

A STUDY OF CERTAIN MEXICAN AND GUATEMALAN SPECIES OF POLYPODIUM.

By WILLIAM R. MAXON.

An attempt to determine a small collection of Mexican ferns made by Dr. J. N. Rose in 1901 has brought to my attention the fact that a number of very variable as well as perfectly distinct forms have been referred commonly to either *Polypodium subpetiolatum* or *P. biserratum*, and that the proper application of the latter name has long been a matter of uncertainty. The present paper, based upon studies of material in practically all leading American herbaria, is offered as the result of an effort to reduce the existing confusion. The several species here proposed as new are certainly distinct from *subpetiolatum*, and several of them are not even closely related to that species. It is not absolutely certain that *biserratum* is identical with *subpetiolatum*, but the evidence gained from specimens at hand strongly indicates such a conclusion.

My thanks are due to the several botanists and curators of the herbaria mentioned hereafter^a for the loan of specimens, and particularly to Professor L. M. Underwood for helpful suggestions.

Polypodium subpetiolatum Hook. in Benth. Pl. Hartw. 54. 1840.

The original description, published by Hooker, is as follows:

Polypodium (Eupolypodium) subpetiolatum, Hook. MS., fronde ovato-lanceolata pinnata, rhachibus costa venis subtus marginibusque pubescenti-hirsutis, pinnis alternis remotis lanceolato-acuminatis undique serrulatis subcoriaceo-membranaceis, inferioribus basi oblique truncatis brevissime petiolatis petiolis superne alatis, superioribus basi oblique cuneatis sessilibus, supremis basi decurrentibus adnatis, soris rotundatis uniserialibus.—Caudex repens, crassitie pennae anserinae, squamosus. Stipes 4-5-pollicaris. Frons pedalis. Venae obliquae 2-3-4-furcatae, basi nigricantes, venula infima superne sorifera, reliquae fere ad marginem attingentes, apicibus clavatis. (*Hooker.*)—Regla.

Hooker redescribed and figured the species without mention of additional specimens in the *Icones*.^b The emended description contains no mention of margins

^aIn this paper the letters C, E, G, M, N, S, U, and Y refer respectively to the Columbia University Herbarium, the D. C. Eaton Herbarium at Yale University, the Gray Herbarium of Harvard University, the Missouri Botanical Garden Herbarium, the U. S. National Herbarium, the private herbarium of Capt. John Donnell Smith, the Underwood Herbarium, and the New York Botanical Garden Herbarium.

^bHook. Ic. Pl. 4: pl. 391-392. 1841.

"pubescenti-hirsutis" or of veins "basi nigricantes," nor does the illustration show ciliate margins. Otherwise the descriptions agree. Regla, which is not on most maps, is not far from Pachuca, Hidalgo, but at a somewhat lower altitude.

Polypodium biserratum Mart. & Gal.^a I can but regard as a synonym of *P. subpetiolatum*. It was described from Galleoti's no. 6410, said to have been found in humid, cool situations in the eastern cordillera of Oaxaca, in the zone of vegetation ranging from 2,000 to 2,300 meters in altitude.

Specimens examined:

Michoacan: Hills of Patzcuaro, on trees and rocks, November, 1890, C. G. Pringle, no. 3328 (N, E, G, M—2 sheets, S, U, as *P. subpetiolatum*).

Federal District: Forest near San Nicolas, Bourgeau, July, 1866, no. 1038 (N, E, G, as *P. biserratum*).

San Luis Potosi: Near city of San Luis Potosi, W. Schaffner, October, 1879 (U).

An examination of the fine series of Mr. Pringle's 3328 shows a high degree of variability. Fournier^b listed *subpetiolatum* and *biserratum* separately, noting that the former "differt a *P. biserrato* frondulis angustioribus, soris approximatis;" and even Hooker^c in uniting them was inclined to shift responsibility upon Mettenius. It is not difficult to understand how, from insufficient material, Fournier's view may appear correct, but it seems pretty plain, upon examination of the series of Mr. Pringle's 3328, that the term *biserratum* has been applied to the more or less infertile states of true *subpetiolatum*. For example, the Bourgeau specimens (no. 1038), labeled *biserratum* agree well with the less fertile and (consequently) more leafy individuals of 3328; yet the more perfectly fertile fronds of 3328 would be referred without question to *subpetiolatum*. Nor is 3328^d separable into two forms; the very considerable variation extends by slight gradations from the symmetrical fertile type, figured by Hooker as *subpetiolatum*, to the leafy, irregularly serrate sort referred to by Fournier and others as *biserratum* and rather diagrammatically figured in the original publication of the species. There is, indeed, a no greater amount of variation here than is to be observed in many or perhaps a majority of the familiar ferns of the eastern United States, whose tendencies toward variability in certain directions are well known and recognized. In general, the more fertile the frond the more approximate are the sori and the less the degree of serration. Marked fertility is usually accompanied also by a loss of foliar tissue. The present case furnishes an excellent illustration. The Hookerian figure is a good representation of normally fertile *subpetiolatum*, except that the margin is not often so evenly serrulate, but shows usually an unmistakable tendency toward double serration. The figure shows rather more pubescence than is to be seen on the specimens cited above. In these the pubescence is mostly confined to both sides of the midveins of the pinnae. On the underside it is rather lighter in color, longer and less matted than above, and extends only very sparingly or not at all along the veinlets. *P. biserratum* was originally described as glabrous; but no known member of the *subpetiolatum* group is absolutely without pubescence. In the several new species here proposed the quality and disposition of the pubescence have seemed valid diagnostic characters.

Polypodium schaffneri Fée^e is often cited as a synonym of *P. subpetiolatum*, but a description seems never to have been published. The name alone was offered by

^a Mem. Acad. Brux. 15⁵: 38. pl. 9. f. 1. 1a. 1842.

^b Mex. Pl. 78. 1872.

^c Sp. Fil. 4: 220. 1862.

^d The rootstock, about 8 mm. thick, is densely clothed with delicate, glossy, irregularly ovate, imbricated scales, attached by their middle, of a mummy-brown verging to walnut-brown as they become long-attenuate at the base of the prominently jointed stipes. The rootstock of none of the specimens here cited under *P. subpetiolatum* shows any variation in this particular.

^e 9^{me} Mem. 22. 1857.

Fée, followed directly by "*P. subpetiolatum*, Hook. Icon. Pl. pl. 391.2 (ex Th. Moore) Sn. Angel, et Sn. Agostin; W. Schaffner, no. 310 (1854) et au Popocatepetl No. 273."

From this it appears that Fée merely quoted Moore's opinion that the plants in hand were *subpetiolatum*, and that Fée holding them to be distinct proceeded to name them as a new species. Still, Fée does not list *subpetiolatum* in his Mexican catalogue,^a and it is possible that he intended to displace the name *subpetiolatum* by *schaffneri*. The reason for such a change is not apparent, for Hooker's name is clearly tenable. The status of Fée's name is, it seems, problematical and unsatisfactory, though it has been cited subsequently under both *subpetiolatum* and *biserratum*.

The immediate bearing of the determination of *P. schaffneri* is that the name may eventually have to be taken up for at least a part of the following specimens (all Mexican), which I am unable at the present time to place satisfactorily:

Federal District: Near Santa Fé, Bourgean, 1865, no. 463bis (N).

Oaxaca: Cañada de San Gabriel, altitude, 2,500 m., Conzatti & Gonzalez, no. 307 (G); Cerro de San Felipe, altitude, 2,800 m., Conzatti & Gonzalez, August, 1897, no. 430 (G).

San Luis Potosi: Near city of San Luis Potosi, W. Schaffner, September, 1879 (U, as *P. schaffneri* Fée); Parry & Palmer, "no. 973 $\frac{3}{4}$ pro parte" (E).

Notes upon these five sheets may be of interest. No. 463bis (ex herb. Mus. Paris) is labeled *P. subpetiolatum* with *P. schaffneri* written as a synonym. It is well matched by no. 307. Both are characterized by their strict appearance, crowded pinnae, and close venation, and have the look of plants grown under semixerophytic conditions, such as might result from removal of forest. No. 463bis has 26 pairs of pinnae, the stipe lacking. No. 307 is a single frond; stipe 9.5 cm. long, markedly canaliculate; lamina 25 cm. long; pinnae about 20 pairs, the lower nearly opposite, very short-petiolate, the uppermost becoming alternate, adnate, and somewhat decurrent; pinnae (maximum) 6 cm. long, having about 24 pairs of sori borne nearer to the midvein than to the margin, which is rather more finely serrate than is usual in *P. subpetiolatum*; veins 3-4-forked. Schaffner's plant (U) has the same strict aspect and is the same as the two preceding. The pubescence of all three is that of *subpetiolatum* (as here understood), but is more copious, and the pinnae are for the most part distinctly petiolate. No. 430 is very similar to 307, but differs slightly in the less close venation. No. 973 $\frac{3}{4}$, comprising two complete fronds, does not differ essentially. All five specimens agree in their rigid strict appearance, and oblique more or less petiolate pinnae, but do not present characters warranting their separation specifically from *subpetiolatum*. It does not seem worth while to recognize the form even subspecifically, owing to the doubt surrounding the proper application of Schaffner's name, and because of the variable characters of the plants. Further material collected completely and in good quantity would be of much interest in serving to indicate the limits of variation in plants of definitely restricted areas.

***Polypodium aequale* sp. nov.**

PLATE LXI.

Rootstock wanting; frond 4 dm. long; stipe (complete) 15 cm. long, very rigid, firmly terete; lamina 25 by 12.5 cm., very minutely glandular (apparently glabrous) below, comprising about 16 pairs of exactly opposite pinnae of which the lowermost are 5.5 by 1.5 cm., cordate at base, sessile; the fourth and fifth pairs about 1 cm. longer and adnate upon the upper basal portion; the upper pinnae becoming quite adnate but not decurrent; margins obscurely undulate, nearly entire; veins mostly free, but occasionally anastomosing to form large acutish areoles which extend nearly to the margin; sori about 16 pairs, large, borne on the first anterior veinlets slightly nearer to the midvein than to the margin.

^a 9^{me} Mem. 22. 1857.

The species is founded on no. 3263B of Capt. John Donnell Smith's Guatemalan plants, collected at San Miguel Uspantán, Department Quiché; altitude 1,800 meters, April, 1892, by Messrs Heyde & Lux. The type specimen, which is the only one known to me, is in the private herbarium of Captain Smith. The plant was distributed as *P. subpetiolatum*, but its affinities seem scarcely to lie with that group, nor does it appear closely allied to any middle American species. Its symmetry and regularity of outline have suggested the specific name here applied.

***Polypodium teresae* sp. nov.**

PLATE LXI.

Rhizome wide-creeping, clothed with light-brown imbricate chaff; frond 30 cm. long; stipe 8 cm. long; lamina 22 by 16 cm., broadly ovate, dark green, noticeably and finely pubescent over the whole lower surface, comprising about 13 pairs of subopposite ligulate membranaceous pinnae; the lowermost pinna (7 cm.) decidedly petiolate and excised below, the third, fourth, and fifth pairs nearly equal (about 8 cm. by 12 to 13 mm.), the uppermost wholly adnate; margins throughout deeply and regularly biserrate; midveins not prominent, dark-colored, as are the mostly 3-forked veins; sori about 20 pairs, equidistant from midvein and margin.

The species is founded upon Dr. J. N. Rose's no. 2205, collected in the Sierra Madre, near Santa Teresa, Territorio de Tepic, Mexico, August 12, 1897. There are two sheets; one, the type, no. 301119, in the U. S. National Herbarium; the other, smaller and less characteristic, in the Gray Herbarium. Undoubtedly the plant is closely related to *subpetiolatum*, to which species Mr. Davenport referred it; but it seems sufficiently distinct in the decidedly petiolate pinnae, more general distribution of the pubescence, position of the sori, and peculiar marginal serration.

***Polypodium firmulum* sp. nov.**

PLATE LXI.

Rhizome wide-creeping, 5 or 6 mm. thick, with yellowish brown curly chaff and copious rootlets thickly covered with a fine, linear, dark brown chaff; frond 22 cm. long; stipe about 8 cm. long, arcuate, greenish-stramineous; lamina 14 by 11 cm., broadly ovate, light green, with about 9 pairs of mostly alternate, linear-lanceolate, subcoriaceous, spreading pinnae which are pubescent over the tissue of both sides; the lowermost pair (sterile) 5.2 cm. by 9 mm., at the base excised below from the rachis a distance of 2 mm. along the midrib to form a broad sinus, above rounded and slightly adnate; the second pair (fertile) 5.8 cm. long, similarly excised below, above less rounded and similarly adnate; the third 6 cm., the fourth 5.5 cm. long; succeeding pinnae gradually shorter, considerably narrower, adnate, apices acute; the pinnae undulate in drying, the revolute margins inconspicuously notched by shallow distant crenations which in the fertile pinnae exactly correspond to the sori; sori averaging about 20 pairs, borne rather closer to the midvein than to the margin, one upon the first branch of the inconspicuous mostly 3-forked veins.

Type in the U. S. National Herbarium (no. 397,906), collected from "the shaded under sides of large oaks at Alvarez, San Luis Potosi, altitude 8,000 feet, by Dr. Edward Palmer (no. 448), September 28–October 3, 1902." Mixed in the number were plants of *P. plebejum*. The type sheet comprises four separate fronds, of which the largest has served for the above diagnosis.

The species is not very closely related to *P. subpetiolatum*, differing from that species in nearly all essential particulars. The coriaceous texture and the breadth of the frond are distinctive characters. The whitish pubescence, noticeable without a glass, is not confined to the venation, but occurs also on the leafy tissue; it is most abundant on the upper side. The sterile pinnae are decidedly obtuse, and the fertile ones are found upon being freshened to be more or less so, though when dry they appear acute. The long, shallow crenations are unique, so far as I have observed, among the polypodies of this group.

I would refer here also specimens in the D. C. Eaton herbarium, collected by Parry & Palmer on "Lerios Mountain, 15 leagues east of Saltillo," Coahuila, Mexico, in 1880. The plants were determined by Professor Eaton as "near *P. subpetiolatum*" and are so labeled. In the published report^a they are listed under this name with the remark "small specimens which agree best with this species." The error was perpetuated in the *Biologia Centrali-Americana*.^b The specimens are too immature to have served for description, but with the material now at hand they may be definitely placed under *P. firmulum*.

Polypodium legionarium Baker in Hook. & Baker, Syn. Fil. 337. 1868.

Polypodium macrodon Hook. Sp. Fil. 4: 218. 1862, not Reinw. (sec. Baker).

Specimens examined:

Mexico: Chiapas, Dr. Ghiesbreght, 1864-1870, no. 393 (G, E); no. 294 (E).

Guatemala: Coban, Vera Paz, altitude 1,500 meters, O. Salvin (G); without station, O. Salvin (G); Calderos, O. Salvin (G).

Of these sheets I suppose nos. 393 and 294 to be most typical of the species in its mature development. They are magnificent specimens, agreeing in every particular with Hooker's very complete and careful description so inaccurately and inadequately paraphrased by Mr. Baker. Salvin's Calderos specimen, aberrant and worn, is referred here with some doubt.

Polypodium fissidens sp. nov.

PLATE LXI.

Rhizome creeping, very firm, whitish, clothed with bright brown chaff; frond 40 to 56 cm. long; stipe 10 to 18 cm. long, stramineous, distinctly articulate, pubescent above; lamina 30 to 38 cm. by 13 to 18 cm., membranaceous, ovate to obcuneiform, broadest near the base, pubescent on both surfaces; pinnae about 30 pairs, exactly opposite, wholly adnate (excepting the lowermost two or three pairs, which may be somewhat rounded either above or below), obtusish at extremity, varying greatly in dimensions according to degree of fertility and bearing (maximum) 25 to 28 pairs of large sori near the sharply biserrate fimbriate margins on the prolonged first branches of the mainly trichotomous entirely free veins, which are rather noticeably enlarged at their extremities.

The species is founded upon no. 244 of Dr. Ghiesbreght's "Filices Austro-Mexicanae," collected in Chiapas, 1864-1870. Three sheets of this number have been examined; two in the D. C. Eaton herbarium (the larger of which is designated as the type); the third in the Gray herbarium. This number was determined by Hall^c as *P. biserratum*, a disposition which, in view of the copious pubescence, peculiar position of the sori, fimbriate margins, and generally distinct facies of the plants, seems quite remarkable.

Polypodium adelphum sp. nov.

PLATE LXII.

Rootstock creeping, about 8 mm. thick, clothed with long-attenuate chaff of a dull burnt amber, becoming lighter at the bases of the stipes; fronds 3.5 to 7 dm. long; stipe 10 to 20 cm. long, rigid and glossy; lamina 25 to 60 cm. long by 15 to 25 cm. broad, ovate, comprising from 10 to 18 pairs of membranaceous, subopposite, linear pinnae becoming more or less alternate above; the lowermost pinnae slightly shorter than the succeeding three or four pairs, which in the largest fronds measure about 12 to 15 cm. by 15 mm. (at the broadest point); pinnae mostly subpetiolate, the base subacutely cuneate, and very slightly winged above, only the pinnae of the upper

^a Proc. Am. Acad. 18: 183. 1883.

^b Biolog. Central. Am. Bot. 3: 662. 1885.

^c Franklin W. Hall, Catalogue of a Collection of Ferns made in Southern Mexico, mainly at Chiapas, by A. Ghiesbreght, in the years 1864-1870, 2. 1873. (Pp. 10. New Haven.)

half winged narrowly both above and below, finally fully adnate; the margins distinctly and uniformly shallow-crenate throughout; midvein prominent, giving rise to about 40 or 45 pairs of mostly 3-forked, free, oblique veins; sori, about 40 pairs, borne at half the distance to the margin.

Specimens examined:

Mexico: Chiapas, Ghiesbreght, 1864-1870, no. 244 in part (G, E—2 specimens); no. 205 (E—2 specimens).

Guatemala: Santiago, Dept. Zacatepequez, altitude 6,500 feet; Rosalio Gomez, 1891, John Donnell Smith's distribution no. 945 (G, N, S).

Of these the first mentioned (in the Gray herbarium) may stand as the type. The full-page illustration accompanying is quite representative of the species, which in general appearance stands almost exactly between *P. subpetiolatum* and *P. fraternum*. From the former it is distinguished by its size, by the uniformly crenate (instead of irregularly serrate) margins, and by the slender shape of the pinnae; from the latter by its membranaceous (instead of decidedly coriaceous) texture, entirely free venation, shorter-petiolate pinnae, regularly crenate (instead of undulate) margins, and by its pubescence. The pubescence is, however, inconspicuous in the plants studied; above it is a short, matted tomentum, confined to the midveins of the upper pinnae and to the terminal portion of the rachis; on the under side it is slight and to be observed only along the lower portions of the midveins. There is in the Gray herbarium an additional sheet from Chiapas, collected by Dr. Ghiesbreght (no. 260), which may or may not belong to this species. It is decidedly pubescent.

Fée's *P. cubense*^a is, I believe, not known in American herbaria. It is, apparently, related closely to the species here described, but both description and figure represent a plant differing in several essential particulars.

***Polypodium fraternum* Cham. & Schlecht. Linnæa 5:608. 1830.**

This species is well diagnosed by its authors. It appears to be rather variable, but is distinguished at once by the very coriaceous texture, long-petiolate, perfectly glabrous pinnae, subundulate nearly entire margins, and somewhat anastomosing venation.

It does not appear to have been much collected, and I have seen only the following specimens:

Specimens examined:

Vera Cruz: Near Jalapa, J. N. Rose, August 13, 1901, no. 6088 (N); near Orizaba, on oaks, C. G. Pringle, January 20, 1895 (G).

State of Mexico: Borrego, Bourgeau, April 14, 1866, no. 2881 (G).

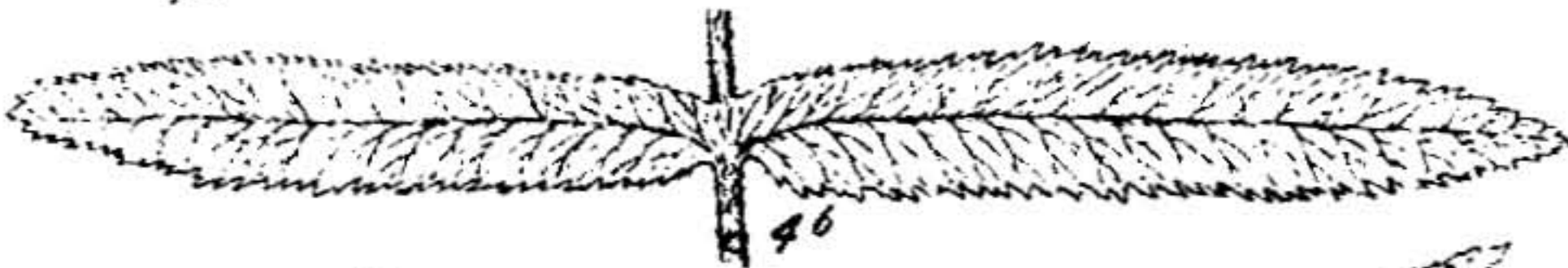
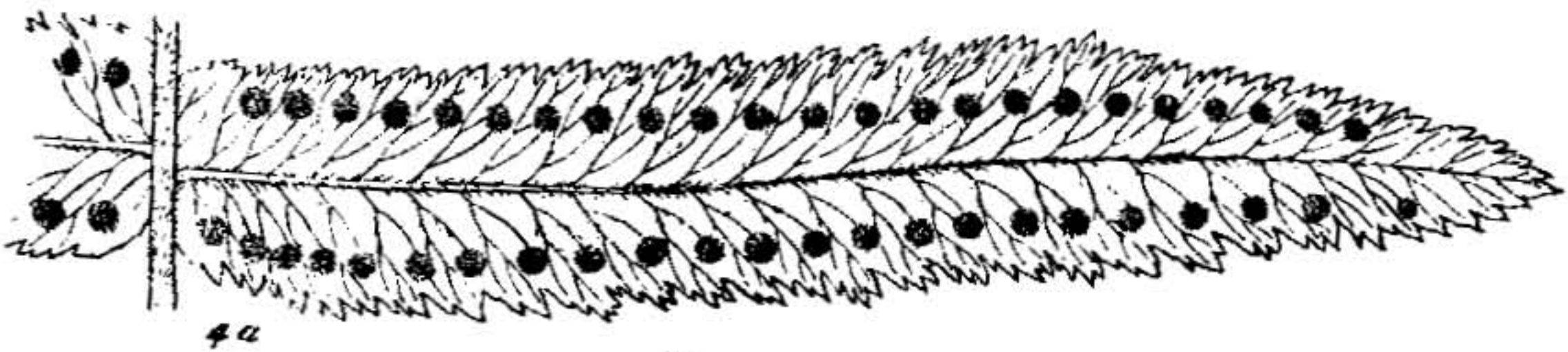
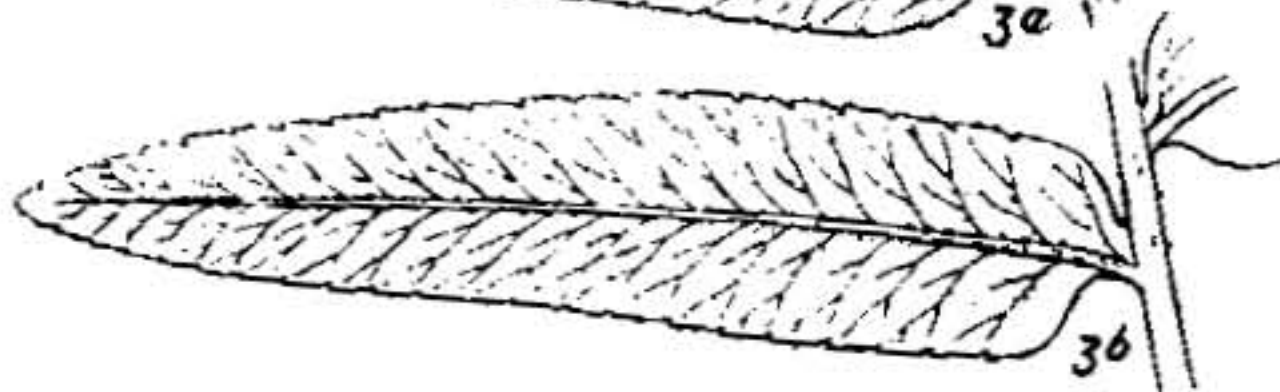
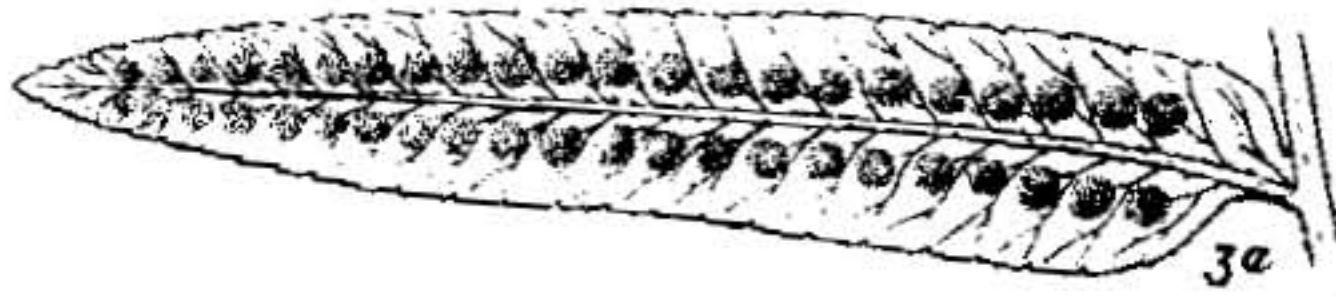
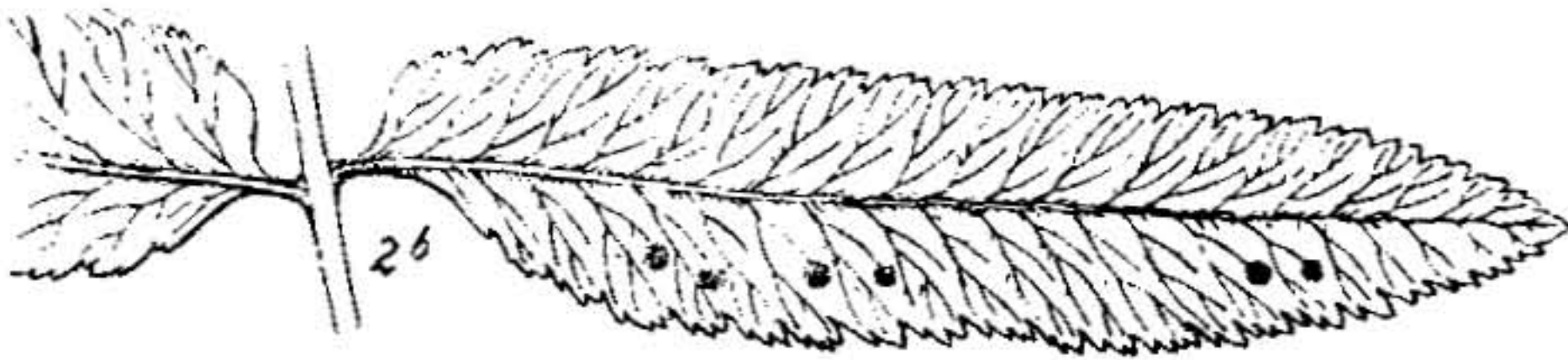
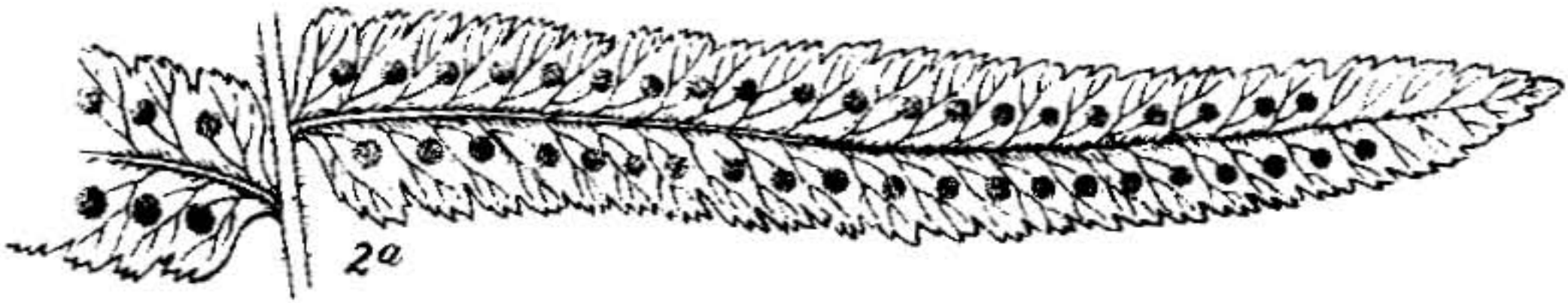
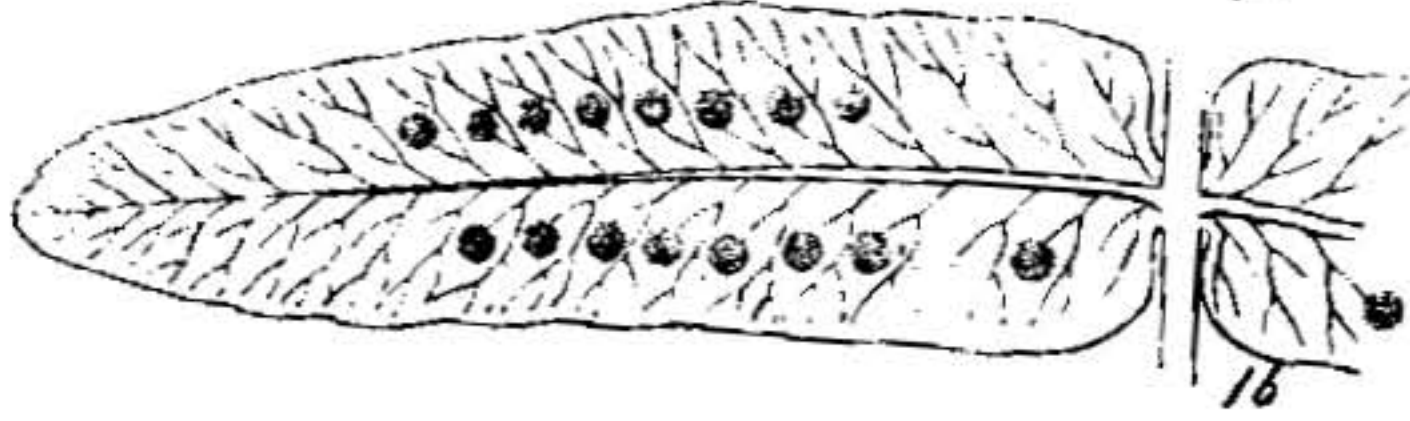
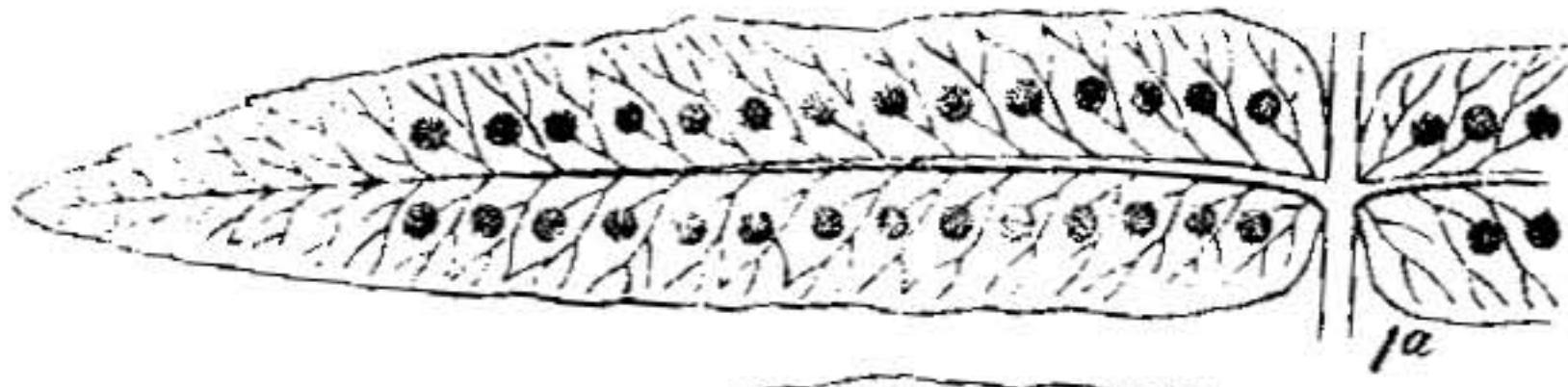
Guatemala: Santa Rosa, Dept. Baja Vera Paz, altitude 5,000 feet, H. von Türckheim, July, 1887, John Donnell Smith's distribution, no. 1291 (S).

^a Gen. Fil. 241. 1850-1852; 7^{me} Mém. 61. pl. 26. f. 1. 1854.

PLATE LXI.

EXPLANATION OF PLATE LXI.

- FIG. 1.—*Polypodium aequale*.—1a, Fourth pair of pinnæ; 1b, First pair of pinnæ.
FIG. 2.—*Polypodium teresae*.—2a, Fifth pair of pinnæ; 2b, First pair of pinnæ.
FIG. 3.—*Polypodium firmulum*.—3a, Fifth pinna; 3b, Lowermost pinna, the origin of the subopposite one indicated.
FIG. 4.—*Polypodium fissidens*.—4a, Fifth pair of pinnæ of type frond; 4b, First pair of pinnæ of a small frond; 4c Sixth pinna of a third frond, very fertile.



PINNÆ OF POLYPODIUM SPP.

PLATE LXII.

EXPLANATION OF PLATE LXII.

Photograph of type specimen of *Polypodium adelphum* (in Gray Herbarium) collected by Ghiesbreght in Chiapas, Mexico.

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POLYPODIUM ADELPHUM MAXON.