group but is related to *P. cultratum* and allied species. The segments are monosorous, as in *P. trichomanoides* and allies, but the sorus is apical, being situated at or near the end of the distal rather than the proximal branch of the usually once-forked vein.

2. POLYPODIUM BLEPHAROLEPIS C. Chr. Ind. Fil. Suppl. 58. 1913.

Described, originally as *P. gracillimum* Hieron.,¹ upon specimens collected between Quito and Mindo, Province of Pichincha, Ecuador (*Stübel* 747) and apparently known only from the type collection. According to description and figure it is most nearly related to *P. daguense*. It departs from other members of this group, as here treated, in sometimes having a second sorus upon some of the pinnae.

3. POLYPODIUM GIBBOSUM Fée, Mém. Foug. 6: 8. pl. 2. f. 2. 1854.

The original specimens of this species are said by Fée to have come from Oaxaca, Mexico, altitude 2,400 to 2,600 meters, and to have been received by him from the collector, Galeotti, under the name of *Polypodium delicatulum*, this, however, as described and figured by Martens and Galeotti, being a very different species of another rather large group, characterized by having numerous biserial sori. Fée, notwithstanding the obvious error of Galeotti's identification (to which he called attention) and the consequent uncertainty as to the correctness of the locality data of the specimen, nevertheless described it as a new species. His illustration shows a plant which, if of a less critical group, would be recognized without much difficulty; but as yet no similar Mexican specimen has come to light among the large collections made in that country of late years. The Galeotti specimen is very likely West Indian in origin and the Mexican locality data wholly wrong.

Hieronymus has associated² under the name *P. gibbosum* several specimens from Jamaica, Trinidad, Venezuela, and Martinique, all of which excepting the last mentioned (Martinique, *Duss* 1654) have been sent to the writer for comparison. They appear to represent more than one species, the one most resembling Fée's figure being Day's 233, from the vicinity of Newcastle, Jamaica. This plant is matched by two Jamaican specimens in the U. S. National Herbarium (*Safford* 10; *Maxon* 962). Although all three may represent *P. gibbosum*, this fact can not be substantiated without comparing them with Fée's actual type. Further consideration of them is, therefore, deferred for the present. Their relationship is with *P. taenifolium* Jenman (*P. sintenisii*), which they resemble in their rhizome scales; but they are clearly not of that species. The *Duss* specimen (no. 1654) from Martinique, mentioned above as not having been seen, is probably the unusually fertile Lesser Antilles form referred to under *P. taenifolium* and the Trinidad material is probably also of that species.

¹ *Hedwigia* 48: 250. pl. 12. f. 18. 1909. Invalidated by *P. gracillimum* Copel. in Perkins, *Fragm. Fl. Phil.* 189. 1905.

² *Hedwigia* 44: 100. 1905.

4. *POLYPODIUM UNDULATUM* Fourn. Mex. Pl. 1: 75. 1872.

Under this name Fournier published a description of certain plants from Mexico, Guiana, and Ecuador, these having rigid, linear, or lanceolate-linear pinnatisect fronds, 10 to 13 cm. long, 2 to 2.5 cm. broad, the segments adnate, subauriculate, gibbous, undulate, with simple veinlets. The sori are said to be 4 or 5 pairs to the segment, dorsal upon the veinlets, and borne midway between the costule and the margin. The last are characters which clearly exclude this species from the group of *P. trichomanoides* and indicate that it belongs presumably with *P. pilosissimum* and allied species.

Fournier described also a variety *parvulum*, characterized by "shorter, monosorous pinnæ," and cited *P. gibbosum* Fée as a synonym, with mention of Galeotti's no. 6378 (in part). This association of a monosorous plant with *P. undulatum*, as a variety, is almost certainly erroneous and has led also to the mistaken reduction¹ of *P. undulatum* to *P. gibbosum*, which is itself a critical species with monosorous segments.

Type specimens of *P. undulatum* Fourn. have not been seen by the writer. If these should prove to represent a valid species it must nevertheless bear a new name, on account of Willdenow's earlier description² of a plant from Tranquebar as *Polypodium undulatum*.

POLYPODIUM FURFURACEUM AND RELATED SPECIES.

Perhaps no members of the genus *Polypodium*, taken in its broad sense, have received more varied and at the same time less satisfactory treatment than those species with lepidote fronds. For the accommodation of the different types more than a few genera have been proposed, as, for example, *Pleopeltis*, *Marginaria*, *Lepicystis*, and *Lopholepis* on the basis of venation, habital characters, and soriation. From the standpoint of venation alone several flexible categories might be recognized, which, with further subdivision on habital differences, would result in an excessive multiplication of genera. The faultiness of such a treatment is at once obvious from a consideration of the large number of intermediate species.

Again, it is possible to group the lepidote species under a single genus, as Diels³ has done, apportioning them among several sections according to their venation. The objections to this are several: (1) It is scarcely possible to draw an obvious line of demarcation between lepidote and nonlepidote species; (2) even if such a separation were made the resulting arrangement would be altogether unnatural, necessitating the reference of very closely allied species to different genera; (3) it can not be admitted that the presence of scales upon the lamina in varying profusion is in this instance a character of generic importance. In Christensen's Index we find, for example, *Polypodium plebejum* referred to the subgenus *Marginaria*, and one of its closest allies, *P. leucosticton*, to *Eupolypodium*; *P. fallax* to *Marginaria*, and *P. typicum* to *Eupolypodium*. These are very similar in their scantily paleaceous surfaces, and their venation is

¹ C. Chr. Ind. Fil. 572. 1906.

² Sp. Pl. 5: 155. 1810.

³ *Lepicystis*. In Engl. & Prantl, Pflanzenfam. 1⁴: 322-324. 1899.

exactly that of *Eupolypodium*. Other instances of similar confusion might be mentioned.

The inadequacy of scaly covering as a generic distinction for "Lepicystis" is shown by the complete gradation that exists, in the species with pinnatifid to pinnatisect fronds, from those with the lamina very densely covered beneath with copious imbricate scales to others in which the scales are very few and so minute as to be readily overlooked, all of these agreeing essentially in venation. This is particularly true of the *Eulepicystis* (free-veined) series. It seems to the writer quite justifiable to include *Lepicystis* in *Polypodium* and to assign its species among the commonly recognized subgenera according to venation, using the scale characters as a convenient means of grouping them within their respective subgenera and of distinguishing them from each other.

Of the free-veined lepidote species *P. furfuraceum*, *P. murorum*, and *P. plebejum* are familiar examples. These and their allies, to the number of 21 species, are treated at some length in the following pages, an effort being made to reduce the confusion which has long existed. There are, besides, brief notes upon 10 doubtful or recently described species which it is impossible to place at the present time.

KEY TO THE SPECIES.

Rhizome scales large, delicate, flaccid, thin, mostly pale and concolorous, thickened and dark-colored (if at all) only near their point of attachment, the cells elsewhere very thin-walled.

Lamina subpinnatisect.

Segments entire; veins diverging from the midvein at an angle of 45 to 60°..... 1. *P. furfuraceum*.

Segments undulate, crenate, or serrate; veins diverging at an angle of 30 to 40°.

Veins usually simple, rarely forked near their apex; segments surcurrent, rounded-excavate to the midvein at the proximal side; stipe much shorter than the lamina..... 2. *P. cryptocarpon*.

Veins invariably once forked in their basal third, the proximal branch rarely forked; segments surcurrent, not excised below; stipe as long as the lamina, or longer..... 3. *P. platylepis*.

Lamina bipinnatifid to quadripinnatisect.

Plants relatively coarse; lamina very deeply bipinnatifid, the segments and narrowly alate secondary rachises about 1 mm. broad..... 4. *P. lindenianum*.

Plants delicate; lamina tripinnatifid to quadripinnatisect, the rachises faintly alate; segments almost capillary, greatly exceeded by the sori..... 5. *P. friedrichsthalianum*.

Rhizome scales smaller, more rigid, mostly bicolorous, having a dark, often sharply defined, elongate or \wedge -shaped median area of sclerotic cells.

Rhizomes about 1 mm. in diameter, extensively creeping; rhizome scales about 0.5 mm. long, bearing from their center a conspicuous erect tuft of long, brown, bristle-like hairs.....

6. *P. fallax*.

Rhizomes (except in no. 10) much stouter, up to 3 mm. thick; rhizome scales much larger, lacking hairs.

Lamina pinnately parted to pinnate, the segments or pinnæ entire to pinnatifid.

Lower surface of the lamina more or less completely covered with imbricate scales, these partially concealing the sori.

Lamina long-attenuate apically, sub-pinnatisect, the segments distant, mostly joined by a very narrow wing; scales of the lamina very numerous, densely imbricate, deeply fimbriate-lacerate, the teeth very deeply bifid.....

7. *P. xantholepis*.

Lamina obtuse or acute, pinnately parted, the segments closer, joined by a broad wing; scales of the lamina fewer, less imbricate, shallowly lacerate-denticulate, the apices of the teeth entire or bipapillate.

Segments 5 to 7 pairs, unequal; rhizome scales 2.5 to 3 mm. long, the cells of the slightly darker \wedge -shaped median line with delicate darkish sclerotic partition walls, a large lumen invariably present.....

8. *P. subvestitum*.

Segments 1 to 3 pairs, subequal; rhizome scales more rigid, 1 to 1.5 mm. long, the cells of the very dark and sharply defined \wedge -shaped median line very strongly dark-sclerotic; lamina minute or obsolete.....

9. *P. fallacissimum*.

Lower surface of the lamina bearing few or numerous, mostly distant, often minute scales, these not at all concealing the sori.

Rhizome scales narrowly linear-deltoid, or long-acuminate or attenuate from a deltoid-ovate base, not sharply fuscous-carinate and not at all repand or crispate.

Scales of the lamina minute, almost linear, 4 to 7 cells broad.....

10. *P. typicum*.

Scales of the lamina much larger, rounded-ovate to deltoid.

- Lamina deeply pinnatifid or sub-pinnatisect, the segments fully adnate.
 Fronds 3.5 to 14 cm. long; lamina 2 to 5.5 cm. long, coriaceous.
 Rhizomes wide-creeping; rhizome scales nearly entire to obtusely sub-denticulate..... 11. *P. bryopodium*.
- Rhizomes creeping; rhizome scales deeply and irregularly denticulate.
 Scales of rhizome narrowly linear-deltoid, almost acicular..... 12. *P. pyenocarpum*.
 Scales of rhizome attenuate or long-acuminate from a relatively broad deltoid-ovate base; plants smaller..... 13. *P. mollendense*.
- Fronds 15 to 30 cm. long; lamina 10 to 18 cm. long, membranous-herbaceous..... 14. *P. rusbyi*.
- Lamina fully pinnate, the segments sessile or subsessile, often deeply pinnatifid..... 15. *P. murorum*.
- Rhizome scales roundish-ovate to broadly oblong, sharply and narrowly fuscous-carinate, the broad pale borders (except in no. 16) repand to complicate-crispate.
 Fronds subdimorphous, the sterile ones short-stipitate, with a very broad lamina; fertile fronds long-stipitate, the lamina linear-oblong..... 16. *P. leucosticton*.
- Fronds uniform.
 Scales of the lamina minute, very few, inconspicuous... 17. *P. plebejum*.
 Scales of the lamina large or, if small, at least very numerous.
 Segments oblique, conspicuously crenate..... 18. *P. tweedianum*.
 Segments divergent, subentire or remotely and minutely notched.
 Scales of the lamina relatively large, conspicuous, castaneous, plane, broadly ovate or deltoid-ovate, long-acuminate, the margins bidentate..... 19. *P. guttatum*.

Scales of the lamina very numerous, tortuous, pale, linear-attenuate from a small rounded base, coarsely fimbriate-dentate..... 20. *P. oulolepis*.

Lamina bipinnate, the rachises very narrowly marginate..... 21. *P. monosorum*.

1. *Polypodium furfuraceum* Schlecht. & Cham. *Linnaea* 5: 607. 1830.

Polypodium nivosum Fée, *Mém. Foug.* 8: 89. 1857.

Polypodium macbridense Shimek, *Bull. Lab. Nat. Hist. Univ. Iowa* 4: 199. 1897.

Polypodium margallii Roviroso, *Pter. Mex.* 206. 1910.

TYPE LOCALITY: Near Jalapa, Mexico.

DISTRIBUTION: Common from Mexico to Panama, at 200 to 1,300 meters elevation, ascending casually to 1,750 meters.

ILLUSTRATIONS: Shimek, *op. cit.* pl. 20. f. 6-9 (as *P. macbridense*); Roviroso, *op. cit.* pl. 38A. f. 1-5 (as *P. margallii*).

Fournier, in his treatment of this species, recognizes three varieties: (1) The typical form, with which Fée's *Polypodium nivosum* is doubtless synonymous, as there stated; (2) a variety β , which is supposed by him to include Fée's *Polypodium cryptocarpon*; and (3) var. γ *coronulatum*. As to *P. cryptocarpon*, it may be said that Fée's description, though imperfect, points unmistakably to the species usually called *P. skinneri*, rather than to *P. furfuraceum*. Fournier's third form, γ *coronulatum*, has not been identified by the writer.

The species was next described as *P. macbridense* by Shimek upon Nicaraguan specimens, his illustration representing the ordinary form. The reference of *Polypodium margallii* to *P. furfuraceum* is also tolerably certain, the venation agreeing exactly.

There is noted in *P. furfuraceum* a great amount of variation in the color of the scales upon both the rhizome and the under side of the lamina, the extremes in color being whitish and clear yellowish brown, with numerous intermediate shades in different plants or even upon fronds of different age in the same plant. The shape of the scales also is variable. Those of the growing part of the rhizome are commonly deltoid-lanceolate, although from their being subappressed and densely imbricate they appear more or less subulate. The venation of a pinnule is shown well in Roviroso's figure above cited.

Polypodium furfuraceum grows usually upon tree trunks but occasionally also upon shaded banks in well-rotted humus. The following specimens are in the U. S. National Herbarium:

MEXICO: Córdoba, Veracruz, *Bourgeau* 1439; *Orcutt* 3208; *Fink* 85½. Zacuapan, Veracruz, *Purpus* 2167. Near Jalapa, Veracruz, *Rose & Hay* 6376. Between Rosario and Colomas, in the foothills of the Sierra Madre, Sinaloa, *Rose* 1642. Orizaba, Veracruz, alt. 1,200 meters, *Scaton* 11. La Barranca, Michoacán or Guerrero, on wet rocks, *Lan-glassé* 317. Hills of Patzcuaro, Michoacán on oak trees, *Pringle* 3357. Between Chicoasen and San Sebastián, Chiapas, alt. 1,200 meters, *Collins & Doyle* 176. Alzada, Colima, *Orcutt* 4637.

GUATEMALA: Cubilquitz, Alta Verapaz, alt. 350 meters, *von Türckheim* (J. D. Smith, no. 7723); *von Türckheim* II. 31. Santa Rosa, Depart. Santa Rosa, alt. 900 meters, *Heyde & Lux* (J. D. Smith, no. 3252). San Juan, Utapá, Depart. Santa Rosa, alt. 1,350 meters, *Heyde & Lux*

(J. D. Smith, no. 4089 B). Fiscal, alt. 1,110 meters, on trees and limestone cliffs, *Deam* 6089, 6229. Volcán de Atitlán, Depart. Sololá, *Kellerman* 5887. Without locality, *Heyde* 212.

COSTA RICA: Verbena, near Alajuelita, alt. 1,000 meters, *Tonduz* 8794. Forests of Tsaki, Talamanca, alt. 200 meters, *Tonduz* 9474. Near Río de las Vueltas, Tucurrique, alt. 635 meters, *Tonduz* 12758. San Jerónimo, alt. 1,500 meters, *Wercklé* (Jiménez, no. 582). Juan Viñas, Reventazón Valley, alt. 1,000 meters, *Cook & Doyle* 298, 341. Río Turrialba, alt. 500 meters, *J. D. Smith* 6913. Turrialba, alt. 200 meters, *Pittier* 4088; *Cook & Doyle* 380. Tablazo, alt. 1,750 meters, *Brade*. Boruca, alt. 460 meters, *Tonduz* 4612. Near Santiago (east of Cartago), alt. 1,050 meters, *Maxon* 95. Vicinity of Cartago, alt. about 1,500 meters, *Maxon* 48; *Alfaro* (J. D. Smith, no. 6954). Navarro, alt. 1,050 meters, *J. D. Smith* 5098. Atirro, alt. 600 meters, *J. D. Smith* 5099. Jiménez, alt. 200 meters, *Alfaro* 155. Near San José, *Beyr* 14; *Pittier* 318; *Cook & Doyle* 12. Cerro de San Isidro, near San Ramón, alt. 1,300 meters, *Brénes* 14220, 14127. Without locality, *Wercklé*; *Cooper*.

PANAMA: Near El Boquete, Chiriquí, alt. 1,200 meters, *Maxon* 4960.

2. *Polypodium cryptocarpon* Fée, Mém. Foug. 8: 88. 1857.

Polypodium skinneri Hook. Sp. Fil. 4: 214. 1862.

Polypodium bernouillii Baker in Hook. & Baker, Syn. Fil. ed. 2. 510. 1874.

TYPE LOCALITY: Córdoba, Mexico (*Schaffner* 194).

DISTRIBUTION: Southern Mexico and Guatemala, at 300 to 1,550 meters altitude.

ILLUSTRATIONS: Hook. op. cit. pl. 276. B (as *P. skinneri*).

Fée's description of *P. cryptocarpon*, though incomplete, clearly applies to the species described and figured subsequently as *P. skinneri* and known usually under the latter name. Fournier listed *P. cryptocarpon* as a variety of *P. furfuraceum* and cited several collections, three of which (*Schaffner*; *Bourgeau* 1440; *Müller*) are represented in the Underwood Fern Herbarium. These agree not only among themselves but also with specimens collected by Fink at the type locality and with ample Guatemalan material, the whole representing a species remarkably distinct in venation and easily recognizable also by the lesser scaly covering of the under surface of the lamina.

Hooker's description of this species (as *P. skinneri*) is excellent, save in the one particular that "both sides" of the lamina are not "copiously clothed" with scales, the scales of the upper surface being relatively few and scattered even in young fronds. The veins are invariably free and very oblique (diverging from the midvein at an angle of 30 to 35 degrees), characters which, with the conspicuously long-paleaceous rhizome, should have sufficed to distinguish this species from the Costa Rican plants erroneously listed under this name by Dr. Christ in 1901.¹ These Costa Rican specimens actually pertain to *P. myriolepis* Christ, described in 1896. Further notes upon their misidentification will be found under *P. myriolepis*.² Christ finally maintains³ that a single specimen of *P. skinneri* (*P. cryptocarpon*) has been collected in Costa Rica by Wercklé, but this must be regarded as very doubtful.

Baker, though the type specimens of *P. skinneri* were available to him at Kew, strangely enough redescribed this species as *P. bernouillii*, as is evident not only from his diagnosis but also from specimens of the type collection (*Bernouilli* 442) which are at hand.

¹ In Pittier, Prim. Fl. Costar. 3: 17.

² Page 581.

³ Bull. Soc. Bot. Genève 1: 220. 1909.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Near San Felipe, Depart. Retalhuleu, alt. 600 meters, *Mazon & Hay* 3512; *J. D. Smith* 2744. Volcán de Ipalá, alt. 1,500 meters, *Pittier* 1866. Mazatanango, Depart. Retalhuleu, *Bernouilli* 442 (type collection of *P. bernouilli*). San Andrés Osuna, Depart. Escuintla, *C. & E. Seler* 2582. Without exact locality, *Watson*; *Mrs. W. P. Cock-erell*.

MEXICO: District of Córdoba, Veracruz, *Fink* 81, 85½ (in part). Finca Mexiquito, Chiapas, *Purpus* 6752.

3. *Polypodium platylepis* Mett.; Kuhn, *Linnaea* 36: 137. 1869.

TYPE LOCALITY: Guatemala.

DISTRIBUTION: Guatemala (and southern Mexico?), at an altitude of 2,400 to 2,500 meters. Ascribed also to "New Granada," probably in error.

The present species was described from material said to have been collected in "New Granada" by Linden and in Guatemala by Skinner. Hieronymus states¹ that he has not seen the original specimens, although these should presumably be in the Mettenius herbarium at Berlin; nor was Professor Underwood able to find them there. There is, in any case, good reason for doubting that Colombia is the source of Linden's plant, since, as pointed out on page 564, several interchanges of locality data are known to have been made for plants collected by him in Mexico, Colombia, and Cuba, and since this species has subsequently been found chiefly, if not altogether, in Guatemala. Linden's specimen almost certainly came from the mountains of southern Mexico. In fact, there is at Kew, according to Dr. Underwood's notes, a specimen of this species, collected at Mirador, Veracruz, by Linden in 1838. This may be a duplicate of that studied by Mettenius and Kuhn. Nevertheless, in view of the uncertainty, it is probably better to take as the type Skinner's plant, concerning the source of which there is no doubt. There is also a duplicate of this at Kew.

Polypodium platylepis is readily recognized by its serrate-tipped pinnæ and by its disproportionately long, slender, shaggy stipes.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Humid forest belt of the Volcán de Agua and in the "Altos" above Solalá, alt. about 2,500 meters, May 31, 1882, *Lehmann* 1484. Above Antigua, alt. 2,400 meters, February 18, 1905, *Kellerman* 4877.

4. *Polypodium lindenianum* Kunze, *Farrnkr.* 2: 83. 1851.

Polypodium cancellatum Fée, *Gen. Fil.* 242. 1852; *Mém. Foug.* 6: 12. 1853.

Polypodium verapax Christ, *Bull. Herb. Boiss.* II. 5: 253. 1905.

TYPE LOCALITY: San Bartolo, Chiapas, Mexico.

DISTRIBUTION: Southern Mexico and Guatemala, ascending to 2,100 meters.

ILLUSTRATIONS: Kunze, *op. cit.* *pl.* 134; Fée, *Mém. Foug.* 6: *pl.* 7. *f.* 2 (as *P. cancellatum*).

The type of the present species was collected by Linden, three separate localities being mentioned by Kunze—San Bartolo, Yerbabuena, and the Province of Chiapas. There are several towns in Mexico called San Bartolo, the one here meant being doubtless the small place of that name (not shown on most maps) about 35 miles due north of Tuxtla, Chiapas. Yerbabuena also is in Chiapas, about 60 miles in a general easterly direction from Tuxtla. Linden's third locality, mentioned by Kunze as the "Provinz Chiapas," was doubtless near by. The last is said to be at about 7,000 feet altitude, the highest elevation known for this species. Munch has recently re-collected it in this general region.²

¹ *Bot. Jahrb. Engler* 34: 531. 1905.

² Christ in *Bull. Herb. Boiss.* II. 5: 253. 1905; 5: 730. 1905.

Polypodium cancellatum Fée is precisely *P. lindenianum* Kunze. It was founded upon specimens said to have been collected in Cuba by Linden. Kuhn long ago correctly pointed out¹ that, no other collector having found this species in Cuba and Linden having collected not only in Cuba, but also in Venezuela and in Mexico, the locality "Cuba" was probably erroneous.

Polypodium verapax Christ was described upon three collections from eastern Guatemala, one of which (*von Türckheim* 7726) is at hand. This is apparently a young state of *P. lindenianum*, differing in no respect from other immature examples of this species.

Kunze's figure, and more particularly Fée's, will convey an excellent idea of this species. It is most nearly related to *P. friedrichsthalianum*.

The following collections, represented by many specimens, are in the U. S. National Herbarium:

GUATEMALA: Cobán, Alta Verapaz, alt. 1,350 meters, *von Türckheim* (J. D. Smith, no. 1); *Salvin.* Senahú, Alta Verapaz, *Maxon & Hay* 3304. Cubilquitz, Alta Verapaz, alt. 105 meters, *von Türckheim* (J. D. Smith, no. 7726).

MEXICO: Cerro del Boquerón, Chiapas, *Purpus* 7227.

5. *Polypodium friedrichsthalianum* Kunze, *Farrnkr.* 2: 55. 1850.

TYPE LOCALITY: Guatemala? (*Friedrichsthal* 1322).

DISTRIBUTION: Mountains of Costa Rica, altitude 810 to 1,550 meters. Also in Guatemala (?).

ILLUSTRATIONS: Kunze, *op. cit.* *pl.* 123; *Mett. Abh. Senckenb. Ges. Frankfurt* 2: *pl.* 1. *f.* 17.

The precise locality for Friedrichsthal's plant was unknown to Kunze, and it is quite likely that in this instance as in others (for example, that of *Hemitelia nigricans* Presl),² the type specimen, though credited to Guatemala, did not actually come from the present limits of that country. At any rate *P. friedrichsthalianum* has not been rediscovered there during the rather extensive botanical exploration of recent years. Christensen assigns to it the range "Mexico-Costa Rica"; but it is probable that it does not occur in Mexico, its reported occurrence there being due to its confusion with *P. lindenianum*. It is known at present chiefly, if not wholly, from Costa Rica, where, according to the writer's observations and several records by Christ,³ it is common at middle elevations in the interior mountain region, growing as commonly perhaps upon old stone walls as upon tree trunks. As Christ has remarked, its segments are almost filiform and are greatly exceeded by the large sori. Kunze's figure well represents a plant of medium size except as to rhizome scales, which should be like those of *P. lindenianum*.

The following collections, representing a large series of specimens, are in the U. S. National Herbarium:

COSTA RICA: Alto de Ochmogo, alt. 1,550 meters, *Tonduz* 10391. San Isidro, alt. 1,100 meters, *Alfaro* 105. Cerro de San Isidro, near San Ramón, alt. 1,200 to 1,300 meters, *Brénes* 14222. Alajuela, alt. 810 meters, *Cooper* (J. D. Smith, no. 6051). Vicinity of Cartago, alt. 1,300 to 1,500 meters, *Beyer* 19; *Maxon* 26; *J. D. Smith* 5100, 6962. Santiago, near San Ramón, alt. 1,100 meters, *Brénes* 14241; *Tonduz* 17574. El Rosario de Rosí, alt. 1,120 meters, *Pittier* 16624. Río Virilla, *Biolley*. Without exact locality, *Wercklé*; *Cooper*.

¹ *Abh. Naturf. Ges. Halle* 11: 21. 1869.

² *Bull. Torrey Club* 38: 547. 1911.

³ In *Pittier, Prim. Fl. Costar.* 3: 13. 1901; *Bull. Herb. Boiss.* II. 5: 253. 1905.

6. *Polypodium fallax* Schlecht. & Cham. Linnaea 5: 609. 1830.*Micropteris fallax* J. Smith, Hist. Fil. 186. 1875.*Lepicystis fallax* Diels in Engl. & Prantl, Pflanzenfam. 1⁴: 323. 1899.*Polypodium margaritifera* Christ, Bull. Herb. Boiss. II. 5: 3. 1905.

TYPE LOCALITY: Region of Misantla, Mexico.

DISTRIBUTION: Mexico to Costa Rica, from sea level to at least 1,300 meters altitude.

ILLUSTRATIONS: Christ, op. cit. text fig. (as *P. margaritifera*); Abh. Senckenb. Ges. Frankfurt 2: pl. 1. f. 4-6; Fée, Gen. Fil. pl. 10. A. f. 2.

The characters of *Polypodium fallax* are well known and need not here be repeated. The form described and figured by Christ as *P. margaritifera* is merely an extreme one and is directly connected with typical *P. fallax* by specimens collected at the type locality of *P. margaritifera* but not included in that by Christ (viz, *Tonduz* 10083).¹

Polypodium fallax is the type species of John Smith's ill-founded genus *Micropteris*. The presence of a few scattered scales upon the lamina is not in any sense a generic character, and the long-scandent rhizome and small fronds characterize a type of plant which has its counterpart in most of the large genera of ferns, as, for example, in *Asplenium*, in the instance of *A. filicaule* Baker.

Fournier cites many Mexican localities for *P. fallax*, omitting altitudes, however. Diels mistakenly refers to it as a Central American species occupying an altitudinal range of from 1,000 to 2,000 meters. The writer has collected it at sea level in Guatemala and has no record of its occurrence above 1,300 meters. It is invariably epiphytic, creeping widely upon trees and shrubs.

The following specimens are in the U. S. National Herbarium:

MEXICO: Tlapacoyo, *Liebmann*. District of Córdoba, Veracruz, *Fink* 68; *Orcutt* 3216. Zacuapan, Veracruz, *Purpus* 4369. Near Orizaba, alt. about 1,300 meters, *Pringle* 6124; *Bourgeau* 2784. San Cristobal, near Orizaba, *Mohr*. Without locality, *Schaffner* 27.

GUATEMALA: Cubilquitz, Alta Verzapaz, alt. 350 meters, *von Türckheim* II. 85. Livingston, near sea level, *Maxon & Hay* 3782. Choctum, *Salvin*.

HONDURAS: Trail near Río Plátano, *Wilson* 685.

COSTA RICA: Santo Domingo de Golfo Dulce, at sea level, *Tonduz* 11257 (type of *P. margaritifera*); *Tonduz* 10083 (J. D. Smith, no. 7252).

7. *Polypodium xantholepis* Harrington, Journ. Linn. Soc. Bot. 16: 36. 1877.TYPE LOCALITY: Oroya, between San Bartolomeo and San Mateo, Peru (*Steere*).

DISTRIBUTION: Mountains of Peru.

Polypodium xantholepis, of which among other material two fronds of the original collection are at hand, was both inappropriately named and inadequately described by Harrington. It is, moreover, not "very near *P. incanum*," as was suggested, but related rather to *P. subvestitum* and *P. fallacissimum*. It differs from all the species of this group in the exceedingly dense and widely imbricate scaly covering of the under surface of the lamina. The scales of the rhizome are 2 to 2.8 mm. long, abruptly lance-attenuate from a much broader base, attached at the yellowish center above the base, the surrounding cells strongly sclerotic, a dark median band of similar but more elongate, thick-walled cells extending nearly to the flexuous, attenuate apex; the margins of the scales are pale or whitish and composed of several rows of short to transversely oblong, mainly thin-walled cells, the outermost row arranged as a shallowly fimbriate-denticulate border, the teeth bifid. The bright brown scales

¹ This number is elsewhere cited by Christ (Bull. Herb. Boiss. II. 3: 13. 1901.) as *P. fallax*.

of the under surface are described briefly in the key. The rachis is strongly elevated beneath and is black or blackish, not (as in *P. subvestitum* and *P. fallacissimum*) more or less completely immersed in the pagina and evident only as a low ridge.

Aside from the very pronounced paleaceous under surface the most conspicuous gross character lies in the slender, long-attenuate apex of the fronds, the terminal segment being greatly elongate, 4 to 6 times as long as the next lowest segments. This alone will distinguish this species from its two nearest allies, though its dense scaly covering beneath, the raised blackish rachis, and the relatively slender rhizome scales are hardly less characteristic.

The following specimens are in the U. S. National Herbarium:

PERU: Two fronds of the type collection, *Steere*. Andes, *Wilkes Exped.* (as *Goniophlebium tweedianum*). Mountains back of Lima, along the Oroya Railway, *Safford* 998.

8. *Polypodium subvestitum* Maxon, sp. nov.

Rhizomes rather short-creeping, 2 to 4 (rarely 10) cm. long, branched, 2 to 3 mm. in diameter, freely radicate, conspicuously paleaceous, the scales appressed, closely imbricate, 2.5 to 3 mm. long, broadly deltoid-ovate, thin, attached above their rounded base, brownish in mass, thin, translucent, with a poorly defined, median, Λ -shaped zone of slightly darker cells (these with dark brown sclerotic partition walls and large lumina), the margins composed of pale thin-walled cells, the outermost row of these transversely linear, forming an irregularly denticulate border, the teeth mostly bipapillate at their tip. Fronds erect, sub-fasciculate, 8 to 16 cm. long, the stipe usually much longer than the lamina; stipes 3.5 to 10 cm. long, about 1 mm. thick, stramineous, faintly marginate toward the apex, deeply bisulcate on the anterior face, deciduously paleaceous; lamina deltoid-oblong, 3.5 to 7 cm. long, 2 to 4 cm. broad at the base, pinnately parted, with 5 to 7 pairs of oblique linear-oblong acutish dilatate segments, these unequal, the basal ones subdistant, 1 to 2.3 cm. long, sometimes with an oblique lobe (2 to 6 mm. long) upon the proximal side, the middle ones closer and slightly shorter, the apical ones gradually much shorter and finally evident as triangular lobes below the acute or abruptly short-caudate apex; margins subentire to distantly repand-serrulate or, in the largest segments, coarsely crenate; rachis and midveins partially concealed, their course evident; veins free, wholly concealed, 6 to 8 pairs, spreading, subdistant, mostly twice forked, the branches short; sori 5 to 8 pairs, large, nearly equidistant, terminal upon the first branch of the veins. Leaf tissue herbaceo-coriaceous, yellowish green, glabrous above, partially covered with scales beneath, these subpersistent, 1.5 to 2 mm. long, orbicular-ovate to deltoid-ovate, acuminate, light brown in mass, appressed, subimbricate, the cells mostly short and subhexagonal (the partition walls somewhat sclerotic but pale), the outermost row transversely elongate, forming an irregular denticulate border, the teeth bipapillate at their extremity.

Type in the U. S. National Herbarium, no. 833209, collected in the vicinity of La Paz, Bolivia, altitude about 3,000 meters, in 1889, by Miguel Bang (no. 122); distributed as *Polypodium macrocarpum* Presl.

The following additional specimens are in the U. S. National Herbarium:

BOLIVIA: A second sheet of the type collection, *Bang* 122. Near La Paz, alt. 3,000 meters, April, 1885, *Rusby* 365 (2 sheets). Without precise locality, *Bang* 2598 (2 sheets).

This species is closely related only to *P. fallacissimum*, from which it may be separated by the characters mentioned in the key and under the description of that species, next following.

9. *Polypodium fallacissimum* Maxon, sp. nov.

Rhizomes short-creeping, sparingly branched, the branches 1 to 3 cm. long, about 1.5 mm. thick, woody, the older portions with numerous short rounded phyllopodia (1 to 3 mm. apart), the growing portion conspicuously paleaceous, the scales subappressed, imbricate, rigid, 1 to 1.5 mm. long, deltoid-ovate, long-acuminate, attached above their base, with a sharply defined black median line of strongly sclerotic cells extending from the apex to each side of the point of attachment (thus narrowly Λ -shaped), the margins composed of pale translucent cells, the outermost row transversely linear, arranged as an irregular papillate-denticulate border. Fronds erect or ascending, closely distichous (appearing subfasciculate), simple or pinnately parted, the smaller simple ones often fertile, 2 to 3 cm. long, subspatulate, the lamina 1 to 1.5 cm. long, rounded-oblongate (the short stipe narrowly marginate), with 6 to 9 pairs of very oblique 1 to 3-forked veins, the sori medial, terminal upon the proximal branches; characteristic pinnately parted fronds 3 to 13 cm. long; stipe 1.5 to 7 cm. long, slender, stramineous, greenish-marginate or at the apex distinctly alate, deciduously paleaceous; lamina 2 to 6 cm. long, 1.3 to 2 cm. broad, variable in shape, with 1 to 3 pairs of oblique, subdistant, oblong to linear-oblong, rounded or sharply acute, subentire to serrulate lateral segments and a similar or larger and elongate terminal segment, these connected by a conspicuous costal wing about 2 mm. broad upon each side of the low, partially concealed, olivaceous costa; veins close, slender, concealed, very oblique, about 7 pairs in the larger segments, free or very rarely subgoniophlebioid, once or twice forked, the large sori (5 or 6 pairs) terminal upon the first (proximal) branches, medial, impressed. Leaf tissue rigidly coriaceous, bright or yellowish green, smooth above, beneath rather densely paleaceous, the scales mostly persistent, 1.5 to 1.8 mm. long, oblong-ovate or mostly ovate-deltoid, brownish castaneous in mass, subappressed, imbricate, nearly homogeneous, the cells mostly short and subhexagonal (the partition walls somewhat sclerotic but yellowish brown, not fuscous), the outer 1 or 2 rows quadrate or transversely oblong, forming an irregular denticulate border, the teeth entire.

Type in the U. S. National Herbarium, no. 471295, collected at San Lorenzo Canyon, 6 miles southeast of Saltillo, State of Coahuila, Mexico, September 21 to 23, 1904, by Dr. Edward Palmer (no. 426). The small, simple-fronded state of this species is represented also by Doctor Palmer's no. 425, collected at the same time and place.

Polypodium fallacissimum, though related to *P. subvestitum*, is readily recognized as distinct by the key characters. The scales of the under surface are brighter colored and rather narrower than those of *P. subvestitum*, their margins also less deeply denticulate, the teeth entire rather than bipapillate. The last character immediately separates both *P. fallacissimum* and *P. subvestitum* from *P. xantholepis*, a species with more slender, deeply lacerate-fimbriate lamina scales, their teeth very deeply bifid.

As mentioned under *P. pycnocarpum*, Fournier reported as *P. macrocarpum* two collections from Jalapa, Mexico, which probably pertain to *P. fallacissimum*. Fée also described, as *Heteroneuron paradoxum*,¹ a plant collected by Galeotti which is either *P. fallacissimum* or a very closely related form. That it is probably not identical with *P. fallacissimum* may be inferred from the regular goniophlebioid venation shown in Fée's figure, but it is strikingly similar in habit and general appearance. Fournier² clearly is wrong in citing it as a

¹ Mém. Foug. 6: 3. pl. 1. f. 4. 1853.

² Mex. Pl. Crypt. 84. 1872.

synonym of *P. thyssanolepis* A. Br., a point noted by Christensen.¹ The name *paradoxum* would in any event be unavailable for the Mexican plant in the genus *Polypodium*, because of *Polypodium paradoxum* Colenso, a New Zealand species described in 1882.

10. *Polypodium typicum* Fée, Crypt. Vasc. Brés. 2: 52. 1872-73.

TYPE LOCALITY: Itatiaia, Brazil (*Glaziou* 5294).

DISTRIBUTION: Brazil.

ILLUSTRATION: Fée, op. cit. *pl.* 96. *f.* 2; Lindm. Ark. för Bot. 1: *pl.* 11. *f.* 8.

This species, which is perhaps not very common, was well illustrated by Fée. The scales of the under side are few, minute, scattered, linear or very narrowly lance-deltoid, only a few cells broad, pale yellowish brown, and retrorsely and irregularly erose-denticulate. The rhizome scales are about 2 mm. long, lance-deltoid, pale yellowish brown in mass (individual scales appearing lighter), and mostly with a pronounced median stripe of opaque dark brown cells, the marginal part being whitish, irregularly lacerate, and composed of pale translucent cells. The scales of both the rhizome and the lamina are very different in shape and structure from those of *P. pycnocarpum* and several related species, to all of which *P. typicum* bears little more than a slight superficial resemblance.

The following specimens are in the U. S. National Herbarium:

BRAZIL: Lages, Santa Catharina, *Spannagel* (Rosenstock, no. 200). Alto do Serra, São Paulo, *Wacket* (Rosenstock, no. 347). Terromecco, Rio Grande do Sul, *Kunert* 7.

11. *Polypodium bryopodum* Maxon, sp. nov.

Rhizome slender, firm, and wide-creeping, 5 to 10 cm. long and more, 1.5 to 2 mm. in diameter, with a few short branches, conspicuously paleaceous, the scales imbricate, subappressed (their long, slender tips divaricate-secund), rather lax, 2.5 to 3 cm. long, long-acuminate or attenuate from a deltoid-ovate rounded base, dark brown in mass, nearly homogeneous, not bicolorous, composed of short to mostly elongate, distinctly luminate, polyhedral cells with dark reddish brown sclerotic partition walls, the outer cells smaller, paler, oblique to transverse, the margins obtusely subdenticulate, or sharply denticulate at the attenuate apices. Fronds erect, 0.5 to 4 cm. apart, 3.5 to 10 cm. long, the stipe usually longer than the lamina; stipe 2.5 to 7 cm. long, 0.5 to 1 mm. thick, stramineous, sparingly and deciduously paleaceous; lamina deltoid to deltoid-oblong, 2 to 4 cm. long, 1 to 2.2 cm. broad at the base, obliquely pinnatifid nearly to the concealed or partially evident rachis; segments 3 to 6 pairs, unequal, the basal ones the largest, 7 to 13 mm. long, 3 to 4 mm. broad, linear-oblong, obtuse, slightly decurrent; upper segments gradually shorter, finally evident as lobes of the short-acuminate apex; margins slightly cartilaginous, distinctly but shallowly crenate, the crenations 1.5 to 2.5 mm. long, nearly straight; midveins concealed; veins 4 to 6 pairs in the larger segments, oblique, once or twice forked, mostly free; sori 3 to 5 pairs, medial or subterminal upon the proximal branches, large, contiguous, nearly covering the segments; sporangia glabrous, the annulus usually 16-celled; spores diplanate, granulose. Leaf tissue yellowish green, coriaceous, glabrous above, beneath distantly paleaceous, the scales persistent, appressed, dark brown, 0.8 to 1.5 mm. long, deltoid-ovate, acuminate to attenuate, subentire to obtusely erose-dentate, nearly homogeneous; cells widely luminate, the middle ones short, polygonal, with brown, strongly sclerotic partition walls, the outer ones transverse and paler.

¹ Ind. Fil. 351. 1905.

Type in the U. S. National Herbarium, no. 464148, collected on moist mountain slopes near La Paz, Bolivia, altitude about 3,900 meters, March 18, 1906, by Dr. O. Buchtien (C. Baenitz, Herbarium Americanum, no. 1451); this number is also well represented in the Gray Herbarium. A second collection of the same species is at hand from Pelichuco, Bolivia, altitude 3,300 meters, *R. S. Williams* 2637.

As noted under *P. pycnocarpum*, the present species is the one mistakenly described by Kunze,¹ upon Peruvian specimens collected by Cuming (no. 940), as *P. macrocarpum*. From *P. pycnocarpum*, which is perhaps its nearest ally, *P. bryopodium* differs materially in its lesser size, wide-creeping rhizomes, and more delicate, distant fronds, as well as in characters afforded by the scales of the rhizome and the under surface of the lamina. The two species are similar in having very narrow, subsecund rhizome scales, a feature which wholly excludes from comparison such plants as the Mexican *P. fallacissimum* and the Bolivian *P. subvestitum*, both here described as new. In the rhizome scales of none of these four species is there the sharp, strongly defined, blackish median stripe which, with the wide, pale, repand border of thin-walled cells, unmistakably characterizes the subgroup of *P. plebejum* and its several allies.

12. Polypodium pycnocarpum C. Chr. Ind. Fil. 326. 1905.

Polypodium macrocarpum Presl, Rel. Haenk. 1: 23. 1825, not Bory, 1810.

TYPE LOCALITY: Mountains of Peru (*Haenke*).

DISTRIBUTION: Mountains of Peru, altitude 3,700 meters.

ILLUSTRATION: Presl, op. cit. pl. 1. f. 4 (as *P. macrocarpum*).

This species as variously misunderstood in the past has included plants from a large part of continental America which pertain to several additional and entirely distinct species; for example, *P. subvestitum*, *P. fallacissimum*, *P. tweedianum*, and *P. bryopodium*. The affinities of these are indicated in the preceding key. True *P. pycnocarpum* is evidently very rare. The name *pycnocarpum* is merely a change made necessary by the circumstance that *P. macrocarpum* Presl is a homonym.

The rather crude original illustration of this species by Presl was republished by Kunze in 1840² in comparison with smaller Peruvian specimens (*Cuming* 940)³ which were assumed to be of the same species and which formed the principal basis of a new description of supposed *P. macrocarpum*, as it was then called. That the figures of Haenke's and Cuming's specimens represent two species is now evident from excellent Peruvian specimens lately received (*Rose* 19467), which agree very closely with Presl's description and figure. The Cuming plants described and figured by Kunze are *P. bryopodium*, a new species here described.

On the basis of Presl's original description and illustration, but chiefly the Peruvian specimens of Dr. Rose's recent collecting, *P. pycnocarpum* may be characterized as follows:

Rhizome creeping, sparingly branched, 2 to 5 cm. long, 1.5 to 2 mm. in diameter, freely radicle beneath, densely paleaceous, the scales imbricate, irregularly subsecund, about 3 mm. long, narrowly linear-deltoid (0.6 to 0.76 mm. broad at the base), long-attenuate, dark brown in mass, somewhat bicolorous by transmitted light, the dark median area composed of mostly linear-oblong, elongate-lunate cells with blackish sclerotic partition walls; marginal zone consisting of 2 or 3 rows of thin-walled whitish cells, the outermost trans-

¹ Farrnkr. 1: 25. pl. 13. f. 2a, c-g. 1840.

² Op. cit. 1: pl. 13. f. 2b.

³ Op. cit. 1: pl. 13. f. 2a. c-g.

verse, arranged as a deeply and irregularly denticulate border, the teeth bifid. Fronds several, 3 to 6 mm. apart, 7 to 14 cm. long; stipe 4 to 9 cm. long, 0.5 to 0.7 mm. in diameter, light brownish from a darker base, conspicuously bisulcate anteriorly; lamina deltoid to ovate-deltoid, acuminate, 3.5 to 5 cm. long, 2.5 to 4 cm. broad at the base, pinnatifid to within 1.5 mm. of the elevated, usually greenish rachis; segments 5 to 7 pairs, spreading nearly at a right angle, very narrowly oblong, the lowermost the largest, 1.8 to 2.2 cm. long, 4 to 5 mm. broad, the upper ones gradually shorter; margins faintly crenate, the crenations 2 to 3 mm. long, straight; midveins wholly concealed; veins 7 to 10 pairs, once or mostly twice forked, the sori terminal upon the first branch; sori 6 to 9 pairs, large, medial, very prominent; sporangia glabrous, the annulus usually 14-celled; spores diplanate, yellowish, granulose. Leaf tissue elastico-coriaceous, the segments often tortuous and somewhat involute in drying; lower surface distantly but distinctly paleaceous, the scales minute, ovate to narrowly ovate-deltoid, long-acuminate to attenuate, 8 to 1.5 mm. long, 0.4 to 0.6 mm. broad, brown with paler margins, denticulate.

As already noted, *P. pycnocarpum* has been very generally misidentified and its concept widely extended. Thus, Christensen, in his Index Filicum, gives the range "Mexico-Chile-Argentina" for this species. The citation of Mexico is presumably taken from Fournier,¹ who mentions two collections by de Buren and Hahn, from the mountains near Jalapa. These plants, which have not been examined, are probably referable to *P. fallacissimum*, a very distinct species which is related rather to *P. subvestitum*.

Also, Diels² has published, as *Lepicystis macrocarpa* (Presl) Diels, a figure which very evidently is redrawn from the original illustration of *P. tweedianum* Hook., a species which is extremely different in characters offered by the scales, particularly of the rhizome. Notes on *P. tweedianum* are given elsewhere.³

Further material in this group is greatly needed. The single specimen of *P. pycnocarpum* mentioned above is from the vicinity of Oroya, Peru, altitude 3,700 meters, *Rose* 19467.

13. *Polypodium mollendense* Maxon, *Smiths. Misc. Coll.* 65⁹: 1. 1915.

TYPE LOCALITY: Low hills near Mollendo, Peru.

DISTRIBUTION: Known only from the type locality.

This recently described species is a close ally of *P. pycnocarpum* and *P. bryopodium*, with which it is contrasted elsewhere. Unlike most of the species of this group it is a plant of low altitudes and occurs, so far as now known, only near the coast. The following collections have been studied:

PERU: Low hills near Mollendo, *Williams* 2978 (type); *Rose* 18989.

14. *Polypodium rusbyi* Maxon, sp. nov.

Rhizome wide-creeping, 10 to 20 cm. long, flattish, rather slender (1 to 2 mm. in diameter), deciduously paleaceous, the scales slender, closely appressed, imbricate, narrowly deltoid-lanceolate, long-attenuate, 3 to 4 mm. long, yellowish brown, the median portion darker, consisting of narrow cells with reddish brown sclerotic partition walls and with mostly distinct lumina, the borders equally broad, not very sharply defined, consisting mainly of translucent, oblique or transversely linear, minute, thin-walled cells, the margin of the scale irregularly erose-denticulate. Fronds few, 1 to 3 cm. apart, 15 to 30 cm. long, borne upon short broad paleaceous phyllopodia; stipe 5.5 to 17 cm. long, 0.6 to 0.9 mm. thick, stramineous to pale brownish, convex upon the posterior side, bisulcate

¹ Mex. Pl. Crypt. 83. 1872.

² Engl. & Prantl, *Pflanzenfam.* 14: 322. f. 167. C. 1899.

³ Page 574.

upon the anterior side, narrowly marginate at the apex; lamina 10 to 18 cm. long, 5 to 8 cm. broad at the base, narrowly deltoid, subpinnatisect throughout, the pinnæ successively shorter toward the conspicuously long-caudate apex (this 2 to 4 cm. long, 3 to 7 mm. broad), the yellowish rachis narrowly foliaceous-marginate in the lower part, more broadly so toward the apex; segments 10 to 12 pairs, horizontal (or the lower ones deflexed), 1 to 3 times their width apart, mostly linear, the basal ones 2 to 4 cm. long, 4 to 7 mm. broad, acutish, surcurrent, excavate nearly to the midvein upon the proximal side; middle segments similar but slightly shorter, subequally dilatate and joined by a narrow wing; apical segments about 1 cm. long, or less; margins slightly cartilaginous, slightly undulate, distantly appressed-serrulate; veins 8 to 13 pairs, partially concealed, mostly twice forked, the large sorus usually terminal upon the proximal branch; sori 7 to 12 pairs, nearly medial. Leaf tissue grayish green, membranaceous, glabrous and nonpaleaceous above, beneath bearing numerous scattered scales, these small but easily visible to the naked eye, 1 to 1.5 mm. long, narrowly deltoid, sometimes long-acuminate, attached above the rounded base, brownish, darker in the median part (the cells rather short, quadrate or polyhedral, with reddish brown sclerotic partition walls and large lumina), the paler borders composed of 1 or 2 rows of transversely oblong thin-walled cells, the margin rather conspicuously erose-denticulate.

Type in the U. S. National Herbarium, no. 50934, collected in the vicinity of Yungas, Bolivia, altitude about 1,800 meters, 1885, by H. H. Rusby (no. 353); distributed as *Polypodium plebejum* Schlecht. & Cham.

The following additional material, all in the National Herbarium, has been studied:

BOLIVIA: A second sheet of the type collection, *Rusby*-353. Soratá, alt. 3,000 meters, February, 1886, *Rusby* 352 (2 sheets). Without precise locality, *Bang* 2592.

The rhizome scales of *P. rusbyi* are slender, closely appressed, and neither crispate nor fuscous-carinate, and so indicate very clearly that this species is not a near relative of *P. plebejum*. They do, however, suggest a relationship with *P. typicum* and *P. murorum*. With the first of these *P. rusbyi* is not likely to be confused, on account of the much greater size of all its parts. From the latter it is easily distinguished by its fully adnate segments, more delicate texture, and the fewer, smaller, paler, and more distant scales of the under surface.

As mentioned on page 575, this plant, as represented by Rusby's 352 and 353, is included by Hieronymus under *P. tweedianum*, a disposition which to the writer seems certainly erroneous.

15. *Polypodium murorum* Hook. Icon. Pl. 1: pl. 70. 1837.

Polypodium sporadolepis var. β Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

TYPE LOCALITY: Vicinity of Quito, Ecuador (*Jameson* 49).

DISTRIBUTION: Costa Rica, Colombia, and Ecuador, ascending to 3,400 meters.

ILLUSTRATION: Hook. op. cit. pl. 70.

Available material of this species is not complete enough to admit of more than temporary treatment. Jameson's original specimens, which are exceedingly fertile and appear to have grown in the open, are matched by several plants of his collecting in the National Herbarium. They represent an extreme form which is deeply bipinnatifid. Most other Ecuador specimens at hand have the pinnæ subentire, an apparently intermediate state being Rosenstock's no. 1a. There is great variation also in the scaly covering of the under side, the congested plants of Jameson having a dense imbricate covering, while larger and

partially sterile fronds of other collections are less scaly. The scales of the under side in all the fronds, however, are distinctive.

Polypodium murorum is known from North America only upon Mr. Pittier's single collection from an isolated and little explored part of Costa Rica, this having been reported upon by Christ¹ in 1901.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: El Páramo de Buena Vista, alt. 3,000 meters, Pittier 10485.

ECUADOR: Without locality, Jamson; Couthouy. Cubillin, eastern Cordillera, alt. 2,400 meters, Rimbach (Rosenstock, no. 1a.). Rio Suguibí, western Cordillera, alt. 3,200 meters, Rimbach (Rosenstock, no. 34). Near Quito, alt. 2,800 to 3,300 meters, Lehmann 157. Near Yerbas Buenas, western Cordillera, alt. 2,600 to 3,300 meters, Lehmann 5726.

16. *Polypodium leucosticton* Kunze, *Linnaea* 20: 380. 1847.

Polypodium karwinskyanum A.Br.; Mett. Abh. Senckenb. Ges. Frankfurt 2: 66. 1856, in part.

Polypodium plebejum var. *columbiense* Kuhn, Abh. Naturf. Ges. Halle 11: 40. 1869.

Polypodium plebejum var. *palmense* Christ, Bull. Herb. Boiss. II. 5: 4. 1905.

TYPE LOCALITY: Colombia.

DISTRIBUTION: Mountains of Central America and northern South America, ascending to 2,300 meters.

The present species, which was founded upon two separate collections from Colombia (*Hartweg* 1499 and *Moritz* 336), has been discussed recently at some length by Hieronymus,² who appears to have somewhat enlarged its scope. In the absence of authentic specimens of the original collections the present writer can add little to Hieronymus's treatment and will merely suggest that there are here included several forms which probably are specifically distinct. In order to distinguish these properly it will doubtless be necessary to assemble a large series of ample and well prepared specimens, which have been carefully selected in the field. Abraded, discolored, and incomplete material in this species is nearly worthless, because of the partial dimorphism of the fronds and the need of a full knowledge of the scale characters. Thus, partly upon this account, Hieronymus has been led into the error of citing Lehmann's no. 640, from southern Colombia, as belonging to this species, whereas in its densely paleaceous under surface it is clearly distinct and possibly represents an undescribed but closely related species.

Christ³ also has discussed the characters of *P. leucosticton* in referring to it his own *P. plebejum* var. *palmense*, founded upon two Costa Rican specimens (*Tonduz* 12571; *Pittier* 13257), and has cited additional Central American material.

Kuhn's *P. plebejum* var. *columbiense* is the exact equivalent of *P. leucosticton*, the name *columbiense* having been given merely as a new designation for *leucosticton*, when this form was reduced to varietal rank under *P. plebejum*, as Kuhn thought proper.

Regarding *P. leucosticton* in the broad sense of Hieronymus and Christ, it may be distinguished from *P. plebejum* not only by its plane or somewhat undulate (not crispate) rhizome scales, but also by its stouter and more or less alate stipes and usually by its subdimorphous fronds; that is, the sterile fronds are short-stipitate, the lamina commonly deltoid-oblong and relatively

¹ In Pittier, Prim. Fl. Costar. 3: 14. 1901.

² Bot Jahrb. Engler 34: 521. 1905.

³ Bull. Soc. Bot. Genève II. 1: 219. 1909.

very broad, and the fertile fronds long-stipitate, the lamina linear-oblong and nearly or quite pinnatisect, the pinnules often distant.

The following specimens in the U. S. National Herbarium are grouped tentatively under *P. leucosticton*:

GUATEMALA: Pansainalá, Dept. Alta Verapaz, alt. 1,150 meters, *von Türckheim* (J. D. Smith, no. 643). Same locality, *J. D. Smith* 1572. Cobán, Alta Verapaz, alt. 1,350 meters, *von Türckheim* II. 1397; II. 2437.

COSTA RICA: Vicinity of La Palma, alt. 1,450 to 1,550 meters, on tree trunks at edge of forest, *Maxon* 449 (type locality of *P. plebejum palmense* Christ).

COLOMBIA: Dense forests near Popoyán, alt. 1,750 meters, *Lehmann* 3556. Same general region, alt. 1,600 to 2,000 meters, *Lehmann* 5724.

VENEZUELA: Los Tegñes, alt. 1,150 meters, *Eggers* 13041.

ECUADOR: Mount Tunguragua, alt. 1,600 to 2,300 meters, *Lehmann* 460.

17. *Polypodium plebejum* Schlecht. & Cham. Linnaea 5: 607. 1830.

Polypodium karwinskyanum A.Br.; Mett. Abh. Senckenb. Ges. Frankfurt 2: 66. 1856, in part.

Polypodium cheilostictum Fée, Mém. Foug. 8: 87. 1857.

Polypodium plebejum cooperi Baker, Journ. Bot. Brit. & For. 25: 25. 1887.

TYPE LOCALITY: Jalapa, Mexico (*Schiede* 746).

DISTRIBUTION: Eastern central Mexico to western Panama, ascending to 2,400 meters in Panama, but occurring mainly at lower altitudes.

The type collection of *P. plebejum*, from Jalapa, which is in the humid region of the eastern part of southern Mexico, has not been seen by the writer; but from this general region and the area southward of Costa Rica there is at hand a wealth of material which seems to place the identity of this species beyond question. These specimens include several collections so determined by Hieronymus and the whole range of North American specimens cited below doubtless pertains to a single species. The South American material previously so referred must probably all be excluded, the wide distribution hitherto ascribed to the species having been due mainly to a lack of critical study.

Both in size and shape of the fronds and segments *P. plebejum* varies widely. The largest plants seen (*Pringle* 3258) have the fronds about 50 cm. long, the stipe and lamina being about equal in length. The rhizome is stout and ropelike, very thickly covered with short, very closely packed, brownish, crispate, divergent but scarcely projecting scales; and, since it is mostly epigeal, these are conspicuous, especially in the long-produced apical portion which commonly extends beyond the fronds a distance of 3 to 10 centimeters. This is in sharp contrast to *P. guttatum*. The scales of the under side of the lamina are the best specific mark; they are usually very few and minute, 0.5 to about 1 mm. long, deltoid-lanceolate or nearly linear from a short triangular base, the margins subentire to irregularly and for the most part bluntly bidentulate, never having the long, slender, almost cilia-like teeth of *P. oulolepis*. In all of the specimens here listed the sori are distinctly impressed at maturity.

Polypodium cheilostictum Fée, described upon specimens collected at Orizaba by W. Schaffner (no. 543) in 1856, is probably synonymous with *P. plebejum*, though listed by Fournier as distinct. The type locality is not far from that of *P. plebejum* and the description indicates no points of difference.

Polypodium karwinskyanum A. Br., which was first definitely described by Mettenius, seems to be mainly this species, although according to Kuhn and

Hieronimus, who have presumably examined the original specimens, it is also partly *P. leucosticton*.

The following specimens are in the U. S. National Herbarium:

MEXICO: Jalapa, Veracruz, *Orcutt* 2806. Region of Orizaba, *Bourgeau* 2895 (distributed as *P. cheilostictum*). Córdoba, Veracruz, *Fink* 61, 73. Zacuapan, Veracruz, *Purpus* 4375. Teziutlán, Puebla, *Orcutt* 4032. Boca del Monte, Puebla, *Purpus* 6426. Near Pantepac, Chiapas, *Collins & Doyle* 221. Tamasopo Canyon, San Luis Potosí, *Pringle* 3258.

GUATEMALA: Cobán, Alta Verapaz, alt. 1,300 meters, *J. D. Smith* 1573; *von Türckheim* (J. D. Smith, no. 641); *von Türckheim* II. 1256. Near the Finca Sepacuité, Alta Verapaz, *Goll* 191; *Cook & Griggs* 541. Trail between Sepacuité and Secanquím, Alta Verapaz, alt. 1,000 meters, *Maxon & Hay* 3285. San Miguel Uspantán, Depart. Quiché, alt. 1,800 meters, *Heyde & Lux* (J. D. Smith, no. 3255). Santa María, Depart. Quezaltenango, *Kellerman* 5572.

COSTA RICA: Cartago, alt. 1,275 meters, *Cooper* (J. D. Smith, no. 6054). Tablazo, alt. 1,900 meters, *C. Brade*; *Biolley*. Several sheets without exact locality, *Cooper*; *Wercklé*.

PANAMA: Above Camp Aguacatal, eastern slope of Chiriquí Volcano, alt. 2,400 meters, *Maxon* 5301. Above the Río Ladrillo, southern slope of Cerro de la Horqueta, Chiriquí, alt. 1,200 to 1,700 meters, *Maxon* 5408.

18. *Polypodium tweedianum* Hook. Icon. Pl. 1: pl. 86. 1837. PLATE 39.

? *Polypodium sporadolepis* Kunze var. *a* Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

Lepicystis macrocarpa Diels in Engl. & Prantl, Pflanzenfam. 1⁴: 322. 1899, in part; not *Polypodium macrocarpum* Presl, 1825.

TYPE LOCALITY: Woods of St. Xavier, Tucumán, Argentina (*Tweedie*).

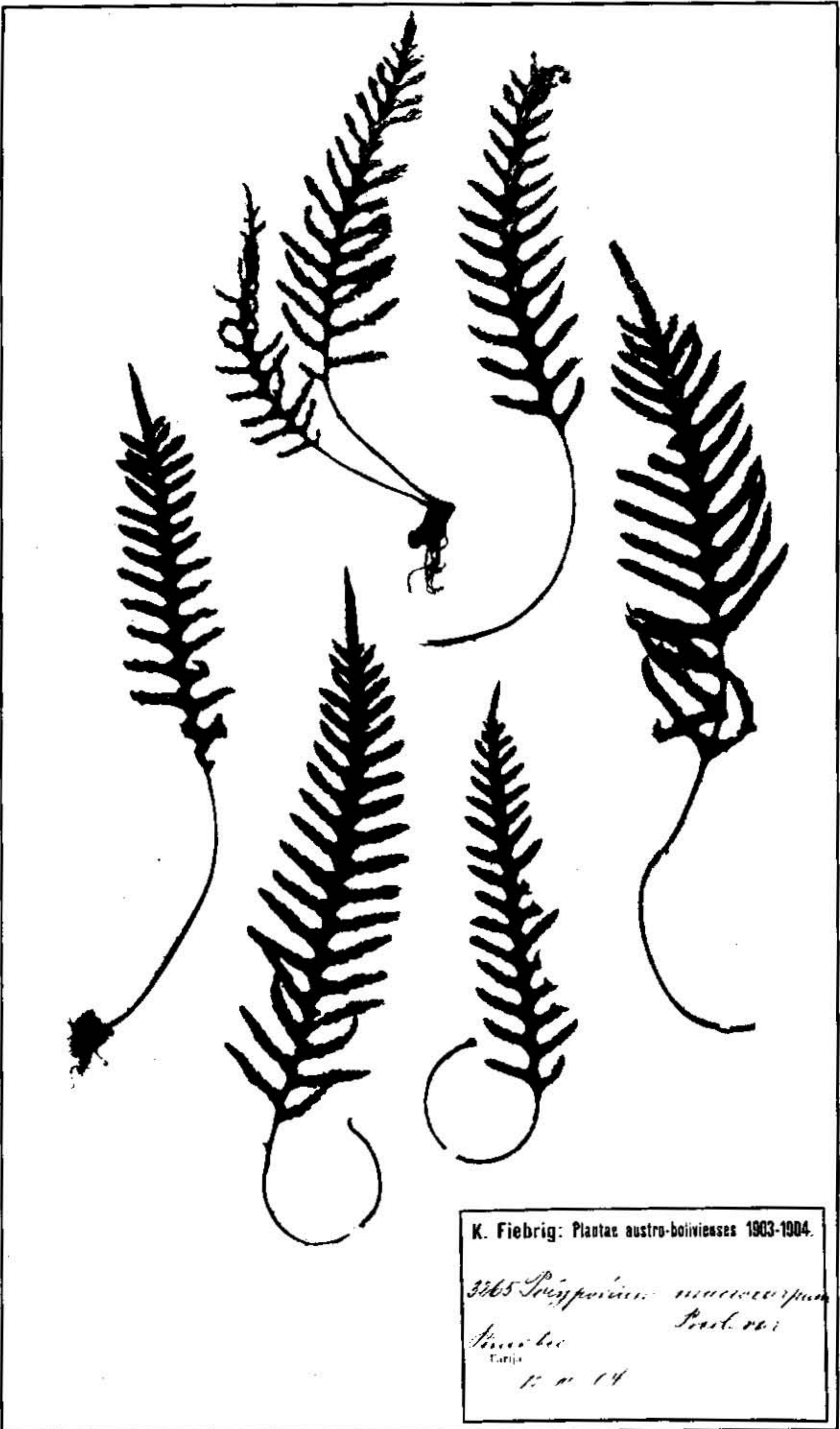
DISTRIBUTION: Bolivia and northern Argentina, and probably northward in the Andes.

ILLUSTRATIONS: Hook. op. cit. pl. 86; Diels in Engl. & Prantl, Pflanzenfam. 1⁴: f. 167. C. (as *Lepicystis macrocarpa*).

In the course of an attempt to reconcile the several conflicting concepts of this species and its nearest allies and to determine, if possible, the precise original application of the name *P. tweedianum*, the writer has sought the loan of a portion of Tweedie's type specimen, shown in Hooker's plate 86, and has been informed that this specimen is not now to be found at Kew. It seems necessary, therefore, to interpret the species solely from Hooker's illustration, and this, in the light of a recent single collection by K. Fiebrig in southern Bolivia, does not appear to be very difficult. The plants referred to are Fiebrig's no. 3265,¹ from Pinos, near Tarija, Bolivia, which agree well with Hooker's illustration of Tweedie's type specimen from the northernmost part of Argentina. Although some of the fronds are larger than Tweedie's, the proportionate length of lamina and stipe is about the same, as also the general form and cut of the lamina, the direction, shape, and number of the segments, and the position and number of the sori. A difference is noted in the more broadly alate bases of the segments of no. 3265, especially upon the distal side, but this is not very pronounced and is perhaps no more than an individual variation.

Interpreted upon the basis of Fiebrig's plants, *P. tweedianum* shows an unmistakable alliance with *P. plebejum* and nearest relatives in several par-

¹ The specimens studied are in the Gray Herbarium and in the U. S. National Herbarium.



K. Fiebrig: Plantae austro-bolivianae 1903-1904.
 3865 Polypodium macrocarpum
 Kunze
 Tarija
 11. 11. 14

POLYPODIUM TWEEDIANUM HOOK.

ticulars, notably in its strongly cartilaginous leaf margins and in the character of its scales. The rather wide-creeping rhizome (2 to 3 mm. in diameter) has a very dense covering of closely imbricate scales. These are mostly roundish-ovate to broadly oblong, 1.5 to 2.5 mm. long, acuminate, fragile, conspicuously and narrowly fuscous-carinate, the broad, pale brown borders distinctly repand but scarcely complicate-crispate, the margins irregularly erose. The scales of the lamina are numerous, but mostly not contiguous, 1 to 1.5 mm. long, deltoid-ovate, abruptly long-attenuate, pale brown, with a darker center, coarsely and deeply denate, the teeth bipapillate. They agree fairly well with the rough drawing of the scales of *P. tweedianum* given by Hooker, much better, in fact, than do those of specimens referred to *P. tweedianum* by Hieronymus.

Hieronymus¹ has mistakenly listed under *P. tweedianum* at least two specimens (*Rusby* 352, 353) which the writer believes to represent a new species, *P. rusbyi* (p. 570). The plants so referred have the fronds larger and decidedly more lax than those shown in Hooker's plate, with the segments less ascending, even spreading. They clearly do not pertain to Hooker's species.

Christ reported *P. tweedianum* from Costa Rica in 1906² upon the basis of specimens collected by Wercklé, Pittier (840, 13257), and Tonduz (16716), although at least one of these numbers (*Pittier* 13257) had previously³ been listed by him as belonging to his new variety, *Polypodium plebejum costaricense*. Subsequently⁴ this variety was reduced by him to *P. leucosticton*, in which species, as now understood, it is certainly to be included. Under these circumstances it is exceedingly doubtful if *P. tweedianum* should be recognized as a member of the North American flora. No specimens from this region have been seen by the writer, at least.

EXPLANATION OF PLATE 39.—Bolivian specimens of *Polypodium tweedianum* (*Flebrig* 3625, U. S. Nat. Herb. no. 694023; ex Herb. Gray). Scale $\frac{1}{2}$.

19. *Polypodium guttatum* Maxon, sp. nov.

PLATE 40.

Rhizome wide-creeping, mostly hypogean, tortuous, rarely branched, 2 to 3 mm. in diameter, freely radice on all sides, densely paleaceous, the scales fragile, closely impacted, broadly ovate-oblong, 1 to 1.5 mm. long, yellowish, deeply fimbriate-lacerate, crispate, with a linear or very narrowly triangular median stripe of elongate blackish cells, these having the outer walls semitranslucent and the partition walls blackish and very strongly sclerotic, the lumen often obsolete. Fronds few, 1 to 3 cm. apart or two borne together, 15 to 35 cm. long, erect; stipe 10 to 20 cm. long, 1 to 1.5 mm. thick, yellowish to pale olivaceous or darker at the base, subterete to angulate, faintly foliaceo-marginate, or noticeably so at the apex; lamina narrowly to broadly oblong or deltoid-oblong, acute, rather abruptly short-caudate, 7 to 22 cm. long, 4 to 12 cm. broad, subpinnatisect throughout, the stout stramineous rachis very strongly elevated; segments 12 to 16 pairs, patent, linear to linear-oblong, often narrowed just above the base, obtuse or acutish, 4 to 10 mm. broad, the lower ones once or twice their width apart, those above gradually closer but never contiguous, all of them dilatate or at least decurrent, connected by an oblique foliaceous wing 0.5 to 2 mm. broad upon each side of the rachis; margins strongly callous, minutely and remotely notched, repand in drying; veins 14 to 18 pairs, concealed, free, spreading, 2 to 4-forked, the large sori terminal upon the elongate first branch, slightly nearer to the margin than to the midrib. Leaf tissue very

¹ Bot. Jahrb. Engler 34: 520, 521. 1905.

² Bull. Herb. Boiss. II. 6: 50. 1906.

³ Bull. Herb. Boiss. II. 5: 4. 1905.

⁴ Bull. Soc. Bot. Genève II. 1: 219. 1909.

thick, rigidly spongiose-coriaceous, the upper surface light or grayish green, glabrous, and non-paleaceous, the lower surface grayish green to distinctly yellowish,¹ glabrous, obviously but sparsely paleaceous, the scales broadly ovate to deltoid-ovate, long-acuminate, 1 to 1.5 mm. long, attached above the cordate base, castaneous, slightly paler toward the irregular bidentate margins, the cells mostly short to elongate-hexagonal, their outer walls transparent, the partition walls thick but yellowish-translucent; marginal row of cells transversely linear.

Type in the U. S. National Herbarium, no. 336056, collected near Saltillo, State of Coahuila, Mexico, altitude about 1,600 meters, April 15 to 30, 1898, by Dr. Edward Palmer (no. 65). A second sheet of the same number is also at hand.

The present species has hitherto been included in *P. plebejum* by Eaton, Davenport, and the writer in reporting upon the collections of Dr. Edward Palmer, who is apparently almost the only one to have collected it. The ample material brought together by him is singularly uniform and indicates that this is the dominant and characteristic member of the *plebejum* group in the States of Coahuila and San Luis Potosí.

Polypodium guttatum is at once distinguishable from the allied species *P. plebejum* and *P. oulolepis* by its different aspect and more particularly by the peculiarity of the scales of the lower side of the lamina. These in *P. plebejum* are rather slender, few, and often so minute as to be nearly invisible to the naked eye; whereas in *P. guttatum* they are more numerous and of different shape and though scattered are large and conspicuous, giving a speckled appearance to the lamina. *Polypodium oulolepis* also has numerous scales beneath, but they are narrowly attenuate and of different structure, being coarsely lacerate-dentate. Although the rhizome scales of all three species are similar, it may be noted that the median stripe in *P. plebejum* and *P. oulolepis* consists of black opaque cells so strongly sclerotic that their distinctness is lost, while in *P. guttatum* the lumina of the dark median cells are usually apparent, being often rather large.

Besides the type the following specimens are in the U. S. National Herbarium:

MEXICO: Same locality data as the type, *Palmer* 65½. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, 1878, *Parry & Palmer* 973. Near San Luis Potosí, same State, *Palmer* 664 in 1898; *Palmer* 99 in 1902. Álvarez, State of San Luis Potosí, at base of trees and upon the shaded under side of large oaks, alt. 2,400 meters, *Palmer* 442 and 448½ in 1902. Mountains 12 to 14 leagues south of Saltillo, State of Coahuila, *Palmer* 1373 in 1880. Sierra de Pachuca, State of Hidalgo, *Rose & Painter* 6717. Without exact locality data, *J. G. Schaffner* 56.

EXPLANATION OF PLATE 40.—Blades of two middle-sized fronds of the type collection of *Polypodium guttatum*, the sterile one showing especially well the guttate under surface. Natural size.

20. *Polypodium oulolepis* Fée, *Mém. Foug.* 8: 86. 1857.

Polypodium madreense J. Smith in *Seem. Bot. Voy. Herald* 338. 1854.

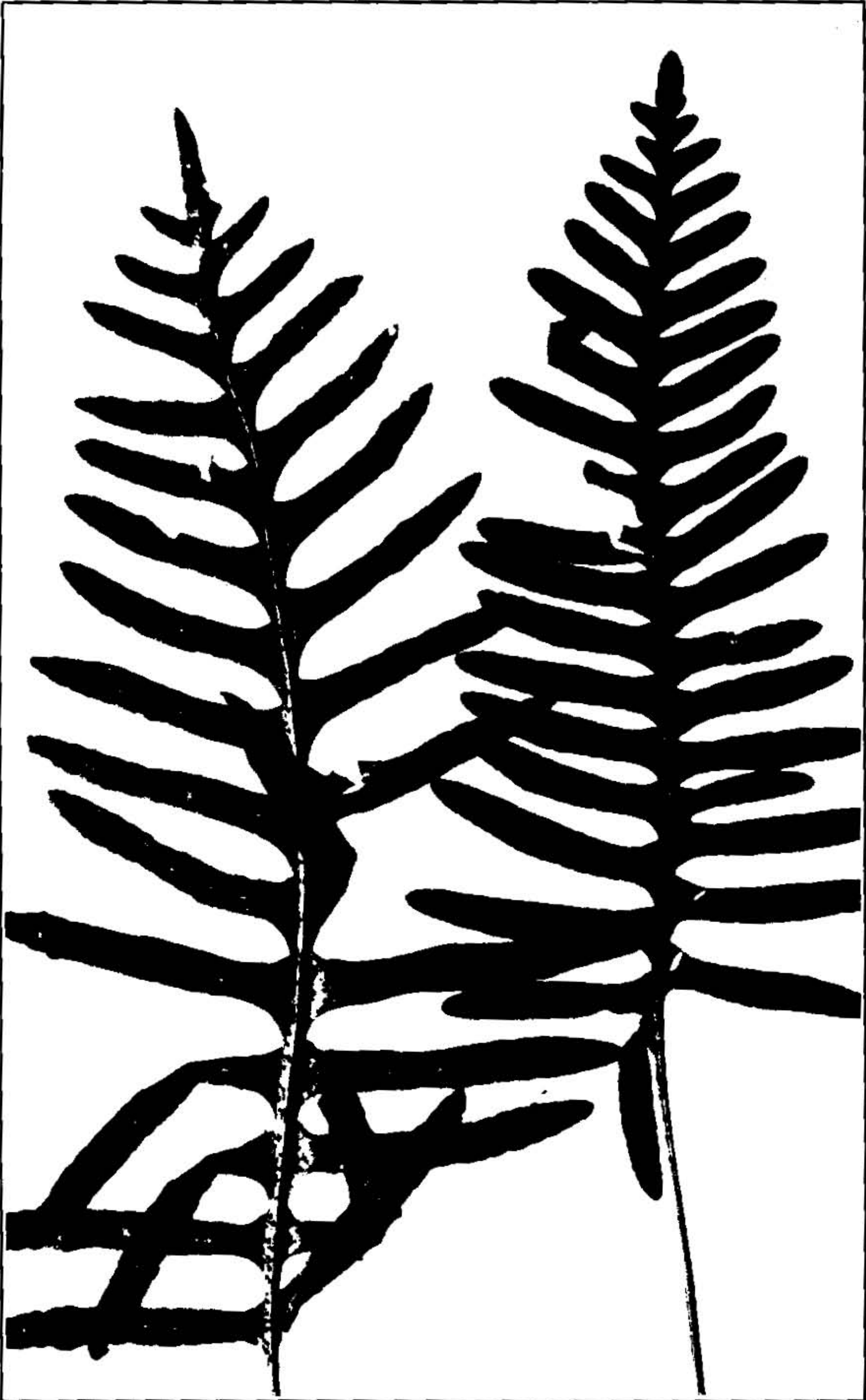
TYPE LOCALITY: "Huatusco, Orizaba et au Popocatepetl, à 2,700 mètres d'altitude (W. Schaffner, nos. 191, 192 et 274 *partim*)."

DISTRIBUTION: Central Mexico, at 2,400 to 2,700 meters altitude.

ILLUSTRATION: J. Smith, *op. cit.* pl. 73 (as *P. madreense*).

The species name *oulolepis* is applied as below partly from Fée's description but principally upon the basis of John Smith's illustration and of specimens

¹ "Olive ocher" and "sulphine yellow" of Ridgway's "Color Standards and Nomenclature," 1913.



POLYPODIUM GUTTATUM MAXON.

cited by Fournier. There can be no doubt that there are represented in *P. oulolepis*, *P. plebejum*, and the plant described in this paper as *P. guttatum*, three distinct specific forms, which, so far as the writer can perceive, show no signs whatever of intergradation. Although the rhizome scales of all three are crispate and are in general structure very similar to each other, the scales of the lower side of the lamina offer excellent distinctive characters. Those of *P. oulolepis* are narrow and coarsely lacerate-dentate, their slender tortuous apices greatly elongate and nearly filiform, as mentioned in the discussion of *P. guttatum*.

Fournier is clearly correct in regarding *P. madrense* as a synonym of *P. oulolepis*. Smith's larger figure illustrates the species tolerably well, especially in habit and in its representation of the straight, narrowly linear, distant segments, characters which may be well observed, for example, in Pringle's 11799; but the scales shown in the detailed figures are sketchily and inaccurately drawn, a significant and conclusive feature, however, being the deeply cleft margins.

The following specimens are in the U. S. National Herbarium:

MEXICO: On trees and rocks of lava fields near Eslaba, Federal District, alt. 2,400 meters, *Pringle* 11799. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, *Parry & Palmer* 974. Near Santa Fé, Valley of Mexico, *Bourgeau* 684. Contreras, Valley of Mexico, *Orcutt* 3484. Popo Park, State of Mexico, *Hitchcock*. Near Clima, State of Mexico, *Rose & Painter* 7200. Near Toluca, State of Mexico, *Rose & Painter* 6798. Sierra de Tepostlán, State of Morelos, *Rose & Painter* 7252. Sierra de Pachuca, State of Hidalgo, *Rose, Painter & Rose* 8754; *Rose & Painter* 6717 in part. Between Pachuca and Real del Monte, State of Hidalgo, *Rose & Painter* 6658. Ixtaccihuatl, alt. 2,400 to 2,700 meters, *Purpus* 329; same region, 1905, *Purpus* 1593. Salto de Agua, State of Mexico, January, 1906, *Purpus* 1593. Cerro Azul, near Morelia, *Arsène*.

21. *Polypodium monosorum* Desv. Ges. Naturf. Freund. Berlin Mag. 5: 319. 1811.

Polypodium onustum Hook. Icon. Pl. 8: pl. 749. 1845.

Polypodium macrosorum Fée, Gen. Fil. 241. 1852, not Baker, 1885.

Polypodium sporadolepis var. γ Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

Polypodium molestum Mett. Ann. Sci. Nat. V. 2: 254. 1864.

TYPE LOCALITY: Peru.

DISTRIBUTION: Colombia to Peru, ascending to 3,400 meters.

ILLUSTRATIONS: Hook. op. cit. pl. 749 (as *P. onustum*); Fée, Mém. Foug. 6: pl. 8. f. 1. (as *P. macrosorum*).

In the group of species with dark-colored rhizome scales this is nearly the counterpart of *P. lindenianum* Kunze, of the group with larger, flaccid, light-colored thin-walled scales. It is a plant of very distinctive form and shows no near approach to *P. murorum*, which has very different scales and is at most only bipinnatifid.

The substitute name *molestum*, proposed by Mettenius in 1864, seems to have been quite unnecessary, since the plant which he described as "*P. onustum* Hook." in 1856¹ undoubtedly does appertain to Hooker's species of that name. This in turn is clearly conspecific with Fée's *P. macrosorum*, which Mettenius² had regarded as a form (var. γ) of *P. sporadolepis*. All are doubt-

¹ Abh. Senckenb. Ges. Frankfurt 2: 68. 1856.

² Ibid. 2: 67. 1856.

less to be associated as *P. monosorum* Desv., as Hieronymus, determining the application of this name from Mettenius's notes, has stated.¹

The following specimens are in the U. S. National Herbarium:

ECUADOR: Cerro de Pichincha, *Jameson*. Without exact locality, *Jameson*. Eastern Cordillera, alt. 3,400 meters, *Rimbach* (Rosenstock, no. 1). "An Bäumen auf dem Nudo de Tiripallo, dem Corazon, dem Pichincha, und auf der Montaña Mojanda, 3,000–3,400 m. 24. XII. 1880," *Lehmann* 431. Without definite locality, *Lehmann* 4448.

DOUBTFUL SPECIES.

1. *POLYPODIUM ATURENSE* Maury, Journ. de Bot. 3: 134. f. 3. 1889.

Described and illustrated upon specimens said to have been collected in "bois humides des bords de l'Orénoque, Salvajito, Raudal d'Atures," by Gallard (no. 111). Judging from the figure this is probably a distinct species, but it can hardly be placed definitely without an examination and comparison of the original specimens, these being apparently the only ones known.

2. *POLYPODIUM BALLIVIANI* Rosenst. Repert. Nov. Sp. Fedde 9: 344. 1911.

Founded upon specimens collected at Antahuacana, Bolivia, in the valley of the Río Espíritu Santo, altitude 750 meters, June, 1909, by Dr. O. Buchtien (no. 2169). Not seen by the writer. According to the ample description it is a strongly characterized species of the group of *P. plebejum*, but not very closely related to that species itself.

3. *POLYPODIUM BUCHTIENII* Christ & Rosenst. Repert. Nov. Sp. Fedde 5: 237. 1908.

Described from specimens collected at Unduavi, Bolivia, altitude 3,300 meters, upon trunks of trees in forests, February 12, 1907, by Dr. O. Buchtien (no. 880). Not seen by the writer. Rosenstock contrasts it with *P. plebejum*, from which it is apparently distinct, especially in scale characters.

4. *POLYPODIUM FRASEBI* Mett.; Kuhn, Linnaea 36: 137. 1869.

Founded upon Ecuador specimens collected by Fraser; not known to the writer. From description a near ally of *P. plebejum*, but probably well marked by the form of the rather large scales of the lamina.

5. *POLYPODIUM MASAFUERAE* Phil. Linnaea 29: 107. 1857.

Described briefly from specimens collected by Germain upon Masafuera, one of the Juan Fernández group, belonging to Chile. Hooker² has figured as *P. macrocarpum* (*P. pycnocarpum*) a Masafuera specimen which agrees fairly well with the original description of *P. masafuerae* and seems to indicate that Christensen is correct in listing it as a valid species.

6. *POLYPODIUM NIGRIPES* Hook. Sp. Fil. 5: 17. 1863.

A peculiar form, described from Venezuela specimens collected by Fendler (no. 247), known to the writer only from an imperfect specimen of the original collection, in the herbarium of the College of Pharmacy, New York City. Notwithstanding its subplebodioid venation the plant in general appearance and in scale characters is clearly allied to the forms grouped at present under *P. leucosticton*, rather than to *P. plebejum* (to which it is referred by Christensen). If it is recognized eventually as a distinct species it must be renamed, on account of a Javan species having been described as *Polypodium nigripes* in 1844. Kuhn's notes³ upon *P. nigripes* Hook. should not be overlooked.

¹ Bot. Jahrb. Engler 34: 523. 1905.

² Cent. Ferns pl. 34. 1854.

³ Abh. Naturf. Ges. Halle 11: 41. 1869.

7. *POLYPODIUM PLATYBASIS* Baker in Hook. & Baker, Syn. Fil. ed. 2. 511. 1874.

The present species, which was founded upon specimens collected near Salta, in the Andes of northwestern Argentina, by Pearce, seems from description to be related to *P. monosorum* and *P. murorum*. Christensen,¹ however, lists it as belonging to the subgenus *Goniophlebium* and as occurring in Guatemala, but upon what ground in either particular is not clear. It has not been seen by the writer.

8. *POLYPODIUM PLEOPELTIDIS* Fée, Crypt. Vasc. Brés. 1: 86. pl. 26. f. 1. 1869.

This species, which is known to the writer only from Fée's illustrations, was founded upon two Brazilian numbers collected by Glaziou (2459, 2817). It is referred by Christensen to *P. plebejum*, a species which it obviously resembles but which does not extend south of Panama, so far as the writer can find. Judging from the figures, *P. pleopeltidis* is more nearly related to certain of the forms included by Hieronymus in *P. leucosticton*.

9. *POLYPODIUM SEGREGATUM* Baker in Hook. & Baker, Syn. Fil. ed. 2. 510. 1874.

An Ecuadorean species, recognized by Christensen, founded upon plants collected in the Andes of Quito by Jameson. Not known to the writer.

10. *POLYPODIUM TÜRCKHEIMII* Christ, Bull. Herb. Boiss. II. 5: 254. 1905.

This, which was founded upon a single collection made by von Türckheim at Cubilquitz, Alta Verapaz, Guatemala, altitude 350 meters, and distributed by Capt. John Donnell Smith under no. 7721, is said by Christ to be exactly intermediate between *P. fallax* and *P. lindenianum*. It is unknown to the writer.

POLYPODIUM SQUAMATUM AND ITS ALLIES.

The grounds for referring *Lepicystis* to *Polypodium* have already been discussed briefly (p. 557). The present notes relate to the tropical American species with pinnatifid to pinnatisect lepidote fronds and more or less typical goniophlebioid venation. *Polypodium squamatum* and *P. lepidopteris* are representative of this group. While the extremes in both character and amount of scaly covering are not so great as in the group of free-veined lepidote species, the actual characters of scale structure are for the most part precise and sufficiently obvious to afford good recognition marks for the species. Of the 17 species here recognized 5 are described as new, and several, previously little known, are reinstated. Three doubtful species also are mentioned.

KEY TO THE SPECIES.

Rhizome scales small, roundish to triangular-ovate, brownish fuscous, very closely appressed, contiguous or subimbricate.

Segments 3 to 6 (rarely 8) mm. broad; lower surfaces brown from the presence of very numerous contiguous or imbricate scales.

Sori 8 to 14 pairs, deeply immersed, the upper surface of the segment strongly embossed.

Sori 20 to 30 pairs, nearly superficial.

Segments 9 to 13 mm. broad; lower surfaces green, bearing numerous distant minute roundish scales.

1. *P. myriolepis.*2. *P. sanctae-rosae.*3. *P. collinsii.*¹ Ind. Fil. 555. 1906.

- Rhizome scales larger, variously shaped (never roundish), with long-acuminate to subacicular tips, straight to oblique or subsquarrose, very widely imbricate. Fronds distant, the rhizome relatively slender and wide-creeping.
- Sori impressed, the upper surface of the segment strongly embossed.
- Fronds large, short-stipitate; segments mostly long-acuminate; sori medial, up to 2.5 mm. broad..... 4. *P. macrolepis*.
- Fronds much smaller, long-stipitate; segments rounded-obtuse; sori supra-medial, appearing submarginal, very much smaller..... 5. *P. polypodioides*.
- Sori superficial or nearly so..... 6. *P. thyssanolepis*.
- Fronds subfasciculate or, if somewhat apart, the rhizome (nos. 6 and 8 excepted) short-creeping and relatively very thick.
- Rhizome scales light brown or grayish, often with a sharply defined fuscous median area.
- Lamina bearing numerous contiguous or slightly imbricate, minutely denticulate scales beneath..... 7. *P. argentinum*.
- Lamina densely covered beneath with widely imbricate, fimbriate scales.
- Segments oblique, widely joined; dark stripes of rhizome scales nearly percurrent..... 8. *P. leucosporum*.
- Segments spreading, narrowly joined; dark median area of rhizome scales basal only..... 6. *P. thyssanolepis*.
- Rhizome scales dark castaneous to ferruginous, never sharply bicolorous.
- Pinnæ distant, membranous, often bipartite or tripartite..... 9. *P. tridens*.
- Pinnæ (segments) much closer, herbaceous to coriaceous, simple.
- Fronds long-stipitate; lamina suborbicular to ovate-oval..... 10. *P. lepidotrichum*.
- Fronds mostly very short-stipitate; lamina narrowly linear to linear-oblong.
- Lamina gradually long-attenuate in the basal half, many pairs of lower segments minute or even vestigial.
- Rhizome scales flaccid, mostly 4 to 7 mm. long, broadly linear-attenuate from a slightly broader base..... 11. *P. lepidopteris*.
- Rhizome scales more rigid, 2 to 3.5 mm. long, relatively broader at the base.

- Scales of the lower surface of segments very numerous, oblique, forming a thick covering; rhizome scales linear-deltoid, attenuate, bright castaneous, concolorous..... 12. *P. bombycinum*.
- Scales of the lower surfaces fewer, closely appressed, imbricate, forming a thin covering, pale castaneous, the margins lighter..... 13. *P. balaonense*.
- Lamina not gradually long-attenuate from the middle, but narrowed (if at all) rather abruptly in the basal third.
- Rhizome scales small, bristle-like, rigidly divergent, abruptly attenuate-acicular from a minute, roundish, appressed base..... 14. *P. pyrrolepis*.
- Rhizome scales larger, widely imbricate, oblique or appressed, either linear-deltoid and attenuate or ovate-acuminate and gradually long-attenuate.
- Sori superficial, the upper side of the segments not at all embossed..... 15. *P. rosei*.
- Sori somewhat impressed, the segments distinctly embossed above.
- Scales of the lower side of the segments very slender, imbricate, but forming a thin covering..... 16. *P. squamatum*.
- Scales of the lower side much broader, more numerous, widely imbricate, forming a very dense thick covering..... 17. *P. fimbriatum*.

1. *Polypodium myriolepis* Christ, Bull. Soc. Bot. Belg. 35: 224. 1896; Bull. Herb. Boiss. 4: 661. October, 1896.

Polypodium costaricanum Hieron. Bot. Jahrb. Engler 34: 530. 1904, not *P. costaricense* Christ, 1896.

Polypodium wendlandii Hieron. Hedwigia 44: 180. 1905.

TYPE LOCALITY: La Palma, Costa Rica, altitude 1,500 to 1,700 meters (*Tonduz* 9692).

DISTRIBUTION: Mountains of Costa Rica and western Panama, at 1,300 to 2,000 meters altitude.

The nomenclatorial history of this species has been rather confusing. In the first place, it was described as new twice by Christ in the same year under the same name, the order of publication probably being as above indicated. In

1904 it was again described, by Hieronymus, as *P. costaricanum*, for which the substitute name *P. wendlandii* was proposed by himself in 1905 because of an earlier *P. costaricense* Christ (1896). A careful reading of Hieronymus's description shows beyond doubt that his species is exactly *P. myriolepis* Christ.

In the meantime Christ had referred¹ specimens of his own *P. myriolepis* to *P. skinneri* Hook., a free-veined plant of Guatemala and Mexico properly known as *P. cryptocarpon*; and a few years later² he formally reduced *P. myriolepis* to that species, citing by number two Guatemalan specimens in Captain Smith's herbarium as agreeing exactly with Costa Rican material described as *P. myriolepis*. Both of these specimens are at hand, and neither of them represents *P. skinneri*. One (Lehmann 1487) is *P. platylepis* Mett., a free-veined species related to *P. furfuraceum* and *P. skinneri*; the other (Heyde & Lux 6288) is *P. sanctae-rosae* (Maxon) C. Chr., a species with regularly goniophlebioid venation resembling that of *P. myriolepis*, but a plant widely different in most other characters. Apparently *Polypodium skinneri* was unknown to Christ both then and at a later time when, in properly restoring³ *P. myriolepis* as a valid Costa Rican species, he nevertheless stated that Wercklé had collected a single specimen of true *P. skinneri* in Costa Rica. The writer has seen no specimen of "*P. skinneri*" from the region south of Guatemala, and seriously doubts the occurrence of this species (*P. cryptocarpon*) in Costa Rica.

As observed by the writer at the type locality and in western Panama *P. myriolepis* grows upon the trunks of living trees and on logs, and particularly about the bases of forest trees. The sinuous rhizomes are wide-creeping and only lightly attached to the substratum. Although covered with very numerous scales, they are perfectly smooth to the touch, owing to the fact that these are exceedingly minute, centrally peltate, and very closely appressed to the rhizome, their paler borders not at all projecting. A similar condition prevails in *P. collinsii*, a species very different in most particulars. In *P. sanctae-rosae* the rhizome scales are very much larger and vary from ovate to deltoid-ovate, as mentioned under that species. See also under *P. macrolepis*.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Forests of La Palma, alt. 1,450 to 1,550 meters, *Tonduz* 9692, 12570; *Maxon* 477. Cartago, alt. 1,300 meters, *Cooper* (J. D. Smith, no. 6047). Tablazo, alt. 1,900 meters, *Biolley* 56. Volcán de Poás, alt. 2,000 meters, *Alfaro* 115.

PANAMA: Humid forest along the Upper Caldera River, near Camp I, Holcomb's Trail, above El Boquete, Chiriquí, alt. 1,450 to 1,650 meters, *Maxon* 5709.

2. *Polypodium sanctae-rosae* (Maxon) C. Chr. Ind. Fil. Suppl. 62. 1913.

Goniophlebium sanctae-rosae Maxon, Contr. U. S. Nat. Herb. 13: 8. 1909.

TYPE LOCALITY: Near Santa Rosa, Baja Verapaz, Guatemala, altitude about 1,600 meters (*von Türckheim* II. 1607).

DISTRIBUTION: Mountains of southern Mexico and Guatemala, at 1,000 to 1,800 meters altitude.

A strongly characterized species which ought not to be confused readily with any other. From the Costa Rican *P. myriolepis* it differs obviously in its thicker and less widely creeping rhizomes, its more numerous and nearly superficial sori, and in the paleaceous covering of both rhizome and lamina. The

¹ In Pittier, Prim. Fl. Costar. 3: 17. 1901.

² Bull. Herb. Boiss. II. 5: 4. 1905.

³ Bull. Soc. Bot. Genève II. 1: 220. 1909.

rhizome scales are very many times larger than those of *P. myriolepis* and are ovate to deltoid-ovate, rather than suborbicular. The scales of the lower side of the lamina are acicular from a small subovate base and are so numerous and so widely imbricate as to wholly obscure the leaf surface; whereas those of *P. myriolepis* are either roundish or deltoid and acuminate, and, though so numerous and closely placed as to give a brownish appearance to the lamina, are not very widely imbricate. The sori of *P. sanctae-rosae* are only very slightly impressed; those of *P. myriolepis* are borne so deeply within the leaf tissue that the upper side of the leaf is conspicuously embossed, the pocket-like cavities in which the sori are sunk standing as slender raised prominences about 1 mm. high. These particulars are not unimportant, considering the former confusion, to which reference has already been made (under *P. myriolepis*).

A number of additional specimens have been received since *P. sanctae-rosae* was described, extending its known range, but not materially changing its characters. The Mexican plant cited below, determined by Liebmann as *P. squamatum*, is somewhat atypical, differing in its more distant sori.

The material in the U. S. National Herbarium is as follows:

GUATEMALA: The type and two additional specimens of the type collection, von Türckheim II. 1607. Cerro Redondo, Depart. Santa Rosa, alt. 1,050 meters, Heyde & Lux (J. D. Smith, nos. 4084, 6288). San Miguel Uspantán, Depart. Quiché, alt. 1,800 meters, Heyde & Lux (J. D. Smith, no. 3257). Volcán de Atitlán, Depart. Sololá, Kellerman 5789. Villa Nueva, Depart. Amatitlán, alt. 1,050 meters, Heyde & Lux (J. D. Smith, no. 4689). Fiscal, alt. 1,110 meters, Deam 6225. Near Santa María, Depart. Quetzaltenango, Kellerman 5571.

MEXICO: Hacienda de Mirador, February, 1843, Liebmann 111.

3. *Polypodium collinsii* Maxon, sp. nov.

PLATE 41.

Rhizome wide-creeping, sinuous, cordlike, wholly epigeal, at intervals freely radicose beneath (the rootlets brownish-tomentose, densely clustered), 6 to 8 mm. in diameter, irregularly sulcate, obtusely angled, smooth, but very densely covered with minute peltate imbricate scales, these suborbicular, 0.5 to 0.75 mm. broad, minutely fimbriate, reddish brown with fuscous centers, the cells short, subhexagonal, with sclerotic partition walls. Fronds apparently erect, 55 to 62 cm. long, the stipe slightly shorter than the lamina; stipe about 25 cm. long, 2.5 to 5 mm. in diameter, deeply and irregularly sulcate, smooth, very closely covered with minute brownish peltate scales like those of the rhizome; lamina 30 to 35 cm. long, 14 to 20 cm. broad, broadly oblong or oval, scarcely or not at all reduced at the base, pinnatisect, abruptly short-acuminate, the terminal segment about 7 cm. long, nearly conform, slightly larger than those next below; pinnae 14 to 18 pairs, slightly ascending, mostly 7 to 11 cm. long, 9 to 13 mm. broad, nearly linear, entire, the lower ones dilatate or slightly excised below and surcurrent, their own width apart, the middle and upper ones closer (the obtuse sinuses 4 or 5 mm. broad), fully adnate, slightly dilatate, all the pinnae broadest in their lower third, thence gradually narrower toward the long-attenuate slender apex; veins oblique, immersed, atypically goniolebioid, a single row of broad soriferous areoles borne upon each side of the elevated blackish costa, an incomplete minor row beyond, with numerous free excurrent branches; sori 14 to 22 pairs, large, partially immersed in the rigid coriaceous leaf tissue (the upper side of the pinna thus coarsely mamillate), borne midway between the midrib and margin, terminal upon the simple included veinlet of the areole or, commonly, the veinlet acutely once forked, both branches extending to the sorus. Lower leaf surface bearing numerous distant pale dark-

centered scales similar in structure to those of the rhizome, but more deeply fimbriate, mostly roundish, 0.4 or 0.5 mm. broad, sometimes deltoid, long-acuminate, and nearly 1 mm. long; scales of the upper surface minute, whitish, substellate, the divisions spreading and unequal.

Type in the U. S. National Herbarium, no. 574354, collected near Pantepec, Chiapas, Mexico, altitude 1,540 meters, January 16, 1907, by G. N. Collins and C. B. Doyle (no. 227). The specimen consists of two complete fronds attached to portions of the rhizome.

Polypodium collinsii has no especially close allies. The characters offered by its smooth, sinuous rhizomes, closely appressed, minute, peltate rhizome scales, and very minute, roundish scales of the under side of the lamina suggest a relationship with *P. myriolepis*; but it differs from *P. myriolepis* wholly in gross morphology. The scales of the under side of the lamina are numerous, but so far apart that the yellowish green leaf surface is not obscured. In dimensions and leaf shape only *P. collinsii* recalls *P. lepidotrichum*; but that is a species with subfasciculate fronds and very long, nearly capillary, ferruginous rhizome scales, and with at least part of the imbricate or contiguous scales of the lower side of the lamina long-aristate from a rounded base.

EXPLANATION OF PLATE 41.—The larger of the two type fronds of *Polypodium collinsii*. Scale $\frac{1}{2}$.

4. *Polypodium macrolepis* Maxon, sp. nov.

Rhizome epiphytic, wide-creeping, sinuous, with a few short or elongate branches, radicose at intervals (the rootlets brownish-tomentose, freely branched), 3 to 5 mm. in diameter, flattish in drying, very firm, densely covered with straight, elongate, widely imbricate scales, these 3 to 4 mm. long, 0.65 to 0.85 mm. broad, narrowly deltoid-oblong, long-attenuate to a subflexuous tip, bicolorous, the broad median portion castaneous, the cells of the basal part mostly short, hexagonal, thick-walled, with closed or concealed lumina, those of the middle and apical part gradually longer and paler, at length narrowly linear and acute; borders pale, the cells in many rows, mostly linear, indistinct; margins deeply denticulate, the teeth bifid, variously curved. Fronds distant, rigid, ascending or erect, 20 to 40 cm. long, the stipe much shorter than the lamina; stipe 4 to 10 cm. long, 1 to 2 mm. thick, flattish, often tortuous, smooth, closely paleaceous, the scales mostly like those of the lower side of the lamina; lamina 13 to 28 cm. long, 5 to 9 cm. broad, oblong to lanceolate-oblong, not or scarcely reduced at the base, here fully pinnate, nearly so throughout, long-caudate, the apical pinnae long, abruptly discontinuous; rachis stout, paleaceous beneath like the stipe; pinnae 15 to 20 pairs, slightly ascending, 3 to 5 cm. long, 4 to 6 (7) mm. broad, linear to linear-lanceolate, acute or mostly long-acuminate, entire, the 2 or 3 lower pairs distant, broadly excavate to the midrib below, slightly constricted above; middle pinnae closer, more oblique, fully adnate, slightly decurrent, faintly joined, the sinuses obtuse or broadly acutish; midveins not elevated above, slightly so beneath; veins oblique, deeply immersed, atypically goniophleboid, a row of elongate-oval areoles extending nearly to the margin, bordered by an incomplete second row of small alternate areoles, the latter without included veins, a few veinlets excurrent; sori 5 to 9 pairs, 1.5 to 2.5 mm. in diameter, round to oval, not contiguous, medial, impressed (the upper surface distinctly mamillate), terminal upon the very oblique, usually simple, single, included veinlet of the areoles; sporangia glabrous, the annulus usually 18-celled; spores diplanate, granulose. Leaf tissue rigidly spongiouse-herbaceous, dull green above, bearing numerous small distant peltate scales, these roundish or deltoid-acuminate, with minute brownish centers, the broad white borders fimbriate-denticulate; under surface closely paleaceous, the scales mostly con-



POLYPODIUM COLLINSII MAXON

tiguous, orbicular to ovate-deltoid, averaging 0.6 mm. broad, peltate, brownish, with delicately toothed yellowish borders.

Type in the U. S. National Herbarium, no. 675627, from tree trunks and logs in forest near Camp Aguacatal, eastern slope of Chiriquí Volcano, Panama, at an altitude of 2,100 to 2,300 meters, March 10 to 13, 1911, by William R. Maxon (no. 5278).

The specific name *macrolepis* is chosen particularly by way of emphasizing the contrast afforded by the rhizome scales of this species to those of its nearest relative, *P. myriolepis* Christ, with which species it might casually be confused. From *P. myriolepis* it differs, nevertheless, not only in its elongate, widely imbricate rhizome scales, which are many times larger and of wholly different character (as described elsewhere), but also in its decidedly fewer, more oblique, and abruptly discontinuous segments and in its very much larger and less deeply immersed sori. In addition, it occupies a higher altitudinal range.

Besides the type, the following specimens of *P. macrolepis* are in the National Herbarium:

PANAMA: Cuesta Grande, eastern slope of Chiriquí Volcano, alt. 2,600 to 2,900 meters, *Maxon* 5312.

COSTA RICA: Volcán de Turrialba, alt. 2,500 meters, *Alfaro* 55.

5. *Polypodium polypodioides* (L.) Hitchc. Rep. Mo. Bot. Gard. 4: 156. 1893.
Acrostichum polypodioides L. Sp. Pl. 1068. 1753.
Acrostichum ferruginosum L. Sp. Pl. ed. 2. 1525. 1763.
Polypodium incanum Swartz, Prodr. Veg. Ind. Occ. 131. 1788.
Polypodium ceteraccinum Michx. Fl. Bor. Amer. 2: 271. 1803.
Polypodium velatum Schkuhr, Krypt. Gewächsh. 1: 188. pl. 11b. 1809.
Marginaria minima Bory, Dict. Class. 10: 177. 1826.
Polypodium squalidum Vell. Fl. Flum. 11: pl. 76. 1827; Arch. Mus. Nac. Rio Janeiro 5: 449. 1881.
Marginaria incana Presl, Tent. Pter. 188. 1836.
Goniophlebium incanum J. Smith, Journ. Bot. Hook. 4: 56. 1841.
Lepicystis incana J. Smith, Lond. Journ. Bot. 1: 195. 1842.
Polypodium microlepis Fée, Gen. Fil. 238. 1852; Mém. Foug. 6: 8. pl. 6. f. 2. 1854.
Polypodium incanioides Fée, Mém. Foug. 8: 88. 1857.
Goniophlebium ceteraccinum Fée, Crypt. Vasc. Brés. 1: 107. 1869.
Goniophlebium microlepis Fée, Crypt. Vasc. Brés. 1: 107. 1869.
Marginaria polypodioides Tidestrom, Torreya 5: 171. 1905.
Polypodium mesetae Christ, Bull. Herb. Boiss. II. 5: 49. 1905.

TYPE LOCALITY: "Habitat in Virginia, Jamaica."

DISTRIBUTION: Maryland and Kentucky to southern Missouri, southward to Florida and Texas and throughout tropical America generally (including the West Indies) to Argentina and Chile.

An ubiquitous species throughout a large part of its wide range, variable in most characters, but even its different forms too distinctive to permit its being confused with other species to any extent. The venation varies from goniophlebioid to that of *Eupolypodium*, and this in plants otherwise essentially identical, ranging from the southeastern United States through Mexico, Central America, and the West Indies to Brazil and Bolivia. Most plants from the regions just mentioned have the scales of the under side of the lamina varying from roundish to deltoid-ovate and acuminate or even attenuate, the roundish type perhaps predominating in plants of northerly distribution; but in certain small forms from Mexico and Costa Rica the scales are much more

slender, the extreme condition being found in a few individuals from Sonora and Chihuahua in which they are very densely imbricate and exactly acicular from a relatively short ovate base. A similarly wide variation is noted in the scales of the upper surface of the segments. These, though small and scattered, are easily evident and usually persistent in most tropical American specimens; in United States plants, however, the segments are nearly or quite devoid of any scales above. The rhizome scales are more nearly constant, but here also there is observed a very considerable variation in size, form, and color, which is not altogether dependent upon age or condition.

Another departure is found in the uniformly small plants of southern Brazil, Uruguay, and Argentina, which, though of rather distinct appearance, apparently do not merit recognition as a separate species, although twice given a name. The South African *P. eckloni* Kunze, also, though recognized by Mettenius, is very questionably distinct.

A more or less critical examination of the very large series of specimens at hand, moreover, shows plainly that we have in *P. polypodioides*, as in *Asplenium monanthes* L., previously discussed,¹ a genuinely polymorphic species, composed of numerous elements so closely interrelated and differing among themselves (often regionally) in such minute and variable degree that segregation is scarcely justifiable. The general character of the species is too unmistakable and the many forms are too obviously parts of a single species complex, their peculiarities often clearly due to unusual conditions of habitat or season.

One almost invariable characteristic of *P. polypodioides*, which will easily distinguish this species from *P. thyssanolepis*, its nearest ally, is found in the more or less immersed sori. These are always somewhat impressed, at least, and in a great majority of mature specimens they are so deeply set in pocket-like depressions of the leaf tissue that the upper side of the segment is strongly embossed, the location of the sori beneath being very plainly indicated by the double row of rounded protuberances.

6. *Polypodium thyssanolepis* A. Br.; Klotzsch, Linnaea 20: 392. 1847.

? *Polypodium lanuginosum* Nees, Linnaea 19: 683. 1847, not Schrad. 1824, nor Vell. 1827.

Polypodium rhagadiolepis Fée, Gen. Fil. 237. 1852.

Goniophlebium rhagadiolepis Fée, Mém. Foug. 7: 62. 1854.

Goniophlebium thyssanolepis Moore, Ind. Fil. 396. 1862.

Polypodium aspidiolepis Baker, Journ. Bot. Brit. & For. 25: 26. 1887.

Polypodium purpusii Christ, Bull. Herb. Boiss. II. 7: 416. 1907.

TYPE LOCALITY: Colombia.

DISTRIBUTION: Arizona; general throughout Mexico and Central America; less common in the Andine region of South America, but occurring from Venezuela to Peru and Bolivia; also in Jamaica; ascends to nearly 4,000 meters.

ILLUSTRATION: Fée, Mém. Foug. 7: pl. 19. f. 3 (as *G. rhagadiolepis*).

Polypodium thyssanolepis, described originally from Colombian specimens collected by Moritz (no. 22) and Otto (no. 896), is a well-known species and is here regarded in its usual and accepted sense. Its taxonomic history concerns principally the following names:

(1) *Polypodium rhagadiolepis* Fée. As stated long ago by Kuhn this name, given to specimens collected by Linden in "Cuba and Mexico," applies to *P.*

¹ Contr. U. S. Nat. Herb. 17: 150-152. pl. 1. 1913.

thyssanolepis. The confusion of locality data for certain of Linden's specimens has already been mentioned.¹ Fée's illustration well represents this species.

(2) *Polypodium aspidiolepis* Baker. An examination of ample material of this form, which seems to be restricted to Costa Rica, shows that not only in general proportions and vestiture but even in the minute structure of its rhizome and lamina scales it is exactly *P. thyssanolepis*. It occurs with the ordinary form of the species and differs from that only in its bipinnatifid condition, the dissection of the pinnae being accompanied by a partial loss of areolation, as might be looked for. This relationship was recognized by Christ, who fully described this state from Costa Rica as *P. thyssanolepis* var. *bipinnatifidum*,² calling attention to *P. aspidiolepis* as being "according to description, an analogous plant."

(3) *Polypodium purpusii* Christ. This was described from specimens cultivated in Darmstadt by Dr. J. A. Purpus, the original plants having been collected at Pachuca, Mexico, by Dr. C. A. Purpus, in 1904, and is known to the writer from several fronds courteously forwarded to Washington by the former. These represent merely a juvenile condition of typical *P. thyssanolepis*.

The identity of *P. lanuginosum* Nees, mentioned by Christensen as a doubtful synonym of *P. thyssanolepis*, is problematical. It is not even apparent that it belongs in *Polypodium*. Moreover, the determination is not of great importance, since, as noted in the synonymy, the species name *lanuginosum* would be unavailable for use in this connection.

Polypodium thyssanolepis, though variable in size, is not readily confused with other species. Christensen ascribes it to Cuba, but that record probably results from the doubtful data of Linden's type of *P. rhagadiolepis*. The following specimens are in the U. S. National Herbarium:

ARIZONA: Conservatory Canyon, Huachuca Mountains, July to September, 1882, *Lemmon*. Ramsey Canyon, Huachuca Mountains, August 23, 1910, *Goodding* 761.

MEXICO: Cold cliffs, rocky hills near Chihuahua, *Pringle* 443. Pachuca, Hidalgo, *Orcutt* 3933; cultivated specimens, originally from the same locality, *Purpus* (type collection of *P. purpusii*). Near El Salto, Hidalgo, on calcareous cliffs, *Rose* 7057. Near Ixmiquilpan, Hidalgo, *Rose* 9042. Barranca de l'Alseseca, Puebla, June 12, 1912, *Arsène*. Alta Suz, Puebla, *Purpus* 2688. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, *Parry & Palmer* 971. Santiago Papasquiario, Durango, *Palmer* 458 in 1896. Near Durango, *Palmer* 885 in 1896. Otinapa, Durango, *Palmer* 359 in 1906. Orizaba, Veracruz, *Hitchcock; Seaton* 99; *J. G. Smith* 82. Near Jalapa, Veracruz, *Rose* 6361. Tonilá, Colima, *Jones* 506. Amecameca, *Purpus* 1825. Río Blanco, near Guadalajara, Jalisco, *Palmer* 730 in 1886; *Rose* 7503. Sierra Madre, west of Bolaños, Jalisco, *Rose* 3710. Near Chapala, Jalisco, *Rose* 7670, 7393. Near Plateado, Zacatecas, *Rose* 2797. Sierra Madre, Zacatecas, *Rose* 2399. Several localities in Valley of Mexico, *J. G. Schaffner* 63; *Bourgeau* 254, 2780; *Orcutt* 3647; *Rose* 6468, 8274, 9462, 11036. Eslaba, Federal District, alt. 2,400 meters, *Pringle* 11801. Toluca, Mexico, *Rose* 6797. Tultenango, Mexico, *Rose* 7856. Las Naranjas and San Luis, Oaxaca, *Purpus* 3154.

GUATEMALA: Depart. Huehuetenango, *C. & E. Seler* 2607.

COSTA RICA: Cartago, alt. 1,300 meters, *Alfaro* (J. D. Smith, no. 6955); *Beyer* 21; *Biolley* 82; *Biolley* 85 (bipinnatifid form). San Rafael de Cartago, alt. 1,600 meters, *Pittier* 9721 (including bipinnatifid form).

¹ Pages 563, 564.

² Bull. Soc. Bot. Belg. 35: 223. 1896.

Valley of the Rancho Redondo, alt. 2,000 meters, *Pittier* 1120. Alto de Ochomogo, alt. 1,550 meters, *Tonduz* 10394 (bipinnatifid form). Without locality, *Wercklé* (bipinnatifid form, ex herb. Christ). Without locality, *Cooper*.

JAMAICA: Near or just below Cinchona, alt. 1,500 meters or less, *Clute* 144; *Hart* 51; *Underwood* 1629, 3245.

COLOMBIA: Near Medellin, *Charetier* 40.

VENEZUELA: Campo Alegre, *Eggers* 13416. Without locality, *Fendler* 252.

PERU: Without locality, *Ruiz* 4549. Hacienda Limón, *Osgood* 64.

BOLIVIA: Soratá, alt. 3,900 meters, *Rusby* 344.

7. *Polypodium argentinum* Maxon, sp. nov.

Rhizome epigeal, creeping, 1.5 to 2 mm. in diameter, copiously radlose beneath, closely covered with appressed widely imbricate scales, these 2 to 2.5 mm. long, oblong to narrowly deltoid-oblong, acute or acuminate, attached above the rounded base, pale brown in mass, bicolorous singly, the narrow median portion falling short of the apex, subopaque (the cells linear-oblong, acutish, with reddish brown outer walls, the partition walls not strongly sclerotic), the wide borders pale, almost transparent, each consisting of 3 to 5 rows of oblique, short or transversely linear, thin-walled cells, the margins subentire, minutely erose-crenulate. Fronds several, 8 to 10 cm. long, erect or arcuate, subfasciculate, borne 2 to 4 mm. apart; stipes 2.5 to 4 cm. long, pale brown, flattish, 1 to 1.2 mm. broad, narrowly bisulcate upon the anterior face, scantily paleaceous, the scales subappressed; lamina lance-oblong, 4 to 6.5 cm. long, 1.5 to 2.5 cm. broad above the base, pinnatifid throughout to within 2 mm. of the broad concealed costa; segments 8 to 10 pairs below the acuminate subcaudate apex, slightly ascending, the lower and middle ones nearly equal, oblong to linear-oblong, 1 to 1.5 cm. long, 3 to 4 mm. broad, rounded-obtuse, close, the sinuses linear, appearing broader from the contraction of the strongly coriaceous leaf tissue in drying, the margins entire, closely revolute; apical segments gradually shorter, the uppermost ones rounded-triangular; midveins of the segments impressed above, partially concealed beneath; veins of larger segments about 7 pairs, mainly joined, subgoniophlebioid, forming a single series of broad oblique areoles upon either side, these extending nearly to the margin, with several very short excurrent branches and a single included veinlet, the latter fertile at its extremity; sori 5 to 7 pairs, large, nearly medial, slightly concealed by the scales of the lower surface, these numerous, contiguous or subimbricate, pale brown, about 1 mm. long, broadly deltoid-ovate, acute or acuminate, peltate, firmly attached above their base, clathrate, nearly homogeneous, the cells mostly short, subhexagonal, with sclerotic yellowish brown partition walls and transparent outer walls, the outer 1 or 2 rows transversely linear or linear-oblong, thin-walled, the margin of the scale minutely denticulate.

Type in the U. S. National Herbarium, no. 691518, collected from rock clefts in the Sierra Ventana, Province of Buenos Aires, Argentina, March 3, 1881, by P. G. Lorentz.

The type specimens consist of two plants, received from Berlin, determined as *Lepicystis macrocarpa*. They are, however, far removed from *P. pycnocarpum* (*P. macrocarpum* Presl), not only by their widely different scale structure but likewise by their gross morphology and subgoniophlebioid venation. From small plants of true *P. tweedii* they are immediately distinguished by their subgoniophlebioid venation, entire segments, coriaceous (not membranaceous) texture, and nonrepand rhizome scales, which, also, are of different structure. Although placed here among the species with anastomosing veins *P. argentinum* is nevertheless nearest related to the species of the *plebejum*

group, from all of which it differs in its mostly closed venation and in scale structure.

This is not improbably the species described and illustrated by Hooker and Greville as *Pleopeltis pinnatifida*, upon specimens collected upon the Cerro del Morro, San Luis, Argentina, by Gillies. These have not been examined by the writer. They came from the region of *P. argentinum* and, as illustrated, agree closely with the Lorentz specimens in general appearance. Their venation and minute scale characters are not described. *Pleopeltis pinnatifida* can, therefore, be cited at present only as a probable synonym of *P. argentinum*. The earlier *Polypodium pinnatifidum* of Gilibert,¹ 1792, would in any event preclude the transfer of *Pleopeltis pinnatifida* to *Polypodium* for this plant.

8. *Polypodium leucosporum* Klotzsch, *Linnaea* 20: 404. 1847.

Pleopeltis leucospora Moore, *Ind. Fil.* LXXVII. 1857.

Lepicystis leucospora Diels in *Engl. & Prantl, Pflanzenfam.* 1⁴: 324. 1897.

TYPE LOCALITY: Mérida, Colombia (*Moritz* 306).

DISTRIBUTION: Mountains of Colombia and Venezuela.

This is a peculiar species which has been redescribed by Mettenius,¹ Hooker,² and Hooker and Baker,³ always rather inadequately and without indication of its true affinities. Thus Diels,⁴ including it in the genus *Lepicystis*, places it in his section *Phlebolepicystis*, as a member of the *P. lanceolatum* group, which is essentially the alliance suggested by Mettenius. It seems to the writer that, notwithstanding the subphlebodioid venation, the relationship is rather with *P. thyssanolepis*. The single specimen in the U. S. National Herbarium (*Lehmann* 580, from Pasto, southern Colombia, altitude 2,544 meters, February 28, 1881) was in fact so determined by Hieronymus,⁵ an error which though obvious enough is accounted for by the general similarity of these two species and the fact that the Lehmann plants of *P. leucosporum* are more regularly pinnatifid and more symmetrical than those of the type collection. The latter are known to the writer from a sketch, and from a single slightly lobate frond in the Underwood Herbarium, which in scale and sorus characters agree essentially with the Lehmann plants, differing only in the shape of the frond. Diels has suggested that *P. leucosporum* is perhaps an abnormal state of *P. lanceolatum* L., a simple-leaved species which does occasionally produce lobate fronds (the variety *elizabethae* Jenman);⁶ but this supposition is readily disproved by an examination of the rhizome and lamina scales.

Chiefly from the new Lehmann material, therefore, *P. leucosporum*, which is believed normally to have regularly and deeply pinnatifid fronds, may be redescribed as follows:

Rhizome short-creeping, the few branches 2 to 5 cm. long, about 2 mm. in diameter, radicose beneath, densely covered with oblique or laxly appressed, widely imbricate scales, these 3 to 5 mm. long, narrowly oblong-lanceolate, long-attenuate, attached far above the rounded base, light brown in mass, bicolorous singly, the dark brown lance-attenuate median line extending nearly to the apex (the cells of this short to linear-oblong, subquadrate to hexagonal, with strongly sclerotic dark brown partition walls and hyaline outer walls, an

¹ *Abh. Senckenb. Ges. Frankfurt* 2: 89. 1856.

² *Sp. Fil.* 5: 76. 1864.

³ *Syn. Fil.* 362. 1868.

⁴ *Engl. & Prantl, Pflanzenfam.* 1⁴: 324. 1897.

⁵ *Bot. Jahrb. Engler* 34: 531. 1905.

⁶ *Bull. Bot. Dept. Jamaica* II. 4: 199. 1897.

elongate lumen invariably present), the whitish borders as broad or broader, composed of several rows of irregular, transparent, thin-walled, mostly transverse cells, the outermost row with their distal ends projecting, connivent in pairs, the free tips deeply bifid, the margin of the scale thus irregularly lacerate-denticulate. Fronds several, 5 to 10 mm. apart, rigidly erect, 15 to 23 cm. long, the stipe longer than the lamina; stipe 10 to 13 cm. long, 1.2 to 1.5 mm. thick, dull grayish brown, subterete, faintly bmarginate, deciduously paleaceous; lamina 8 to 10.5 cm. long, sometimes linear and nearly simple, 0.5 to 1.5 cm. broad, with a few low or irregularly elongate lobes, but normally deltoid to ovate, 3 to 4.5 cm. broad, abruptly acuminate and conspicuously long-caudate, very deeply pinnatifid or pinnately parted, densely paleaceous beneath, minutely and scantily so above, the principal segments (4 to 6 pairs) mostly less than their own width apart, 1 to 2.5 cm. long, 5 to 8 mm. broad, oblong to linear-oblong, rounded at the apex, decurrent, joined by a costal wing, this about 1 mm. broad upon each side of the stout, partially concealed, brownish rachis at the base, gradually very much broader toward the apex, the uppermost segments giving way abruptly to the broad crenations of the elongate apex; venation wholly concealed, goniophleboid or subphleboid, a row of large oblique elliptical areoles extending nearly to the margin, the few excurrent ultimate veinlets free or variously joined: sori 5 to 8 pairs, very large, dark brown, broadly oval, nearly medial, partially concealed by the scales, terminal upon one or both of the branches of the once forked included veinlet, or the fertile veinlet simple. Leaf tissue opaque, rigidly herbaceo-coriaceous; scales of the lower surface very numerous, widely imbricate, suborbicular to deltoid-ovate, 1 to 2 mm. long, yellowish brown in mass, with small dark brown centers, irregularly denticulate, the narrow teeth bipapillate at their extremity; scales of the upper surface similar but paler, narrower, and with much longer teeth.

Though confused with *P. thyssanolepis*, which is certainly a close ally, *P. leucosporum* differs widely in gross characters from adult specimens of that species in its pinnately parted, conspicuously long-caudate lamina and in its oblique, long-decurrent segments. As to minute characters, both the rhizome and lamina scales have the marginal teeth about half the length (or less) of those of *P. thyssanolepis*; and, under the microscope, the dark median area of the rhizome scales is seen to extend nearly to their slender tip, instead of being confined to the basal portion of the scale. The broadly joined segments of the lamina are sufficiently distinctive.

Aside from the specimens discussed above, *P. leucosporum* is known from at least two other collections: Colombia, *Burschel*, mentioned by Hooker; and Venezuela, *Fendler 251*, listed by Eaton.¹ Neither of these has been seen by the writer.

9. *Polypodium tridens* Kunze, *Farrnkr.* 1: 23. 1840.

TYPE LOCALITY: Galápagos Islands, Ecuador (*Cuming 112*).

DISTRIBUTION: Galápagos Islands.

ILLUSTRATION: Kunze, *op. cit.* *pl. 13. f. 1.*

This species which was known to its describer only from a single frond, is the subject of a subsequent note by Hooker,² who, basing his conclusions upon more ample material, was inclined to look upon the fronds with forked or tripartite pinnæ as atypical, the simply pinnate fronds representing the normal. The tendency toward bipartite or tripartite pinnæ seems, however, to be nor-

¹ Mem. Amer. Acad. n. ser. 8: 200. 1860.

² Hook. Sp. Fil. 4: 211. 1862.

mal. Of the single specimen of a different collection, cited below, two of the three fronds have simple pinnæ, while those of the third range from simple to subequally bipartite. This specimen has an incomplete rhizome which may be described as follows: Woody, horizontal, about 4 mm. in diameter, freely radice on all sides, closely beset with rigid, oblique, imbricate scales, these 1.5 to 2 mm. long, narrowly deltoid, attenuate-acuminate, opaque, very dark-castaneous by transmitted light (otherwise appearing fuscous), with a paler, mostly narrow border of 3 to 6 rows of minute, short to irregularly oblong, subquadrate or polygonal cells, these with pale-castaneous partition walls and nearly transparent outer walls. The scales of the under side of the lamina have precisely the structure indicated by Kunze's illustrations.

Only the following specimen, collected during the cruise of the Bureau of Fisheries steamer *Albatross*, is at hand:

ECUADOR: Charles Island, Galápagos Group, April 8, 1888, *Leslie A. Lee*.

10. *Polypodium lepidotrichum* (Fée) Maxon.

Goniophlebium lepidotrichum Fée, Mém. Foug. 8: 93. 1857.

TYPE LOCALITY: Orizaba, Mexico (*Schaffner* 451).¹

DISTRIBUTION: State of Veracruz, Mexico.

This species, though strongly marked and represented in herbaria by at least two widely distributed numbers (viz, *Bourgeau* 2883 and *Pringle* 5586), has been passed by for many years, partly because of inadequate material, and possibly also because of obvious deficiencies in the original description which made it difficult of application. If the two collections above mentioned are correctly referred to this species, the type specimen of which has not been seen, the number of segments (about 40 pairs) stated by Fée is certainly incorrect, the actual number being far less; but in most particulars his description exactly fits these plants. The fronds are 30 to 60 cm. long and subfasciculate, the stipe a little shorter than the suborbicular to ovate-oval lamina. The very thick, creeping rhizome is covered on all sides with a closely packed mass of slender, silky, ferruginous scales, these 4 to 6 mm. long, straight, nearly acicular, tapering gradually from the slightly rounded base, which is 0.5 to 0.7 mm. broad. The rhizome scales of no other species of the whole group of *P. squamatum* and *P. lepidopteris* approach these in slenderness.

The lamina is 20 to 35 cm. long, 16 to 20 cm. broad and embraces 10 to 17 pairs of linear, acute, entire pinnæ, the fully fertile pinnæ being 6 to 8 mm. broad, the sterile ones sometimes 15 mm. broad in their lower third. The lower surface bears numerous adjacent or contiguous, minute, closely appressed scales (these 0.6 to 0.7 mm. broad, with dark centers and broad, fimbriate, whitish margins), many of them with a long hairlike tip. The scales of the upper side are fewer, more deeply lacerate, and with a greatly elongate, setaceous tip, being more like those which thickly but laxly clothe the rachis and sulcate stipe.

In dimensions and general form of lamina only *P. lepidotrichum* suggests *P. collinsii*, with which species it is elsewhere compared. From *P. squamatum*, with which it was merged by Fournier, it differs widely in habit and in form of lamina, and wholly in the character of its rhizome scales.

¹*Schaffner* 198, from Córdoba, is also cited. This number appears to have been mixed with *Schaffner* 197, the type of *Goniophlebium pyrrolepis* Fée. At least, no. 198 at Kew, as represented by fragments in the Underwood Herbarium, is very clearly *P. pyrrolepis*, according to description and by comparison with very complete material of that species.

The following specimens are in the U. S. National Herbarium:

MEXICO: Region of Orizaba, Veracruz, *Bourgeau* 2883; *Pringle* 5586 (2 sheets); *Purpus* 5093; *Mohr*; *Chas. G. Wood*.¹ Jalapa, Veracruz, *Orcutt* 2839.

11. *Polypodium lepidopteris* (Langsd. & Fisch.) Kunze, Linnaea 13: 132. 1836.

Acrostichum lepidopteris Langsd. & Fisch. Icon. Fil. 1: 5. 1810.

Polypodium sepultum Kaulf. Enum. Fil. 104. 1824.

Polypodium hirsutissimum Raddi, Opusc. Sci. Bologna 3: 286. 1819; Pl. Bras. 1: 17. 1825.

Polypodium rufulum Presl, Del. Prag. 1: 164. 1822.

Polypodium tricholepis Schrad. Gött. Anz. Ges. Wiss. 1824: 867. 1824.

Polypodium raddii Desv. Mém. Soc. Linn. Paris 6: 232. 1827.

TYPE LOCALITY: Island of Santa Catharina, Brazil.

DISTRIBUTION: Brazil and Uruguay.

ILLUSTRATIONS: Langsd. & Fisch. op. cit. pl. 2 (as *A. lepidopteris*); Raddi, Pl. Bras. 1: pl. 26 (as *P. hirsutissimum*).

The above names are applied variously to several forms which, taken together, constitute a single species, *P. lepidopteris*, as currently understood. That this concept is erroneous seems probable, if we may judge from the diverse forms included. Material at hand is too incomplete, however, to more than suggest probable lines of segregation, and the critical revision of this species is accordingly deferred until it may be possible to study a sufficiently large series of complete individual plants.

12. *Polypodium bombycinum* Maxon, sp. nov.

Rhizome short-creeping, with numerous short closely clustered branches, these stout, 3 to 5 mm. in diameter, freely radice, densely and divaricately paleaceous, the scales 3 to 4 mm. long, 0.7 to 0.8 mm. broad at the base, very gradually narrowed to a long linear-attenuate apex, castaneous, concolorous, the cells mostly very large, narrowly hexagonal to linear and sharp-pointed, with very strongly sclerotic partition walls and much thinner, slightly paler outer walls (lumina very narrow or wanting); margins of the scales beset with numerous straight or curved, divergent, acicular, cilia-like teeth, these mostly 0.12 to 0.17 mm. long, slightly cleft at the tip. Fronds several, stiffly erect, 5 to 7 mm. apart, nearly exstipitate (the stipe 0.3 to 2 cm. long), 17 to 45 cm. long, very densely appressed-paleaceous throughout; lamina subpinnatisect, linear to very narrowly linear-oblongate, 2 to 4.5 cm. broad at the middle, attenuate to the acute, abruptly caudate apex, very gradually long-attenuate to the base, the 4 to 10 lowermost pairs of segments broadly deltoid, 2 to 5 mm. long; rachis stout, divaricately paleaceous, the scales of the lower side similar to those of the rhizome but shorter, narrower, and with relatively longer teeth; segments 35 to 60 pairs, divergent, about their own width apart, mostly 1 to 2.3 cm. long, 2.5 to 4 mm. broad, oblong to linear-oblong, acute, distinctly dilatate (with a minute distal auricle), connected by a faint wing, conspicuously paleaceous upon both surfaces; scales of the upper side yellowish white, numerous, rigid, imbricate, 3 to 4 mm. long, almost capillary, with a few long ascending teeth in the narrow basal part; scales of the lower side ferruginous, very numerous, oblique, densely imbricate, 3 to 4 mm. long, stiffly capillary-acicular from a minute few-celled deeply stellate base, minutely, obliquely, and distantly

¹ From a large specimen, in cultivation at the New York Botanical Garden, which was raised from a small plant taken from a tuft of a living orchid (*Gongora truncata*) received from Mr. Charles G. Wood, Orizaba, in 1903.

toothed; venation wholly goniophleboid, a single row of oblique broadly elliptical areoles extending nearly to the margin, the few veinlets short and obliquely excurrent, free or forming an incomplete minor row of areoles; sori about 10 pairs, small, inframedial, terminal upon the short simple included veinlet, nearly concealed by the scales of the segment. Leaf tissue dull green, rigidly coriaceous-herbaceous.

Type in the U. S. National Herbarium, no. 833131, collected from trees and rocks, "Boqueron del Río Dagua," western Cordillera, Province of Cali, Colombia, altitude 300 to 1,000 meters, by F. C. Lehmann (no. 7666).

Related to *P. lepidopteris*, under which species it was listed by Hieronymus,¹ but differing widely not only in the form and cellular structure of its rigid (not flaccid) rhizome scales but also in the form and structure of the very abundant scales of the under surface of the lamina. The latter are exceedingly numerous and so closely placed and rigidly appressed-imbricate that their bases are completely obscured, the appearance being that of a very dense silky covering.

A single additional collection of *P. bombycinum* is in the National Herbarium:

PANAMA: Vicinity of Cana, Province of Panama, alt. 1,050 meters, June 3, 1912, Goldman 1915.

13. *Polypodium balaonense* Hieron. Bot. Jahrb. Engler 34: 529. 1905.

TYPE LOCALITY: Near Balao, Ecuador (Eggers 14286).

DISTRIBUTION: Ecuador.

This excellent species, which is undoubtedly the one mistakenly described by Sodiro² as *P. lepidopteris*, is briefly but adequately distinguished by Hieronymus. The scales of the rhizome may be further described as follows: 2.5 to 3.5 mm. long, light castaneous with paler borders, exactly ovate in the lower half, thence narrowly linear-attenuate, the borders throughout irregularly denticulate (closely so in the basal part), the teeth slender, sometimes connivent, deeply cleft at their tip, the two divisions often unequal; median cells of the basal portion mostly elongate-hexagonal, subopaque (open lumina mostly wanting), the partition walls very strongly sclerotic, with interior, transverse, elongate, moniliform thickenings.

The following specimens are in the U. S. National Herbarium:

ECUADOR: Balao, growing upon forest trees, January, 1892, Eggers 14286 (the type collection). Near El Recreo, Province of Manabi, Eggers 14873.

14. *Polypodium pyrrolepis* (Fée) Maxon.

Goniophlebium pyrrolepis Fée, Mém. Foug. 8: 94. 1857.

TYPE LOCALITY: Huatusco, Veracruz, Mexico (W. Schaffner 197).

DISTRIBUTION: Apparently confined to the State of Veracruz, Mexico.

This species, which was most injudiciously reduced to *P. lepidopteris* by Fournier,³ and is so referred also in Christensen's Index Filicum, is represented in the National Herbarium by an excellent series of specimens, which show it to be an ally of *P. squamatum* rather than of *P. lepidopteris*. It differs from *P. lepidopteris* in its longer stipes, in its broader, nonattenuate laminae, and in the form and structure of its rhizome scales (these divergent, rigidly bristle-like in general appearance, 2.5 to 4.5 mm. long, abruptly attenuate-acicular from a small roundish or narrowly ovate base and very highly colored, the median cells nearly opaque, the strongly sclerotic partition walls apparently somewhat

¹ Bot. Jahrb. Engler 34: 529. 1905.

² Crypt. Vasc. Quit. 361. 1893.

³ Mex. Pl. Crypt. 84. 1872.

thicker than the castaneous outer walls). It resembles *P. squamatum* somewhat in leaf shape, but it is a much more rigid plant, with stout, deeply sulcate, divaricately paleaceous stipes and more numerous pinnae, these with conspicuous, rigid, wide-spreading, subcapillary, fulvous scales. It is related also to *P. rosei*, but differs widely in its scales, as also in stature and general appearance. The wide-creeping, branched, woody rhizomes, with numerous prominent knoblike, shallowly cyathiform phyllopodia, are wholly characteristic.

The following specimens of *P. pyrrholepis* are in the U. S. National Herbarium:

MEXICO: Vicinity of Córdoba, Veracruz, *Pink* 74 (4 sheets), 73 in part. Tezonapa, Veracruz, *Orcutt* 3375. Zacuapan, Veracruz, January, 1906, *Purpus* 2166. Orizaba, *Mohr* "20, 30, 32."

15. *Polypodium rosei* Maxon sp. nov.

Rhizome creeping, simple or with a few short branches, 2.5 to 5 mm. in diameter, freely radicate beneath, densely paleaceous, the scales 3 to 6 mm. long, 0.6 to 0.9 mm. broad, linear-deltoid, mostly long-attenuate, variable in color, richly castaneous with age, the cells of the basal part mostly small, short or oblong-hexagonal, with thick, highly colored partition walls and hyaline to castaneous outer walls, the lumina open or inclosed; margins with numerous, close, mostly divergent, cylindrical teeth, these averaging about 0.13 mm. long, cleft half their length or less. Fronds several, ascending, 15 to 30 cm. long, arising 0.5 to 3 cm. apart, densely paleaceous throughout; stipes 2.5 to 8 cm. long, arcuate; lamina linear-oblongate to linear-oblong, 10 to 25 cm. long, 3.5 to 6 cm. broad, subpinnatisect, acute, caudate, rather abruptly narrowed in the basal third (the 1 to 3 lowermost pairs of segments 0.5 to 2 cm. long) or not at all reduced; segments 15 to 20 pairs, their own width apart or more, spreading, mostly 2 to 3 cm. long, 3 to 5 mm. broad, linear, acute, widely dilatate (sometimes bearing a minute distal auricle), connected by a narrow wing, the sinuses broad, rounded-obtuse; scales of the lower surface of segments very dense, widely imbricate, buff to reddish brown in mass, dark-centered, 1 to 2.5 mm. long, deltoid-ovate and acuminate-attenuate or rounded and rather abruptly subulate, the basal portion bearing numerous, very long, closely set, divergent, slender, deeply once cleft teeth, similar but shorter and oblique teeth borne also toward the apex; scales of the upper side whitish, fewer, smaller, nearly capillary, with long spreading teeth; venation concealed, gonioleptoid, a single row of 7 to 13 angular-oval areoles extending more than halfway to the margin, the excurrent veinlets free or partly joined in a minor series; sori 6 to 12 pairs, small, slightly inframedial, superficial, terminal upon the short simple included veinlets, evident at maturity. Leaf tissue yellowish green above, rigidly herbaceous.

Type in the U. S. National Herbarium, no. 450839, collected from cliffs of the Sierra de Tepostlán, State of Morelos, Mexico, September 21, 1903, by J. N. Rose and Joseph H. Painter (no. 7254).

Scarcely to be confused with any other species of Mexico, unless perhaps with small specimens of *P. pyrrholepis*, from which it differs widely in its rhizome scales, these (though variable) being flaccid, imbricate, and distinctly linear-deltoid; whereas those of *P. pyrrholepis* are rigidly divergent and almost capillary, being abruptly attenuate-acicular from a small rounded or subovate base. The scales of the lamina show differences almost equally great.

Polypodium rosei is not very unlike small plants of *P. squamatum* in leaf form, but it differs very plainly in most of the minute characters, notably in scale shape and structure, and in having superficial rather than impressed sori. *P. squamatum* is wholly West Indian.

The following additional specimens of *P. rosei* are in the U. S. National Herbarium:

MEXICO: Near El Parque, Morelos, *Rose & Rose* 11117. Hills near Guadalajara, Jalisco, on ledges and trees, *Pringle* 4535 (2 sheets).

16. *Polypodium squamatum* L. Sp. Pl. 1086. 1753.

Marginaria squamata Presl, Tent. Pter. 188. 1836.

Goniophlebium squamatum Moore, Ind. Fil. 391. 1862.

Drynaria squamata Fée, Mém. Foug. 11: 72. 1866.

Pleopeltis squamata J. Smith, Hist. Fil. 114. 1875.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and Porto Rico, ascending to 1,600 meters.

ILLUSTRATION: Plum. Trait. Foug. pl. 79.

Polypodium squamatum was founded by Linnæus upon the "*Polypodium longifolium, squamulis argenteis*" of Petiver. Petiver's illustration (pl. 7. f. 11) is obviously redrawn from Plumier's plate 79, depicting in exaggerated form a Jamaican plant. Authors from that time to the present have included in their concept of *P. squamatum* several different species from the American mainland (Christensen's Index, for example, giving the range "Ind. occ. Mexico-Peru"), although material at hand shows clearly that this is a species confined to the West Indies. The "*P. squamatum*" of Mettenius¹ is problematical; that of Liebmann is, at least in part, *P. sanctae-rosae*.

The most dependable character of *P. squamatum*, leaving out of consideration the unmistakable and distinctive facies of the plant, lies in the form and color of its rhizome scales. These are 3 to 4 mm. long; the basal third is broadly ovate, the apical two-thirds long-acuminate and very gradually attenuate to a hairlike point. Only the extreme lacerate-fimbriate border of the scale is pale and transparent, the entire median portion being dark reddish-castaneous. The partition walls of the median cells are, apparently, no thicker than in several related species; but both they and the outer walls are so richly colored that the lumina are nearly or quite obscured. The castaneous scale thus appears to have a darker, broad, median band nearly throughout. The rhizome scales of *P. pyrrolepis* also are highly colored, but they are smaller and of very different shape, being more abruptly attenuate from a roundish base. The lamina scales of the two species also are widely different, as explained under *P. pyrrolepis*.

Jenman attempted to distinguish two forms in Jamaica, under the names *P. squamatum* and *P. lepidopteris*, upon the basis of texture, dwarfing of basal segments, and color of lamina scales; but these must needs be variable characters in a plant extending from the lowlands to 1,600 meters altitude, occurring indiscriminately on exposed banks and ledges and upon rotten branches of forest trees; and the whole series of specimens here cited is believed to represent but a single variable species. The resemblance of any of them to the Brazilian *P. lepidopteris* must be called remote; it is true that 1 to 4 pairs of lower pinæ are vestigial, but this change is abrupt, the lamina never being gradually long-attenuate to the base.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Mount Airy, *Maxon* 853. Chestervale, *Underwood* 3269. Near Cinchona, alt. 1,500 meters, *Underwood* 3113. Above Abbey Green, on trail to Blue Mountain Peak, *Maxon* 1395. Vicinity of Hollymount, Mount Diabolo, alt. 750 meters, *Maxon* 2300. Near Mandeville, alt. 600

¹ Abh. Senckenb. Ges. Frankfurt 2: 70. 1856.

meters, *Maxon* 2585. Vicinity of Troy, alt. 600 to 660 meters, *Maxon* 2937; *Underwood* 2932, 2964, 3312. Without exact locality, *Hart* 52, 122a.

PORTO RICO: Near Adjuntas, *Sintenis* 4068, 4282. Las Mesas, near Mayagüez, alt. 350 meters, *Holm* 249a. Without locality, *H. T. Cowles* 257, 273.

17. *Polypodium fimbriatum* Maxon, nom. nov.

Polypodium villosum Karst. Fl. Columb. 2: 87. 1865-69, not L. 1753, Dulac, 1867, nor Fée, 1872-73.

TYPE LOCALITY: "Valador de Fuquene," Cordillera of Bogotá, Colombia, altitude 2,900 meters.

DISTRIBUTION: Mountains of Colombia.

ILLUSTRATION: Karst. op. cit. pl. 144. f. 1-7 (as *P. villosum*).

Known to the writer only from the Lehmann specimen cited below, listed by Hieronymus¹ as *P. villosum*. This is only about half the size indicated by Karsten's large illustration, but in its minute morphology it agrees absolutely with the excellent detailed figures. Unfortunately the name *Polypodium villosum* is invalid because of its earlier use for the large tropical American species now known as *Dryopteris villosa* (L.) Kuntze. The above new name, *P. fimbriatum*, is therefore suggested.

Mettenius² cites two additional Colombian localities for this species, and Christensen ascribes it also to Venezuela and Peru. Lehmann's specimen, above mentioned, is:

COLOMBIA: Near Facatativa, Province of Cundinamarca, alt. 2,600 meters, on sandstone rocks, *Lehmann* 2456.

DOUBTFUL SPECIES.

1. POLYPODIUM LANOSUM Fée, Gen. Fil. 237. 1852.

According to Christensen's Index Filicum, Fée's *Polypodium lanosum*, described from Chile, is referable to *P. lepidopteris* var. *rufulum*. If it should prove to be distinct and not to have been described under some other name since 1852, it must be renamed, on account of the earlier *Polypodium lanosum* Poir. (1804), applied to other plants.

2. POLYPODIUM LONGICAULE (Fée) C. Chr. Ind. Fil. 326. 1905.

Judging from description this species, published originally as *Goniophlebium longicaule* Fée,³ is of the *P. squamatum* group. It does not appear to have been mentioned by recent authors and is wholly unknown to the writer. The original specimens are from Río Hacha, Colombia, *Schlth* 847, and the species is ascribed only to Colombia.

3. POLYPODIUM VEXILLARE Christ in Schwacke, Pl. Nov. Mineiras 2: 21. 1900; Bull. Herb. Boiss. II. 2: 373. 1902.

Founded upon specimens collected by F. Müller in Santa Catharina, Brazil. Though given a binary name it is described by Christ as a subspecies of *P. lepidopteris*, having the "general aspect of *P. moniliforme* or of very small *P. furfuraceum*." It was collected also by Ule in the same region. Not seen by the writer.

¹ Bot. Jahrb. Engler 34: 530. 1905.

² Ann. Sci. Nat. V. Bot. 2: 254. 1864.

³ Mém. Foug. 8: 95. 1857.

NEW SPECIES OF POLYPODIUM.

In continuation of a study of the tropical American species of *Polypodium* the five species here described are among those recognized as new. The first four belong to the subgenus *Eupolypodium*, one being allied to *P. pendulum* Swartz, one to *P. subsessile* Baker, and two to *P. capillare* Desv., as that species is currently understood; while the remaining species is of the subgenus *Phymatodes* and allied to *P. lycopodioides* L.

Polypodium flexuosum Maxon, sp. nov.

PLATE 42.

Plants epiphytic, the several fronds pendent, fasciculate, 10 to 15 cm. long. Rhizome decumbent, less than 1 cm. long, 2 to 3 mm. in diameter, densely paleaceous, the scales brownish castaneous in mass, 1 to 1.7 mm. long, linear-deltoid or nearly linear from a rounded base, about 0.3 mm. broad, semitranslucent (the partition cell walls darker visually than the yellowish or yellowish brown outer walls), long-ciliate throughout, the cilia divergent, nearly straight, acicular, unicellular, yellow, 0.2 to 0.4 mm. long; stipe slender, 1 to 2 cm. long, 0.3 to 0.5 mm. in diameter, light brown, dull, scantily long-pilose; lamina 9 to 14 cm. long, 1 to 1.7 cm. broad, linear, arcuate, attenuate in both directions, alternately pinnatifid nearly to the slender blackish flexuous elevated rachis, the sinuses very wide, rounded; segments 15 to 25 on each side, exactly alternate, slightly oblique, 5 to 9 mm. long, 2.5 to 3 (3.5) mm. broad at the middle, oblong or mostly triangular-oblong from a broadly dilatate base (this 4 to 10 mm. broad), obtuse, both leaf surfaces bearing short multicellular simple or branched hairs, the upper surface hirsute also with long, stiff, unicellular hairs, both kinds extending to the margins, the segments ciliate; lower 3 or 4 segments on each side gradually shorter, the basal ones slight; midveins slender, subflexuous, parallel to the proximal margin; veins 3 or 4 pairs, arising at an angle of 50° to 60°, simple, ending in minute hydathodes far from the margin; sori 2 to 4 pairs, small, distant, superficial, supramedial or subterminal, the vein not geniculate; sporangia rigidly long-setose, the setae yellowish brown, 0.13 to 0.2 mm. long; annulus 14 or 15-celled. Leaf tissue pale dull green, quickly discolored, membrano-herbaceous, the veins not readily visible by transmitted light.

Type in the U. S. National Herbarium, no. 657904, collected at Camp La Gloria, south of Sierra Moa, Oriente, Cuba, December 24 to 30, 1910, by J. A. Shafer (no. 8037).

In habit and leaf outline *Polypodium flexuosum* closely resembles *P. pendulum* Swartz, of Jamaica and the Lesser Antilles, and this species alone. *Polypodium pendulum* is, moreover, its closest relative, but differs very definitely in its much larger, distinctly clathrate, shorter-ciliate rhizome scales, its non-hirsute, nonciliate segments, its more numerous veins, its somewhat impressed medial sori, and its bright green leaf tissue.

EXPLANATION OF PLATE 42.—A part of the type specimens of *Polypodium flexuosum*. Natural size.

Polypodium chiricanum Maxon, sp. nov.

PLATE 43.

Plants epiphytic, the fronds (4 to 8) depending obliquely, subfasciculate, 15 to 25 cm. long. Rhizome decumbent, curved, about 3 cm. long, 4 mm. in diameter, obscurely paleaceous at the apex, the scales brownish, 1.9 to 3 mm. long, 0.45 to 0.75 mm. broad (excluding cilia), lanceolate to ovate from a cordate base, acute to attenuate, 12 to 22 cells broad (the partition cell

walls reddish brown, moderately sclerotic, the outer cell walls hyaline or lutescent), copiously ciliate (chiefly above the middle), the cilia 0.15 to 0.3 mm. long, bristle-like, hyaline; stipe 1.5 to 2.5 cm. long, 0.8 mm. in diameter, pale brown, terete, minutely pubescent; lamina 14 to 24 cm. long, 8 to 12 cm. broad, oblong, acutish at the apex, essentially pinnate, very abruptly expanded above the base, the extreme basal portion consisting of a few alternate sinuately joined lobes or low crenations; rachis slender, blackish, slightly elevated, subflexuous toward the apex, glabrescent; principal segments 15 to 17 pairs, spreading (70°), alternate, mostly straight, 4 to 6.5 cm. long, 3 to 5 mm. broad, linear-attenuate, acutish, lightly sinuate, slightly dilatate above, strongly so below, 10 to 11 mm. broad at the rachis, the segments here contiguous but scarcely at all connected (the sinus wide, inequilateral, obliquely acutish), elsewhere 1 to 3 times their width apart; midvein subflexuous, nearly immersed; veins 12 to 22 pairs, arising at an angle of about 40° , simple, the sterile ones straight, the fertile ones sharply geniculate nearly at a right angle from the proximal side of the protruding receptacle; sori 7 to 14 pairs, slightly suprasedial in attachment, deeply impressed, apart, equidistant from the midvein and margin; sporangia glabrous, the annulus 12-celled. Leaf tissue dark green, glabrous, rigidly subspongiose-herbaceous, semitranslucent, pustulate over the sori.

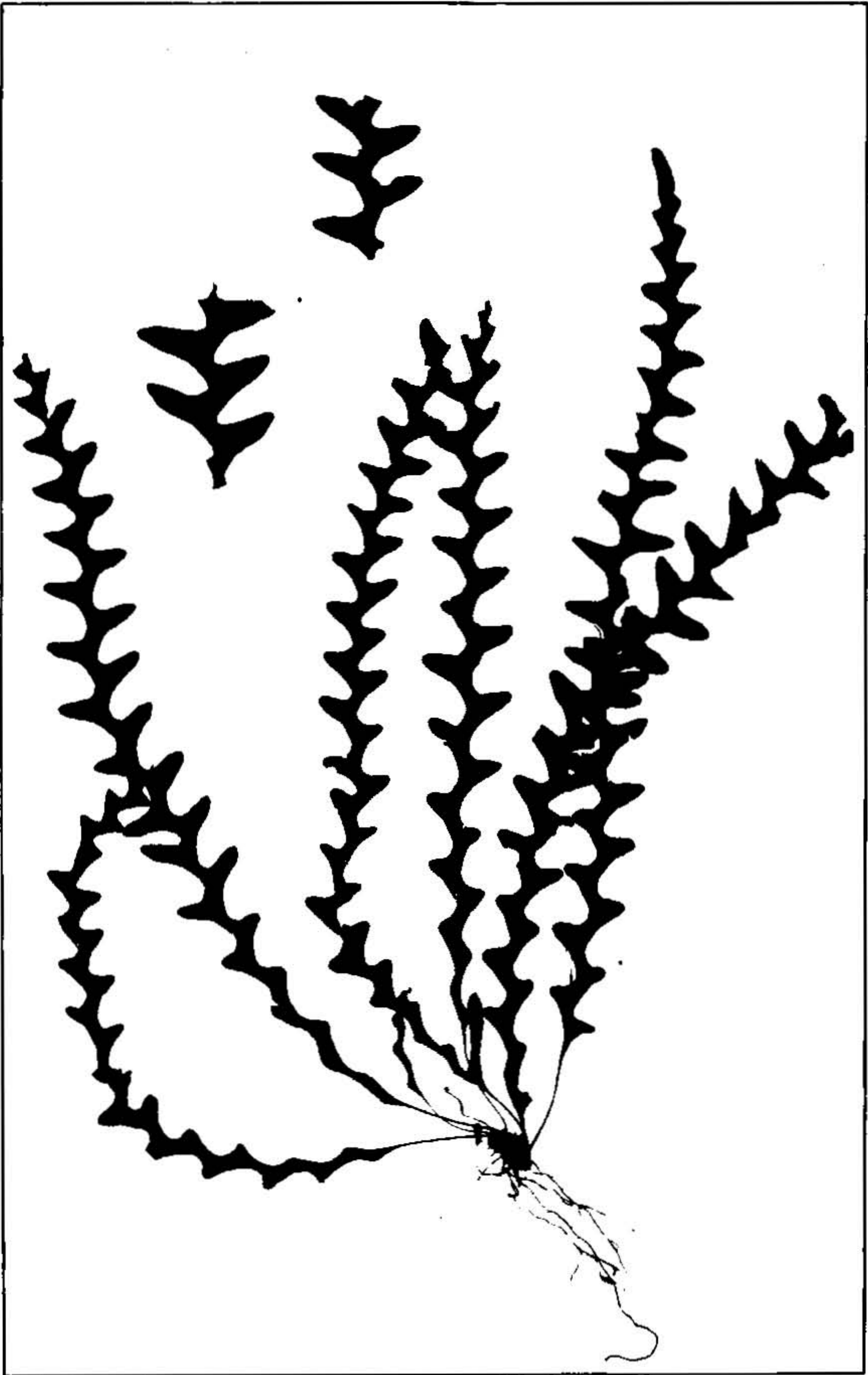
Type in the U. S. National Herbarium, no. 675858, collected from a tree trunk in humid forest between Alto de las Palmas and top of Cerro de la Horqueta, Chiriquí, Panama, altitude 2,100 to 2,268 meters, March 18, 1911, by William R. Maxon (no. 5478).

Polypodium chiricanum, which is known only from the type specimen, is a near ally of *P. subsessile* Baker, differing from that species especially in its greater size, its broader, scarcely clathrate, longer-ciliate rhizome scales (these brownish and not at all grayish in mass), its longer, broader, and strongly decurrent (not subequally dilatate) segments, nearly immersed midveins, and more acutely divergent veins.

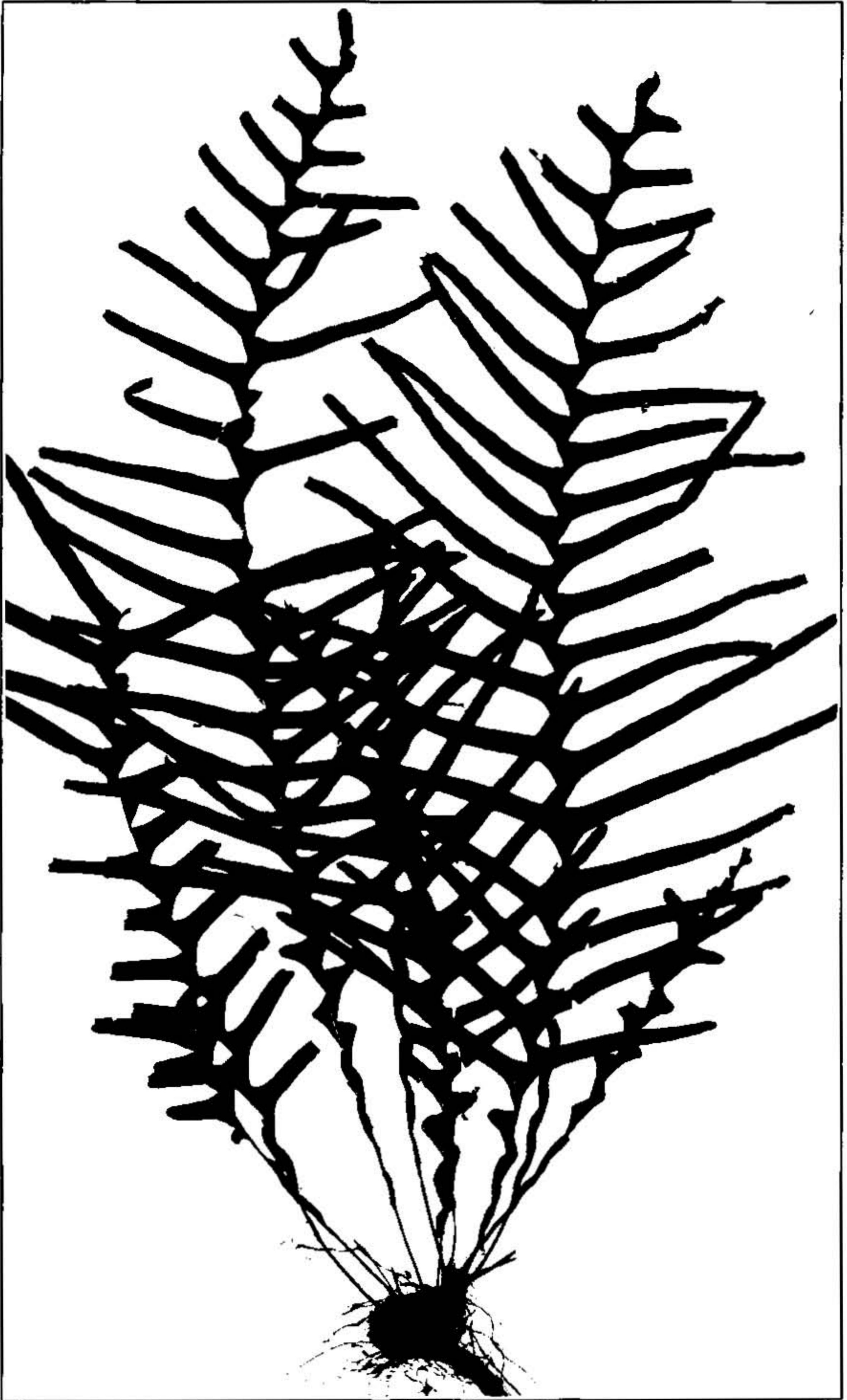
EXPLANATION OF PLATE 43.—Type specimen of *Polypodium chiricanum*. Scale $\frac{1}{2}$.

Polypodium crassulum Maxon, sp. nov.

Plants epiphytic, the fronds pendent, several to very numerous, imbricate-fasciculate, long-persistent, 20 to 40 cm. long. Rhizome stout, erect, 2 to 5 cm. long, nearly 1 cm. in diameter, copiously and coarsely radice, only the apex paleaceous, the scales concealed, reddish brown in mass, 2 to 3 mm. long, 0.15 to 0.25 mm. broad, linear, entire, semitranslucent, yellowish brown singly, concolorous, both outer and partition cell walls thin; stipe 1 to 5 cm. long, subterete, gradually flattish above, very copiously tomentose-pilose, the close-set spreading hairs reddish brown, very slender, 3 to 5 mm. long; lamina 18 to 38 cm. long, 5 to 8 cm. broad, linear, acuminate at the apex, acute at the base, subpinnate, often more or less irregular in outline from the abortion of the apex and of the segments; rachis flexuous, wholly immersed; segments 20 to 50 pairs, oblique (60°), 3 to 8 cm. long, 2 to 2.5 mm. broad, linear, long-attenuate, entire or slightly sinuate, fully adnate but not surcurrent, long-decurrent and faintly connected, elsewhere 1 to 3 times their width apart; segments sometimes once or twice dichotomous in their outer part; midvein immersed, medial, decurved at the base; veins 10 to 20 pairs, immersed, borne at an angle of 10° to 30° , simple or mostly once forked, the proximal branch greatly extended; sori rather few and intermittent, 3 to 8 pairs, nearly superficial, terminal upon the vein or at the clavate end of the proximal branch, touching or exceeding the margin, paraphysate; sporangia glabrous, the annulus 11 or 12-celled. Leaf tissue rig-



POLYPODIUM FLEXUOSUM MAXON.



POLYPODIUM CHIRICANUM MAXON.

idly herbaceous, slightly translucent, nearly glabrous above, beneath bearing a few fuscous 2 to 5-celled glandular hairs, these 0.13 to 0.2 mm. long.

Type in the U. S. National Herbarium, no. 600742, collected at Tablazo, Costa Rica, altitude 1,900 meters, March 4, 1908, by C. Brade; received under the name *P. capillare* Desv. Two additional specimens are at hand, both collected in Costa Rica by Wercklé. Of these only one (distributed by Jiménez as no. 588) bears precise locality data; namely, San Jerónimo, altitude 1,500 meters.

Polypodium crassulum is clearly related to *P. capillare*, but more closely to *P. pilipes* Hook., of the Peruvian Andes, from which, as illustrated, it differs in its entire or faintly undulate, mostly simple segments. It is a rigidly herbaceous plant and of harsh texture in drying, a circumstance which has suggested the specific name employed.

Polypodium nubigenum Maxon, sp. nov.

Plants usually epiphytic, the fronds pendent or prostrate, numerous, fasciculate, 10 to 25 cm. long. Rhizome erect or oblique, 1 to 3 cm. long, about 4 to 7 mm. in diameter, freely radicate throughout, densely but inconspicuously paleaceous, the scales dark glossy brown in mass, nearly acicular, 1.8 to 3 mm. long, 0.1 to 0.2 mm. broad, subflexuous toward the tip, distantly erose-denticulate, sparingly long-ciliate (the cilia divergent, acicular, hyaline, fragile, mostly 0.08 to 0.17 mm. long, sometimes shorter and glandlike), castaneous by transmitted light, semitranslucent, the cells narrowly oblong to linear, both partition and outer walls thin but highly colored; stipes 1 to 2 cm. long, 0.3 to 0.4 mm. in diameter, densely pilose with long spreading reddish hairs; lamina very nearly pinnate, 9 to 23 cm. long, 1 to 6 cm. broad, linear, acutish at both ends; rachis slender, blackish and raised below, bearing a few scattering but persistent stiffish hairs like those of the stipe, also, together with both surfaces of the lamina throughout, copiously glandular-pulverulent, the hairs minute, consisting of 2 to 4 spherical whitish beadlike cells; segments unequal, numerous, spreading (averaging 70°), alternate, straight or subflexuous, 0.5 to 5 cm. long, 2 to 3 mm. broad, linear, usually attenuate and acutish, strongly sinuate, slightly decurved and decurrent at the fully adnate base (here 3 to 4 mm. broad), the segments rather close, faintly connected, the sinuses narrow, acutish; midveins subflexuous, mostly concealed; veins 3 to 18 pairs, very oblique (20 to 30°), simple (or the basal ones forked), slightly curved, extending halfway to the margin; sori 2 to 17 pairs, terminal, superficial, not confluent, extending to or at maturity slightly beyond the margin; sporangia glabrous, the annulus usually 12-celled. Leaf tissue subspongiose-herbaceous, the veins not wholly evident by transmitted light.

Type in the U. S. National Herbarium, no. 427732, collected at the summit of Blue Mountain Peak, Jamaica, altitude 2,220 meters, April 20 or 21, 1903, by William R. Maxon (no. 1477).

The present species is known only from the highest peaks of the Blue Mountains, Jamaica, where it is locally abundant. It was described by Jenman¹ as "*Polypodium capillare* Desv.," but represents a form specifically distinct from the several others which are so referred by various writers. *Polypodium capillare* is, in fact, a very poorly understood species, described originally from the "Antilles," but since assigned a wide tropical American range. The original description is brief and may be said to apply indifferently to several forms. There is, however, slight probability of its having been founded on the isolated plant of Blue Mountain Peak, here described as *P. nubigenum*.

Polypodium nubigenum is most closely related to *P. graveolens* Baker, an endemic Jamaican plant of lower altitude, which it resembles closely in most

¹ Bull. Bot. Dept. Jamaica II. 4: 120. 1897.

gross characters. It differs constantly from that, however, in its very much narrower rhizome scales, more slender stipes, sparingly but persistently pilose rachises, slightly broader segments, acutish sinuses, and mostly simple veins.

It is possible that *P. graveolens* Baker represents the true *P. capillare* Desv. This and the status of *P. decipiens* Hook. will be discussed later.

***Polypodium palmeri* Maxon, sp. nov.**

Rhizome funiform, wide-creeping, stout (3 to 5 mm. in diameter), usually not much branched but with numerous short innovations, densely paleaceous, the scales lance-linear, long-attenuate, 6 to 8 mm. long, widely imbricate, appressed, attached far above the base, the central basal portion ferruginous, the borders and slender tips whitish and fragile, the scales thus broken and darker with age. Fronds numerous, subdimorphous, the sterile ones 5 to 20 cm. long, 2 to 4 cm. broad, very variable in shape, oblong, linear-oblong, or lanceolate, nearly exstipitate, cuneate at the base, the apices broadly rounded to acute, the extremes occurring in the same plant; fertile fronds 8 to 18 cm. long, 0.8 to 2.5 cm. broad, linear, linear-oblong, or rarely lanceolate, acute or rarely obtuse, exstipitate, narrowly cuneate; leaf tissue rigidly chartaceous, more or less translucent, glabrous or at first slightly fibrillose beneath along the slender costa; venation variable, commonly evident beneath, the costal areoles very small, parallel to the costa; paracostal areoles large, obliquely transverse, extending more than half way to the margin, broadly oblong, usually subdivided into several diverse minor areoles, these with or without free veinlets; 1 or usually 2 rows of small areoles borne between the paracostal row and the margin, these small, with recurved veinlets; sori uniserial, large, 15 to 30 pairs, extending usually from base to apex, nearly medial, lightly impressed, borne only in the paracostal areoles, usually toward their distal end.

Type in the U. S. National Herbarium, no. 572544, collected from specimens climbing 2 to 3 meters high upon trees in a rocky forest near Gómez Farias, State of Tamaulipas, Mexico, altitude about 350 meters, April 13 to 21, 1907, by Dr. Edward Palmer (no. 308); distributed as *Phymatodes palmeri* sp. nov.

Probably not a rare species; in the past not unnaturally confused with *P. lycopodioides*, its nearest North American ally, which occurs throughout the West Indies and on the continent from Guatemala to Panama. From that species *P. palmeri* differs in its much thicker and heavier, ropelike rhizomes and its very large sterile fronds, which are of different shape. The extremes of leaf shape include those of *P. lycopodioides*, but that is a smaller plant of very different facies. The very thick, whitish-scaly rhizomes of *P. palmeri* are especially characteristic.

Besides the type, the following specimens, most of which are stated to have grown on tree trunks, are in the U. S. National Herbarium:

MEXICO: Antigua, *Liebmann*. Curahuesco, Tabasco, *Rovirosa* 210. Zacuapan, State of Veracruz, December, 1906, *Purpus* 2164. Near Tampico, Tamaulipas, alt. 15 meters, June, 1910, *Palmer* 508. Coatzacoalcos, Isthmus of Tehuantepec, State of Veracruz, *C. L. Smith* 2108. Orizaba, *J. G. Smith* 85; *Mohr*. Limestone hills of Las Palmas, State of San Luis Potosí, *Pringle* 3355. Sanborn, State of Veracruz, *Orcutt* 3389. Chichen Itzá, Yucatán, *C. & E. Seler* 5573. Izamal, Yucatán, *Gaumer* 528.

HONDURAS: San Pedro Sula, Department of Santa Bárbara, alt. 300 meters, *Thieme* (J. D. Smith, no. 5688). Near Highland Creek, Puerto Sierra, *Wilson* 81.

NICARAGUA: Greytown, *Wright*; *C. L. Smith*, 2044.

PANAMA: Chagres, *Fendler* 395.

NOTES ON NOTHOLAENA.

The following notes relate to several species of *Notholaena* which have been generally misunderstood or misidentified in recent years. There are included, incidentally, descriptions of two new species.

Notholaena cretacea Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 216. 1849.

It has been customary to regard *Notholaena cretacea* as a species of relatively wide distribution, extending from Puebla, the type locality, northwestward to Arizona, California, and Lower California. Its characters have not as a rule been sharply drawn, having been regarded conveniently as those of a polymorphic species, or else it has been redescribed on the basis of the well known plant of southern California, which was described long ago by Eaton as a distinct species, *Notholaena californica*, but subsequently reduced to *N. cretacea*. In reality Eaton's species is well founded, and it is equally clear that a third species, intermediate in range, must be recognized. This has been variously determined as *Notholaena cretacea*, *N. californica*, *N. candida*, and *N. schaffneri*. No published name being available it is here described as a new species, *Notholaena neglecta*, and comparative notes upon the several species mentioned are given.

Notholaena cretacea was founded upon specimens collected from clefts of limestone cliffs in the vicinity of Tehuacán, State of Puebla, altitude about 5,400 ft. by Liebmann, no other localities being mentioned. The description, like most of Liebmann's, is excellent, and, so far as it goes, applies perfectly to a plant of the type collection received from Copenhagen through the courtesy of Mr. Carl Christensen. This in turn agrees with a more completely fertile specimen collected at the same locality in 1906 by Dr. J. N. Rose (no. 11384). A better development of the species is seen, however, in two Puebla specimens collected by Purpus (3145, 4028), these being larger and more robust and having the laminae slightly more divided.

These four numbers taken together show *N. cretacea* to differ constantly from the plant of northern Mexico and southern Arizona, *N. neglecta*, in several important characters. The rhizome scales are larger (3.5 to 4.5 mm. long) and much darker in the broad median area, and have the narrow translucent margins minutely denticulate, the teeth tipped with short, capitate, glandular prominences; the lamina is relatively broader, not at all elongate toward the apex, less compound, and more freely pulverulent above; the pinnae are fewer and pinnatifid to the extreme tip, thus lacking the conform or elongate, entire terminal segment which is characteristic of *N. neglecta*; and the segments are relatively flat and close, the sporangia from the closely revolute margin never concealing the dense, pale yellowish, ceraceous covering of the lower surface. The points of distinction from *N. californica* are stated under that species.

The specimens of *N. cretacea* above mentioned are:

PUEBLA: Vicinity of Tehuacán, alt. about 1,620 meters, Liebmann (type collection). Same locality, Rose 11384. Vicinity of San Luis Tultitlanapa, June, 1908, Purpus 3145. Tlacuiloltepec, alt. 1,800 to 2,100 meters, July, 1909, Purpus 4028.

The two Purpus numbers were distributed as *N. candida* (Mart. & Gal.) Hook., from which species they differ widely in their narrow and inconspicuously bicolorous scales, as also in the size, outline, and dissection of the lamina.

Notholaena neglecta Maxon, sp. nov.

Plants fasciculate, the fronds numerous, erect or ascending, 3 to 20 cm. high. Rhizomes large, multicipital, the numerous branches short (0.5 to 2 cm. long), decumbent, 3 to 5 mm. in diameter, very densely paleaceous, copiously radice beneath; scales imbricate, closely impacted, 3 to 3.5 mm. long, 0.5 to 0.7 mm. broad near the base, linear-lanceolate, long-attenuate to a subflexuous apex, bicolorous (usually sharply so), the narrow, dark brown, sclerotic median stripe percurrent, opaque, the cells linear, minute, indistinct; borders as broad as the dark median area or slightly narrower, delicate, pale yellowish or usually whitish and transparent, irregularly denticulate, the teeth hyaline. Fronds close, apparently distichous, usually long-stipitate; stipes 1 to 16 cm. long, slender (0.4 to 0.7 mm. thick), terete, black, sublustrous, with a few deciduous scales toward the base; lamina nonpaleaceous, elongate-pentagonal, acuminate, 2.5 to 8.5 cm. long, 2 to 6.5 cm. broad, tripinnate to quadripinnate in the basal half, simpler above, the apex usually produced, finally pinnatisect; rachis similar to the stipe but slightly sulcate ventrally; basal pinnae much the largest, sessile, deltoid, acuminate, inequilateral, basispic, the lowermost of the inferior pinnules greatly produced, the others gradually shorter and simpler; second pair of pinnae shorter, elongate-deltoid, inequilateral, basispic, sometimes rather strongly so; other pinnae simpler, contiguous, narrowly deltoid-oblong to oblong, usually (except in the largest specimens) once pinnate, the segments oblique, mostly simple, narrowly oblong from a slightly broader, subcordate, inequilateral base, obtuse or acutish, subsessile or semiadnate, the base slightly overlying the slender secondary rachis; terminal segments of pinnae and pinnules conform or slightly produced, entire; segments in general similar, or the lateral ones of the basal pinnae sometimes short and rounded, all the segments deeply concave, apart, rigidly herbaceo-coriaceous, light grayish green and slightly pulverulent above (the granules few, distant, subpersistent), beneath densely pulverulo-ceraceous, the powder very pale ochroleucous, nearly or quite concealed at maturity by the very numerous brown sporangia thrust far inward by the widely concave margins; spores globose, about 50 μ in diameter, minutely roughened.

Type in the U. S. National Herbarium, no. 397878, collected among rocks on the dry, sloping sides of a canyon near Saltillo, State of Coahuila, Mexico, November 10 to 20, 1902, by Dr. Edward Palmer (no. 324).

The following additional specimens are in the National Herbarium:

COAHUILA: Sierra Mojada, April 19, 1892, *Jones* 520; same locality and date, *Jones* (2 specimens without number). San Lorenzo Canyon, 6 miles southeast of Saltillo, September 21 to 23, 1904, *Palmer* 424.

CHIHUAHUA: Limestone cliffs, Santa Eulalia Mountains, September 9, 1885, *Pringle* 452 (2 sheets).

ARIZONA: Huachuca Mountains, August, 1882, *Lemmon* (2 sheets). Mule Mountains, Cochise County, on exposed south face of limestone cliffs, January 1, 1913, *Goodding* 1384.

The collection selected as the type includes the largest specimens seen, these apparently representing the maximum development of the species. In several of them the lamina is truly quadripinnate at the base and the stipes are extreme in length, the latter condition probably arising from the fact that the plant grew among loose rocks. In most of the other collections the stipes are shorter and the laminae smaller and simpler, usually tripinnate at the base. The Arizona and Chihuahua specimens average considerably smaller, but evidently are different in no characters not dependent upon their lesser size. The Lemmon specimens are in all probability the Arizona element included by Eaton in his description of *Notholaena californica*.

From *Notholaena cretacea*, as restricted above, *N. neglecta* differs in the characters already mentioned. It is compared with *N. californica* in the notes under the latter species.

Notholaena californica D. C. Eaton, Bull. Torrey Club 10: 27. 1883.

This species was at first confused with *Notholaena candida* by Eaton as "the California form of that species," but was subsequently described by him as new under the above name, the description being based chiefly upon specimens from San Diego County, California, but including characters derived from Arizona specimens collected by Lemmon. The choice of specific name, the greater amount of California material studied, and the above quoted phrase are sufficient to fix the California plant as the typical element of Eaton's species. Lemmon's Arizona specimens in the National Herbarium are a rather small state of *N. neglecta* and those in the Eaton Herbarium are doubtless of the same species.

The copious material at hand indicates that *N. californica* is a well-marked species, differing from *N. cretacea* in its far lesser size and its more distant, shorter, and more rounded segments; from *N. neglecta* in its broadly pentagonal (never elongate) lamina and its relatively broad, rounded-obtuse segments; and from both species obviously in its brown to light castaneous (never blackish) stipes and rachises and in the peculiar character of its rhizome scales. The scales are rigidly subacicular, straight or usually curved, 3.5 to 4.5 mm. long, 0.17 to 0.26 broad in the basal part, long-attenuate to the filiform subflexuous tip, nearly concolorous, dark reddish brown, opaque, with only the marginal row of cells in the middle and lower part of the scale pale, this consisting mainly of numerous spreading, unicellular, hyaline teeth, the teeth in the apical part of the scale slender, longer (up to 0.15 mm. long), mostly curved (often retrorsely), rigid, hyaline or commonly reddish brown and sclerotic.

There is noted a good deal of variation in the color and the degree of development of the ceraceous covering of the lamina, some of the specimens being densely glandular or glandular-viscid beneath and nearly or quite devoid of the usual yellowish ceraceous covering. These have sometimes been referred to as "the white powdered form." Their status and relationship are not altogether clear, but the variations observed are probably well within the species limits and may be correlated with local or seasonal conditions. It is possibly this form which was designated by Prantl¹ as a new species, *N. albida*, but never described.

The following specimens of *N. californica* are in the National Herbarium:

CALIFORNIA: Slover Mountain, near Colton, April, 1886, S. B. & W. F. Parish; May, 1894, S. B. Parish; May 4, 1901, S. B. Parish 4739. San Bernardino, W. B. Wright. Near Colton, May, 1882, Jones. Agua Caliente, desert slope of San Jacinto Mountain, April, 1884, S. B. & W. F. Parish 502A; April, 1886, S. B. & W. F. Parish 502. Andreas and Murray Canyons, Palm Springs (eastern slope of San Jacinto Mountain), August 23, 1906, Kearney. Spring Valley, San Diego County, Laura F. Kimball 21. Mountain Spring, San Diego County, May 12, 1894, Schoenfeldt 3078. San Diego County, G. R. Vasey 691. Avalon, Santa Catalina Island, February, 1897, and March, 1889, Blanche Trask. Without definite locality, Parry & Lemmon 429.

ARIZONA: Hills 4 miles northwest of Congress Junction, altitude 750 to 900 meters, February 17, 1912, Wootton.

¹ Bot. Jahrb. Engler 3: 405. 1882.

LOWER CALIFORNIA: San Telmo, April 17, 1886, *Orcutt* 1461. Los Angeles Bay, Gulf of California, 1887, *Palmer* 552. Ensenada, January 25, 1889, *Orcutt*. Santa Margarita Island, March 3, 1899, *Brandege*. Cedros Island, March 18 to 20, 1889, *Palmer* 748.

The known ranges of the three species just discussed are entirely natural. *Notholaena cretacea* is apparently confined to the southerly region of Puebla; *N. neglecta* is found chiefly in the northern parts of Mexico, barely entering the United States in extreme southeastern Arizona; *N. californica* occupies the region of California and Lower California, the single Arizona station being close to the southern California localities and of very similar character, and remote from the Arizona localities for *N. neglecta*.

Notholaena schaffneri (Fourn.) Underw.; Davenp. Gard. & For. 4: 519. 1891.

Aleuritopteris schaffneri Fourn. Bull. Soc. Bot. France 27: 328. 1880.

Notholaena nealleyi Seaton, Contr. U. S. Nat. Herb. 1: 61. 1890.

Notholaena nealleyi var. *mexicana* Davenp. Bot. Gaz. 16: 54. 1891.

Notholaena schaffneri var. *mexicana* Davenp. Gard. & For. 4: 519. 1891.

Although *Notholaena schaffneri* is not at all of close relationship to any of the foregoing species, specimens of *N. neglecta* have nevertheless been so named and distributed in at least one instance (Sierra Mojada, *Jones*). On this account and also because the excellent distinctive characters of *N. schaffneri* have been very generally overlooked, it seems desirable to include a re-description of this species. A considerable amount of variation in the glandular-ceraceous covering is observed, some of the specimens (notably *Seaton* 894 (560) and *Palmer* 555) having the fronds rather densely covered beneath with separate translucent glands and nearly or quite lacking the usual thick, continuous coating of whitish powder. Pringle's 1864, however, embraces specimens of both types. These differences, which are apparently not wholly due to age, are similar to those mentioned under *N. californica*, above.

Plants 10 to 35 cm. high, with numerous stiffish fasciculate fronds, their vascular parts freely barbate-paleaceous. Rhizome multiclital, the divisions several, stout, aggregated, decumbent or ascending, densely covered with closely impacted scales, these 2.5 to 3.5 mm. long, very slender, long-attenuate and subulate from a slightly broader base, coal-black and opaque (except for a short yellowish brown median stripe at the extreme base), rigid, evenly long-ciliate throughout, the cilia 0.09 to 0.15 mm. long, blackish, rigid, mostly straight, divergent, 15 to 25 on each side; stipes straight or nearly so, 2.5 to 10 cm. long, about 1 mm. in diameter, dark brown to blackish, closely glandular, often deciduously whitish-farinose, bearing numerous rigidly divergent ciliate scales similar to those of the rhizome but reddish brown in color; lamina linear-oblong to linear-oblongate, 7 to 20 cm. long, 2 to 5.5 cm. broad, acuminate, gradually narrowed toward the base, at least bipinnate throughout, the largest fronds subtripinnate; rachises and the midveins of the segments beneath bearing numerous long spreading subulate scales, these only 1 or 2 cells broad, appearing like stiff turgid jointed hairs; pinnæ 15 to 25 pairs below the acuminate apex, subopposite to alternate, the lower ones gradually reduced, deltoid, 7 to 15 mm. long, subdistant, those above gradually longer, larger, and closer, mostly 1.5 to 3 cm. long, deltoid-ovate to narrowly oblong, slightly inequilateral, acutish, with about 5 to 9 pairs of subdistant to approximate narrowly oblong segments below the lobate apex; segments sessile and pinnatisect, or mostly semiadnate and pinnately lobed, the lobes (3 or 4 pairs) rounded, adnate, suborbicular, obscurely crenate, or the smaller ones entire; leaf tissue rigidly herbaceous, sparsely but evenly glandular or delicately whitish-ceraceous above, densely so beneath, usually developing a thick white

ceraceous covering; margins slightly revolute, concealed at maturity by the continuous but narrow line of very dark brown sporangia.

The following specimens of *N. schaffneri* are in the National Herbarium:

TEXAS: Limpia Canyon, Presidio County, *Nealley* 894 (560), the type of *N. nealleyi*. Goodenough Spring (near Comstock), Valverde County, October, 1892, *Nealley* 123 (3 sheets).

JALISCO: Dry shaded ledges, barranca near Guadalajara, alt. 1,500 meters, *Pringle* 1864 (2 sheets); *Pringle* 3880 (2 sheets); *Pringle* 11789. Face of large rocks in a canyon at Río Blanco, September 19, 1886, *Palmer* 555 (2 sheets). Bolaños, *Rose* 2910.

ZACATECAS: Near Monte Escobedo, *Rose* 2662.

PUEBLA: Tlacuilotepec, July, 1909, *Purpus* 4029 (ex Mus. Bot. Berol.).

VERACRUZ: Barranca de Santa María, Zacuapan, October, 1912, *Purpus* 6199.

Of these specimens, *Pringle's* 1864 was distributed as *N. grayi* Davenp., and *Palmer's* 555 was so referred by Eaton.¹ *Notholaena schaffneri* is not very closely related to that species, however, differing widely in its black, rigidly long-ciliate rhizome scales and its strongly barbate-paleaceous rachises and midveins, characters described above. The differences in leaf cut and in general appearance are equally pronounced, *Notholaena grayi* having the fronds, rachises, and midveins clothed with numerous lax, tortuous, pale brown, deciduous scales wholly different in color, form, structure, and direction from those of *N. schaffneri*.

The characters and distribution of *N. grayi* were discussed briefly by the writer² some time ago with reference to the strict form of this species described, under the invalid name *Notholaena hypoleuca* Goodding,³ upon specimens collected from Slavonian Canyon, Mule Mountains, Arizona, August, 1911, by Leslie N. Goodding (no. 1004); U. S. Nat. Herb. no. 692687. Of the United States specimens mentioned those collected in Arizona by Lemmon and by G. R. Vasey are the best developed, agreeing closely with Faxon's beautiful illustration of the type.⁴

In studying *Notholaena grayi* the following new species was detected:

Notholaena aliena Maxon, sp. nov.

Plants small, 6 to 13 cm. high, the several fronds slender, long-stipitate, fasciculate. Rhizome (incomplete) small, presumably multicapital, the branches apparently very short, horizontal, thick, densely paleaceous, the scales appressed, 1.5 to 2 mm. long, linear-deltoid, stiff, very dark brown, opaque, conspicuously long-ciliate, the cilia stout, brown, unicellular, curved, irregularly divergent, either antrorsely or retrorsely directed, fragile; stipes 3 to 7 cm. long, about 0.4 mm. in diameter, arcuate, light brown from a darker base, here deciduously paleaceous, the scales nearly capillary; lamina linear to linear-oblong, 4 to 8.5 cm. long, 1 to 1.5 cm. broad, acutish, subbipinnate in the basal part, very deeply bipinnatifid nearly throughout, the pinnæ minutely glandular-ceraceous above and laxly villous with tortuous white hairs, densely yellowish ceraceous beneath, this covering mostly concealed at maturity by numerous pale-brown capillary scales arising from the secondary rachises and the midveins of the segments; pinnæ 8 to 13 pairs, subopposite to alternate, slightly ascending, the lower and middle ones deltoid to deltoid-ovate, acutish, distant, the upper

¹ Proc. Amer. Acad. 22: 463. 1887.

² Amer. Fern Journ. 3: 112, 113. 1913.

³ Muhlenbergia 8: 94. 1912.

⁴ Bull. Torrey Club 7: 50. pl. 4. 1880.

ones mostly oblong, narrower, and closer; segments 4 or 5 pairs, mostly approximate, oblong, subfalcate, obtuse, only the basal ones of the larger pinnæ sessile or subsessile, these 3 to 4.5 mm. long, strongly crenate, the other segments entire or sometimes lightly crenate; sori marginal, strongly confluent at maturity in a relatively broad line, covering the concave leaf surface between the midvein and the slightly revolute but unmodified margin, partially concealed by scales.

Type in the U. S. National Herbarium, no. 50929, collected in low mountains about 25 miles southwest of Monclova, State of Coahuila, Mexico, September 9 to 19, 1880, by Dr. Edward Palmer (no. 1389). Additional specimens of the same collection are mounted on sheet no. 834644.

Related to *Notholaena grayi* Davenp., with which it was confused by Eaton,¹ but readily distinguished from that species in having its upper leaf surfaces distinctly villous from the presence of numerous lax, whitish, tortuous hairs, *Notholaena grayi* being sparsely pulverulo-ceraceous above and devoid of any hairy covering whatever. The rhizome scales also are smaller and much more strongly ciliate.

Notholaena galeottii Fée, Gen. Fil. 159. 1852.

Notholaena arsenii Christ, Not. Syst. 1: 232. 1910.

Notholaena hyalina Maxon, Amer. Fern Journ. 5: 4. 1915.

The above synonymy will indicate an error, pointed out by Mr. Carl Christensen in a recent letter, into which both Christ and the writer have fallen in describing independently, as a segregate of *Notholaena aschenborniana*, the plant of southern Mexico long ago described by Fée as *Notholaena galeottii*. Fée's type (Caputalpan, Oaxaca, alt. 3,000 meters, *Galeotti* 6565) has not been seen by the writer; but the description, so far as it goes, seems to apply to *N. hyalina*. Christ's description of Puebla specimens as *N. arsenii* was, unfortunately, overlooked by the writer until the article describing *N. hyalina* was in type. The inaccurate and misleading phrase "pinnis . . . pagina superiore laevigatis" left some doubt that the plants described by the writer as having the upper surfaces "conspicuously hispid by numerous spreading hyaline simple hairs" could really be the same, although the general agreement of the descriptions was recognized at that time. Christensen has since examined Arsène's specimens and associates them with *Pringle* 3297, the type of *N. hyalina*.

In addition to the specimens of *N. galeottii* previously listed by the writer (as *N. hyalina*) the following are now at hand:

PUEBLA: Near Tehuacán, *Rose, Painter, & Rose* 10126.

GUERRERO: Cañón de la Mano Negra, near Iguala, *Rose, Painter, & Rose* 9392.

The more northerly range of *N. aschenborniana* Klotzsch (*N. bipinnata* Liebm.) has been indicated elsewhere,² with citation of specimens.

Notholaena greggii (Mett.) Maxon.

Pellaea greggii Mett.; Kuhn, Linnaea 36: 86. 1869.

Notholaena pringlei Davenp. Bull. Torrey Club 13: 132. pl. 58. 1886.

Allosorus greggii Kuntze, Rev. Gen. Pl. 2: 806. 1891.

In describing *Notholaena leonina* several years ago³ the writer had occasion to consult the original description of *Pellaea greggii* Mett., but at that time was unable to identify the plant described. A recent reading of the description,

¹ Proc. Amer. Acad. 18: 184. 1883.

² Amer. Fern Journ. 5: 6, 7. 1915.

³ Contr. U. S. Nat. Herb. 16: 58. 1912.

however, strongly suggested *N. pringlei*, and subsequent comparison of a specimen of the type collection of *P. greggii* with *N. pringlei* has shown them to be identical in every respect. The specimen referred to, *Gregg* 467, is no. 47866 in the Herbarium of the Missouri Botanical Garden and has the following data: "*Allosorus Greggii* n. sp. 467. Rock-fern. Rocky hill n. west of Mapimi, N. Mexico. Dr. J. Gregg. April 17, 1847." The name is in Mettenius's handwriting. Mapimi is situated in the northern part of the State of Durango, northwest of Lerdo and Torreón. The displacement of the well-known name, *N. pringlei*, given first to Pringle's excellent material, is unfortunate. It is, however, important to place beyond doubt the older species of Mettenius, which apparently has had only nominal recognition, and that under the wrong genus.

The following specimens of *N. greggii* are in the National Herbarium:

DURANGO: El Mundo Hill, near Lerdo, alt. 1,650 meters, *Chaffey* 58 in small part.

CHIHUAHUA: Dry calcareous ledges and bluffs, Santa Eulalia Mountains, April 23, 1885, *Pringle* 441 (4 sheets), the type collection of *N. pringlei*.

COAHUILA: Sierra Mojada, *Jones* 519. San Lorenzo de Laguna and vicinity, 22 to 27 leagues southwest of Parrás, May 1 to 10, 1880, *Palmer* 1382 (2 sheets); *Palmer* 1383 (2 sheets). Mountains 24 miles northwest by north from Monclova, September 1 to 6, 1880, *Palmer* 1384 (2 sheets).

MISCELLANEOUS NOTES.

Bommeria ehrenbergiana (Klotzsch) Fourn.

An additional collection of this rare species has been received:

MEXICO: Pont de México, near Puebla, December 20, 1908, *Arsène*.

Coniogramme americana Maxon, nom. nov.

Gymnogramme subcordata Eaton & Davenp. Contr. U. S. Nat. Herb. 5: 138. pl. 16. 1897.

Coniogramme subcordata Maxon, Contr. U. S. Nat. Herb. 17: 174. 1913, not Copel. 1910.

In transferring recently to *Coniogramme* the Mexican plant described originally as *Gymnogramme subcordata* the writer overlooked the fact that the name *Coniogramme subcordata* had already been formed by Copeland for a Philippine plant. The Mexican plant is therefore renamed as above. It is the only American member of the genus *Coniogramme*.

Danaea crispa Endres.

An excellent illustration not mentioned in the North American Flora¹ is plate 1700 of Hooker's *Icones Plantarum*, 1887.

Lycopodium tubulosum Maxon, Contr. U. S. Nat. Herb. 17: 178. 1913.

Apparently not rare in Costa Rica at 1,200 to 1,500 meters. The following additional specimen is received:

COSTA RICA: Sur les vieux troncs d'arbres aux collines supérieures de Santiago près San Ramón, *Brénes* 14419.

Odontosoria guatemalensis Christ.

The known range of this species is now extended to include southern Mexico, two recent collections having come to hand from Chiapas: *Purpus* 6747, 6872. Three Guatemalan localities are known.²

¹ 16: 19. 1909.

² Contr. U. S. Nat. Herb. 17: 168. 1913.

***Polypodium myosuroides* Swartz.**

This species, whose history and relationship were discussed at length in the last paper of this series,¹ may now be reported from Porto Rico upon the basis of a single specimen collected by Mrs. Elizabeth G. Britton (no. 2670a) at Río de Maricao, altitude 500 to 600 meters, on rocks, April 2, 1913.

***Polystichum tridens* (Moore) Fée.**

Known hitherto only from Jamaica. The following specimen has been received under the wrong name *P. triangulum* var. *ilicifolium*:

SANTO DOMINGO: Azua, ad Las Cañitas, alt. 1,350 meters, August, 1912,
Fuertes 1931.

¹Contr. U. S. Nat. Herb. 17: 398-406. 1914.