

SYSTEMATIC INVESTIGATIONS IN  
PHANEROGAMS, FERNS, AND MOSSES

## ADVERTISEMENT.

The United States National Herbarium, which was founded by the Smithsonian Institution, was transferred in the year 1868 to the Department of Agriculture and continued to be maintained by that department until July 1, 1896, when it was returned to the official custody of the Smithsonian Institution. The Department of Agriculture, however, continued to publish the series of botanical reports entitled "Contributions from the United States National Herbarium," which it had begun in the year 1890, until, on July 1, 1902, the National Museum, in pursuance of an act of Congress, assumed responsibility for the publication. The first seven volumes of the series were issued by the Department of Agriculture.

RICHARD RATHBUN,  
*Assistant Secretary, Smithsonian Institution,*  
*in charge of the United States National Museum.*



ASPENIUM ANDREWSII A. NELSON.

SMITHSONIAN INSTITUTION  
UNITED STATES NATIONAL MUSEUM

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# CONTRIBUTIONS

FROM THE

# UNITED STATES NATIONAL HERBARIUM

VOLUME 16

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SYSTEMATIC INVESTIGATIONS  
IN  
PHANEROGAMS, FERNS,  
AND MOSSES



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## NOTE.

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## PREFACE.

Volume 16 of the Contributions consists of 24 papers originally published in 14 parts. The first of four papers constituting part 1 is a discussion, by Mr. William R. Maxon, Associate Curator of the National Herbarium, of the systematic standing of *Asplenium andrewsii* with a reprint of Professor Nelson's description. The second, much longer one consists of a report, by Dr. J. N. Rose and Mr. Paul C. Standley, Assistant Curator of the National Herbarium, on a collection of plants chiefly from the region between the Pinacate Mountains of Sonora, Mexico, and Tucson, Arizona. The plants were obtained by an expedition directed by Dr. D. T. MacDougal, of the Desert Laboratory of the Carnegie Institution. Determinations of the plant species collected are given, together with descriptions of a few which proved to be new. In the third paper Doctor Rose describes a new cucurbitaceous plant from the vicinity of Tucson, Arizona, and bases upon it a new genus, *Tumamoca*. The last paper, by Mr. R. S. Williams, of the New York Botanical Garden, consists of descriptions of several new mosses collected in Panama by Mr. Maxon, with notes on other interesting species.

The second part consists of a third installment of the results of Mr. Maxon's studies of tropical American ferns. The most important portion is a monographic treatment of the North American species of *Hemitelia*, subgenus *Cnemidaria*, a group which has received little attention from fern students for many years and the members of which have been determined generally under wrong and loosely applied names. With an ample amount of material at hand the problem became chiefly one of taxonomy. That it is possible to offer a solution of its difficulties is due in large measure to the courteous assistance extended by the curators of several European herbaria.

Part 3 is devoted to a monograph of the North American species of *Nymphaea*, the work of Mr. Gerrit S. Miller, jr., Curator of the Division of Mammals, in the National Museum, and Mr. Standley. It contains descriptions and illustrations of all the species of yellow pond lilies known at present from the New World. Heretofore there have been recognized in this area about half a dozen forms; the number in the present paper is 19. Most of the new species come from the Southern States, mainly from the coastal plain of the Gulf of Mexico. The work was initiated by Mr. Miller about ten years ago and was carried far forward by him, but owing to interruption by other duties he has availed himself of the assistance of Mr. Standley

to complete the undertaking. The history and method of the work are noted in an introduction by Doctor Rose.

The next paper (part 4), by Mr. E. O. Wooton, of the United States Department of Agriculture, and Mr. Standley, contains descriptions of many new plants from the State of New Mexico. These have been discovered by the authors while engaged in the preparation of a report upon the flora of that State which is designed for future publication as a volume of the Contributions from the United States National Herbarium.<sup>1</sup> That a large number of undescribed plants have been detected in the progress of the work has resulted not only from the neglect of this area by most recent students of systematic botany, but also from the fact that there are now assembled for the first time fairly complete collections from all parts of the State. In addition to the diagnoses of many new species and one new genus, the publication of a number of new names is found necessary.

There follow seven short papers (composing part 5), all of them systematic studies. The first four of these are by Prof. Charles V. Piper, of the Department of Agriculture, one supplementing his work on the grasses of the genus *Festuca*, published in volume 10 of the Contributions; a second revising the larkspurs of the group represented by *Delphinium simplex* and describing a new species; a third settling the application of the name *Heuchera cylindrica* of Douglas; the fourth presenting miscellaneous new or noteworthy plants from the Pacific coast and adjusting questions of nomenclature. The fifth paper, by Mr. William E. Safford, of the Department of Agriculture, describes a new genus of Annonaceae from Colombia, with the species upon which it is based. The sixth paper, by Doctor Rose and Mr. Standley, is a revision of the section *Nephromeria* of the genus *Meibomia*, in which nine species, three of them new, are described. In the seventh paper Mr. E. S. Steele, of the National Herbarium, characterizes four new species of goldenrod from the northeastern United States.

The next paper (part 6), dealing with certain South American palms, by Messrs. O. F. Cook and C. B. Doyle, of the Bureau of Plant Industry, U. S. Department of Agriculture, is devoted chiefly to descriptions of three new genera of the family Iriarteaceae and the three new species which serve as generic types. All three genera were found in the forests of the Pacific coast of Colombia, near Buenaventura, in a region that seems not to have been visited by earlier students of this group of plants. The specimens, with notes, measurements, and photographs, were secured in 1905, when Mr. Doyle accompanied Mr. H. Pittier, also of the Bureau of Plant Industry,

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<sup>1</sup> See volume 19.

during a visit of agricultural exploration in Colombia. As much of the literature of the palms is based on rather fragmentary information, these more complete data, drawn from fresh material, will be appreciated. One of the results of the present study is to show the desirability of a subdivision of the family Iriarteaceae into three tribes, a synopsis of which is included. Synopses and descriptions are also given of the genera and species of the two tribes in which the new genera are placed.

A paper follows (part 7) in which Dr. N. L. Britton and Doctor Rose put on record some results of their joint studies in the cactus family, describing seven new species and revising several old names. As the authors are likely to publish in the Contributions from time to time further results of their work in this field, it has seemed advisable to connect their reports in a series under a uniform title.

The succeeding paper (part 8), by Mr. Cook, is in the nature of a continuation of a study on the "Relationships of the Ivory Palms," published as volume 13, part 5, of these Contributions. The results reached in the former study are applied to the classification of another aberrant genus of palms whose affinities have been misunderstood. In the way of a conclusion the paper gives the outlines of a general treatment of all the American palms.

Another paper (part 9), by Doctors Britton and Rose, follows, dealing with *Epiphyllum* and related genera of the family Cactaceae, the treatment being similar to that of the genus *Cereus* and its allies in volume 12 of the Contributions, but including in addition South American species. It is parallel also to the preliminary treatment of the tribe *Opuntioideae*, by the same authors, in the Smithsonian Miscellaneous Collections, volume 50, part 4. Two new genera and five new species are described.

In part 10 Mr. Safford presents further results of his studies in tropical American Annonaceae, dealing with a subgroup of the genus *Annona*, which he distinguishes as a new section, *Pilannona*, with *Annona sericea* as its type. Ten species are recognized, of which seven are described as new. The older species are redescribed after a critical examination of the type specimens.

In the next number (part 11) Mr. Cook reviews the botanical history of two well-known tropical fruit trees, the sapote and the sapodilla.

The following paper (part 12), on the tribes *Hauyae* and *Gongylocarpeae* of the evening primrose family, by John Donnell Smith and Doctor Rose, is of a monographic character, embodying all that is at present known of these two tribes. The tribe *Gongylocarpeae* is here first established, as are also two of the genera and one of the species. The authors have availed themselves of the resources of the National Herbarium, and Doctor Rose has had the additional advantage of a field acquaintance with *Xylonagra* and *Burragea* in



the deserts of Lower California. Of special interest is the unique fruiting habit of *Gongylocarpus* and *Burragea*, which bear their capsules embedded in the wood of the flowering branches.

The two short papers forming part 13 are studies by Mr. Ivar Tidestrom, of the Bureau of Plant Industry, United States Department of Agriculture, of plants in which he has become interested. These are considered with reference both to their nomenclatorial history and to their botanical characters. The first paper relates to a well-known fern type, the forms of which are regarded by the author as composing two species. The second treats of two tropical and subtropical weeds which have found their way into the southern United States.

In the final paper Mr. Edward A. Goldman puts on record the the botanical results of a biological exploration in Lower California, which was carried out in 1905 and 1906 by Mr. E. W. Nelson and himself, as members of the staff of the Bureau of Biological Survey, United States Department of Agriculture. The paper consists primarily of a list of the plants collected, with notes on distribution, to which are added descriptive ecological and economic data and technical descriptions of three new species of oak. A limited use has been made of the collections and records of others. This paper adds materially to our knowledge of an extensive flora, very interesting in its adaptations to diversified conditions of latitude, altitude, and rainfall.

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# THE RELATIONSHIP OF ASPLENIUM ANDREWSII.

By WILLIAM R. MAXON.

In the final brochure<sup>1</sup> of the Proceedings of the Biological Society of Washington for 1904, volume 17, Prof. Aven Nelson published, as one of several undescribed species collected in Colorado by Mr. D. M. Andrews, a supposed new *Asplenium*, which he dedicated to its discoverer as *Asplenium andrewsii*.<sup>2</sup> The description and notes are as follows:

“Rootstock short, wholly enveloped in matted roots; stipes naked, ebeneous below, becoming green above, from 2–10 cm. long, somewhat angled or striate; lamina thinly herbaceous, deltoid-ovate or narrower, 3–10 cm. long, somewhat narrower at its widest part, bipinnatifid, diminishing nearly uniformly from base to tip; pinnae lanceolate, the lower nearly at right angles to the rachis, the upper ascending, gradually diminishing and passing into the pinnatifid tip, all rather closely approximate and subopposite or the lower more distant (1 cm. or more) and alternate; pinnules 3–12 mm. long, ovate, more or less cuneate at base, sharply incised but cut not quite to the costa, sharply and somewhat incisely serrate; the veins rather inconspicuous and but slightly divergent; sori short but nearly connecting to those in the successive lobes, so forming almost a continuous sorus from base to apex of pinnule; indusium straight, forced back and finally concealed by the sporangia.

“Perhaps most nearly allied to *A. bradleyi* D. C. Eaton, but probably not very closely even to this. Mr. Andrews writes of it as follows: ‘The most interesting item on the list to me. I am sending a better specimen. It is certainly indigenous and grows on the south face of a white sandstone (alkaline) cliff extending along Boulder Creek for a mile or more, the ferns growing in crevices abundantly for nearly the whole distance. It is growing with *Cheilanthes feei*, a specimen of which I send you. The sandstone is porous and is not entirely dry.’”

Not long after this Professor Underwood called my attention to the obviously close relationship of this form to the Old World *Asplenium adiantum-nigrum*, and, if I am not mistaken, to the great difficulty or impossibility of distinguishing it specifically from that species, as usually accepted by European botanists. In 1906, however, the species was recognized by him as valid in Rydberg's Flora of Colorado, and again in his article “American Ferns, VI—Species added to the flora of the United States from 1900 to 1905,”<sup>3</sup> here with the comment, “This new discovery from Colorado is a member of the *adiantum-nigrum* group of *Asplenium*, and is closely related to *Asplenium adiantum-nigrum* of central and southern Europe. Among our

<sup>1</sup> Issued December 27, 1904.

<sup>3</sup> Bull. Torrey Club 33: 193. 1906.

<sup>2</sup> Page 174.

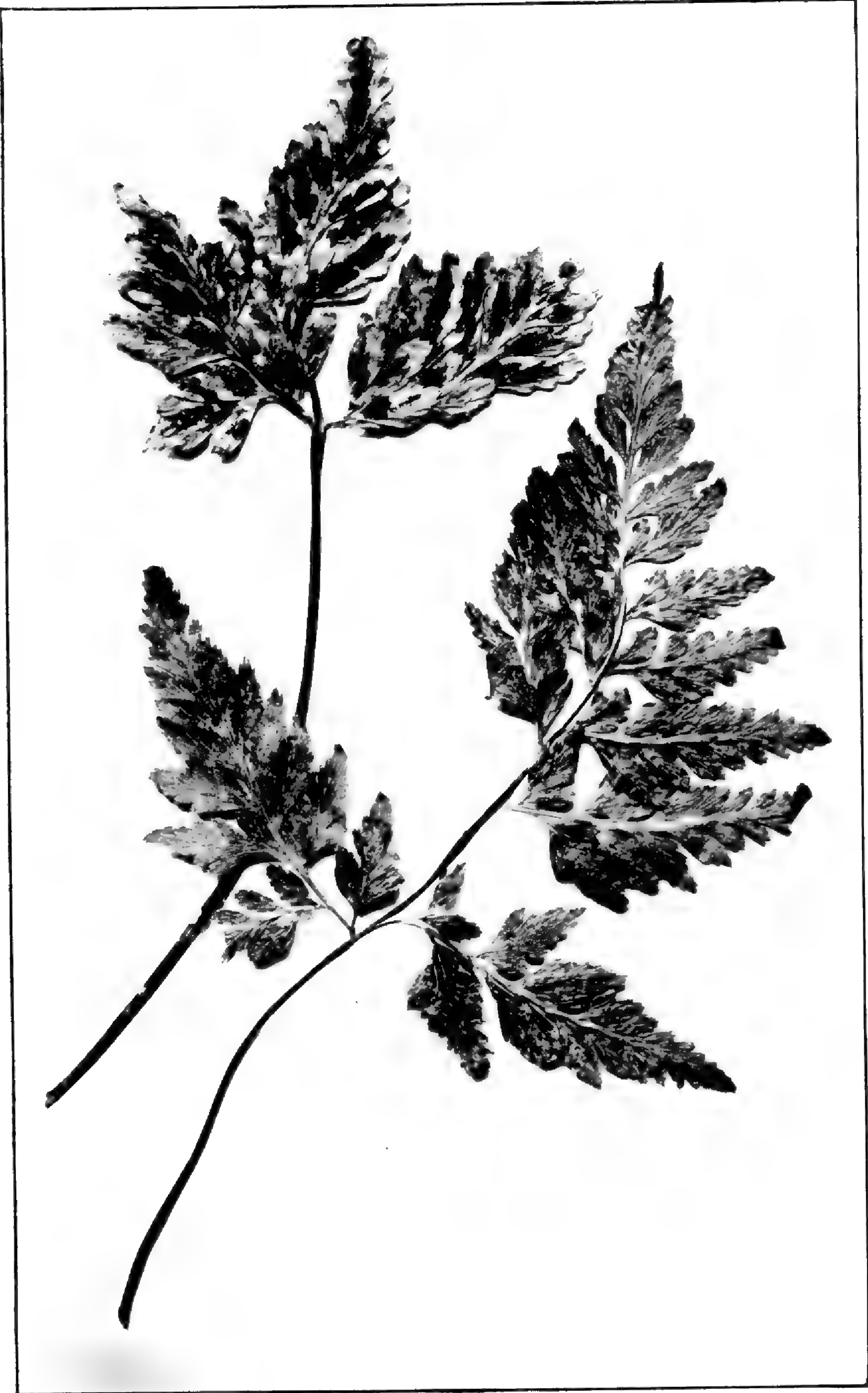
species it will stand nearest to *A. montanum*." From which it may be noted that Doctor Underwood was not only unwilling, apparently, to ascribe to *A. adiantum-nigrum* itself an extra-European range (though the species is usually accredited also to various parts of Africa, and to the Himalayas, Asia Minor, and other parts of Asia), but that also, in accordance with his often-expressed views as to the relatively restricted range of fern species, he was inclined upon *a priori* grounds to look upon the American plant as specifically distinct from that of the Old World. That *A. adiantum-nigrum* as ordinarily accepted does occur in Africa and Asia is apparent from specimens at hand; and if we admit the various forms distinguished by Milde,<sup>1</sup> Luerrsen,<sup>2</sup> Christ,<sup>3</sup> and others as constituting but a single highly variable species, there seems to be no logical ground for regarding *A. andrewsii* as other than a geographical phase of *A. adiantum-nigrum*. Excepting only *Athyrium filix-foemina*, there is, probably, no fern occurring in the United States which closely approaches it in extent of variation.

The two illustrations (Pls. 1 and 2) herewith represent at natural size the type specimens of *Asplenium andrewsii*, which have courteously been lent from the Rocky Mountain Herbarium, University of Wyoming, by Professor Aven Nelson. In general shape the lamina is apparently unusual for *A. adiantum-nigrum* in its relatively great width. Most of the foreign material at hand most closely resembling this shows blades elongate-deltoid in form, the upper portion often attenuate,—a leaf shape more nearly approached by some of the smaller fronds here shown. In fact not one frond of the foreign material available for comparison has precisely the same leaf shape as that of *A. andrewsii*, the nearest approach being in specimens from Doullens, France, *Copineau*, July 12, 1887, and from Devonshire, England, *Ware*, July 15, 1904. These appear to represent the variety *argutum*, as described by Luerrsen. Lacking a first-hand knowledge of *A. adiantum-nigrum* as it occurs in Europe, I hesitate to refer to it without reservation this American form, which is known only from such meager material; but I believe that the highly complex "species" *A. adiantum-nigrum*, as generally understood at present, embraces among its various and varying forms several elements which, in their extreme states, differ more widely from each other than from *A. andrewsii*. In degree of dissection, leaf texture, color of leaf tissue and of vascular parts, shape of pinnae, extent and character of sori, and in more minute characters, such as the peculiar form and structure of the long, slender, hair-pointed scales of the rhizome, the American plant certainly agrees very closely with some

<sup>1</sup> Milde, Fil. Eur. Atlant. 85. 1867.

<sup>2</sup> Luerrsen, Die Farnpflanzen 260. 1889.

<sup>3</sup> Christ, Die Farnkräuter der Schweiz 68. 1900.



ASPENIUM ANDREWSII A. NELSON.

of the European material, especially with the Devonshire specimen cited. The differences consist principally in its more broadly deltoid fronds and perhaps in its shorter stipe; the stipes of the two large fronds of the type, however, are incomplete, and one of the fronds is seen to be malformed. Through the generosity of Professor Nelson one of the smaller fronds of the type has been presented to the National Herbarium.

The collecting of more adequate material of *A. andrewsii* at the type locality, which is, I believe, not very readily accessible, would be of the greatest interest as throwing light upon the extent of variation in the American plant and its relationship to the Old World forms; and it is hoped that the publication of illustrations of the type specimens (Pls. 1 and 2) may assist in calling to the attention of collectors in the Rocky Mountain region the main characters of a plant which has remained so little known since the time of its description. The original locality has, indeed, been revisited by Prof. E. Bethel, who collected further specimens. Of these a small plant has recently been figured in the Fern Bulletin, with notes by Mr. Clute.<sup>1</sup>

A somewhat similar instance of distribution among the ferns is that of *Asplenium septentrionale*, a species which is common in Europe, occurs in the Caucasus, the Himalayas, and Tibet, and in North America ranges from the Black Hills of South Dakota (*Rydberg* 1194) to New Mexico (several collectors), Arizona (*MacDougal* 68), Colorado (several collectors), and Wyoming (*A. Nelson* 8900), and is known even from the San Pedro Martir Range of Lower California (*Brandegee*, May 18, 1893). Specimens from all these localities are in the National Herbarium.

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<sup>1</sup> Fern Bull. 19: 3. *Frontis*. 1911.

# REPORT ON A COLLECTION OF PLANTS FROM THE PINACATE REGION OF SONORA.

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BY J. N. ROSE AND PAUL C. STANDLEY.

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## INTRODUCTION.

An expedition was organized at the Desert Laboratory of the Carnegie Institution by Dr. D. T. MacDougal in the autumn of 1907 for the purpose of making a general bio-geographical reconnaissance of the region between Tucson and the Gulf of California. Attention was to be directed chiefly to a comparison of the physical features of the coastal desert with those of the elevated arid area in which the Desert Laboratory is located and to obtaining data regarding the general features of distribution and environment of the higher plants and animals.

The expedition left Tucson, Arizona, November 2, 1907, going westward 125 miles to the northern end of the Ajo Mountains, thence southward across the Mexican boundary to the village of Sonoyta, and westward through Santo Domingo and Quitovaquito. The course of the Sonoyta River was now followed southward to Agua Dulce where its waters are lost in the sands and then the route was laid across the desert to Monument 180 on the boundary, from which a departure was made that took the party southward along the western side of the Pinacate Mountains, the principal stations being Papago Tanks, Tule Tanks, and Pinacate Peak. In addition to this Mr. G. Sykes made a forced march to the shore of Adair Bay on the Gulf of California.

The Pinacate Mountains are the highest in northwestern Sonora. They run north and south just east of parallel  $113^{\circ} 30'$  longitude, between  $31^{\circ} 40'$  and  $31^{\circ} 50'$  north latitude. The highest peak, Pinacate, is about 1,218 meters in height, its slopes extending with but slight interruption to the shore of the Gulf. The entire range is of recent volcanic origin, with many sunken or elevated craters, the formations including great areas of volcanic sand, ashes, tufa, and hard lava, and the range lies in a vast field of broken lava which extends northward into Arizona. A careful survey of the region traversed was made by Mr. G. Sykes and his most excellent map is reproduced in connection with this article.

A small but very interesting collection of herbarium specimens made by Doctor MacDougal forms the basis of this paper. No attempt was made to obtain a full representation of the flora of the

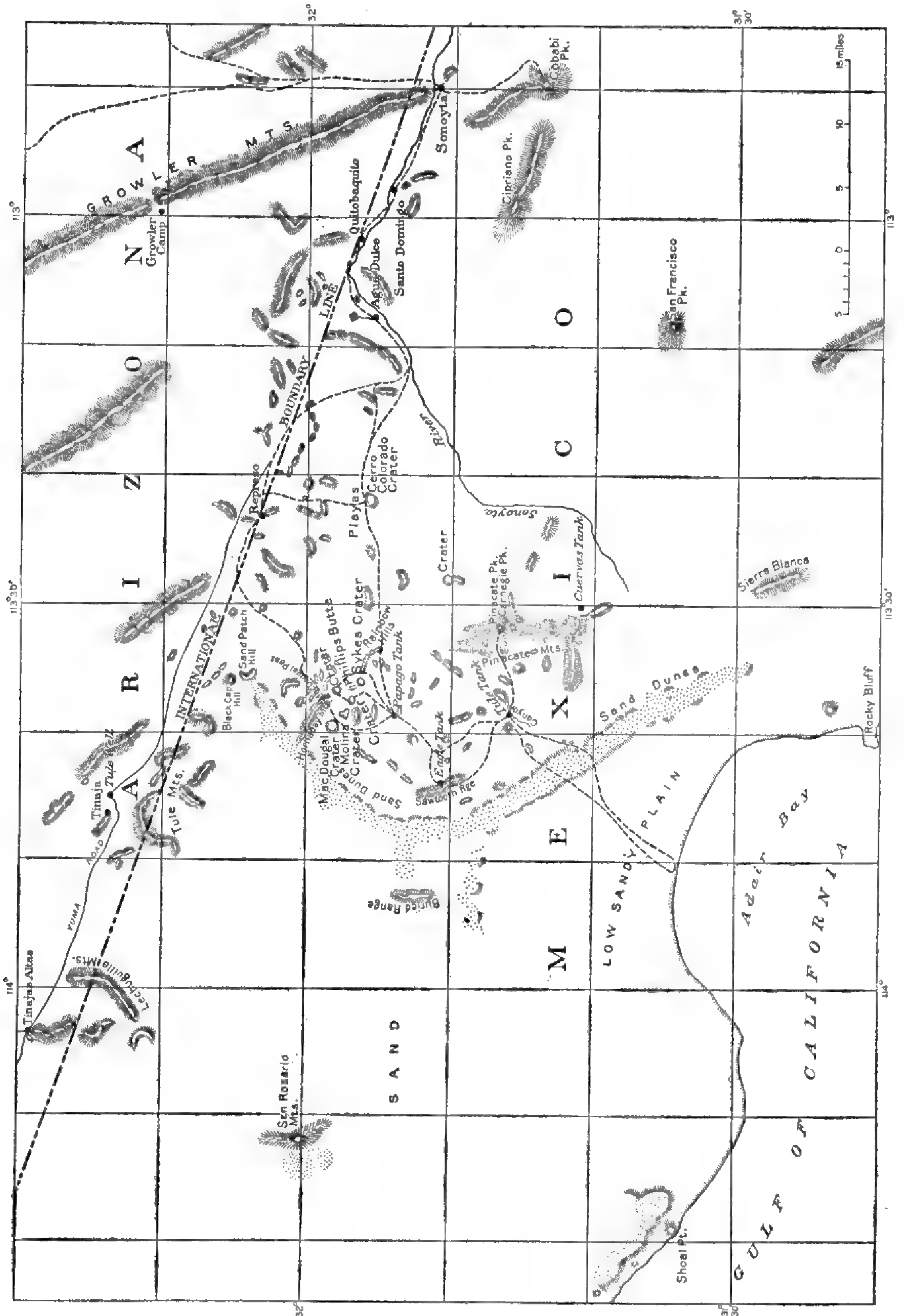


FIG. 1.—Map of the Sonoran Desert Region between Tucson, Arizona, and the Gulf of California.

region but only those plants were taken which were especially interesting or were in suitable condition. In addition a large series of photographs showing the botanical and geographical features was

obtained. A general discussion of the principal facts as to the distribution of the plants has been published by Doctor MacDougal in the Year Book of the Carnegie Institution of Washington for 1908 and a fuller treatment in the Bulletin of the American Geographical Society for December, 1908, and in The Plant World for May and June, 1908. The data respecting the animal life of the region obtained by Dr. W. T. Hornaday and Mr. J. S. Phillips have been published under the title of "Camp-Fires on Desert and Lava" by Doctor Hornaday, a most delightful book dealing with the experiences of the naturalists on the expedition, illustrated with many plates showing characteristic desert shrubs and trees.

The botanical collections, although small, have proved to be most interesting, as was to be expected from an unexplored region. Several of the plants appear to be new and these are here described. Some of those already known are noteworthy, representing forms seldom collected. No botanical collector had ever visited the Pinacate region. At Sonoyta a small collection was made by Dr. E. A. Mearns in 1894. A list of his plants will be found in Bulletin 56 of the U. S. National Museum.

The photographs here reproduced were taken by Dr. MacDougal, and these with the line drawings are the gift of the Carnegie Institution of Washington.

### LIST OF PLANTS, WITH DESCRIPTIONS OF NEW SPECIES.

**Aristida bromoides** H. B. K. Nov. Gen. & Sp. 1: 122. 1815.

Type locality, "In montibus regni Quitensis, juxta Tambo de Guamote et Llanos de Tiocaxas, alt. 1600 hexap."

Quitovaquito, November 11, 1907, *MacDougal*.

**Aristida californica major** Vasey, Proc. Calif. Acad. II. 2: 212. 1889.

Type locality, Magdalena Island, Lower California.

MacDougal Pass, Pinacate Mountains, November 14, 1907, *MacDougal* 32.

**Bouteloua polystachya** Torr. U. S. Rep. Expl. Miss. Pacif. 5: 366. 1853.

*Chondrosium polystachyum* Benth. Bot. Voy. Sulph. 56. 1844.

Type locality, "Bay of Magdalena," Lower California.

Papago Tanks, November 17, 1907, *MacDougal*.

**Cenchrus palmeri** Vasey, Proc. Calif. Acad. II. 2: 211. 1889.

Type locality, "Guaymas, Mexico."

Sand hills near the Adair Box, November 20, 1907, *Sykes* 58.

**Heteropogon contortus** (L.) Beauv.; Roem. & Schult. Syst. 2: 836. 1817.

*Andropogon contortus* L. Sp. Pl. 1045. 1753.

Type locality, "In India."

Papago Tanks, November 17, 1907, *MacDougal* 52.

**Leptochloa mucronata pulchella** Scribn. Bull. Torrey Club 9: 147. 1882.

Type locality, "Santa Cruz Valley, near Tucson."

Papago Tanks, Pinacate Mountains, November 17, 1907, *MacDougal* 40.

**Triodia pulchella** H. B. K. Nov. Gen. & Sp. 1: 155. *pl.* 47. 1815.

Type locality, "In subfrigidis, siccis, apricis regni Mexicani inter Guanaxuato, Mina de Bel grado et Cubilete, alt. 1050 hexap."

Agua Dulce, November 11, 1907, *MacDougal*.

**Hesperocallis undulata** A. Gray, Proc. Amer. Acad. 7: 390. 1868.

Type locality, "Desert plains at Jessup Rapids, Arizona."

This was seen at Walls Well, in southern Arizona, but no specimens were collected. The plant is commonly known as "ajo," and it is from this plant that the Ajo Range receives its name. The word signifies "garlic" and the roots are said to have a strong alliaceous flavor.

**Momisia pallida** (Torr.) Planch. in DC. Prodr. 17: 191. 1873.

*Celtis pallida* Torr. Bot. Mex. Bound. 203. 1859.

Type locality, "In western Texas and along the Rio Grande from Fort Duncan to the Gulf and west to Magdalena, in Sonora."

Walls Well, Ajo Mountains, Arizona, November 7, 1907, *MacDougal* 8.

There are three other species of the genus *Momisia* in Mexico for which the proper names seem not to have been formed. They may, for convenience, be entered here.

**MOMISIA ANFRACTUOSA** (Liebm.) Rose & Standley.

*Celtis anfractuosa* Liebm. Vidensk. Selsk. Skr. V. 2: 338. 1851.

Type locality, "Xalcomulco, Vera Cruz."

**MOMISIA PLATYCAULIS** (Greenm.) Rose & Standley.

*Celtis platycaulis* Greenm. Proc. Amer. Acad. 39: 78. 1903.

Type locality, "State of Morelos; volcanic hills near Yautepec."

**MOMISIA IGUANAEA** (Jacq.) Rose & Standley.

*Rhamnus iguanaea* Jacq. Enum. Pl. Carib. 16. 1762.

*Celtis aculeata* Swartz, Prodr. Veg. Ind. Occ. 53. 1783.

*Mertensia laevigata* H. B. K. Nov. Gen. & Sp. 2: 31. *pl.* 103. 1817.

*Momisia aculeata* Klotzsch, Linnaea 20: 539. 1847.

*Celtis iguanaea* Sarg. Silva N. Amer. 7: 64. 1895.

Type locality, West Indies.

**Phoradendron californicum** Nutt. Journ. Acad. Phila. n. ser. 1: 185. 1847.

Type locality, "In the mountains of upper California. Parasitic on the trunks and branches of a *Strombocarpus*."

Pinacate Region, November, 1907, *MacDougal*.

In his account of the trip Doctor Hornaday writes as follows concerning this plant:<sup>1</sup>  
 "Throughout our trip we found the large mesquite trees of the valleys and flood plains grievously afflicted with mistletoe. It usually appears as a great, dark-colored bunch 2 feet in diameter, and sometimes we found a dozen clumps in one tree. This parasite, like most others, is destructive when overdone. We saw many hapless trees that had literally been murdered by it and were only lifeless stubs. It was in the valley of the Sonoyta River, near Agua Dulce, that Doctor MacDougal photographed a wide-spreading mesquite whose top was so overloaded with mistletoe that it looked as if a small load of clover hay had been pitched into it."<sup>2</sup>

**Eriogonum fasciculatum** Benth. Trans. Linn. Soc. 17: 411. 1837.

Type locality, "Upper California."

Walls Well, Ajo Mountains, November 5, 1907, *MacDougal* 9.

<sup>1</sup> Camp-Fires on Desert and Lava, page 48.

<sup>2</sup> For illustration of this tree, see plate opposite page 48 of the "Camp-Fires."



**Eriogonum pinetorum** Greene, *Muhlenbergia* 6: 3. 1910.

Type locality, "Black Range, Sierra County, New Mexico."

Paso Blanco, November 6, 1907, *MacDougal* 2.

This species has long been confused with *Eriogonum abertianum*, but is readily distinguished from it. Its habit is strikingly different and the calyx is a light pink instead of dark red.

**Eriogonum vimineum** Dougl.; Benth. Trans. Linn. Soc. 17: 416. 1837.

Type locality, "Columbia river."

Pinacate Mountains, at 1,200 meters, November 21, 1907, *MacDougal* 71. The specimens appear to belong to this species, although they are not in the best condition for determination.

**Rumex hymenosepalus** Torr. Bot. Mex. Bound. 177. 1859.

Type locality, "Sandy soils from El Paso to the cañons of the Rio Grande."

No specimens were collected but it was seen at Walls Well in the Ajo Mountains. It is a common southwestern plant whose roots are much used for tanning.

**Atriplex canescens** (Pursh) James, Trans. Amer. Phil. Soc. 2: 178. 1825.

*Calligonum canescens* Pursh, Fl. Amer. Sept. 370. 1814.

Type locality, "In the plains of the Missouri, near the Big-bend."

Walls Well, Ajo Mountains, November 8, 1907, *MacDougal* 4.

**Amaranthus palmeri** S. Wats. Proc. Amer. Acad. 12: 274. 1877.

Type locality, "At Larkin's Station, San Diego County, California."

*MacDougal* Crater, Pinacate Mountains, November 14, 1907, *Sykes*. This is perhaps the commonest species of *Amaranthus* in the Southwest. Very frequently the plants occur in such abundance that they are cut and cured for hay.

**Cladotrix lanuginosa** Nutt.; Moq. in DC. Prodr. 13<sup>2</sup>: 360. 1849.

*Alternanthera lanuginosa* Moq. op. cit. 359. 1849.

Type locality, "Secus Salt-river et Red-river."

*MacDougal* Crater, Pinacate Mountains, November 14, 1907, *Sykes* 29 and 31.

**Boerhaavia wrightii** A. Gray, Amer. Journ. Sci. II. 15: 322. 1853.

Type locality, "Pebbly hills near El Paso."

Papago Tanks, Pinacate Mountains, November 16, 1907, *MacDougal* 43.

**Wedeliella incarnata** (L.) Cockerell, *Torreyia* 9: 167. 1909.

*Allionia incarnata* L. Syst. Nat. ed. 10. 890. 1759.

*Wedelia incarnata* Kuntze, Rev. Gen. Pl. 533. 1891.

Type locality, Peru.

*MacDougal* Crater, Pinacate Mountains, November 14, 1907, *MacDougal* 30.

**Isomeris arborea** Nutt.; Torr. & Gr. Fl. N. Amer. 1: 124. 1838.

Type locality, "St. Diego, California."

Pinacate Mountains, at 600 to 900 meters, November 21, 1907, *MacDougal*.

**Wislizenia costellata** Rose, Proc. Biol. Soc. Washington 19: 132. 1906.

Type locality, "Sonora, Mexico. Between Nogales and Guaymas."

Sonoyta, November 8, 1907, *MacDougal* 12.

**Krameria glandulosa** Rose & Painter, Contr. Nat. Herb. 10: 108. 1906.

Type locality, "Near El Paso, Texas."

Hornaday Range, Pinacate Mountains, November 14, 1907, *MacDougal* 23.

**Acacia greggii** A. Gray, Smiths. Contr. Knowl. 3: 65. 1852.

Type locality, "Dry valley west of Patos, Northern Mexico."

No specimens were collected but the plant was observed throughout the region visited.

**Parkinsonia microphylla** Torr. U. S. Rep. Expl. Miss. Pacif. 4: 82. 1856.

Type locality, "Banks of the Colorado, and on Williams' river," Arizona.

This, the common palo verde, is discussed and illustrated by Doctor Hornaday in the "Camp-Fires." Doctor Hornaday speaks of it as follows: <sup>1</sup>

"Of all the tree products of the desert the palo verde is one of the most beautiful and interesting. Its name is Spanish and means 'green tree.' According to its soil and water supply, it may be as large as an adult apple tree—fifteen feet high, with a trunk nine inches in diameter—or as small as a mountain laurel bush three feet high. Almost as far as it can be seen, you recognize it at once as something different and remarkable. Instead of a top that is made up of leaf masses, one laid upon another, you see that its foliage—or rather the masses where its foliage ought to be—is composed of *straight lines*, and angles. The palo verde bears a few tiny leaflets, so small that it would take about twelve of them to cover a postage stamp; but in November they exert no influence whatever upon the general aspect of the tree.

"Regardless of leaves, however, from root to top the palo verde is of the most beautiful green that could be imagined. It is not the bold, waxy, aggressive green of the creosote bush, but the soft, smooth, and delicate green of the asparagus.

"The bark is as smooth as the surface of polished oak, and trunk, branch, and twig are alike persistent green. Even the bark of the trunk has a surface like a robin's egg.

"The terminal twigs are long, straight, and slender, like masses of green darning needles set where the leaves ought to be. The density of their color, added to their unique form, gives the tree as a whole a peculiarly lined top. This is one of the very few desert trees that is free from thorns.

"This tree is not particularly useful. Its chief purpose is to ornament the arroyos and flood basins of the desert regions, and to furnish brake blocks for desert freight-wagons. It strings along the arroyos, wherever the water supply is a little above the average, but on the open, level plains it is rare. Often from many a square mile it is quite absent. In density and grain, its wood is much like that of the white birch. The trunk consists of a single stem, upon which the branches are set in very abrupt and angular fashion, all of which merely adds to the odd appearance of the tree."

**Prosopis velutina** Wooton, Bull. Torrey Club 25: 456. 1898.

Type locality, "Probably first collected with young fruit in the valley of the Nazas in northern (?) Mexico by Gregg."

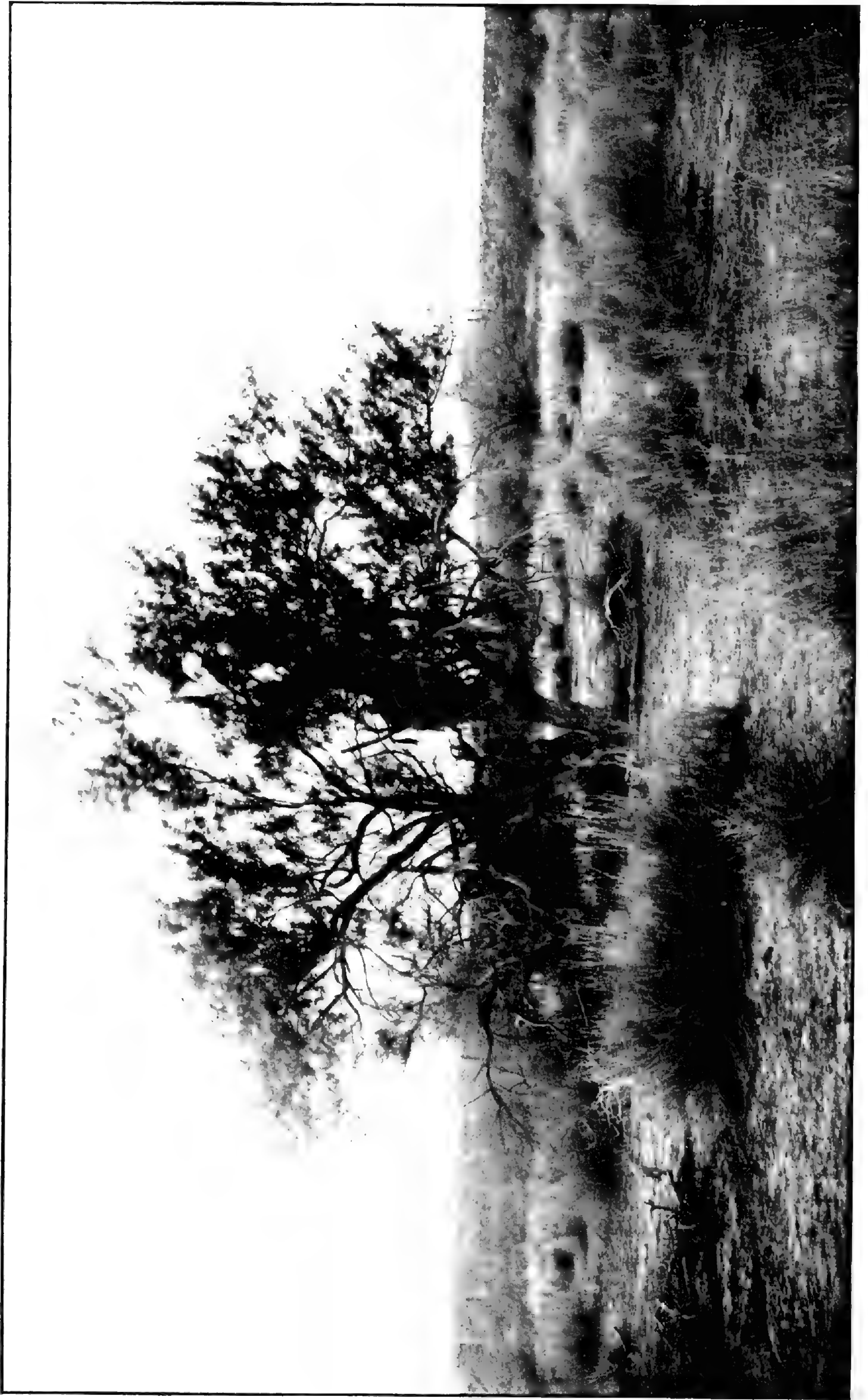
No specimens of this were collected, but it is illustrated in several of the illustrations of the "Camp-Fires." Doctor Hornaday writes of it as follows: <sup>2</sup>

"The honey-pod mesquite is the most persistent bush tree of the deserts. Both in form and size it is much like the palo verde, and in southern Arizona and Mexico the two species are almost inseparable companions. On the desert plains, where water is scarce and dear, the mesquite is a modest little bush three feet high; but along the arroyos, the valleys, and in the business centers of the flood basins, where the water wagon is more in evidence, it develops into a real tree. Often it grows to a height of twenty-five feet, with a writhing trunk twelve or more inches in diameter. In growth habit it is very much like an apple tree—a low, heavy, wide-spreading top with crooked branches that frequently are horizontal, on a short, stout trunk of irregular shape. The bark is gray and the foliage is of a pale gray green tint—not so pleasing as the asparagus green of the palo verde. \* \* \* Both foliage and "beans" are eaten by horses and cattle when grass is not obtainable and hunger is great. Its seeds are greedily eaten by all the small rodents of the deserts, and by many birds also. Although its leaves are very small, the shade of the mesquite is very grateful and comforting.

"The mesquite is well provided with thorns, but, fortunately for the proletariat, they point forward instead of back. Its wood is hard, fine-grained, durable, and the general stand-by for fuel throughout the whole Southwest. Blessed is the desert wayfarer

<sup>1</sup> Page 45; see also plate facing p. 70, same work.

<sup>2</sup> Page 47.



OLNEYA TESOTA A. GRAY.

who has dry mesquite for his camp-fire; for without it fire making is a serious problem. It burns freely, makes a hot fire, and quickly produces a good bed of coals for the baking of bread and the frying of meat.

"In the simple house building of the deserts, mesquite constitutes well-nigh the only wood that is available. The stems are used to support the earth roofs of houses, to build into fences for corrals and cultivated fields, and to repair broken wagons. It is said that the Mexicans also use it in the making of furniture."

***Olneya tesota*** A. Gray, Mem. Amer. Acad. II. 5: 328. 1855.

PLATE 3.

Type locality, "On the table-lands of the Gila."

No specimens of this were collected, either, but it is common about the Pinacates and in southern Arizona, where it is known as ironwood. Of it Doctor Hornaday says:<sup>1</sup>

"The ironwood tree is not of sufficient importance to justify prolonged attention. It looks very much like the mesquite, but its wood is as hard as its name implies, and so heavy that it will not float in water. The largest specimen I noted particularly was a conspicuous part of our aforesaid bivouac on Pinacate. A trunk fully a foot in diameter and twenty feet long was twisted almost into a figure-8 knot, but it was what cattlemen call a 'lazy 8,' for it lay upon the ground."

EXPLANATION OF PLATE 3.—From a photograph by Dr. D. T. MacDougal.

***Parosela emoryi*** (A. Gray) Heller, Cat. N. Amer. Pl. ed. 2. 6. 1900.

*Dalea emoryi* A. Gray, Mem. Amer. Acad. II. 5: 315. 1855.

Type locality, "On the desert table-lands of the Gila."

Adair Box, November 20, 1907, *Sykes* 65.

***Parosela spinosa*** (A. Gray) Heller, Cat. N. Amer. Pl. ed. 2. 7. 1900.

*Dalea spinosa* A. Gray, Mem. Amer. Acad. II. 5: 315. 1855.

Type locality, "Arroyos on the Gila; and on the Californian desert west of the Colorado."

Sandhills, Adair Box, November 20, 1907, *Sykes* 64.

This is spoken of as the "spiny smoke tree." It is well illustrated in the "Camp-Fires."<sup>2</sup>

***Phaseolus wrightii*** A. Gray, Smiths. Contr. Knowl. 3: 43. 1852.

Type locality, "Declivity of a mountain, near El Paso."

Papago Tanks, Sonora, November 17, 1907, *MacDougal* 48.

***Covillea glutinosa*** (Engelm.) Rydb. N. Amer. Fl. 25<sup>3</sup>: 108. 1910.

*Larrea glutinosa* Engelm. in Wislitz. Mem. North. Mex. 93. 1848.

Type locality, "Olla and Fray Cristobal," New Mexico.

The common creosote bush, occurring nearly throughout the arid Southwest. Again we quote Doctor Hornaday from the "Camp-Fires:"<sup>3</sup>

"Last of the important bushes and trees of the desert—but often it is the first—is the creosote bush. It is by far the most omnipresent representative of the plant world throughout the region we traversed. I think we saw hundreds of square miles of it, and most of all was on the trail from the Ajo mines up to Gila Bend.

"The specimen shown with Mr. Sykes and the grave of the murdered Mexican is an excellent picture of a creosote bush, which may be regarded as the type of ten million others. The creosote bush is a big cluster of small and brittle woody stems, covered with smooth brown bark. The stems do not branch until near their tops, and there they send off a few fine twigs to support the irregular clusters of tiny leaves that form the outer surface of the bush. The leaves are of a rich, bright green color, and so shiny that they look as if recently varnished. They taste unpleasantly like creosote (oil of smoke), and no animal can eat them.

<sup>1</sup> Page 52.

<sup>2</sup> Plate opposite page 182.

<sup>3</sup> Page 53.

"The leaves of the creosote bush are so wholly on its outer surface that it would be quite easy to shear them all off, as one shears a sheep, and leave the bush nearly full size but perfectly bare. The usual height of this bush is from two to three feet. The clumps stand about ten feet apart, and usually there are from 100 to 150 per acre. In a few localities we saw some very large specimens, which grew fully ten feet in height."

**Kallstroemia grandiflora** Torr.; A. Gray, *Smiths. Contr. Knowl.* 3: 28. 1852.

Type locality, "Borders of the Gila," New Mexico or Arizona.

MacDougal Crater, Pinacate Mountains, November 14, 1907, *MacDougal* 25.

**Chamaesyce pediculifera** (Engelm.) Rose & Standley.

*Euphorbia pediculifera* Engelm. in Torr. *Bot. Mex. Bound.* 186. 1859.

Type locality, "Sonora."

Quitovaquito, Sonora, November 11, 1907, *MacDougal* 17; MacDougal Crater, Pinacate Mountains, November 14, 1907, *Sykes* 28.

**Croton arenicola** Rose & Standley, sp. nov.

Low shrub, less than a meter high, much branched, the stems strictly erect, whitish, slender, densely lepidote throughout; leaves linear to linear-oblong or lanceolate, 20 to 35 mm. long, 2 to 6 mm. wide, rounded at the apex, attenuate to the base, densely lepidote-stellate on both surfaces, whitish, on slender petioles 5 to 14 mm. long; flowers dioecious, both kinds apetalous; staminate flowers in few-flowered racemes 15 to 30 mm. long, naked below, the calyx lobes ovate, densely stellate and lepidote, obtuse, the flowers 4 mm. broad, on pedicels 5 to 8 mm. long; stamens slightly exceeding the sepals; pistillate raceme about 3 cm. long, sometimes less, the flowers on stout pedicels 4 to 6 mm. long, the calyx lobes ovate, obtuse; capsule 10 or 11 mm. high, densely and finely stellate and somewhat lepidote; seeds oval or oblong, 7 or 8 mm. long, variegated with brown and gray, the caruncle stipitate, small.

Type in the U. S. National Herbarium, no. 574267, collected on sand hills about Adair Bay, Gulf of California, in northwestern Sonora, November 20, 1908, by Mr. G. Sykes (no. 62).

This is near *Croton tenuis* but has more abundant pubescence so that the plant appears silvery throughout; the leaves are also narrower, and the seeds are much larger with a different caruncle.

**Ditaxis odontophylla** Rose & Standley, sp. nov.

Low, 20 cm. high or less, erect or ascending; stems stout, pilose; leaves oblanceolate, attenuate at the base into a short petiole, rather thin, bright green, more or less pilose on both surfaces, broadly obtuse and coarsely dentate near the apex; staminate flowers with linear-oblong sepals and oval, clawed petals, the latter white tinged with purple near the base, the sepals pilose; pistillate flowers with linear-lanceolate, hirsute sepals, the style tips not enlarged; capsule strongly hirsute; seeds subspherical, smooth, brown.

Type in the U. S. National Herbarium, no. 574248, collected at the Papago Tanks, Sonora, November 14, 1908, by Dr. D. T. MacDougal (no. 36).

The plant is similar to *Ditaxis neomexicana* but has very different leaves and much more abundant pubescence.

Here may be inserted a description of another apparently new species of *Ditaxis*, detected while attempting to determine *Ditaxis odontophylla*.

**DITAXIS GRACILIS** Rose & Standley, sp. nov.

Low, sparingly branched, slender annual, 30 to 40 cm. high; stems sparingly pilose, pale green; leaves lanceolate or elliptic-lanceolate, 5 to 6 cm. long and 20 to 25 mm. wide, acute, somewhat attenuate at the base, thin, bright green, all except the youngest glabrous, all on slender petioles 10 to 18 mm. long; racemes few-flowered and



ABUTILON MACDOUGALII ROSE & STANDLEY.



*SPHAERALCEA MACDOUGALII* ROSE & STANDLEY.

axillary; staminate flowers with linear, acute, sepals, their pale green petals broadly lanceolate and one-half longer; pistillate flowers with linear-lanceolate, attenuate sepals 6 to 8 mm. long, the petals spatulate, very short and inconspicuous; style tips not enlarged; capsule hirsute, the mature ones and seeds not seen.

Type in the U. S. National Herbarium, no. 45193, collected at Guaymas, Sonora, in 1887 by Dr. Edward Palmer (no. 624).

A very distinct species, readily separated by its large, thin, finally glabrous leaves with slender petioles.

Another species of *Ditaxis* from Lower California seems never to have been referred to the correct generic name:

*DITAXIS BRANDEGEI* (Millspaugh) Rose & Standley.

*Argythamnia brandegei* Millspaugh, Proc. Calif. Acad. II. 2: 220. 1889.

Type locality, "San Gregorio," Lower California.

*Mozinna spathulata* Orteg. Hort. Matr. Dec. 8: 105. pl. 13. 1799.

*Jatropha spathulata* Muell. Arg. in DC. Prodr. 15<sup>2</sup>: 1081. 1866.

Type locality, "Habitat in Nova Hispania."

Hornaday Range, Pinacate Mountains, November 14, 1907, *MacDougal* 21.

*Poinsettia eriantha* (Benth.) Rose & Standley.

*Euphorbia eriantha* Benth. Bot. Voy. Sulph. 51. 1844.

Type locality, "Bay of Magdalena," Lower California.

Pinacate Mountains, at 600 to 900 meters, November 21, 1907, *MacDougal* 69.

*Stillingia linearifolia* S. Wats. Proc. Amer. Acad. 14: 297. 1879.

Type locality, "S. California; near Boundary Monument, San Diego."

MacDougal Pass, Pinacate Mountains, November 14, 1907, *MacDougal* 59.

*Abutilon macdougalii* Rose & Standley, sp. nov.

PLATE 4.

Herbaceous throughout, tall, probably about a meter high; stems stout, much branched, densely covered with soft, short, spreading hairs; leaves broadly ovate-cordate, 9 cm. long or usually smaller, the sinus closed, irregularly serrate, thick, velvety-tomentose on both sides, canescent beneath, all on petioles longer than the blades; inflorescence a terminal, sparingly branched panicle, the flowers on pedicels 10 to 15 mm. long; lobes of the calyx triangular-ovate, attenuate, divided two-thirds of the way to the base, densely villous; petals orange yellow, 20 mm. long, more than twice as long as the calyx; carpels slightly surpassing the calyx, 10 in number, villous, with conspicuous, divergent, rather long beaks; seeds brown, glabrous, papillose.

Type in the U. S. National Herbarium, no. 574255, collected in the Pinacate Mountains, November 22, 1907, by Dr. D. T. MacDougal (no. 47).

Near *Abutilon aurantiacum* but with different inflorescence and seeds, and with shorter calyces with narrower lobes.

EXPLANATION OF PLATE 4.—Branch of the type specimen. Natural size.

*Hibiscus denudatus* Benth. Bot. Voy. Sulph. 7. pl. 3. 1844.

Type locality, "Bay of Magdalena," Lower California.

Papago Tanks, Pinacate Mountains, November 20, 1907, *MacDougal*.

*Sphaeralcea macdougalii* Rose & Standley, sp. nov.

PLATE 5.

Stems stout, erect, branched, densely velvety-stellate; petioles 15 to 20 mm. long; leaf blades ovate, obscurely 3-lobed, obtuse, cordate at the base, densely velvety-stellate on both surfaces, prominently veined, the margins somewhat undulate; flowers few, in short terminal racemes; pedicels 1 cm. long or less; bracts subulate, inconspicuous; calyx 10 to 12 mm. high, cleft nearly to the base, the lobes oblong-lanceolate, acute, densely stellate; petals 2 cm. long, purplish red; immature carpels densely stellate on the back, 2-seeded, blunt, nearly smooth on the inner faces.



Type in the U. S. National Herbarium, no. 574253, collected at the Papago Tanks in the Pinacate Mountains, Sonora, November 16, 1907, by Dr. D. T. MacDougal (no. 45).

EXPLANATION OF PLATE 5.—Branch of type specimen. Natural size.

**Elaphrium microphyllum** (A. Gray) Rose, N. Amer. Fl. **25**<sup>3</sup>: 250. 1911. PLATE 6.

*Bursera microphylla* A. Gray, Proc. Amer. Acad. **5**: 155. 1861.

*Terebinthus microphylla* Rose, Contr. Nat. Herb. **10**: 120. 1906.

Type locality, Lower California.

Hornaday Range, Pinacate Mountains, November 14, 1907, *MacDougal* 22; slope of the Pinacate Mountains, November 20, 1907, *MacDougal* 55.

EXPLANATION OF PLATE 6.—From a photograph by Dr. D. T. MacDougal.

**Fouquieria splendens** Engelm. in Wislitz. Mem. North. Mex. 98. 1848.

Type locality, "Jornada del Muerto," New Mexico.

This is illustrated in several plates of the "Camp-Fires."<sup>1</sup> Concerning this characteristic desert plant Doctor Hornaday writes:<sup>2</sup>

"There is one other arboreal feature of the deserts which, because of its picturesque oddity, I have reserved to the last. It is a product of the plant world unique in character, and standing as much apart from related genera and species as does the prong-horned antelope among hoofed animals. It is the Ocotillo, the Spanish name of which is pronounced o-co-tee'-yo. Next to the giant cactus, it was the most monumental and picturesque thing of plant growth found by us in two hundred miles of fertile deserts.

"The ocotillo is a multiform tree, and there is nothing else that is at all like it. Instead of having a tall main stem and many branches, large and small, it has an exceedingly short stem and many very long, wandlike branches. The leaves grow all along each branch, from bottom to tip. The stem is a big, thick mass of solid wood, *all underneath the earth* (where the earth has not been blown away), and the top of it is large enough to afford holding ground for each branch. From the very limited upper surface of the main stem, starting usually at the level of the ground, there rise a score or more of long, slender rods of light wood, their bases firmly packed together, but otherwise free. They are like slender and very symmetrical fishing rods. As they rise they droop outward and spread apart, until they form a group shaped like a morning-glory vase. When it is in full leaf, the ocotillo is like a bouquet of green wands held at the bottom by an invisible hand.

"The stems vary in number from three to seventy-three or even more. I can vouch for the last-named number by count. The largest ocotillo that I particularly noted had some stems that were, by measurement, eighteen feet long.

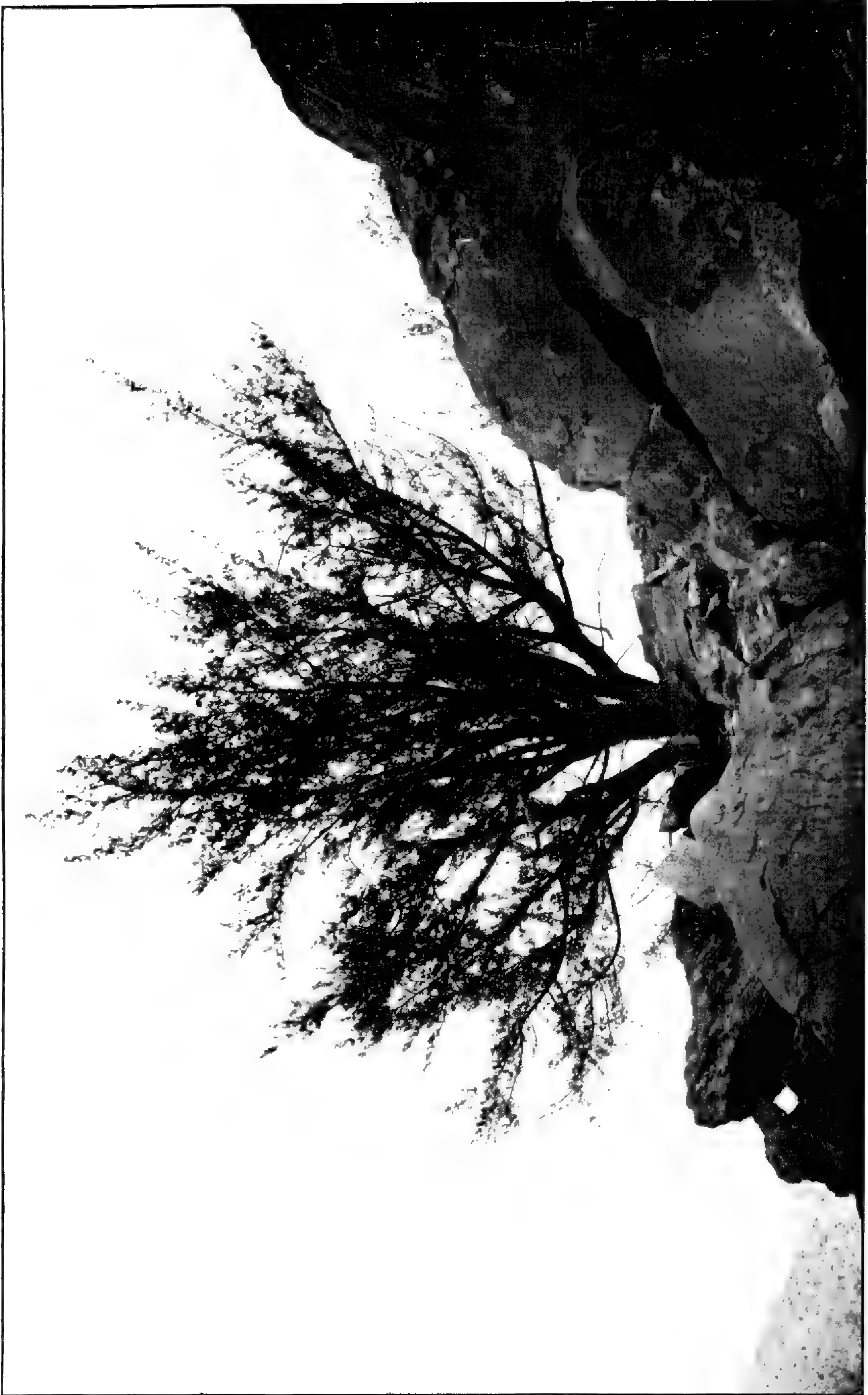
"One of the strangest features of this odd multiple-tree is its leaves and thorns. The leaves grow thickly all along the stem, each blade an inch and a half in length. The blade springs full-fledged from the upright woody stem, with no free petiole, and its color is dark pea green. This profusion of leaves gives each stem of the ocotillo a highly pleasing appearance, and denotes water in the not-far-distant yesterday. A large ocotillo in full leaf is a beautiful object, and every line of its ensemble bespeaks development in a land of queer things.

"But mark the transformation.

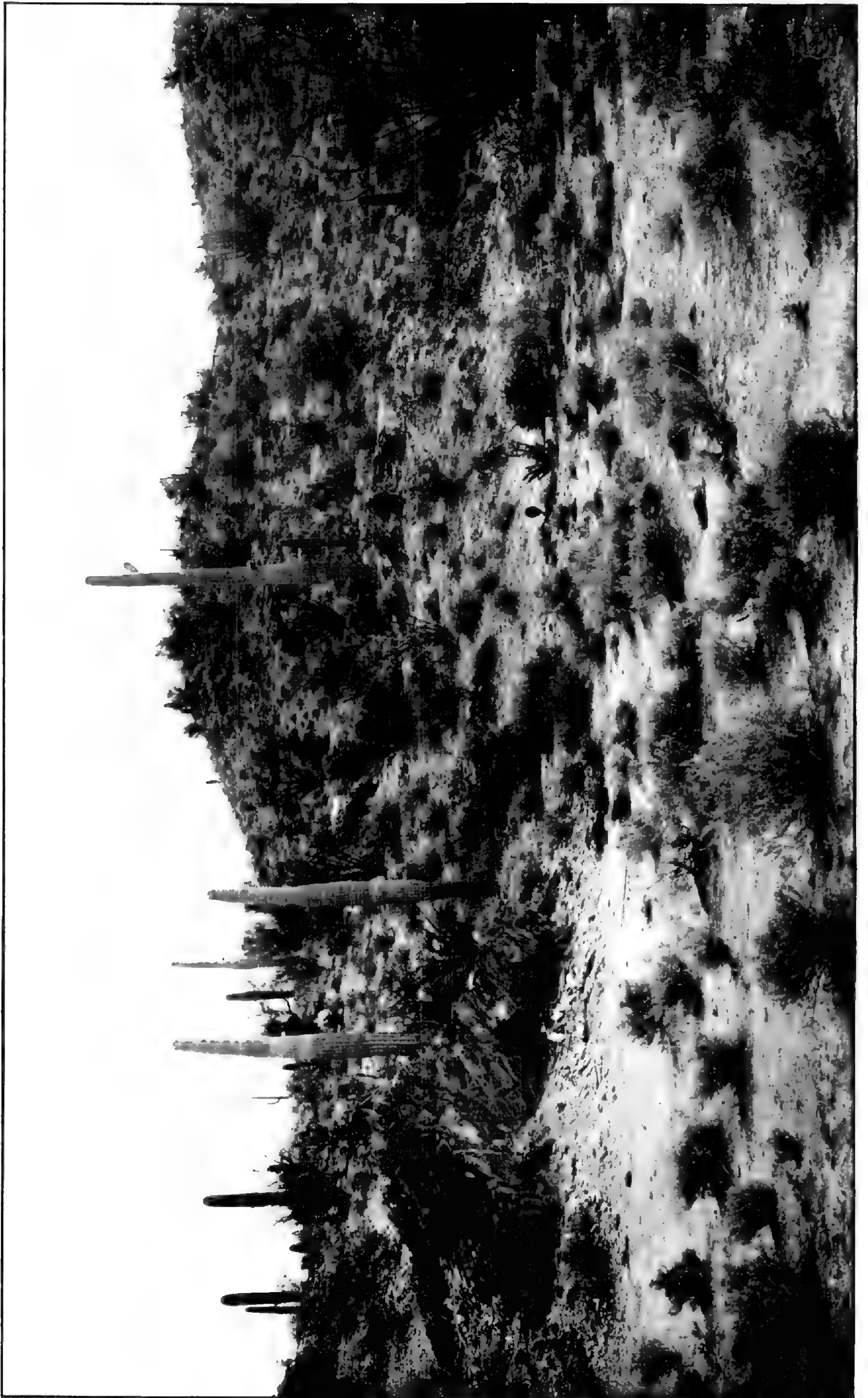
"When the last rain has become only a distant memory, when the hungry roots have sucked the last drop of moisture from the sandy soil, the hour for the change has struck. Fleshy leaves an inch and a half long are far too luxuriant to last long in a

<sup>1</sup> On the plate opposite page 52 several fine specimens are shown, photographed in the Ajo Valley 10 miles south of Montezumas Head, Arizona. A young plant in full leaf is shown opposite page 80; a plant in full leaf, in color, opposite page 100; another opposite page 230.

<sup>2</sup> Page 49.



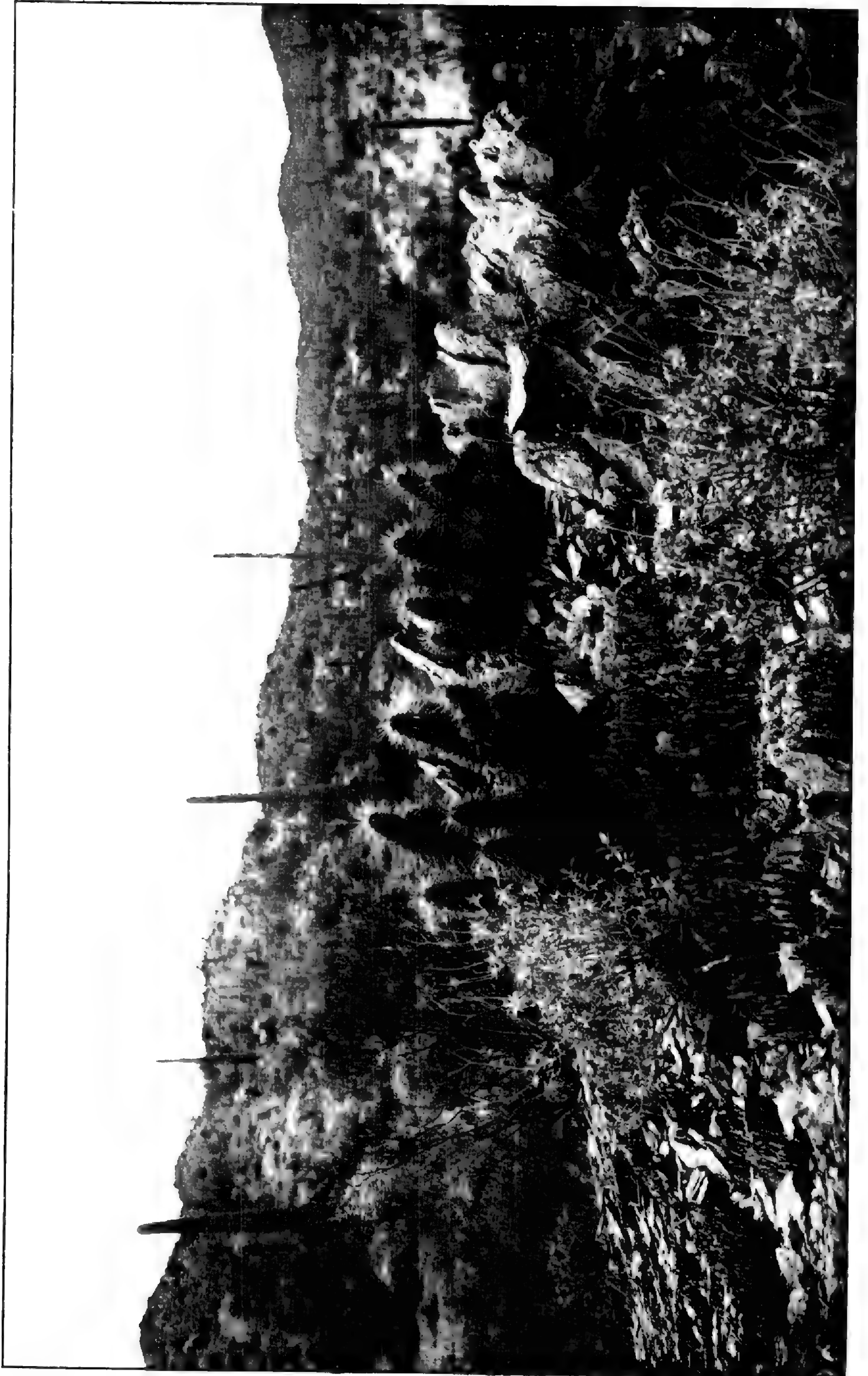
ELAPHRIUM MICROPHYLLUM (A. GRAY) ROSE.



CARNEGIEA GIGANTEA (ENGELM.) BRITTON & ROSE.



ECHINOCEREUS ENGELMANNI PARRY RUMPL.



ECHINOCEREUS ENGELMANNI PARRY RÜMPL.

desert. They dry up, and they drop off—all but the midrib, which takes form as a big, woody *thorn* an inch or more in length. Then and thereafter each stem presents the most frightful array of thorns to be found on anything outside the cactus family. So far as cattle, burros, and wild animals are concerned, an ocotillo in a state of defence is practically impregnable. We saw only two stems that had been barked by food-seeking animals, and that work had been done by wild burros, at great trouble and expense.

“Except on the plains dedicated to the creosote bush and mesquite, the ocotillo stayed with us from Tucson to the very foot of Pinacate Peak. It is the inseparable companion of the giant cactus, but, unlike the latter, it grows larger along the international boundary than fifty miles farther north. On the night that three of us “laid out” on the slope of Pinacate, we found near our bivouac a large dead ocotillo whose rods of clean white wood burned with a brilliant light—too bright to last. These naked rods are used by the Papago Indians in building fences, and screens around the verandas of their adobe houses.”

**Petalonyx thurberi** A. Gray, Mem. Amer. Acad. II. 5: 319. 1855.

Type locality, “Valley of the Rio Gila.”

Sandhills, Adair Bay, November 20, 1907, *Sykes*.

**Sympetaleia rupestris** (Baill.) A. Gray; S. Wats. Proc. Amer. Acad. 24: 50. 1889.

*Loasella rupestris* Baill. Bull. Mens. Soc. Linn. Paris. 1: 650. 1886.

Type locality not ascertained.

Pinacate Mountains, November 21, 1907, *MacDougal* 74

**Carnegiea gigantea** (Engelm.) Britton & Rose, Journ. N. Y. Bot. Gard. 9: 188. 1908. PLATE 7.

*Cereus giganteus* Engelm. in Emory, Mil. Recon. 158. 1848.

Type locality, along the Gila River, Arizona.

No specimens were collected but many fine photographs were taken. The finest specimen seen is illustrated by Doctor Hornaday in a beautiful colored plate.<sup>1</sup> It was about 60 feet high and had 9 branches, an unusually large number. The species was found to range from Tucson to the Pinacates, and from near sea level to an altitude of 1,200 meters.

EXPLANATION OF PLATE 7.—From a photograph by Dr. D. T. MacDougal.

**Echinocactus emoryi** Engelm. in Emory, Mil. Recon. 156. 1848.

Type locality not specifically given; in southeastern Arizona, near the New Mexican line.

A living specimen was collected in the Pinacate Mountains and sent to Washington.

**Echinocactus wislizeni** Engelm. in Wislitz. Mem. North. Mex. 96. 1848.

Type locality, “Doñana,” New Mexico.

No material of this species was taken but Doctor Hornaday gives an illustration<sup>2</sup> of a very large plant from which water is being extracted.

**Echinocereus engelmanni** (Parry) Rümpl.; Först. Handb. Cact. ed. 2. 805. 1886.

PLATES 8, 9.

*Cereus engelmanni* Parry, Amer. Journ. Sci. II. 14: 338. 1852.

Type locality, “Mountains about San Felipe,” California.

A cluster of living specimens was collected on the Pinacate Mountains and sent to Washington. Doctor Hornaday illustrates a group of these.<sup>3</sup>

EXPLANATION OF PLATES 8, 9.—From photographs by Dr. D. T. MacDougal.

<sup>1</sup> “Camp-Fires,” facing page 72.

<sup>2</sup> Ibid., facing page 216.

<sup>3</sup> Ibid., facing page 236.

**Lemaireocereus thurberi** (Engelm.) Britton & Rose, Contr. Nat. Herb. **10**: 426. 1909.

*Cereus thurberi* Engelm. Amer. Journ. Sci. II. **17**: 234. 1854.

Type locality, "Canyon near the mountain pass Bachuachi."

A living specimen and fruit were collected at Sonoita, Sonora, and sent to Washington. A fine colored illustration of this species is given by Doctor Hornaday.<sup>1</sup> The plant illustrated had 22 stems, the tallest being 20 feet high. The species was first seen at Sierra Blanca and last at the Ajo mines, Arizona, at about the same latitude as Tucson, and these may be considered as the northern limits for the species.

**Lophocereus schottii** (Engelm.) Britton & Rose, Contr. Nat. Herb. **12**: 427. 1909.

*Cereus schottii* Engelm. Proc. Amer. Acad. **3**: 288. 1856.

*Pilocereus schottii* Lem. Rev. Hort. **1862**: 428. 1862.

Type locality, "Toward Santa Magdalena," Sonora, Mexico.

A living specimen was collected at Sonoita, Sonora, and sent to Washington.

**Mamillaria grahami** Engelm. Proc. Amer. Acad. **3**: 262. 1856.

Type locality, "Mountains from El Paso southward and westward to the Gila and Colorado, and up the latter river."

Living specimens were collected on the Pinacate Mountains and sent to Washington.

**Opuntia bigelovii** Engelm. Proc. Amer. Acad. **3**: 307. 1856.

PLATE 10.

Type locality, "On Williams River" (Bill Williams River), Arizona.

Common on Hornaday Mountain, Sonora.

EXPLANATION OF PLATE 10.—From photograph by Dr. D. T. MacDougal.

**Opuntia chlorotica** Engelm. & Bigel. Proc. Amer. Acad. **3**: 291. 1856.

Type locality, "From San Francisco Mountains to Mojave Creek," Arizona.

Near summit of Pinacate Mountains, *MacDougal*.

**Opuntia fulgida** Engelm. Proc. Amer. Acad. **3**: 306. 1856.

Type locality, "Mountains of western Sonora," Mexico.

Sonoita, Sonora, *MacDougal*.

**Philibertella hartwegii heterophylla** (Engelm.) Vail, Bull. Torrey Club **24**: 308. 1897.

*Sarcostemma heterophylla* Engelm. in Torr. U. S. Rep. Expl. Miss. Pacif. **5**: 362. 1856.

Type locality, "Near Fort Yuma," Arizona.

Walls Well, Ajo Mountains, Arizona, November 7, 1907, *MacDougal* 7.

**Cuscuta californica** Choisy, Mem. Soc. Phys. Hist. Nat. Genève **9**: 279. 1841.

Type locality, "Nov. [am] Californiam."

MacDougal Crater, Pinacate Mountains, November 14, 1907, *MacDougal* 26. The immature plants are growing on *Kallstroemia grandiflora*.

**Euploca aurea** Rose & Standley, sp. nov.

PLATE 11.

Low, much branched annual, 30 cm. high or less; branches spreading, stout, hirsute; leaves oblong to elliptic or oval, thick, yellowish green, hirsute, small, mostly about 1 cm. long, acutish, rounded at the base, all on short, stout petioles one-third as long as the blades; flowers axillary, scattered; lobes of the calyx linear-subulate, strigose; corolla bright yellow, the limb about 6 mm. wide, the throat somewhat inflated; style long and slender; stigma penicillate; achenes 2, hemispherical, each finally splitting into 2, strigillose, smooth.

Type in the U. S. National Herbarium, no. 574265, collected on sand hills near Adair Bay, Gulf of California, November 20, 1907, by Mr. G. Sykes (no. 61).

This is not closely related to any other species of the genus, being distinguished chiefly by its yellow corollas and bristling indumentum.

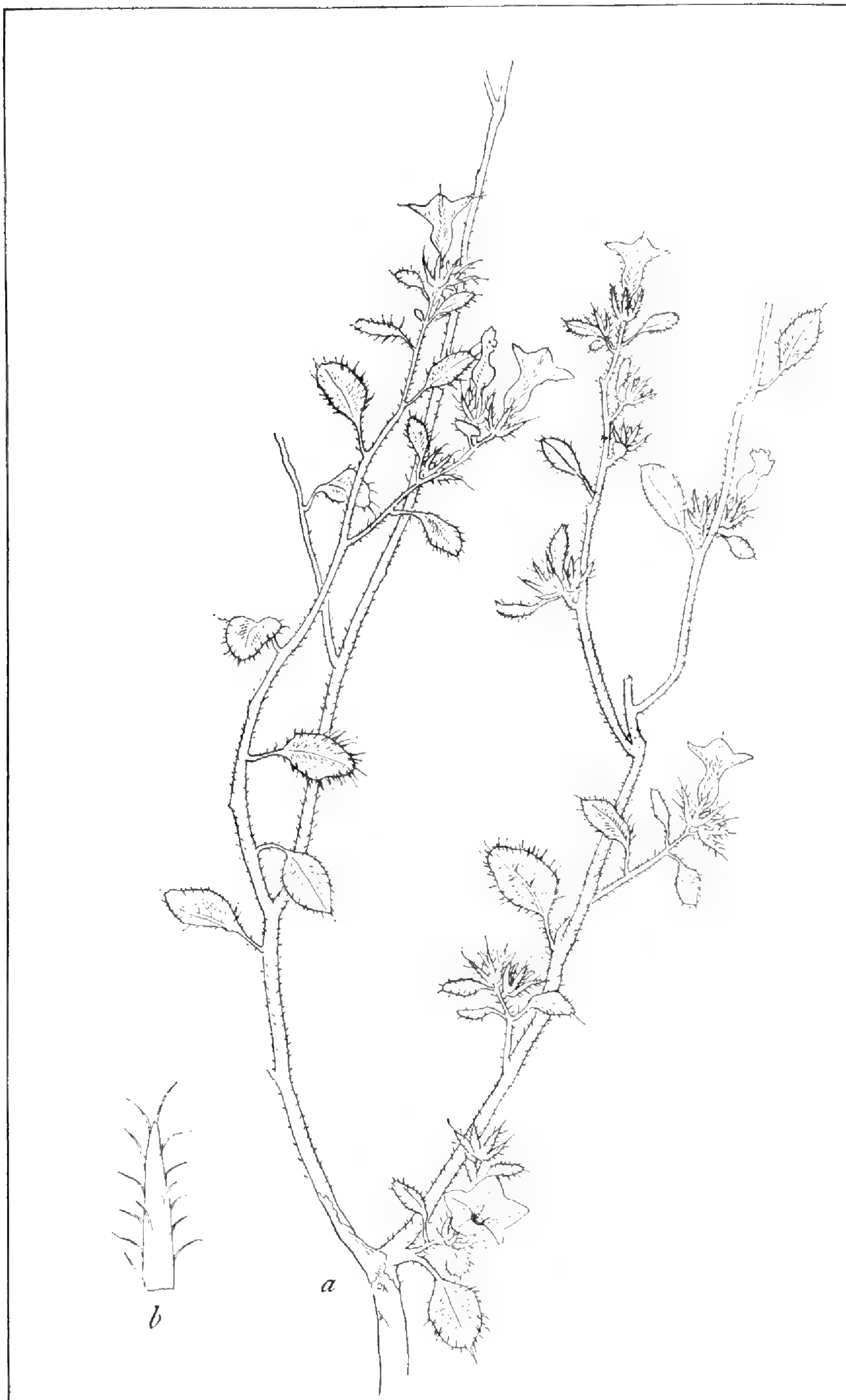
EXPLANATION OF PLATE 11.—*a*, Branch of type; *b*, calyx lobe. *a*, Natural size; *b*, scale 4.

<sup>1</sup> "Camp-Fires," facing page 136.



OPUNTIA BIGELOVII ENGELM.





EUPLOCA AUREA ROSE & STANDLEY.

Here may be inserted the description of another species of *Euploca* from southwestern Texas.

*EUPLOCA RACEMOSA* Rose & Standley, sp. nov.

Low, much branched annual, about 30 cm. high; stems slender, spreading, strigose; leaves elliptic, 20 to 25 mm. long, acute at both ends, strigose, all on very short petioles (2 to 4 mm. long); flowers mostly axillary forming slender, one-sided racemes; leaves of the inflorescence much reduced; calyx lobes linear-lanceolate, 5 or 6 mm. long, strigillose; corolla white, its limb 7 mm. in diameter; style long and slender, the stigma penicillate; fruit smooth, strigillose.

Type in the U. S. National Herbarium, no. 45192, collected in southwestern Texas, between September, 1879, and October, 1880, by Dr. Edward Palmer (no. 889).

This is distinguished from *Euploca convolvulacea* by its smaller corolla, different inflorescence, and shorter petioles.

*Verbena bracteosa* Michx. Fl. Bor. Amer. 2: 13. 1803.

Type locality, "In regione Illinoensi et in urbe Nash-ville."

Pinacate Mountains, at 900 to 1,200 meters, November 21, 1907, *MacDougal* 73. The specimens are unusually villous but otherwise seem to belong here.

*Ramona capitata* (A. Gray) Briq. Bull. Herb. Boiss. 2: 440. 1894.

*Audibertia capitata* A. Gray, Proc. Amer. Acad. 7: 387. 1868.

Type locality, "Summit of Providence Mountain, Mohave Desert."

Pinacate Mountain, November 21, 1907, *MacDougal* 72.

*Datura discolor* Bernh. Linnaea. 8: Litt. Ber. 138. 1833.

Type locality, "Hab. in India occidentali."

Walls Well, Ajo Mountains, November 7, 1907, *MacDougal*.

*Nicotiana trigonophylla* Dunal in DC. Prodr. 13<sup>1</sup>: 562. 1852.

Type locality, "In Mexico ad Aguas calientes."

Papago Tanks, Sonora, November 17, 1907, *MacDougal* 41.

*Physalis cardiophylla* Torr. Bot. Mex. Bound. 153. 1859.

Type locality, "Sonora and California, desert of the Colorado."

Papago Tanks, Sonora, November 17, 1907, *MacDougal*.

*Solanum hindsianum* Benth. Bot. Voy. Sulph. 39. 1844.

Type locality, "Bay of Magdalena," Lower California.

Pinacate Mountains, November 19, 1907, *MacDougal*.

*Antirrhinum chytrospermum* A. Gray, Proc. Amer. Acad. 12: 81. 1877.

Type locality, "Ehrenberg, Arizona."

Papago Tanks, Pinacate Mountains, November 16, 1907, *MacDougal* 44.

*Chilopsis linearis* (Cav.) Sweet, Hort. Brit. 283. 1827.

*Bignonia* ? *linearis* Cav. Icon. Pl. 3: 35. pl. 269. 1794.

Type locality unknown.

Walls Well, Ajo Mountains, November 8, 1907, *MacDougal* 6.

*Anisacanthus thurberi* (Torr.) A. Gray, Syn. Fl. 2<sup>1</sup>: 328. 1886.

*Drejera thurberi* Torr. Bot. Mex. Bound. 124. 1859.

Type locality, "Along water-courses, Las Animas, Sonora."

Walls Well, Ajo Mountains, November 7, 1907, *MacDougal* 10. This plant is known as *tuparosa*, probably a corruption of *chuparosa*—"humming-bird flower."

*Ptiloria tenuifolia* (Torr.) Raf. Atl. Journ. 145. 1832.

*Prenanthes* ? *tenuifolia* Torr. Ann. Lyc. N. Y. 2: 210. 1828.

*Lygodesmia minor* Hook. Fl. Bor. Amer. 1: 205. 1833.

Type locality, "Rocky Mountains."

Pinacate Mountains, November 15, 1907, *MacDougal* 34.

**Dicoria calliptera** Rose & Standley, sp. nov.

PLATE 12.

Branches half a meter long or less, spreading, diffusely branched; stems very slender, finely canescent, striate; leaf blades ovate or broadly oblong, small, 5 to 14 mm. long and 3 to 11 mm. wide, obtuse, narrowed at the base, entire, somewhat crispate, rather thick, finely but not closely canescent on both surfaces, all on slender petioles as long as the blades; outer involucre bracts oblong to ovate, obtuse, the inner saccate, scarious, becoming 5 mm. long, sparingly glandular-viscid, the margins dentate; achenes 1 or 2, oblong, 5 mm. long and 2 mm. wide, somewhat puberulent and viscid, bidentate at the apex, dark brown, the wings scarious, pectinate, more than half as wide as the achene, straw-colored, not incurved.

Type in the U. S. National Herbarium, no. 574268, collected on sand hills near Adair Bay, Gulf of California, Sonora, November 20, 1907, by Mr. G. Sykes, (no. 63).

This is nearest *Dicoria canescens*, but the fruit has much wider, not incurved wings, the inner bracts are much smaller, and the pubescence of the stem is all appressed and not spreading as in that species.

EXPLANATION OF PLATE 12.—*a*, Branch of the type; *b*, staminate floret; *c*, fruiting head; *d*, outer involucre bracts; *e*, achene; *f*, inner involucre bract. *a*, Natural size; *b*, scale 12; *c*, scale 6; *d*, *e*, *f*, scale 8.

**Chrysoma laricifolia** (A. Gray) Greene, *Erythea* 3: 11. 1895.

Type locality, "On mountains, at Guadalupe Pass, New Mexico."

Hornaday Range, Pinacate Mountains, November 14, 1907, *MacDougal*.

**Baccharis glutinosa** Pers. Syn. Pl. 2: 425. 1807.

Type locality, "In R. Chilensis ruderatis."

Walls Well, Ajo Mountains, Arizona, November 8, 1908, *MacDougal* 13.

**Baccharis sarothroides** A. Gray, Proc. Amer. Acad. 17: 211. 1882.

Type locality, "Southern borders of California, San Diego Co., near the old Mission station, the boundary monument, etc."

Walls Well, Ajo Mountains, November 8, 1907, *MacDougal* 5. The specimens have heads somewhat larger than the typical form and the pappus is about twice as long as in specimens from southern California.

**Encelia farinosa** A. Gray, Torr. in Emory, Mil. Recon. 143. 1848.

Type locality not given.

This is well illustrated in a plate of the "Camp-Fires."<sup>1</sup> The name of "white brittle-bush" is there suggested for it.

**Isocoma fruticosa** Rose & Standley, sp. nov.

PLATE 13.

Low, straggling, much-branched shrub; branches stout, covered with rough, gray bark; leaves very thick and fleshy, resiniferous, viscid, simple or usually pinnatifid, the divisions coarsely filiform, alternate, divergent or directed forward, the whole leaf 25 mm. long or less, the lateral divisions usually 2 to 4 mm. long; heads few, 3 to 5, clustered at the ends of the branches, all conspicuously pedicelled; involucre bracts oblong, obtuse, coriaceous, much imbricated; heads narrowly campanulate, 7 to 9 mm. high; pappus pale yellow, 6 mm. long; achenes 2 mm. long or less, sericeous.

Type in the U. S. National Herbarium, no. 574278, collected in MacDougal Pass near the Pinacate Mountains, Sonora, November 14, 1907, by Dr. D. T. MacDougal.

The plant is nearest *Isocoma tenuisecta*, but differs notably in habit and the characteristics of the leaves.

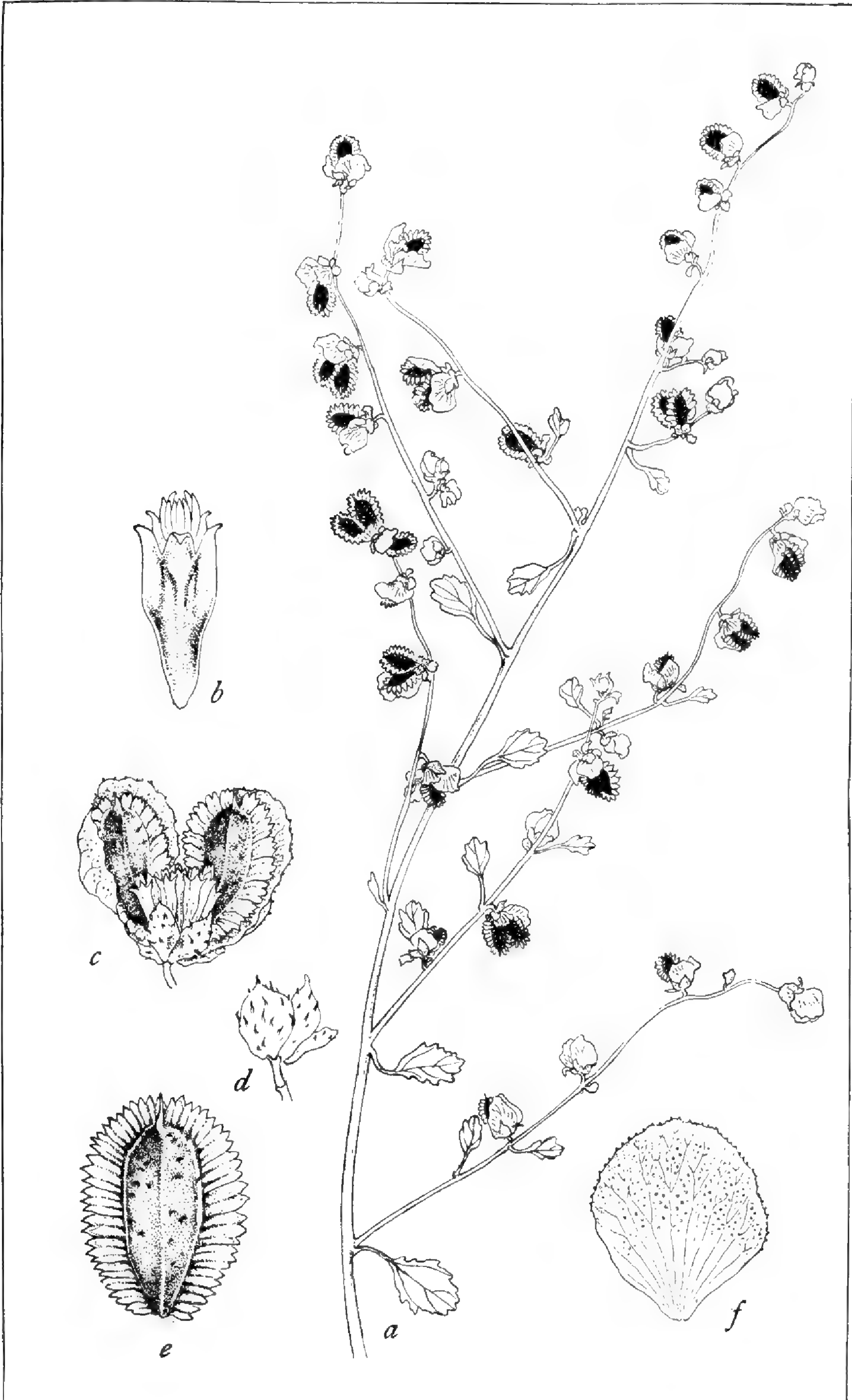
EXPLANATION OF PLATE 13.—*a*, Branch of type; *b*, involucre bract; *c*, head; *d*, floret and immature achene. *a*, Natural size; *b*, scale 12; *c*, scale 4; *d*, scale 8.

**Isocoma limitanea** Rose & Standley, sp. nov.

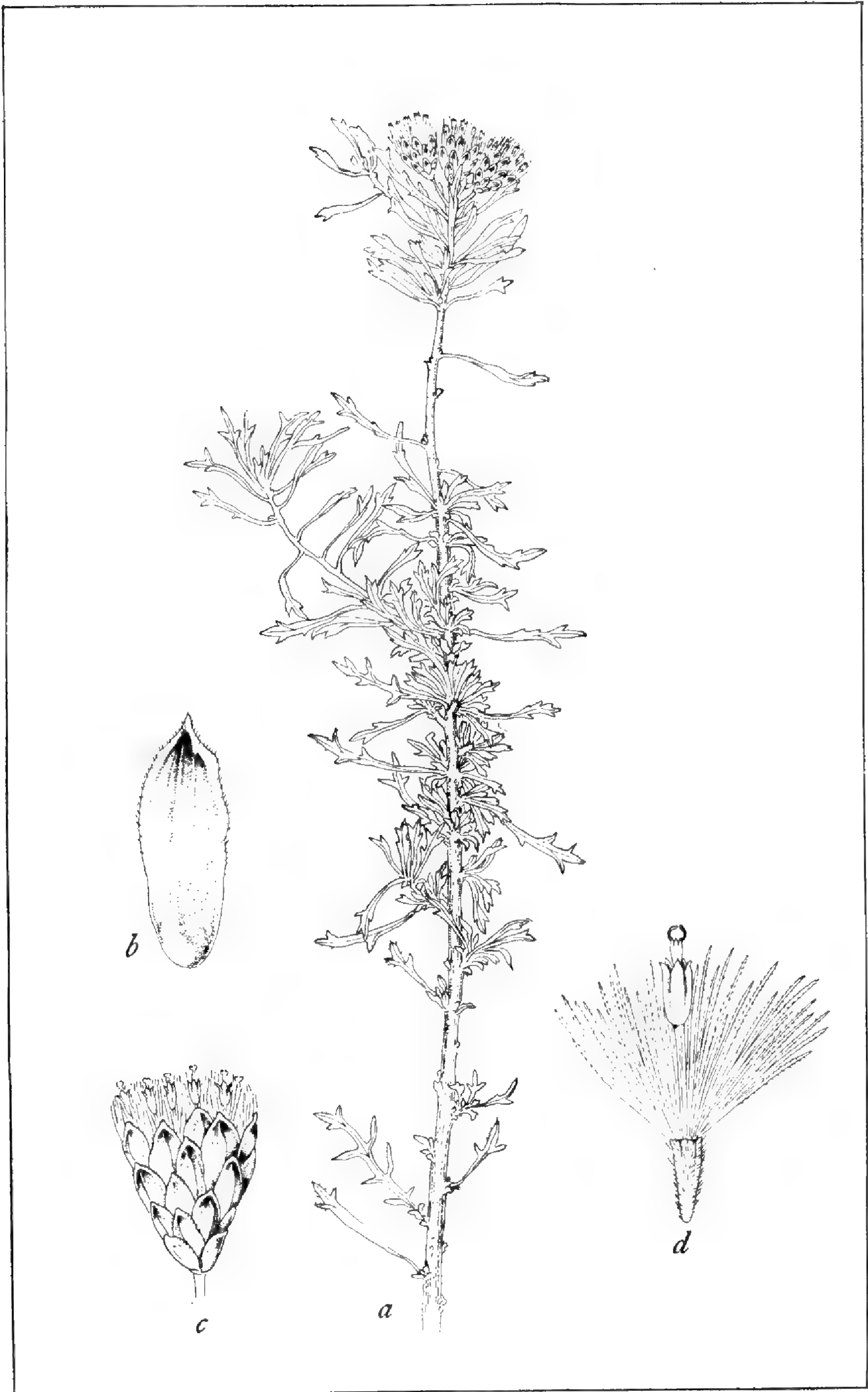
PLATE 14.

Stout perennial; stems several from each root, simple below, corymbosely branched above, glabrous except about the inflorescence, there viscid, conspicuously striate;

<sup>1</sup> Facing page 182.



DICORIA CALLIPTERA ROSE & STANDLEY.



ISOCOMA FRUTICOSA ROSE & STANDLEY.



ISOCOMA LIMITANEA ROSE & STANDLEY.



SIDERANTHUS VIRIDIS ROSE & STANDLEY.

lower leaves linear-oblongate, acutish, attenuate to the sessile base, 55 mm. long or less, dull yellowish green, sometimes whitened with a resinous excretion, the upper leaves smaller and linear, all glabrous, thick, very numerous; inflorescence corymbosely much branched, the heads sessile or short-peduncled, 2 to 5 at the end of each branch, campanulate, 5 mm. high; bracts coriaceous, straw-colored, greenish at the tips, oblong to linear-lanceolate, the outer obtuse, the inner acute, all minutely ciliolate, otherwise glabrous, much imbricated; achenes 2 mm. long, strigillose, the tawny pappus 4 to 5 mm. long.

Type in the U. S. National Herbarium, no. 574227, collected at the village of Sonoyta, Sonora, November 14, 1907, by Dr. D. T. MacDougal (no. 14).

Although related to the more eastern *Isocoma heterophylla*, our plant may be distinguished at once by its different inflorescence, more glabrous stem, and very different leaves.

EXPLANATION OF PLATE 14.—*a*, Branch of the type specimen; *b*, head; *c*, floret and immature achene; *d*, involucral bract. *a*, Natural size; *b*, scale 5; *c*, scale 10; *d*, scale 14.

**Pectis angustifolia** Torr. Ann. Lyc. N. Y. 2: 214. 1828.

Type locality, "On the Rocky Mountains."

MacDougal Crater, November 14, 1907, *Sykes* 27 (in part).

**Pectis papposa** Harv. & Gray, Mem. Amer. Acad. II. 4: 62. 1849.

Type locality, "California."

Pinacate Mountains, November, 1907, *MacDougal*; MacDougal Crater, November 14, 1907, *Sykes* 27 (in part).

**Perityle emoryi** Torr. in Emory, Mil. Recon. 142. 1848.

Type locality, "The Cordilleras of California."

Pinacate Mountains at 1200 meters, November 21, 1907, *MacDougal* 68.

**Porophyllum gracile** Benth. Bot. Voy. Sulph. 29. 1844.

Type locality, "Bay of Magdalena," Lower California.

The specimens collected apparently belong to this species, but they are in an unsatisfactory state for determination.

**Senecio flicifolius** Greenm. ined.

Walls Well, Ajo Mountains, Arizona, November 8, 1907, *MacDougal* 11.

**Sideranthus viridis** Rose & Standley, sp. nov.

PLATE 15.

Biennial or perennial, somewhat woody near the base; stems slender, branched from the base and sparingly above, glabrous below, minutely glandular-viscid above, bright green; leaves linear and entire or sometimes with a few lateral lobes, bristle-tipped, bright green, finely glandular-viscid, small, rather numerous; heads numerous, solitary at the ends of the very slender, leafy branches; involucral bracts linear-lanceolate, irregularly imbricated, green for half their length, viscid, 5 or 6 mm. long; rays numerous, pale yellow, linear, 8 or 9 mm. long; pappus abundant, almost pure white; mature achenes not seen.

Type in the U. S. National Herbarium, no. 574279, collected on the Pinacate Mountains, November 21, 1907, by Dr. D. T. MacDougal.

This is easily separated from the other members of the genus by its bright green stems and leaves, the latter of peculiar form. The pubescence, too, is different from that of our other species.

EXPLANATION OF PLATE 15.—*a*, Root and base of plant; *b*, branch of type; *c*, involucral bract; *d*, flower with young achene; *e*, leaf and axillary branch; *f*, ray floret. *a*, *b*, Natural size; *c*, *d*, scale 8; *e*, *f*, scale 4.

**Trixis californica** Kellogg, Proc. Calif. Acad. 2: 182. *f.* 53. 1863.

Type locality, "Cerros Island."

Quitovaquito, Sonora, November 11, 1907, *MacDougal* 16. This is the species that has been passing as *Trixis angustifolia* DC. That, however, is a very different plant, with leaves of different form and with strongly pubescent stems.



**Viguiera** sp.

Possibly *V. deltoidea* A. Gray. Papago Tanks, Pinacate Mountains, November 17, 1907, *MacDougal* 50. The plants are not in flower and it is impossible to be certain of their proper identification.

**Viguiera sonora**e Rose & Standley, sp. nov.

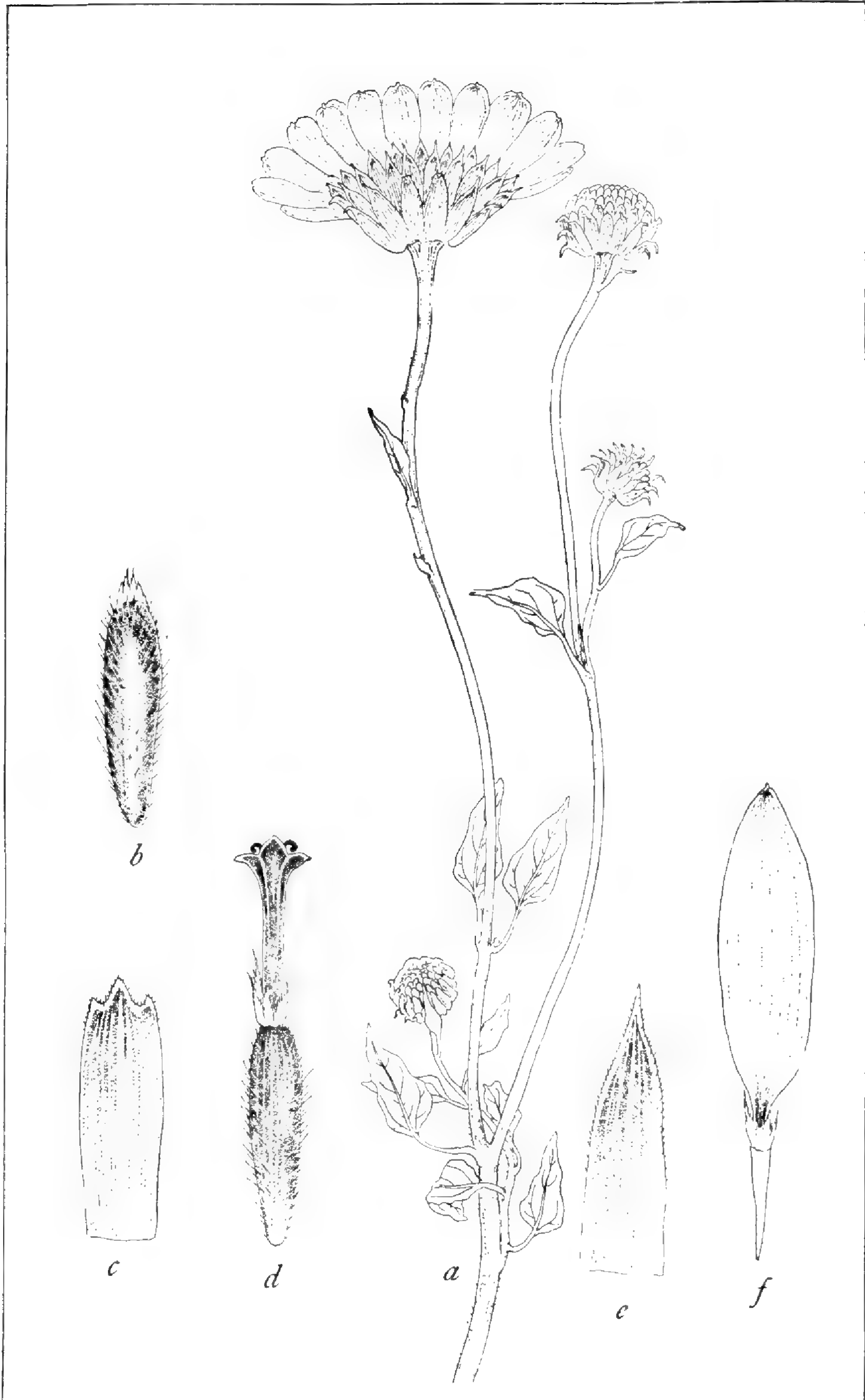
PLATE 16.

Apparently a tall plant sparingly branched below; stems stout, finely and rather densely canescent throughout; leaf blades deltoid-ovate, thick, finely and densely canescent, obtuse, subcordate or truncate at the base, all on stout, finely canescent petioles one-third to one-half as long as the blade, the margins undulate, somewhat crispate; heads few, loosely corymbose, on peduncles 10 to 20 cm. long, naked or with a few much reduced leaves; heads subspherical, 15 mm. in diameter and 12 to 14 mm. high; involucre bracts lanceolate, attenuate, finely and densely canescent; chaff of the receptacle oblong, entire or 3-toothed at the apex; achenes 8 mm. long, somewhat 3-angled, loosely and conspicuously pilose; pappus of 2 or 3 short, triangular-lanceolate paleæ at the angles of the achene and of several slightly shorter intermediate paleæ, the pappus finally deciduous, equaled or exceeded by the pilose hairs; rays about 2 cm. long, bright yellow.

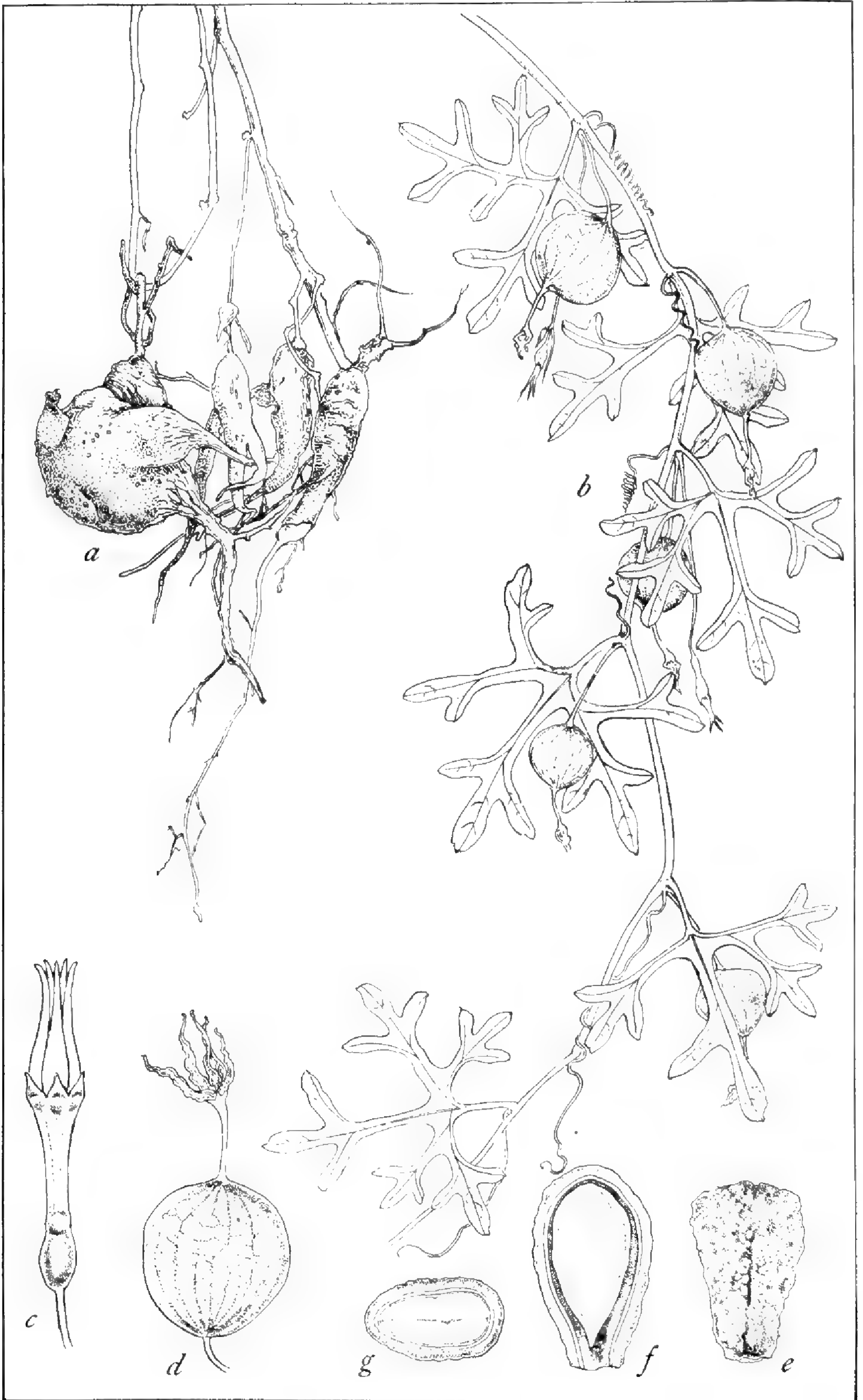
Type in the U. S. National Herbarium, no. 574262, collected at the Papago Tanks, Sonora, November 20, 1908, by Dr. D. T. MacDougal (no. 57).

Apparently this is not closely related to any other species. Its nearest relative, perhaps, is *Viguiera canescens*.

EXPLANATION OF PLATE 16.—*a*, Part of type; *b*, achene; *c*, palea of the receptacle; *d*, disk floret; *e*, involucre bract; *f*, ray floret. *a*, Natural size; *b* to *e*, scale 4; *f*, scale 2.



VIGUIERA SCNORAE ROSE & STANDLEY.



TUMAMOCA MACDOUGALI ROSE.

# TUMAMOCA, A NEW GENUS OF CUCURBITACEAE.

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By J. N. ROSE.

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For several years Dr. D. T. MacDougal has been sending to the National Museum specimens of a curious little cucurbit which grew up over the low bushes about the Desert Laboratory at Tucson, Arizona. In 1909 I saw it myself and obtained some roots, which, however, failed to grow. It resembled somewhat a delicate *Ibervillea* but seemed different from all the described species. In the fall of 1910 Doctor MacDougal sent me fruit, and I was then convinced that it is generically distinct from all the species of *Ibervillea*.

**Tumamoca** Rose, gen. nov.

Flowers monoecious; male flowers in few-flowered racemes; calyx with very slender tube and 5 small sepals; corolla pale yellow with narrow, elongated lobes; stamens 3, borne on the tube about one-fourth the distance below the mouth; 2 of the anthers 2-celled, the third 1-celled; female flowers axillary, solitary, without stamens; fruits globular, several-seeded; seeds horizontal, black, obovoid, truncate at apex, roughened, not marginate.

This genus differs from *Ibervillea* in having monoecious flowers and a very slender calyx tube upon which the stamens are borne. The seeds, too, are unlike those of *Ibervillea* in shape and marking, while it always produces a cluster of tuberous roots instead of a single globular root.

The name is from "Tumamoc," the Indian name of the hill upon which is located the Desert Laboratory of the Carnegie Institution.

**Tumamoca macdougalii** Rose, sp. nov.

PLATE 17.

A delicate vine climbing over shrubs; stems annual, arising from a cluster of shallow tuberous roots, low, glabrous throughout; leaf blade thin, 3-parted, the lobes usually once, rarely twice parted, the ultimate segment narrow, obtuse; male flowers in 2 to 6-flowered racemes (6 to 10 cm. long); female flowers pale yellow, solitary on peduncles 5 to 15 mm. long; calyx lobes narrow, 10 mm. long; petals 8 to 12 mm. long; fruit globular, red, rarely yellow, 8 to 10 mm. in diameter.

Type in the U. S. National Herbarium, no. 591589, collected near the Desert Laboratory, Tucson, Arizona, July 31, 1908, by Dr. D. T. MacDougal.

EXPLANATION OF PLATE 17.—*a*, Cluster of roots; *b*, fruiting branch; *c*, flower; *d*, fruit with old flower; *e*, seed; *f*, longitudinal section of seed; *g*, cross section of seed. *a, b*, Natural size; *c-g*, enlarged.

# NEW OR INTERESTING MOSSES FROM PANAMA.

By R. S. WILLIAMS.

The following mosses are from a collection made in the Province of Chiriqui, Panama, in the spring of 1911, by Mr. William R. Maxon, in connection with the Smithsonian Biological Survey of the Panama Canal Zone, and are here published in advance of a complete list which will appear later. Two of the species seem never to have been collected before. Of the other two, one was first obtained in Mexico by Schaffner in 1875, but has remained undescribed until now; the other was described as a *Porotrichum* by Carl Müller from sterile specimens collected in Guatemala.

Specimens of the species here described are in both the U. S. National Herbarium and the herbarium of the New York Botanical Garden; those in the latter institution having served for actual diagnosis, may stand as the type specimens.

***Dicranoloma meteoroides*** R. S. Williams, sp. nov.

Apparently dioicous; in lax pendent tufts, with flexuous, somewhat branching stems up to 30 cm. long; leaves distant, three-ranked, 9 or 10 mm. long, 1 mm. wide a little above the base, spreading-flexuous, often spirally twisted above, distinctly serrulate three-fourths of the way down the margin or more, from an ovate base gradually narrowed to a slender, lanceolate, keeled point, with costa short-excurrent; costa just above the colored base of leaf 60 to 70  $\mu$  wide, smooth throughout, in cross section near the middle showing about 4 guide cells with thin stereid bands on either side; alar cells brown, extending to the costa, about 20  $\mu$  wide and from square to twice longer than wide, often with somewhat thickened walls; cells throughout the rest of the leaf mostly elongate, with thickened more or less sinuous and pitted walls, the median cells 8 to 10  $\mu$  wide and 12 to 20  $\mu$  long; perichæcial leaves costate, the inner three or four from a convolute base, mostly abruptly narrowed to a serrulate, setaceous, erect point 3 or 4 mm. long, inclosing 8 to 10 archegonia without paraphyses; seta smooth, 12 to 14 mm. long; calyptra (from very immature capsule) slightly rough above.

**TYPE LOCALITY:** Humid forest between Alto de las Palmas and top of the Cerro de la Horqueta, Chiriqui, Panama; altitude 2,100 to 2,268 meters, March 18, 1911, *Maxon* 5499.

**DISTRIBUTION:** Known only from the type locality, having been collected there also, at the same time, by Mr. H. Pittier.

The specimens, pendent from branches of trees and shrubs, are in very immature fruit.

***Leucodon macrosporus*** R. S. Williams, sp. nov.

Dioicous, male flowers scarcely 1 mm. high, with numerous slender paraphyses and about 16 antheridia 0.5 or 0.6 mm. long; primary stems creeping, leafless, the secondary more or less erect, arcuate, 3 to 6 cm. high and about 3 mm. across, with somewhat spreading secund leaves; leaves ecostate, yellowish at base, about 2.5 mm. long, rather broadly ovate-lanceolate, acuminate, concave, 4-plicate, the borders more or

less recurved and slightly serrulate one-third the way down; cells throughout upper leaf elongate with somewhat unequally thickened, slightly sinuous walls; median cells about  $5\ \mu$  wide by 20 to  $35\ \mu$  long, toward the base rather larger and cell walls pitted near the insertion of the leaf toward the costa; cells at basal angles numerous, short, often transversely elongate and extending some distance upward; outer perichaetial leaves short; the inner oblong-lanceolate, 6 or 7 mm. long, convolute nearly to the acute entire apex and extending to above the middle of seta, sometimes nearly to the base of the capsule; seta 7 to 9 mm. long with erect oval capsule 2.5 mm long, bearing a conical-apiculate or short-rostrate lid about 1 mm. long; annules wanting; peristome double, the outer of pale, papillose to nearly smooth, rather irregular teeth with indistinct articulations, separate to below rim of capsule and solid, or more or less pertuse along median line; inner peristome a low, pale membrane scarcely one-fifth the teeth in height, with margin nearly entire; spores not quite smooth, roundish ( $80\ \mu$  in diameter) to oblong (up to  $120\ \mu$  long).

TYPE LOCALITY: Vicinity of Camp Aguacatal, eastern slope of Chiriqui Volcano, Chiriqui, Panama, altitude 2,100 to 2,300 meters, March 10 to 13, 1911, *Maxon* 5276. On tree trunks.

DISTRIBUTION: Chiriqui Volcano, Panama, to valley of Mexico (*Schaffner*, 1875) and San Luis Potosí, Mexico (*Schaffner* 340 in 1879).

This species in habit much resembles *L. cryptotheca*, but is rather smaller and with leaves more pointed.

**Thamnum cobanense** (C. Müller), R. S. Williams.

*Porotrichum cobanense* C. Müller, Bull. Herb. Boiss. **5**: 202. 1897.

The specimens at hand were collected from tree trunks in a moist ravine above El Potrero Camp, Chiriqui Volcano, Chiriqui, Panama, altitude 2,890 to 3,025 meters, March 12, 1911, by William R. Maxon (no. 5330). They are in fine fruit, the fruiting state hitherto unknown, I believe. The species is dioicous. It has perichaetial leaves nearly or quite ecostate and entire, the inner abruptly narrowed to a smooth point about one-third the entire length; seta 15 to 18 mm. high, curved; capsule oblong, about 2.5 mm. long, slightly contracted under the mouth when dry; annulus of 2 or 3 rows of cells; lid convex, obliquely rostrate, about 1.5 mm. long; outer peristome with teeth finely cross-striate over half way up from base, in upper part paler and papillose; inner peristome pale brown like outer, the segments from high basilar membrane, pertuse along median line with one or mostly two smooth cilia between; spores nearly smooth, 12 to  $14\ \mu$  in diameter.

TYPE LOCALITY: Guatemala.

DISTRIBUTION: Guatemala and Panama.

**Cyclodictyon maxoni** R. S. Williams, sp. nov.

Flowers and fruit unknown; plants in lax dusky brown tufts, green only at the tips of the branches, the stems mostly denuded of leaves below, 6 to 8 cm. long, and bearing rather numerous irregular branches; leaves, when dry, spreading-incurved or loosely imbricate, about 1.6 mm. long, broadly ovate, very concave, with flat, entire or nearly entire margins and with the apex broad and rounded or scarcely acutely pointed; leaves bicostate, the costæ nearly or quite smooth on the back, extending usually four-fifths the length of the leaf; leaf cells smooth on both sides, elongate-hexagonal to oblong or linear, a little below apex about  $5\ \mu$  wide by  $20\ \mu$  long, gradually longer below, up to 50 or  $60\ \mu$  long toward base with about 2 rows of short brown cells extending across the base at insertion of leaf, the marginal cells a little longer and narrower than within but not forming a distinct border; cell walls thin, not pitted.

TYPE LOCALITY: Humid forest along the upper Caldera River, near "Camp I," Holcomb's trail, above El Boquete, Chiriqui, altitude 1,450 to 1,650 meters, March 22 to 24, 1911, *Maxon* 5619. On stones in bed of swift current, mostly submerged.

DISTRIBUTION: Known only from the type collection.

This species seems to be nearest *C. obscurifolium* (Mitt.) Broth., but the latter has a shorter, broader, and more pointed leaf with a distinct border.

# STUDIES OF TROPICAL AMERICAN FERNS—NO. 3.

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By WILLIAM R. MAXON.

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## INTRODUCTION.

The present paper is in continuation of two others published<sup>1</sup> under the same title, giving the results of various studies of tropical American ferns. With the accumulation of a large amount of herbarium material the work of revision offers less difficulty than heretofore; but there is still very great need of specimens from the wet forested regions of eastern and southern Mexico. That adequate botanical exploration may be carried on in these mountain districts is of the first importance, not only in the study of pteridophyta, but to a great extent of other groups as well.

## THE NORTH AMERICAN SPECIES OF HEMITELIA, SUBGENUS CNEMIDARIA.

The genus *Hemitelia* was founded by Robert Brown in 1810<sup>2</sup> upon three previously described species: *Cyathea multiflora*, *C. horrida*, and *C. capensis*. As pointed out by the writer in a recent paper,<sup>3</sup> the first of these, which has long been misidentified and now proves to be the species described later as *Hemitelia nigricans* Presl, has been generally accepted by writers on ferns as the type of the genus. All recent writers have agreed also that *H. multiflora* and *H. capensis*, at least, are congeneric. Presl, however, who was the first to divide the genus, restricted *Hemitelia* to the single species *H. capensis*, relegated *H. multiflora* to *Alsophila*, and established<sup>4</sup> the genus *Cnemidaria* to include *H. horrida* and several related species. The first species listed by him is "*Cnemidaria speciosa* (*Hemitelia speciosa* Kaulf, nec Willd.)" which, being figured by him, will stand as the type of his genus. In a later publication<sup>5</sup> Presl proposed a rather elaborate reclassification of the group which we

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<sup>1</sup> Contr. Nat. Herb. 10<sup>7</sup>: 473-508. pls. 55, 56. Mar. 30, 1908. Contr. Nat. Herb. 13<sup>7</sup>: 1-43. pls. 1-9. June 30, 1909.

<sup>2</sup> Prodr. Fl. Nov. Holl. 158. 1810.

<sup>3</sup> Bull. Torrey Club 38: 545-550. pl. 35. 1911.

<sup>4</sup> Tent. Pterid. 56. 1836.

<sup>5</sup> Abh. Böhm. Ges. Wiss. V. 5: 349-356. 1848.

now call *Hemitelia*, basing his treatment mainly upon characters offered by supposed differences in the arrangement of the fibrovascular bundles of the stipe and upon venation. The genera recognized by him are: (1) *Hemitelia*, with two sections, *Notophoria* and *Euhemitelia*; (2) *Microstegnus*, founded on *Cyathea grandifolia* Willd., in part; (3) *Hemistegia* with six "species"; (4) *Actinophlebia*, with two species; and (5) *Cnemidaria*, which he restricted to the original type species, *C. speciosa*, the other species having been removed by him to *Actinophlebia* and *Hemistegia*. The results of his investigation can not be regarded as satisfactory from any point of view, the principal objections being that, despite his undoubted keenness of observation, the work abounds in error due apparently to a willingness to accept many published observations and citations of specimens without substantiating them, a marked tendency to overestimate the systematic value of trivial characters, a lack of sufficiently extensive and complete material, and a singularly inadequate conception of the requirements of nomenclature, especially as regards the use of species names. Here and there are found in it observations and distinctions of merit; but to attempt, in review, to distinguish these from the many fallacious statements of fact or to explain in detail the various taxonomic errors, would be no simple task nor lead to any very useful result. In the writer's opinion the genus *Hemitelia* should be of sufficiently wide extent to include all these "genera" of Presl. In fact, there is much to be said in support of Mr. Copeland's recent proposition<sup>1</sup> to unite *Hemitelia*, *Alsophila*, and *Cyathea* in a single genus. The writer prefers for the present, however, to retain the three genera in their traditional sense, partly from practical considerations. Adhering to this view it is possible to recognize two fairly distinct sections of *Hemitelia* in the American tropics; (1) *Euhemitelia* and (2) *Cnemidaria*; the first, embracing large species of truly arboreal growth, with mainly tripinnatifid fronds and narrow, often rather minute segments; the latter, plants which are scarcely arborescent, with ample, pinnate to bipinnatifid (or rarely tripinnatifid) fronds, the leafy parts broad and little dissected.

Professor Underwood, who had undertaken a study of this group, regarded *Cnemidaria* as a valid genus, its "typical members having a basal areole or arch formed by a union of veins rising from adjacent series of primary veins" of the pinnæ. But in about half of the species the veins are free, ordinarily. The indusium characters are, it is true, fairly constant for the species of *Cnemidaria*, but there is closer agreement in this particular between these and *H. multiflora* than there is between *H. multiflora* and some of its near relatives in *Euhemitelia*. Undoubtedly there is in habit and leaf shape a close

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<sup>1</sup> Philippine Journ. Sci. C. Bot. 3: 353. 1908.



general resemblance among the species of *Cnemidaria*, which stamps them as obviously related and as forming a natural group; but that there is any logical ground for setting these apart as a genus distinct from *Hemitelia* is not apparent.

As with most members of the *Cyatheaceae* there are serious difficulties to be met in a satisfactory delimitation of the species, mainly on account of their great size and the consequent incompleteness of herbarium material. Most collectors seem to have thought it of little importance to collect the different characteristic parts of the plants. Naturally several species have been redescribed under new names; and most of them have been very inadequately described, usually with scant attention to venation, which, however unsatisfactory it may be as a generic character in this group, yet seems to be fairly constant for the recognition of species. Latterly there has accumulated at Washington and New York a large amount of material which affords the main basis for the present paper. It would have been impossible, however, to bring the work to a satisfactory conclusion without the courteous assistance of the authorities of several European herbaria. Acknowledgments are therefore gratefully extended to the Director of the Royal Gardens, Kew; to Mr. A. B. Rendle, Keeper of the Herbarium, British Museum (Natural History); to Mr. Carl Christensen, of the Botanisk Museum, Copenhagen; to Prof. H. de Willdman, Curator, Jardin Botanique de l'Etat, Brussels; to Dr. H. Christ, Basel; to Dr. E. Rosenstock, Gotha; and especially to Prof. Dr. I. Urban, Assistant Director of the Royal Botanical Garden and Museum, Berlin.

From data and specimens thus made available, and with the help derived in several instances from Doctor Underwood's unpublished notes, it has been possible to bring to completion that which appeared at first an almost hopeless task. It has been found that, with ample material, definite lines of demarcation may be drawn about as sharply among the species of this group as in related genera of the *Cyatheaceae*. The segregation of the species, indeed, has offered far less difficulty than the purely taxonomic problem of reapplying several of the early names in their original sense and of indicating with certainty their later synonyms. That several of these names are now to be applied in a sense wholly or partly different from their employment by recent writers will occasion at most a slight and temporary confusion, since the species of this genus have been so illy defined in recent years and their limits so misunderstood and so persistently disregarded that there is, in fact, no recognized treatment of the group to be disturbed thereby. For the same reason a rather large proportion of the species here recognized must be described as new. Within the past 15 years but two species of the subgenus *Cnemidaria* have been described from North America as new, and one of these (*H. bullata*), from Grenada, proves to be synonymous with an early species. It is entirely probable

that additional species will be found, on the continent, from Mexico southward; and it is sincerely to be hoped that further collections may be made in the humid districts of eastern and southern Mexico to bring to light complete material of those known at present only from the original collections.

KEY TO THE NORTH AMERICAN SPECIES.<sup>1</sup>

Veins mostly free, only very rarely forming basal arches along the costa.

Pinnæ varying from entire or slightly repand to crenate.

Texture thin; veins not strongly elevated; sori extending half way to the midvein of the pinnæ..... 1. *H. speciosa*.

Texture coriaceous; veins strongly raised beneath; sori in submarginal lines on shallow scallops..... 2. *H. integrifolia*.

Pinnæ cut from one-third to completely to the costa.

Segments obtuse or distinctly rounded (rarely acute in no. 8).

Sori submarginal..... 3. *H. bella*.

Sori borne distinctly apart from the margin, varying from supramedial to inframedial.

Pinnæ pinnately cut about halfway to the costa; veins simple (those on the distal side of the segments usually so), or once-forked..... 4. *H. contigua*.

Pinnæ deeply pinnatifid, two-thirds or nearly to the costa; all but the outer veins of the segments once or twice-forked.

Segments oblong or deltoid-oblong, relatively broad; veins 10 to 14 pairs.

Pinnæ oblong-linear, 30 to 35 cm. long, 4 to 5.5 cm. broad, relatively short-acuminate; segments 10 to 12 mm. broad at the sinuses, strongly arcuate toward their apices..... 5. *H. pittieri*.

Pinnæ oblong-lanceolate, 18 to 25 cm. long, 3.2 to 3.8 cm. broad, the apex gradually long-acuminate; segments 7 to 9 mm. broad at the sinuses, slightly or not at all arcuate..... 6. *H. chiricana*.

Segments narrowly oblong; veins 14 to 23 pairs; pinnæ much more deeply pinnatifid.

Veins 14 to 17 pairs, the branches distant and divergent; sori medial. 7. *H. arachnoidea*.

Veins 19 to 23 pairs, the branches very close and diverging at a very acute angle; sori distinctly inframedial, crowded..... 8. *H. mutica*.

<sup>1</sup> For the sake of comparison or for the purpose of explaining taxonomic confusion there are included in the present treatment several species which are not known to occur in North America, including Panama.

Segments acute to long-acuminate or caudate.

Fronds relatively small, the pinnæ 4.5 cm. broad, or less; segments arcuate, abruptly acuminate-cuspidate; veins 12 to 14 pairs, mostly once-forked; sori supræmedial to submarginal. . . . . 9. *H. apiculata*.

Fronds very much larger, the pinnæ 7 to 22 cm. broad; segments (or pinnules) long-acuminate to caudate; veins 16 to 18 pairs, twice to several times branched; sori medial or in a broad medial zone.

Segments 20 to 23 pairs, linear-oblong, long-acuminate, only the subcaudate apices conspicuously crenate-serrate; veins about 16 pairs, alternately 2 to 4-branched. . . . . 10. *H. subglabra*.

Segments about 28 pairs, deltoid-lanceolate, deeply crenate or crenately lobed, the apices usually linear-caudate, sharply serrate-crenate; veins about 20 pairs, with 4 to 8 pairs of mostly simple, pinnately arranged branches. . . . . 11. *H. grandis*.

Veins (basal) regularly united by a transverse veinlet, forming a single series of costal areoles.

Lamina bipinnate. . . . . 12. *H. petiolata*.

Lamina pinnate to very deeply bipinnatifid (or, as to largest pinnæ, bipinnate in no. 11).

Pinnæ subentire to serrate, crenate, or lobed not more than half way to the costa.

Margins lightly and remotely crenate-serrate; pinnæ decurrent. . . . . 13. *H. decurrens*.

Margins deeply crenate, crenate-serrate, or crenately lobed; pinnæ not decurrent.

Veins (excepting those joined to form basal arches) simple; pinnæ deeply crenate.

Major crenations 5 to 7 mm. broad at sinuses, short-apiculate distally; pinnæ 2.5 to 3 cm. broad. . . . . 14. *H. mexicana*.

Major crenations 6 to 12 mm. broad at sinuses, never apiculate; pinnæ 3 to 4.2 cm. broad.

Basal vein of each side joined to opposed basal vein of next crenation by a transverse veinlet, then produced and commonly joining the second vein of its own group; crenations 9 to 12 mm. broad at sinuses. . . . . 15. *H. lucida*.

Basal vein of each side similarly joined to opposed basal vein of adjacent crenation, the veins otherwise all free; crenations mostly 6 to 8 mm. broad at sinuses. . . . . 16. *H. guatemalensis*.

Veins mostly once-forked; pinnæ distinctly lobed one-third to one-half the distance to the costa. . . . . 17. *H. choricarpa*.

Pinnæ cut more than half-way or nearly to the costa.

Segments acuminate, usually very strongly so;  
pinnæ 6 to 26 cm. broad.

Costæ and costules conspicuously paleaceous,  
the scales whitish and numerous. . . . . 18. *H. grandifolia*.

Costæ and costules devoid of scales or, in very  
immature fronds, rarely bearing an  
occasional thin brownish caducous scale. 19. *H. horrida*.

Segments rounded or, if rarely subacute, at least  
never acuminate; pinnæ 2.5 to 5 cm. broad.

Costæ and costules bearing numerous slender  
lax white long-pointed scales. . . . . 20. *H. kohautiana*.

Costæ and costules bearing fewer, larger, and  
broader, subbullate or bullate, brown-  
ish scales. . . . . 21. *H. obtusa*.

1. **Hemitelia speciosa** (H. & B.) Kaulf. Enum. Fil. 252. 1824.

*Cyathea speciosa* H. & B.; Willd. Sp. Pl. 5:490. 1810.

*Hemitelia lindeni* Hook. Icon. Pl. pl. 706. 1848.

TYPE LOCALITY: Caripe, Venezuela, *Humboldt*.

DISTRIBUTION: Known only from Venezuela.

ILLUSTRATION: Hook. loc. cit. pl. 706 (as *H. lindeni*).

This species has been the subject of a great amount of misunderstanding. Kaulfuss was the first to transfer the name to *Hemitelia*; and there is, so far as his diagnosis is concerned, no reason for supposing *Hemitelia speciosa* Kaulf. to be anything more than a change of name for *Cyathea speciosa* H. & B.

Presl, however, in 1836, regarded *H. speciosa* Kaulf. as not only specifically but even generically different from the original *speciosa* of Humboldt and Bonpland. The latter he retained in *Cyathea*, as *Cyathea speciosa* H. & B.; the former he made the type of a new genus *Cnemidaria*, as *Cnemidaria speciosa* (Kaulf.) Presl [*"Hemitelia speciosa* Kaulf. nec Willd."]. In thus determining the identity of *Hemitelia speciosa* Kaulf. he seems to have been guided solely by herbarium material; for, as stated above, Kaulfuss's diagnosis applies well enough to the true *speciosa* H. & B. In fact, Kaulfuss's phrase "*Sori venis simplicibus patentibus apicem versus impositi*" seems almost certainly to apply to the Humboldt and Bonpland plant, rather than to that figured by Presl in figures 16 and 17,<sup>1</sup> as may readily be concluded by comparing these and Hooker's illustration of *H. lindeni* with Kaulfuss's diagnosis.

Kunze appears to have been reluctant to believe Kaulfuss in error, for he points out<sup>2</sup> with what care Kaulfuss was accustomed to compare his material with specimens in the Willdenow herbarium. Following a full discussion of the subject, however, he finally coincided in Presl's opinion, and described a new species, *Hemitelia subincisa*, basing it in part upon "*Hemitelia speciosa*, Kaulf." which Presl had called (as *Cnemidaria speciosa*) a misidentification of the Humboldt and Bonpland species. Further notes on *H. subincisa* will be given hereafter.<sup>3</sup>

The proper identification of *Cyathea speciosa* H. & B. was complicated further by Hooker, who published<sup>4</sup> under the name "*Hemitelia speciosa* Kaulf.," in 1844, an illustration of a wholly distinct (third) species. This, later in the same year, became the foundation of a new species, *Hemitelia integrifolia* Klotzsch,<sup>5</sup> which will be discussed in this paper under that name.<sup>6</sup> Having thus wrongly applied the name *speciosa* to a species other than the original Hooker subsequently (in 1848) redescribed the true *Cyathea speciosa* upon Venezuela plants collected by Linden (no. 663) under the name *Hemitelia lindeni*. His illustration of *H. lindeni* agrees in every particular

<sup>1</sup> Presl, Tent. Pterid. pl. 1. f. 16, 17.

<sup>2</sup> Bot. Zeit. 2:295. 1844.

<sup>3</sup> Page 49.

<sup>4</sup> Sp. Fil. 1: pl. 13 B.

<sup>5</sup> Linnaea 18:539. 1844.

<sup>6</sup> Page 31.

with the type specimens of *Cyathea speciosa* H. & B. in the Willdenow herbarium, as shown by an excellent photograph of these, forwarded by Doctor Urban. This fact, which seems never to have been pointed out, should be kept clearly in mind, as fixing beyond doubt the characters of cutting and venation in true *H. speciosa*.

The present species (under the name *H. lindeni* Hook.) was compared by Hooker with *H. integrifolia* Klotzsch (the "*H. speciosa*" of the species *Filicum*, plate 13 B), from which, writes Hooker, it "will be at once recognized as distinct \* \* \* by the deeply lobed, almost pinnatifid, margins of the pinnæ, and by the different appearance of the fructifications," which, he adds, "constitute a broad band, occupying almost one-half of the portion between the margin and the costa"—in distinction to the submarginal line of sori and the crenate-sinuate margins of *H. integrifolia*. It may be noted that these are the very points of distinction enumerated by Klotzsch in criticising Hooker's earlier (1844) erroneous interpretation of *C. speciosa* H. & B. which led him to found the new species *H. integrifolia*.

## 2. *Hemitelia integrifolia* Klotzsch, *Linnaea* 18: 539. 1844.

*Hemitelia speciosa* Hook. Sp. Fil. 1: 28 (in part, excl. syn.) pl. 13 B. 1844, not *H. speciosa* (H. & B.) Kaulf. 1824.

TYPE LOCALITY: Near Caracas, Venezuela, *Otto* 671; *Moritz* 107.

DISTRIBUTION: Northern portions of Colombia and Venezuela.

ILLUSTRATIONS: Hook. *loc. cit.* pl. 13B; Hook. Exot. Ferns pl. 66 (both as *H. speciosa*).

Klotzsch in his original diagnosis of this species cites, as representing it, "*Hemitelia speciosa* Hook. Spec. Fil. t. XIII. B. excl. diagn. et syn." and adds: "Ab *Hemitelia speciosa* Hook. nec Kaulf. (*Cyathea speciosa* Humb. Bonpl. Willd. Kth. et Presl) differt: caudice bipedali, nec quadriorgyali, pinnis subintegris, rigidis, nec profunde sinuatis tenuique membranaceis, venulis trifurcatis aut parce ramosis, soris crebris, marginalibus, nec distantibus." A few years later<sup>1</sup> he called further attention to Hooker's error in applying the species name *speciosa* of Humboldt and Bonpland and pointed out again very carefully the characteristic points of difference, adding in conclusion that, if Hooker did indeed have before him pinnæ of one of Humboldt's specimens from Caripe, he had nevertheless apparently drawn his figure from another plant.

At some time during the same year (1844) that Klotzsch published his first description of *H. integrifolia*, Kunze also published<sup>2</sup> upon Hooker's treatment of *Hemitelia*, which had recently appeared in volume 1 of the *Species Filicum*. His conclusions, in so far as they recognize "*Hemitelia speciosa*" of Hooker as the equivalent of *Cyathea speciosa* H. & B., are erroneous; but it should be noted also that Kunze subsequently<sup>3</sup> receded from this position, at least partially, and came later to regard *H. integrifolia* as truly distinct from *H. speciosa* (H. & B.). Mettenius<sup>4</sup> also recognized *H. integrifolia* as distinct and, following his description of it, cited Hooker's plate 13B. Nevertheless, Hooker in the *Synopsis Filicum* (1867) held to his previous erroneous treatment.

## 3. *Hemitelia bella* Reichenb. f.; Mett. Fil. Hort. Lips. 110. 1856.

TYPE LOCALITY: Caracas, Venezuela.

DISTRIBUTION: Venezuela.

Doctor Underwood's note on this species is as follows: "The only specimens seen are from material cultivated in the Botanical Garden at Leipzig, of which specimens may be found in the herbaria at New York, Kew, and Berlin, and probably elsewhere."

Excellent material from the same source has been received recently by the U. S. National Museum. Apparently the species is not known from North America.

<sup>1</sup> *Gartenzeit.* 20: 50, 51. 1852.

<sup>2</sup> *Bot. Zeit.* 2: 294-298. 1844.

<sup>3</sup> *Linnaea* 23: 310. 1850.

<sup>4</sup> *Fil. Hort. Lips.* 110. 1856.

**4. *Hemitelia contigua* (Underw.) Maxon, sp. nov.**

PLATE 18.

*Cnemidaria contigua* Underw. MS.

"Caudex ascending, then erect, 80 cm. long;" fronds 1.4 meters long, few; stipe slender, 20 cm. long, brown, very narrowly but deeply sulcate at either side of the upper surface, scantily and minutely puberulous, and bearing scattered brown ovate-lanceolate scales, the rachis similar and with a shallow dorsal groove; lamina about 120 cm. long, oblong-lanceolate from a rather abruptly narrowed base (5 cm. broad), 30 to 38 cm. broad near the middle, the apex acuminate; pinnae opposite, about 37 pairs, subsessile (the short stout stalks 1 to 2 mm. long, often narrowly alate, especially at the upper side), the lowermost pair oblong, 2 to 2.5 cm. long, the next pair 6 cm. distant, 5 cm. long, linear-oblong, deeply crenate, those above rather abruptly larger, closer, and crenately lobed; middle pinnae approximate or contiguous, 15 to 19 cm. long, 2.5 to 3.2 cm. broad, linear-oblong from an obliquely truncate slightly inequilateral base, pinnately cut about halfway to the costa, the apex gradually tapering, long-acuminate, the costae elevated on both surfaces, broader below and bearing a few large membranous bright brown scales at the sides; lobes about 20 to 24 pairs, deltoid-oblong, 7 to 8 mm. broad at the broadly triangular sinuses, 7 to 10 mm. long, slightly falcate toward the rounded apex, entire or nearly so, the costules evident, bearing an occasional thin scale below; veins 9 or 10 pairs, free, prominent below, simple, or those of the proximal sides sometimes once-forked, the branches each soriferous; sori large, the uppermost ones near the costule, those below medial, the lower ones distinctly supra-medial, the series thus broadly  $\Lambda$ -shaped, the sori of the lobe proper equidistant from the margin; indusia pale brown; leaf tissue membranous, paler and decidedly lustrous below.

Type in the Underwood Fern Herbarium, New York Botanical Garden, collected in wet forest in mountains 5 miles south of Cartago, Costa Rica, altitude about 1,800 meters, May 12, 1906, by William R. Maxon (no. 523). This specimen consists of two sheets, comprising the lamina complete and a portion of the stipe.

Related to *H. chiricana*, from which it departs widely in its simpler venation, shorter and triangular-oblong lobes, darker scales, and especially in its greatly reduced lower pinnae. The species is known only from the type collection.

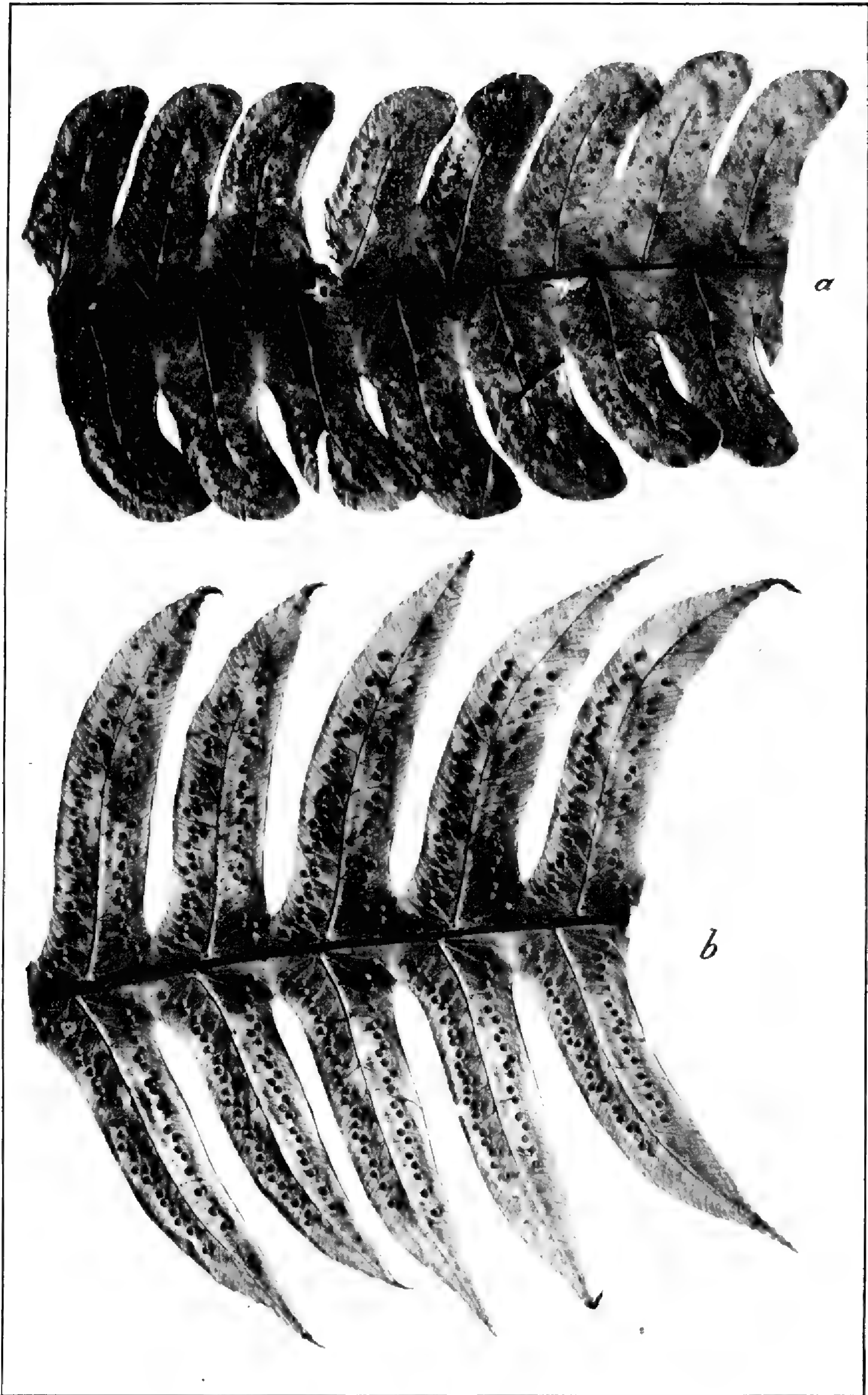
EXPLANATION OF PLATE 18.—Middle pinnae of type specimen, *Maxon 523*. Natural size.

**5. *Hemitelia pittieri* Maxon, sp. nov.**PLATE 19, *a*.

Caudex and stipe unknown; lamina apparently 1.5 meters long or more, 60 to 70 cm. broad, abruptly acuminate; rachis stoutish, stramineous, distantly muricate, canaliculate ventrally, closely and deciduously yellowish-furfuraceous and bearing an occasional dark-centered ovate scale with wide whitish erose-fimbriate margins; pinnae ample, nearly alternate, inserted about 7 cm. apart on each side, oblong-linear, 30 to 35 cm. long, 4 to 5.5 cm. broad, spreading, sessile, not narrowed at the base, obliquely truncate at the upper side, rounded or subcordate at the lower, in the lower and middle part pinnatifid two-thirds the distance to the costa, the costal wing thus 8 to 10 mm. broad from sinus to costa, gradually broader toward the apex, the pinna there pinnatifid more than halfway to the costa except at the relatively short and deeply serrate acuminate apex; costae elevated, lightly canaliculate and glabrous above, glabrescent below; segments about 21 to 25 pairs, oblong, 10 to 12 mm. broad at the sinuses, falcate, close, parallel, the sinuses acute, linear, 1 to 2 (or rarely 3) mm. broad, the margins sub-revolute, subentire or at the rounded apex obscurely crenate-dentate, the costules elevated, slender, strongly arcuate toward the apex, yellowish and glabrous above, glabrate below; veins almost invariably free, slender, elevated, 10 to 14 pairs, mostly once-forked near the base, the branches divergent, mostly soriferous near their middle; sori large, approximate, extending in an unbroken medial line from near the apex downward to a point on the costal wing much nearer to the costa than to the sinus, there meeting the sori of the adjoining segment and forming one end of a nearly perfect ellipse; indusium ample, membranous, semicircular in outline, commonly bilobed, the lobes

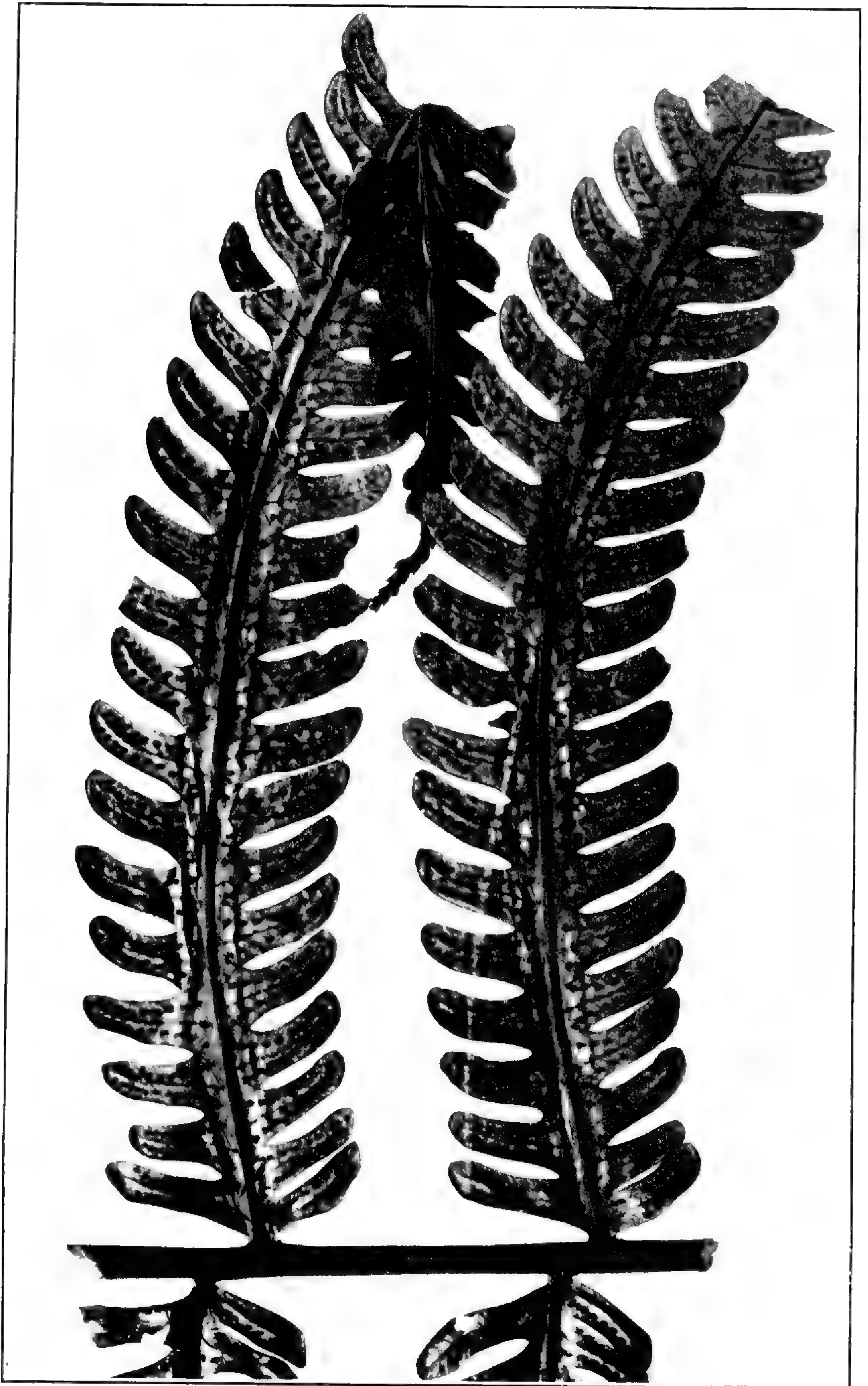


HEMITELIA CONTIGUA (UNDERW.) MAXON.



HEMITELIA PITTIERI MAXON AND H. SUBGLABRA (UNDERW.) MAXON.





HEMITELIA CHIRICANA MAXON.

spreading, papilionaceous; receptacle cylindrical-globose, minutely squamulose-setose; leaf tissue membrano-herbaceous, dark green and somewhat lustrous above, much paler below.

Type in the U. S. National Herbarium, no. 830314, collected at Cañas Gordas, Valle de Agua Buena, Costa Rica, altitude 1,100 meters, February, 1897, by H. Pittier (no. 10969). Known only from this collection.

Not very closely related to any other of the free-veined species of this group, the shape and curvature of the segments being distinctive.

EXPLANATION OF PLATE 19.—Middle sections of typical pinnæ of the type specimens (a) of *Hemitelia pittieri*; (b) of *H. subglabra*. Both natural size.

### 6. *Hemitelia chiricana* Maxon, sp. nov.

PLATE 20.

Caudex slender, erect, about 20 cm. high, 2.5 to 3 cm. in diameter, radicate below, above sheathed with old fibrous stipe bases, paleaceous at the crown, the scales very firm, ovate-lanceolate, acuminate, about 8 mm. long, dark glossy brown (or with whitish margins), those of the lower stipe much thinner, yellowish brown or light brown, deltoid-ovate, subfalcate, more or less fimbriate; fronds 1 to 1.7 meters long; stipe relatively stout, 5 to 8 mm. in diameter, 20 to 35 cm. long, dull dark brownish, minutely tuberculate near the base, closely invested with a thin harsh subpersistent covering of light crispate hairs; lamina elliptic-oblong, abruptly acuminate, 80 to 145 cm. long, 35 to 45 cm. broad near the middle, 15 to 20 cm. broad at the base, deeply bipinnatifid, the rachis closely crispate-tomentulose; pinnæ 20 to 25 pairs, subopposite or (toward the apex) alternate, inserted 4 to 7 cm. apart on each side, oblong-lanceolate, the middle ones 18 to 25 cm. long, 3.2 to 3.8 cm. broad, straight or commonly decurved, usually not narrowed at the unequally truncate or slightly semicordate base, deeply pinnatifid to within 3 or 4 mm. of the costa in the basal part, a little less deeply outward, the costal wing 4 to 5 mm. broad on each side below the long-acuminate apex; basal pinnæ shorter and relatively broader, strongly deflexed, 10 to 13 cm. long; costæ strongly elevated on both sides, above canaliculate and glabrous, below much stouter, at first closely and scantily yellowish-pubescent and with a few deciduous broad flaccid whitish fimbriate scales at the sides; segments of the middle pinnæ about 25 pairs, oblong or (in fully fertile fronds) narrowly deltoid-oblong, obtuse, 7 to 9 mm. broad at the base, 5 to 7 mm. broad at the middle, falcate toward the apex, distinctly separated by rather narrow acute sinuses, or in partially fertile specimens much closer; margins slightly revolute, distantly serrulate (or appearing subentire) except at the lightly serrate-crenate apices; costules clothed below like the costæ, or the few scales at once caducous; veins free, evident, glabrous above, minutely furfuraceous below, 10 to 13 pairs, oblique, mostly once-forked nearer the costule than the margin, or the lower ones forked medially, the branches all rather close, oblique, not widely divergent; sori borne usually at the fork of the veins, or at the base of the anterior branch, or (in the case of the basal veins) upon each branch, mostly apart, the lower ones medial, those above closer to the costule, the ones at the apex nearly basal, thus forming a  $\Lambda$ -shaped line; indusium firmly membranous, dark brown, semicircular, entire to obtusely lobed; receptacle globose-capitate, closely setiferous; leaf tissue firmly herbaceous, very dark green above, conspicuously lighter below.

Type in the U. S. National Herbarium, nos. 675908–675910, comprising a frond and part of the rhizome of a plant collected in humid forest between the Alto de las Palmas and the top of the Cerro de la Horqueta, Chiriqui, Panama, altitude 2,100 to 2,268 meters, March 18, 1911, by William R. Maxon (no. 5519). Known only from the type locality, other specimens being *Maxon* 5521, with identical data.

This species stands about midway between *H. pittieri* and *H. contigua*. It may be separated readily from the former by the characters noted in the key. It is contrasted with *H. contigua* under the discussion of that species.

EXPLANATION OF PLATE 20.—Middle pinnæ of the type specimen, *Maxon* 5519. Natural size.

7. *Hemitelia arachnoidea* (Underw.) Maxon, sp. nov.PLATE 21, *a, b*.*Cnemidaria arachnoidea* Underw. MS.

Caudex not noted; fronds 2 to 3 meters long, spreading; stipes stout, about 85 cm. long, brownish green from a light castaneous base, armed with scattered stout conical introrse spines 2 to 3 mm. long, eventually tuberculate, and bearing occasional lightish scarious lanceolate scales (these dark-centered at their base), otherwise closely covered with a thin subpersistent whitish-arachnoid tomentum; rachis greenish, muricate, arachnoid-tomentulose; middle pinnae subopposite, spreading, spaced their own width or more (10 to 12 cm. apart at point of insertion), ligulate-lanceolate, 40 to 50 cm. long, 5 to 6.5 cm. broad, sessile, slightly falcate, at the middle and base pinnatifid nearly to the costa, gradually less deeply so below the acuminate crenate-serrulate apex; basal pinnae smaller, about 20 cm. long, 3 cm. broad, strongly deflexed; segments of middle pinnae about 30 pairs, linear-oblong, 2.5 to 3.5 cm. long, 10 to 12 mm. broad at the slightly dilatate base, a little narrower toward the rounded apex, the basal pair one-half the size of the second (or even vestigial), joined to them by a narrow costal wing about 1.5 mm. broad, this gradually broader outward, 4 to 5 mm. broad upon each side of the costa at the middle of the pinna; all the segments separated by narrow acutish sinuses; margins slightly revolute, subentire or obscurely crenulate; costae stout, elevated, stramineous, glabrous above, below minutely whitish arachnoid tomentulose and deciduously paleaceous, the scales flaccid, lanceolate to oblong-ovate 4 to 7 mm. long, minutely erose, dirty white, dark-centered at the base; costules prominent, yellowish and glabrous above, whitish-tomentulose below, the veins similar; veins free, oblique, about 14 to 17 pairs to the segment, the lower ones arcuate, these and the middle ones forked at the base, the branches divergent, distant, both usually soriferous midway to the margin, or often the anterior branch divaricately forked, with one or both divisions immediately soriferous; sori large, contiguous, forming a straight or slightly irregular heavy medial line nearly to the apex of the segment; indusia ample, 2 or 3 lobed; receptacle cylindrical-capitate, squamulose-pilose; leaf tissue rigidly herbaceous, lustrous upon both surfaces, dark green above, yellowish-green below.

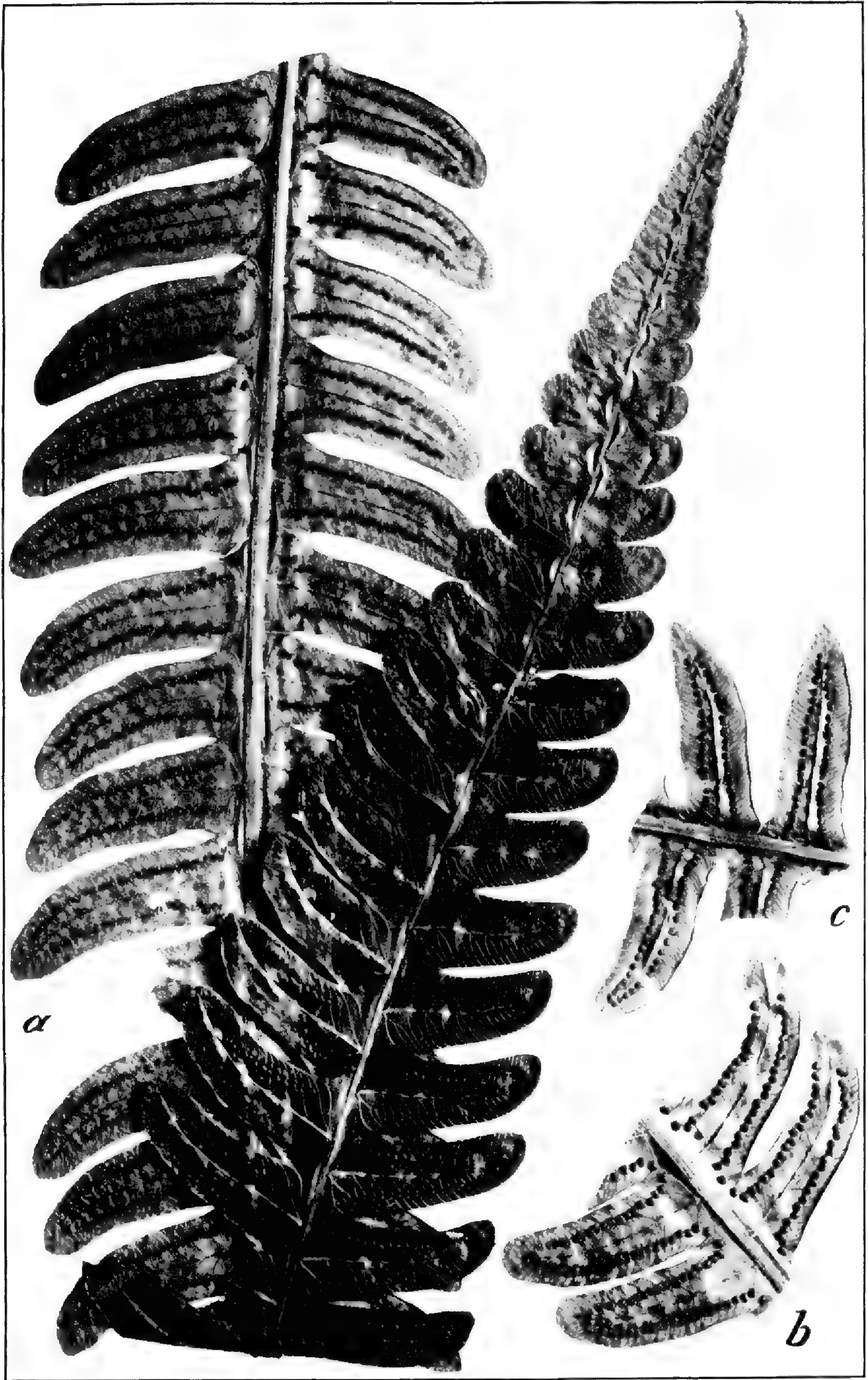
Type in the U. S. National Herbarium, nos. 575819 and 575820, collected on wet slopes in partial shade, vicinity of La Palma, Costa Rica, altitude 1,450 to 1,550 meters, May 6 to 8, 1906, by William R. Maxon (no. 453).

Allied to *H. mutica*, from which it differs in dimensions and in the characters enumerated in the key. Known only from the type collection.

EXPLANATION OF PLATE 21.—*a, b*, Portions of characteristic middle pinnae of the type specimen of *H. arachnoidea*; *c*, fragment from type of *H. mutica*, furnished by Doctor Christ. All natural size.

8. *Hemitelia mutica* Christ, Bull. Soc. Bot. Genève II. 1: 233. 1909. PLATE 21, *c*.

Rhizome "arborescent" but presumably very short; stipe stout, about 45 cm. long, yellowish brown, bearing numerous short spines, these dilatate at the base, and a few ovate scales up to 4 mm. long, these with shining blackish brown rounded centers and delicate whitish fimbriate margins; lamina deltoid-oblong, about 1 meter long and 60 cm. broad, very deeply bipinnatifid, the rachis clothed with flaccid grayish appressed scales; pinnae spreading, about 15 pairs, the lower ones petiolulate, the middle ones sessile, those above broadly adnate and crenately lobed, the uppermost decurrent, crenate or subentire; characteristic lower or middle pinnae lanceolate-ligulate from a slightly narrower base, about 30 cm. long, 4.5 to 6 cm. broad, nearly straight, close, at the base and middle pinnatifid to within 2 or 3 mm. of the costa, beyond this the costal wing gradually broader, about 4 mm. broad on each side below the acuminate-caudate serrate apex; costae lightly sulcate and glabrous above, below very stout, yellowish brown, sparingly muricate, canaliculate, at the base deciduously paleaceous like the rachis, also lightly yellowish araneose-furfuraceous; segments 27 to 30 pairs, elongate-oblong, mostly falcate, 2 to 3 cm. long, 9 to 11 mm. broad at the



HEMITELIA ARACHNOIDEA (UNDERW.) MAXON AND H. MUTICA CHRIST.

dentally or perhaps subsequently, either by him or by Mr. Baker; and that Jürgensen's 873 must stand as the actual type of the species. Baker in the *Flora Brasiliensis*<sup>1</sup> later modified the description and cited Brazilian specimens (*Burchell* 2527 and *Glaziou* 2420) in addition to the Mexican plant. The writer has not seen the Burchell plant; but *Glaziou* 2420, of which the National Herbarium has a fragmentary specimen, is much larger than the Mexican plant and represents a species of no particularly close alliance to it. Unless the Burchell specimen is of the same species as the Mexican (which is exceedingly unlikely), the range of *H. apiculata* must include at present only Mexico, where, as it appears, the species has not been re-collected since Jürgensen's time.

In several respects *H. apiculata* is unique, but especially in its pungent segments and in the position of the sori, the last a character which may be observed very well in plate 22.

EXPLANATION OF PLATE 22.—Type specimen, *Jürgensen* 873, in herb. Kew. At about two-thirds natural size.

10. *Hemitelia subglabra* (Underw.) Maxon, sp. nov.

PLATE 19, b.

*Cnemidaria subglabra* Underw. MS.

Caudex unknown; frond 2 to 3 meters long; stipes rather stout, 60 cm. or more long, olivaceous to pale brownish, scantily short-aculeolate, eventually tuberculate, very sparingly paleaceous, the scales with black centers and whitish erose margins; rachis similar, muricate toward the base, more or less deeply sulcate on all sides, scantily and deciduously paleaceous; pinnæ ample, subopposite, inserted 8 to 12 cm. apart on each side, oblong-lanceolate, 30 to 35 cm. long, 7 to 10 cm. broad, divergent, sessile or short-petiolate, slightly narrowed at the rounded inequilateral base, deeply and subequally pinnatifid to within 3 mm. of the costa in the basal part, the costal wing gradually broader outward, 5 to 6 mm. wide on each side below the acute or short-acuminate apex; costæ elevated on both surfaces, stout, glabrous and yellowish above, below closely invested with a minute whitish-arachnoid covering, soon glabrescent, toward the base bearing a few deciduous broad whitish darker centered coarsely erose flaccid scales; basal pinnæ shorter and narrower, about 20 cm. long, strongly deflexed, the segments more or less unequal; segments of middle pinnæ about 20 to 23 pairs, linear-oblong, long-acuminate, 12 to 15 mm. broad at the slightly dilatate base, 8 to 12 mm. broad at the middle, falcate toward the apex, separated by rather narrow acutish sinuses, the segments 3 to 6 mm. apart at their middle; margins plane or slightly revolute, subentire to lightly undulate-serrate, only the subcaudate apices conspicuously crenate-serrate; costules prominent, similar to the costæ, not paleaceous below; veins free, prominent, glabrous above, nearly so below, about 16 pairs below the apex of the segment, the lowermost one to three times forked (the basal branch strongly arcuate, extending to the sinus, soriferous about midway between the costa and sinus), those above mostly twice-forked near the base, oblique, the branches divergent, relatively distant, mostly soriferous (the middle one beyond the others), the large sori thus borne in an irregular nearly medial line falling short of the apex of the segment by 1 to 2 cm., the individual sori approximate but usually not continuous; indusium membranous, semicircular, ample, 2 or 3-parted, the lobes large, bullate, with irregular margins; receptacle globose-capitate, squamulose-pilose; leaf tissue as in *H. arachnoidea*.

Type in the U. S. National Herbarium, no. 575817, collected on a wet slope, in partial shade, vicinity of La Palma, Costa Rica, altitude 1,450 to 1,550 meters, May 6 to 8, 1906, by William R. Maxon (no. 451).

Known only from the interior mountain region of Costa Rica, at elevations of from 1,135 to 1,550 meters, but apparently common. The following additional specimens are in the National Herbarium:

COSTA RICA: Same data of locality as the type, *Maxon* 382. Forests of Juan Viñas, *Pittier* 1837. La Palma, *Tonduz* 12532; *Brade* 102.

<sup>1</sup>Baker in Mart. Fl. Bras. 1<sup>2</sup>: 312. 1870.



HEMITELIA APICULATA HOOK.

sinus, rather close, separated by narrow acute or acutish sinuses, the margins minutely revolute, subentire or toward the subobtuse or obtuse apices minutely but distinctly crenulate-serrate; costules elevated, glabrous above, below stouter and deciduously grayish to brownish furfuraceo-paleaceous at the base; veins free, 19 to 23 pairs to the segment, once-forked or one of the branches again forked, in the case of the lower veins the first fork close to the costule, the branches soriferous about halfway to the sinus; most of the veins forked about 1 mm. from the costule, the branches strongly elevated, very close, oblique, glabrous above, nearly so below, mostly soriferous at or just above the base; sori large, numerous, about 25 to 35 on each side of the costule, closely crowded, forming a dense usually uniserrate line much nearer to the costule than to the margin; indusium membranous, yellowish brown, semicircular, irregularly lobate-saccate, erose; receptacle globose, setiferous; leaf tissue herbaceous, dark green and sublustrous above, yellowish green and paler below.

*Hemitelia mutica*, which appears to be confined to Costa Rica, was founded by Christ upon several specimens, the first cited being from Turrialba, altitude 850 meters, collected by Wercklé. This, which is here figured from fragmentary specimens courteously forwarded by Doctor Christ, may stand as the type. The relationship is with *H. arachnoidea*.

EXPLANATION OF PLATE 21.—See p. 34.

9. *Hemitelia apiculata* Hook. in Hook. & Baker, Syn. Fil. 29. 1868. PLATE 22.

Rhizome, stipe, and length of lamina unknown; lamina 35 to 50 cm. broad, the pinnae inserted 4 to 5 cm. apart, slightly ascending, opposite, sessile, narrowly oblong-lanceolate, not narrowed at the base, 18 to 30 cm. long, 2.5 to 4.5 cm. broad below the gradually long-acuminate apex, pinnatifid throughout from two-thirds to nearly four-fifths the distance to the costa, the costa stout, stramineous, prominent on both surfaces, glabrous above, essentially so below; segments 30 pairs or more, close, separated by very acute linear sinuses, slightly oblique, elongate-oblong, 7 to 9 mm. broad, distinctly but lightly falcate in the outer half, the apices acuminate and sharply aristate, the margins everywhere lightly revolute, distantly subserrulate, the yellowish costules glabrous and distinctly elevated upon both surfaces; inferior basal segments sometimes broader and coarsely incised upon the proximal margin; veins free, 12 to 14 pairs, oblique, distinct, elevated, glabrous, almost invariably once-forked near the base (or rarely again forked), each branch soriferous about two-thirds or three-fourths the distance to the margin or beyond, the sori forming a single line; sori rather small, apart; indusium small, narrow or broadly ovate, simple, cucullate, yellowish brown; receptacle cylindrical-globose, short, setiferous; leaf tissue herbaceous, scarcely lustrous, much paler below.

TYPE LOCALITY: Mexico (Sierra San Pedro Nolasco, Talea, etc.), 1843-44, C. Jürgensen 873.

DISTRIBUTION: Apparently confined to Mexico; ascribed to Brazil in error.

Hooker's remark, following his description of this species in the Synopsis Filicum, is as follows: "Hab. Mexico and Brazil.—My specimen of 5 pairs of pinnae, partially fertile, has very much the appearance of *H. (Euhemitelia) grandifolia*; but the lobes are submucronate and pungent at the apex, and the veins are everywhere quite free." The Mexican plant here referred to is Jürgensen's 873 (sometimes written 273), and plate 22 is from a photograph of Hooker's "specimen of 5 pinnae," which is now in the Kew Herbarium. Doctor Underwood states (in MS.) that he was unable to find any Brazilian material under this name at Kew, but a memorandum from the Director of the Royal Gardens, dated January 1, 1910, contains the statement that "the species is represented at Kew by the following specimens only—Mexico, Jürgensen 273; Brazil Burchell 2527, Glaziou 2420."

From the foregoing it will be evident that Hooker's description was drawn with especial reference to Jürgensen's 873; that the Brazilian reference was included inci-

dentally or perhaps subsequently, either by him or by Mr. Baker; and that Jürgensen's 873 must stand as the actual type of the species. Baker in the *Flora Brasiliensis*<sup>1</sup> later modified the description and cited Brazilian specimens (*Burchell* 2527 and *Glaziou* 2420) in addition to the Mexican plant. The writer has not seen the Burchell plant; but *Glaziou* 2420, of which the National Herbarium has a fragmentary specimen, is much larger than the Mexican plant and represents a species of no particularly close alliance to it. Unless the Burchell specimen is of the same species as the Mexican (which is exceedingly unlikely), the range of *H. apiculata* must include at present only Mexico, where, as it appears, the species has not been re-collected since Jürgensen's time.

In several respects *H. apiculata* is unique, but especially in its pungent segments and in the position of the sori, the last a character which may be observed very well in plate 22.

EXPLANATION OF PLATE 22.—Type specimen, *Jürgensen* 873, in herb. Kew. At about two-thirds natural size.

**10. *Hemitelia subglabra*** (Underw.) Maxon, sp. nov.

PLATE 19, b.

*Cnemidaria subglabra* Underw. MS.

Caudex unknown; frond 2 to 3 meters long; stipes rather stout, 60 cm. or more long, olivaceous to pale brownish, scantily short-aculeolate, eventually tuberculate, very sparingly paleaceous, the scales with black centers and whitish erose margins; rachis similar, muricate toward the base, more or less deeply sulcate on all sides, scantily and deciduously paleaceous; pinnae ample, subopposite, inserted 8 to 12 cm. apart on each side, oblong-lanceolate, 30 to 35 cm. long, 7 to 10 cm. broad, divergent, sessile or short-petiolate, slightly narrowed at the rounded inequilateral base, deeply and subequally pinnatifid to within 3 mm. of the costa in the basal part, the costal wing gradually broader outward, 5 to 6 mm. wide on each side below the acute or short-acuminate apex; costae elevated on both surfaces, stout, glabrous and yellowish above, below closely invested with a minute whitish-arachnoid covering, soon glabrescent, toward the base bearing a few deciduous broad whitish darker centered coarsely erose flaccid scales; basal pinnae shorter and narrower, about 20 cm. long, strongly deflexed, the segments more or less unequal; segments of middle pinnae about 20 to 23 pairs, linear-oblong, long-acuminate, 12 to 15 mm. broad at the slightly dilatate base, 8 to 12 mm. broad at the middle, falcate toward the apex, separated by rather narrow acutish sinuses, the segments 3 to 6 mm. apart at their middle; margins plane or slightly revolute, subentire to lightly undulate-serrate, only the subcaudate apices conspicuously crenate-serrate; costules prominent, similar to the costae, not paleaceous below; veins free, prominent, glabrous above, nearly so below, about 16 pairs below the apex of the segment, the lowermost one to three times forked (the basal branch strongly arcuate, extending to the sinus, soriferous about midway between the costa and sinus), those above mostly twice-forked near the base, oblique, the branches divergent, relatively distant, mostly soriferous (the middle one beyond the others), the large sori thus borne in an irregular nearly medial line falling short of the apex of the segment by 1 to 2 cm., the individual sori approximate but usually not continuous; indusium membranous, semicircular, ample, 2 or 3-parted, the lobes large, bullate, with irregular margins; receptacle globose-capitate, squamulose-pilose; leaf tissue as in *H. arachnoidea*.

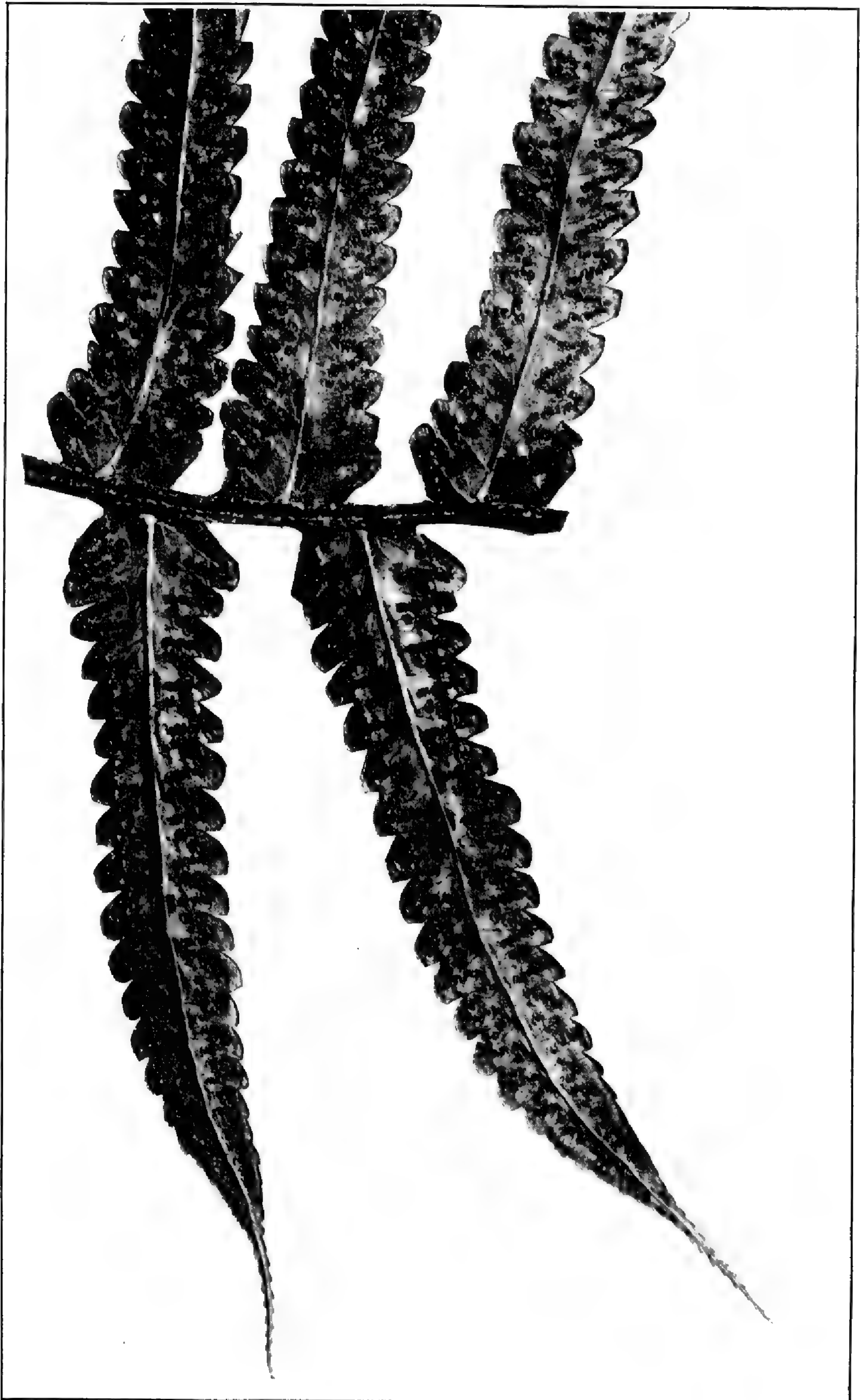
Type in the U. S. National Herbarium, no. 575817, collected on a wet slope, in partial shade, vicinity of La Palma, Costa Rica, altitude 1,450 to 1,550 meters, May 6 to 8, 1906, by William R. Maxon (no. 451).

Known only from the interior mountain region of Costa Rica, at elevations of from 1,135 to 1,550 meters, but apparently common. The following additional specimens are in the National Herbarium:

COSTA RICA: Same data of locality as the type, *Maxon* 382. Forests of Juan Viñas, *Pittier* 1837. La Palma, *Tonduz* 12532; *Brade* 102.

<sup>1</sup> Baker in Mart. Fl. Bras. 1<sup>2</sup>: 312. 1870.





HEMITELIA GRANDIS MAXON.

Superficially *H. subglabra* bears a certain resemblance to *H. horrida* of the West Indies, which, however, is not free-veined; hence Mr. Pittier's 1837 was so determined by Bommer. But there is no apparent reason for the previous determination of Tonduz' 12532 as *H. apiculata*, except that the species of this group as a whole have been greatly neglected and the few names applied very loosely. Brade's 102 bears the name *Hemitelia grandifolia* in Doctor Christ's hand. The species is apparently very distinct from other members of the genus and finds its nearest ally in *H. grandis*, from which it may be distinguished by the key characters.

EXPLANATION OF PLATE 19.—See p. 33.

11. *Hemitelia grandis* Maxon, sp. nov.

PLATE 23.

Caudex aborescent, ascending, about 75 cm. long; fronds wide-spreading, about 3 meters long; stipe stout, olivaceous to pale brown, freely short-aculeate on the convex lower side, sulcate above and bearing numerous lanceolate long-acuminate scales, 1.5 to 2 cm. long, with shining dark brown centers and whitish scarious margins; lamina very ample, 120 to 140 cm. broad at the middle, very deeply bipinnatifid or (as to the largest pinnae) fully bipinnate, the rachis very stout, short-aculeolate, muricate upward or smoothish, deciduously and closely whitish-araneose, sparingly paleaceous; pinnae sessile, mostly alternate, lanceolate, the larger middle ones 75 cm. long, 20 to 22 cm. broad from the middle nearly to the rounded slightly narrower base, in the basal third cut to the costa and upward nearly to the costa, the costal wing 1 to 2 mm. broad on each side at the middle of the pinna, 3 to 5 mm. broad on each side below the crenately lobed or ultimately crenate-serrate acuminate apex, the costa sulcate and glabrous above, below stout (2.5 to 3 mm. broad), convex, yellowish brown, smoothish, minutely and closely whitish-araneose and deciduously paleaceous toward the base, the scales ample, ovate, flaccid, dirty white, with darker bases; segments (or pinnules) of the larger pinnae about 28 pairs, alternate, deltoid-lanceolate, falcate, the larger ones 10 to 11 cm. long, 2 to 2.3 cm. broad just above the obtusely cuneate adnate base, about 18 mm. broad at the middle (the inferior basal one about 6 cm. long), the sixth to the tenth pairs lightly decurrent, beyond this connected by a conspicuous costal wing; all but the uppermost pinnules deeply crenate or crenately lobed (the lobes or crenations about 4.5 to 6 mm. broad, mostly shorter than broad), gradually serrate-crenate toward the linear-caudate apex, the costules glabrous above, below whitish-araneose, glabrescent; veins all free, about 20 pairs, divergent, slightly elevated, glabrescent, with about 4 to 8 pairs of very oblique, mostly simple pinnately arranged branches, these appressed-setulose below and soriferous below their middle (or the upper ones soriferous close to the vein), the rather large sori thus borne in distinct but contiguous rounded-angular groups (comprising 4 to 8 pairs of sori each) in a nearly medial zone between the costule and the crenate margins; indusia very ample, membranous, 2 or 3-lobate, the lobes irregularly erose, spreading with age and shallow; receptacle elongate-capitate, setiferous; leaf tissue rigidly herbaceous, very dark green and lustrous above, sublustrous and much paler below.

Type in the U. S. National Herbarium, nos. 575746 and 575747 (comprising a large middle pinna in two sections), collected in a humid forest ravine, vicinity of Coliblanco, lower slopes of the volcano Turrialba, Costa Rica, altitude about 1,950 meters, April 30, 1906, by William R. Maxon (no. 307).

To be compared only with *H. subglabra*, from which it differs for the most part in those characters which would naturally be correlated with its much greater size. The pinnate arrangement of the ultimate veins is a noteworthy character. Additional Costa Rican specimens (without definite locality), collected by Wercklé, have been received from Doctor Christ under the names *H. horrida* and *H. apiculata*. The species was collected in Costa Rica also by J. J. Cooper and determined by Baker as *H. horrida*.

EXPLANATION OF PLATE 23.—Section from lower third of a large pinna of the type specimen. Natural size.

**12. *Hemitelia petiolata* Hook. Sp. Fil. 1: 31. 1844.**

TYPE LOCALITY: Isthmus of Panama, *Sinclair*.

DISTRIBUTION: Republic of Panama (several collectors); reported<sup>1</sup> also from the island of Gorgona, Colombia.

ILLUSTRATIONS: Hook. loc. cit. *pl.* 16.

Hooker's short description is supplemented by so excellent a plate that there is no need of here redescribing the species, particularly since it is not very closely allied to any other. The species was observed by the writer at several localities in the lowlands of the Isthmus of Panama and is probably an abundant species there. The following specimens are in the U. S. National Herbarium.

PANAMA: Near Bismark, *R. S. Williams* 512. Without definite locality, *Hayes* 7. Chagres, *Fendler* 417. Hilly forest around the Agua Clara Reservoir, near Gatun, Canal Zone, altitude 20 to 30 meters, *Maxon* 4645. Valley of the Masambi, on the road to Las Cascadas Plantation, Canal Zone, altitude 20 to 100 meters, *Maxon* 4684. Forest near Porto Bello, Province of Colon, altitude 5 to 200 meters, *Maxon* 5769.

**13. *Hemitelia decurrens* Liebm. Vid. Selsk. Skr. V. 1: 285. 1849.**

*Hemistegia decurrens* Fourn. Mex. Pl. 1: 135. 1872.

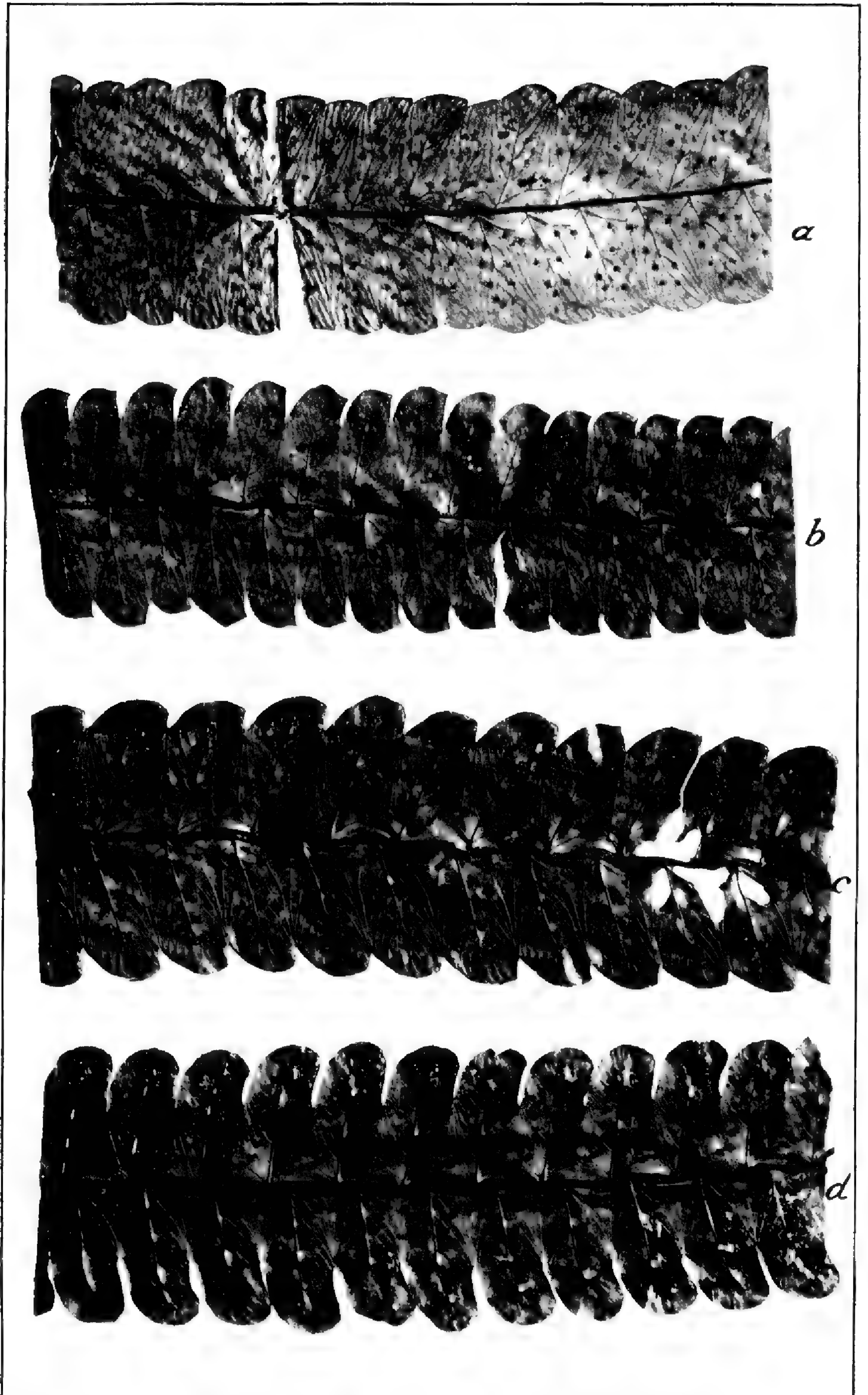
Caudex 30 cm. high, or less; fronds 1 meter or more long; stipe about 30 cm. long, armed with short spines toward the base, above (together with the rachis) arachnoid-pubescent, compressed, sulcate ventrally, narrowly membranaceo-alate laterally, with slender scattered whitish falcate scales, or those toward the base of the stipe broader, more rigid, and brownish margined; lamina ovate-lanceolate, about 75 cm. long, 20 to 23 cm. broad, simply pinnate; pinnæ about 20 pairs or fewer, subopposite or alternate, narrowly oblong-lanceolate, 12 to 15 cm. long, 2.5 to 3 cm. broad, straight or slightly falcate, the uppermost fully adnate and confluent, those below ascending, unequally cuneate, constricted, semiadnate and obliquely cuneate at the upper side, obtusely and abruptly constricted below and long-decurrent, a narrow decreasing foliaceous wing (1 to 4 mm. broad) extending downward upon each side of the rachis (above) to the pinna next below; characteristic middle pinnae subsessile, spreading, unequally and obtusely cuneate, the short petiolule distinctly foliaceo-marginate, the decurrent wing about 2 mm. broad at origin, narrowed downward; costæ elevated, yellowish, sparingly clothed toward the base below with whitish membranous, rounded or ovate, erose scales; margins remotely and lightly crenate-serrate, the teeth at the middle of the pinnæ about 6 to 8 mm. broad and 1 mm. long; main veins about 25 pairs or fewer, oblique, 5 to 9 mm. apart, elevated below, slender, with about 4 pairs of similar veinlets, the basal ones of adjacent groups joined by an obliquely transverse veinlet (forming a narrowly pentagonal elongate costal areole, cuneate proximally, much broader distally), then excurrent toward the margin, one or both extending to the minute sinus; other veinlets very oblique, nearly parallel, excurrent to the margin; sori few, occupying a slightly inframedial zone between the costa and the margin, in the partially infertile specimen at hand confined to the basal veinlets (above the areole and distant about 2 mm. from it) and the second pair of veinlets; indusium proximal, whitish, lobate, erose; leaf tissue rigidly membrano-herbaceous, lustrous above, pale below.

TYPE LOCALITY: Mountain forests near Lobani, District of Chinantla, Oaxaca, Mexico, altitude 900 to 1,050 meters, *Liebmann*.

DISTRIBUTION: Known only from Oaxaca.

The material at hand, which was received from Copenhagen, comprises a short section of the rachis, to which are attached the fourth pair of pinnæ. With this was sent by Mr. Christensen a sketch of the upper pinnæ showing the decurrent wings which extend along the rachis. It is sufficient to establish the validity of the species, which must be reckoned one of the most peculiar in the genus.

<sup>1</sup> Hook. & Baker, Syn. Fil. 28. 1868.



FOUR SPECIES OF HEMITELIA.

**14. *Hemitelia mexicana* Liebm.** Vid. Selsk. Skr. V. 1: 287. 1849. PLATE 24, *b*.*Hemistegia mexicana* Fourn. Mex. Pl. 1: 135. 1872.

Caudex about 30 cm. high; fronds 1.8 to 2.25 meters long; stipe 30 to 45 cm. long, squamulose, at length glabrescent, toward the base very minutely aculeolate; lamina broadly lanceolate, 1.5 to 1.8 meters long, 45 cm. or more broad, simply pinnate, acuminate; pinnæ numerous, alternate, oblique, linear, about 30 cm. long, 2.5 to 3 cm. broad, straight or slightly falcate, sessile, not narrowed at the inequilateral base, obliquely truncate at the upper side, rounded below, deeply crenate about one-third the distance to the costa at the base, about one-fourth the distance to the costa (or less) at the middle, only the outer fourth obliquely and broadly crenate-serrate, the apex appressed-serrulate; major crenations 3 to 5 mm. long, 5 to 7 mm. broad at the base, rounded-subtruncate, short-apiculate distally, the margins minutely revolute, entire; costæ elevated, greenish brown, glabrescent, a very few minute flattish yellowish scales subpersistent at the sides; main veins 50 pairs, nearly at right angles, 4 to 7 mm. apart, elevated, very slender, with 5 to 8 pairs of simple oblique arcuate veinlets, the basal of these usually joined by a transverse veinlet, then (one or both) excurrent to the sharply acute sinus, the other veinlets also extending to the margin, but mostly beyond the sinus; veins and veinlets minutely squamulose-setiferous; areoles relatively broad, ample, subhexagonal, broadest distally; sori 2 or 3 pairs to each group of veinlets, occupying a slightly inframedial zone between the costa and margin of the pinnæ; indusium light brown, semicircular or commonly suborbicular, crenately 3 to 6 lobed, the lobes repand-pateriform, reflexed; receptacle capitate, squamulose; leaf tissue membrano-herbaceous, dark shining green above, lighter below.

TYPE LOCALITY: Mountain forests near Cacolá (printed Cacoba, in error), District of Chinantla, Oaxaca, Mexico, altitude 750 to 900 meters, *Liebmann*.

DISTRIBUTION: KNOWN definitely only from the original collection.

The above description is drawn partly from two middle pinnæ (with a portion of the rachis) of the type specimens, which have been received from the Botanisk Museum, Copenhagen, through the kindness of Mr. Carl Christensen; and partly from Liebmann's original diagnosis. The species is well marked and will probably be found not uncommon in the mountainous districts of Oaxaca at mid-elevations.

EXPLANATION OF PLATE 24.—Portions of characteristic pinnæ (*a*) of type specimen of *Hemitelia guatemalensis*; (*b*) of type specimen of *H. mexicana*; (*c*) from type collection of *H. lucida*; (*d*) of type specimen of *H. choricarpa*. All natural size.

**15. *Hemitelia lucida* (Fée) Maxon.**PLATE 24, *c*.*Hemistegia lucida* Fée, Gen. Fil. 351. 1850-52.

Caudex undescribed; stipe very stout, somewhat spiny, paleaceo-furfuraceous; lamina (estimated) about 2 meters long, apparently ovate-oblong, about 80 cm. broad near the middle, 40 cm. broad at the base; pinnæ numerous, divergent, the larger ones about 8 cm. apart on each side, ligulate-lanceolate, straight or upwardly falcate, up to 45 cm. long, 3.5 to 4.2 cm. broad, serrate to serrulate at the gradually tapering, long-acuminate apex, elsewhere crenate to crenately lobed; principal crenations or lobes 28 to 34 pairs, rounded, 9 to 12 mm. broad at the sinuses, less than one-half as long, rounded, directed forward and subrectangular at the distal border, the sinuses obliquely triangular, open and acute, the margins subentire, minutely revolute; costæ elevated, glabrous above, nearly glabrous below, there bearing a few minute deciduous dirty white scales; midveins (or costules) divergent from the costa, subopposite to alternate, 9 to 10 mm. apart on each side, elevated, glabrous upon both surfaces, discontinuous (*i. e.*, forked) at the apex of the lobes, below this nearly straight; veinlets 5 to 9 pairs, oblique, simple, the lowermost ones of adjacent crenations joined by a transverse veinlet (this distant 2 to 2.5 mm. from the costa), then immediately soriferous and produced, commonly joining the second oblique vein of the same group at a point about one-half the distance to the sinus (or beyond)

at an acute angle; third pair of veins usually free and excurrent to or above the sinus; succeeding veins free, closer, extending to the margin above the sinus; sori 4 to 9 pairs, large, the basal ones 3 to 4 mm. distant from the midvein and 2 to 3 mm. from the costa, those above gradually approaching the midvein, the uppermost basal upon the veinlets, the sori of each lobe or crenation thus borne in an elongate A-shaped line; indusium ample, irregularly repand-lobate, the lobes shallow and reflexed; receptacle relatively large, globose, squamulose-setiferous; leaf tissue membrano-herbaceous, dark green and shining above, much paler below.

**TYPE LOCALITY:** District of Chinantla, Oaxaca, Mexico, altitude about 2,000 meters.

**DISTRIBUTION:** Known only from the original collection, *Galeotti* 6537.

Fée's original diagnosis is very incomplete and has afforded scant data for the above redescription, which is based almost wholly upon material of the type collection forwarded to the U. S. National Museum from Brussels by Professor de Willeman. This species is obviously related to *H. guatemalensis*, but appears to differ constantly in its deeper crenations and the very frequent junction of the first and second veinlets of each group at an acute angle below the sinus.

EXPLANATION OF PLATE 24.—See p. 39.

**16. *Hemitelia guatemalensis* Maxon, sp. nov.**

PLATE 24, *a*.

Caudex and stipe wanting; lamina ample, presumably about 2 meters long, at least 60 cm. broad, the apex very abruptly short-acuminate, the rachis stout, 6 to 8 mm. broad, firm, compressed, narrowly canaliculate ventrally, brownish, closely grayish squamulose-pubescent; pinnæ alternate, spaced, divergent, falcate and decurved, ligulate-lanceolate, the larger ones about 32 cm. long, 3 to 3.5 cm. broad, sessile or stoutly short-petiolate, slightly narrowed at the unequally rounded subcordate base, or obtusely cuneate at the upper side, irregularly and obliquely crenate nearly throughout, only the apical fourth serrate, gradually serrulate at the long-acuminate apex; crenations 2 mm. or rarely 3 mm. long, 6 to 8 (casually 10) mm. broad at the base, rounded, acutish distally, the margins entire, closely revolute, the sinuses acute or acutish; costæ very stout, elevated upon both sides, below similar to the rachis, above (together with the veins, veinlets, and leaf tissue above) glabrous; main veins about 40 pairs, the venation (including areolation) otherwise similar to that of *H. mexicana*, except as to the number of veinlets (these 4 to 6 pairs to each group); sori 4 to 6 pairs, distinctly inframedial upon the veinlets; indusium light brown, irregularly semicircular, 2 or 3-lobate, the lobes pateriform; receptacle elongate-capitate, minutely squamulose-pubescent; leaf tissue rigidly membrano-herbaceous, light green and lucid above, very much paler below.

Type in the U. S. National Herbarium, no. 830363, collected in Guatemala by O. Salvin (without number), distributed from the Royal Gardens, Kew, as *H. subincisa*.

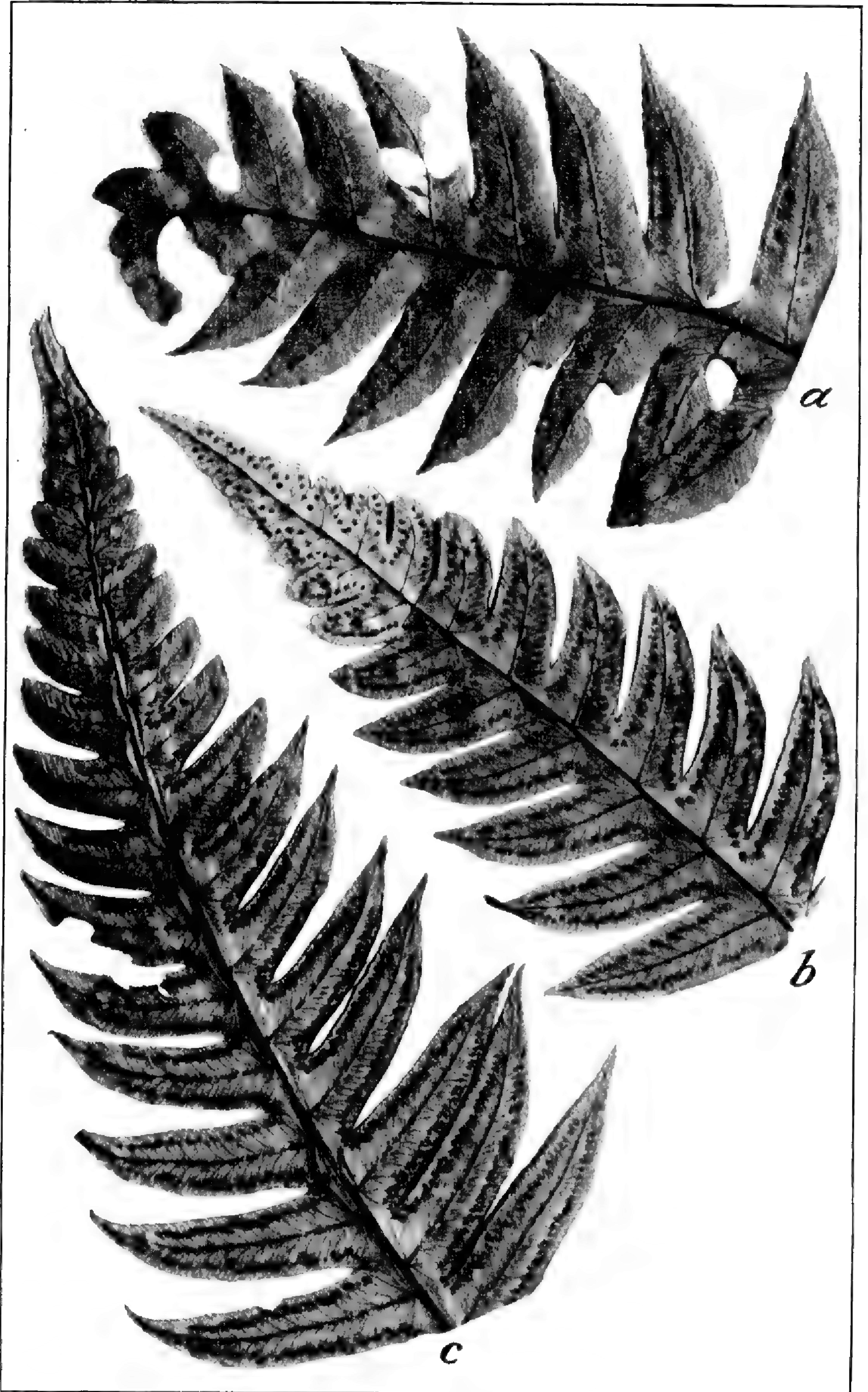
*Hemitelia guatemalensis* is to be compared with *H. mexicana* and *H. lucida*. Only the type specimens have been seen.

EXPLANATION OF PLATE 24.—See p. 39.

**17. *Hemitelia choricarpa* Maxon, sp. nov.**

PLATE 24, *d*.

Caudex and stipe wanting; lamina apparently about 1.5 meters long, 40 to 50 cm. broad, pinnate, acuminate, the rachis very firm, rather slender, yellowish brown, sharply bicarinate-sulcate and glabrous above, the under surface loosely crispate-tomentulose, the persistent whitish or yellowish hairs short and somewhat spreading; pinnæ subopposite to nearly alternate, 5 to 6 cm. apart on each side, oblong-linear, sessile, the upper ones ascending, obtusely and subequally cuneate or at the upper side slightly excavate; middle pinnæ divaricate or ascending, rounded-truncate or subcordate at the base, 27 to 32 cm. long, 3.5 to 4 cm. broad, pinnately lobed at the base about one-half the distance to the costa, above this (and nearly throughout) about two-fifths the distance to the costa, beyond this crenate, the acuminate-attenuate extremity obscurely serrulate; costæ conspicuously elevated on both surfaces, glabrous above,



HEMITELIA GRANDIFOLIA WILLD.

below crispate-tomentulose, glabrescent; major lobes about 27 to 32 pairs, subequal, 7 to 9 mm. broad at the base, obtuse, close, separated by narrow nearly closed sinuses, the margins slightly revolute, subentire, the costules elevated, arcuate toward the apex, glabrous above, glabrate below; veins 10 to 14 pairs to the lobe, oblique, the lowermost ones of adjacent segments joined by a transverse veinlet (forming a narrow elliptical areole), with 1 or 2 veinlets irregularly soriferous and excurrent to the sinus, there meeting the two basal veins, the other veins simple or mostly once-forked below the middle, soriferous at or below the fork or rarely (in the case of the lower veins) beyond the fork; sori distinctly apart, forming a slightly inframedial line extending from below the apex downward nearly to the costa, there joining the sori of the adjacent lobe at a point remote from the sinus, thus forming one end of a nearly perfect ellipse; indusium ample, membranous, semicircular in outline, 2 or 3-lobed, the lobes shallow, spreading, irregular; receptacle capitate, setiferous; leaf tissue membrano-herbaceous, dark and lustrous above, paler below.

Type in the U. S. National Herbarium, no. 830322; collected in forest near Buenos Aires, Costa Rica, February, 1892, by H. Pittier (no. 4835).

*Hemitelia choricarpa* is apparently confined to Costa Rica, the only other specimens seen being from Cañas Gordas, altitude 1,100 meters, March, 1897, Pittier 10966. The characters depended upon in the key to distinguish it from related species are diagnostic.

EXPLANATION OF PLATE 24.—See p. 39.

**18. *Hemitelia grandifolia*** (Willd.) Spreng. Syst. Veg. 4: 125. 1827. PLATE 25.

*Cyathea grandifolia* Willd. Sp. Pl. 5: 490. 1810.

*Hemitelia imrayana* Hook. Icon. Pl. 7: pl. 669. 1844.

*Hemitelia horrida imrayana* Hook. in Hook. & Baker, Syn. Fil. 28. 1868.

*Hemistegia willdenovii* Fée, Gen. Fil. 351. 1850-52.

*Microstegnus grandifolius* Presl, Abh. Böhm. Ges. Wiss. V. 5: 354. 1848.

*Hemistegia insignis* Fée, Mém. Foug. 11: 99. 1866.

*Hemitelia insignis* C. Chr. Index Fil. 349. 1905.

Caudex arborescent, erect, frequently 4 to 5 meters high, about 10 cm. in diameter, at the base (with its copious covering of brownish flexuous adventive roots) about 15 cm. in diameter, densely clothed at the summit with whitish lanceolate scales; fronds ascending, arching, up to 1.7 meters long, the stipes very stout, more or less imbricate, adnate or ascending close to the caudex, whitish-paleaceous at the base, eventually deciduous, leaving definite spaced quincuncially arranged elongate-oval scars; lamina ample, ovate, 1 to 1.25 meters long or more, 60 to 80 cm. broad, short-acuminate, the rachis very stout, yellowish brown, distantly muricate to smooth, convex or lightly sulcate on the lower side, on the upper side (at least in the lower part) deeply and narrowly sulcate, the ridges rounded, each similarly sulcate at the outer side; scales of the rachis deciduous, ovate or deltoid-ovate, long-acuminate, whitish, with a bright brown median stripe, finely erose; pinnae opposite or subopposite, the lowermost somewhat deflexed, ovate-lanceolate, about 25 cm. long; middle pinnae spreading, 8 to 10 cm. apart on each side, very narrowly deltoid-lanceolate to narrowly oblong-lanceolate, 30 to 40 cm. long, 6 to 11.5 cm. broad, sessile, scarcely or not at all reduced at the base, at the lower side strongly imbricate upon the rachis, close above, pinnatifid nearly to the costa, or the basal segments free, above this the segments connected by a narrow gradually increasing costal wing 2 to 4 mm. broad or finally about 4 to 6 mm. broad on each side below the crenate-serrate, ultimately biserrate, acuminate apex; costae very stout, yellowish brown to castaneous, glabrous above, below (especially toward the base) freely paleaceous, the scales similar to those of the rachis but smaller and relatively broader, the brownish median stripe often obsolete; segments adjacent or somewhat apart, 25 to 34 pairs, oblong-lanceolate, sometimes dilatate, the inferior basal one often reduced, inequilateral, and invariably



clasping the rachis, the others falcate or subfalcate, 3 to 6 cm. long, 12 to 16 mm. broad at the sinuses, slightly narrower above, the margins lightly revolute, obliquely crenate to deeply crenate-serrate (in very large specimens), crenate-serrulate at the acuminate to long-acuminate apex; costules elevated, bearing numerous small white bullate scales in the lower part below, otherwise glabrous; veins 15 to 20 pairs below the apex, minutely setulose, subpinnately forked (with about 2 to 4 pairs of branches) or 2 to 5-forked, the branches oblique, arcuate, soriferous toward their extremities; lowermost branches of basal veins of adjacent segments usually joined by a transverse veinlet, forming a narrowly elongate costal areole; basal branches of veins in the basal third of the segment also infrequently joined similarly, forming relatively broad costular areoles; sori rather small, biseriata and slightly supramedial, or in larger segments forming a continuous regular and deeply crenate line about 1 to 2 mm. distant from the margin; indusium bright brown, simple or 2 or 3-lobed, the margins uneven to lacerate; receptacle capitate to subcylindric, setose; leaf tissue firmly herbaceous, lustrous, often discolored in drying, dark above, much lighter below.

TYPE LOCALITY: Martinique (herb. Willd. 20167).

DISTRIBUTION: Apparently confined to the Lesser Antilles—Dominica, Martinique, Guadeloupe, Montserrat, and St. Kitts—at 300 to 1,200 meters elevation.

ILLUSTRATIONS: Hook. Icon. Pl. *pl.* 669 (as *Hemitelia imrayana*); Fée, loc. cit. *pl.* 26 (as *Hemistegia insignis*).

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

MARTINIQUE: *Duss* <sup>1</sup> 1605 (as *H. horrida*); *Duss* 4435 (as *Hemitelia* sp.); *Duss* 4605 (as *H. grandifolia*).

GADELOUPE: *Duss* 4154 (as *H. grandifolia*); *Duss* 4155 (as *H. horrida*); *Duss* 4449 (as *H. insignis*); *Duss* 4451, 4452 (as *Hemitelia* sp.).

DOMINICA: In forests, Laudat, *Eggers* 867; Laudat, *Lloyd* 263.

ST. KITTS: Forested slopes of Mount Misery, *Britton & Cowell* 510.

MONTSERRAT: Chauers Mountain, altitude 600 meters, *Shafer* 283. Without locality, *Turner*.

The taxonomic history of this species, which is rather complicated, is briefly as follows:

(1) *Grandifolia*. The species was first described as *Cyathea grandifolia* by Willdenow who cited Plumier's plate 20 and Petiver's plate 2, figure 10, and gave as the sole locality Martinique. If we are to interpret the species wholly upon the basis of the illustrations cited the name will apply to no other species than that described later by Kunze as *H. kohautiana*, the type of which (Sieber's 375, from Martinique) will be seen (Pl. 26) to agree closely with Plumier's plate 20, the latter also representing a Martinique plant. But there is in this instance a Willdenovian type specimen (herb. Willd., no. 20167) of the species *grandifolia*; and this, by a careful reading of the original description and especially of the part describing the acuminate segments, will be seen to have served for the really diagnostic features of the description. It seems far preferable, therefore, to give greater weight to the specimen than to the figures cited; and this even though a later writer, Presl, has confused the matter by stating <sup>2</sup> (by implication) that Willdenow's type was from Caracas, collected by Bredemeyer. The Willdenow specimen (no. 20167) shows no such data,<sup>3</sup> and there is far better reason to credit Willdenow's statement than Presl's. The other locality cited by Presl for his *Microstegnus grandifolius* is Mount Misery, St. Kitts, the specimen collected by Breutel. This the writer has not seen; but specimens collected on this

<sup>1</sup> The *Duss* numbers frequently embrace more than one species. The numbers here listed apply only to specimens in the National Herbarium.

<sup>2</sup> Loc. cit., 354, in describing *Microstegnus grandifolius*.

<sup>3</sup> Professor Urban writes that it has merely the following locality data: "Habitat in America calidiore."

mountain by Britton and Cowell (no. 510, in 1901) are evidently not specifically different from the fragment of Willdenow's type (no. 20167) shown in plate 25, *a*; and there is, therefore, on grounds of geographic distribution a strong presumption that Presl was in error as to the origin of the Willdenow specimen.

Fée's change of name for the plant to *Hemistegia willdenovii* was made purely from a supposed nomenclatorial difficulty, arising from his desire to retain both *Microstegnus grandifolius* Presl and *Hemistegia grandifolia* Presl ("*Hemitelia grandifolia* Hook.") in the same genus; unfortunately he in error chose the true *grandifolia* for renaming.

(2) *Imrayana*. Described from Dominica by Hooker on plants collected by Doctor Imray. A specimen at hand from this island differs in no essential particular from more copious material from Guadeloupe and Martinique.

(3) *Insignis*. A name applied by Fée to specimens collected by l'Herminier in Guadeloupe. A considerable number of specimens from Guadeloupe and Martinique give us our best idea of this species. They are clearly of the same species as Willdenow's type.

*Hemitelia grandifolia* is sufficiently distinct from *H. kohautiana* and *H. obtusa* by the data given in the key. This has been made as full as possible for the purpose of pointing out very definitely the characters by which these species, which have so long been confounded by nearly every writer, may be adequately distinguished.

EXPLANATION OF PLATE 25.—*a*, Fragment from the type specimen, herb. Willdenow (no. 20167), from Martinique; *b*, tip of a small upper pinna of a Martinique specimen, *Duss* 1605; *c*, tip of a large lower pinna of a Guadeloupe specimen, *Duss* 4452.

**19. *Hemitelia horrida* (L.) R. Br.; Spreng. Syst. Veg. 125. 1827.**

*Polypodium horridum* L. Sp. Pl. 1092. 1753.

*Cyathea horrida* J. E. Smith, Mem. Acad. Turin 5: 416. 1793.

*Cyathea commutata* Spreng. Anleit. Kennt. Gewächse 3: 146. 1804 (excluding all reference to Plumier).

*Cnemidaria horrida* Presl, Tent. Pterid. 57. 1836.

*Actinophlebia horrida* Presl, Abh. Böhm. Ges. Wiss. V. 5: 356. 1848.

*Hemistegia horrida* Fée, Gen. Fil. 351. 1850-52.

*Hemitelia hookeri* Presl, Abh. Böhm. Ges. Wiss. V. 5: 350. 1848.

*Hemitelia hookeriana* Schlecht. Bot. Zeit. 14: 474. 1856.

?*Hemitelia acuminata* Karst.; Schlecht. Bot. Zeit. 14: 474. 1856.

*Hemitelia commutata* Schlecht. Bot. Zeit. 14: 474. 1856.

*Hemistegia repanda* Fée, Gen. Fil. 351. 1850-52; Mém. Foug. 11: 98. 1866.

TYPE LOCALITY: Near Port de Paix, Haiti, *Plumier*.

DISTRIBUTION: Santo Domingo, Jamaica, Cuba, Porto Rico, Costa Rica, and doubtfully Colombia.

ILLUSTRATIONS: *Plumier*, Traité Foug. pl. 8; Spreng. loc. cit. pl. 4. f. 32; Hook. Sp. Fil. 1: pl. 15; Hook. & Bauer, Gen. Fil. pl. 4.

A redescription of this species is scarcely necessary, inasmuch as it is common in the Greater Antilles and is doubtless well represented in all the larger herbaria. Scant material of *H. horrida* and a consequent failure to recognize the full extent of its variation were, however, responsible for a large amount of speculation and critical comment in earlier times. Thus, Presl in 1848 founded a new species, *Hemitelia hookeri*, (without description) upon plate 15 of Hooker's Species Filicum and plate 4 of his Genera Filicum, supposing these to illustrate a species distinct from *H. horrida*, whereas they represent a condition not infrequently observed in particularly robust individuals of that species. Presl cited also Venezuelan specimens collected by Linden (no. 1572); but if we regard his species as typified by plate 15, as seems proper, it becomes a straight synonym of *H. horrida*, whatever may be the identity of Linden's no. 1572.

Schlechtendal published<sup>1</sup> in 1856 a very elaborate analysis of "*H. horrida*," as understood by various writers and as evidenced by living specimens and the relatively small amount of herbarium material available. His conclusion was to recognize tentatively five specific forms as follows:

1. *Hemitelia horrida* R. Br. = *Polypodium horridum* Lin. Plum. Fil. p. 9. t. 8. Plum. Amer. p. 3. t. 4.
2. *Hemitelia commutata* = *Cyathea commutata* Spreng. Einleit. in d. Stud. d. krypt. Gew. S. 147. fig. 32. a. b.
3. *Hemitelia hookeriana* = *H. horrida* Hook. Spec. Filic. 1. p. 30. t. XV. excl. synonym.
4. *Hemitelia Imrayana* Hook. Ic. pl. t. 669. Sp. Filic. 1. p. 33.
5. *Hemitelia acuminata* Karsten in litt. = *H. horrida* hortorum et nonnull. auct."

He suggested, however, that a better knowledge of these in the future might result in their recognition merely as forms of a single highly variable species. As to the status of these it may now be said that: (1) Plumier's plate 8 (the type of *Polypodium horridum* L.) shows crudely but unmistakably the typical form of the West Indian plant known commonly as *Hemitelia horrida*; (2) *H. commutata* (Spreng.) Schlecht., leaving out all reference to Plumier's plate 14 and judging the species by Schlechtendal's own figure, is assuredly *H. horrida*; (3) *H. hookeriana* Schlecht. is only an extreme development of the ordinary West Indian *H. horrida*, matching perfectly certain material from Jamaica which apparently owes its form to unusually favorable conditions of growth; (4) *H. imrayana* Hook. is identical with *H. insignis* Fée, a Lesser Antilles species<sup>2</sup> which (see page 42) must be known under the still earlier name *H. grandifolia* (Willd.) Spreng.; and (5) *H. acuminata* Schlecht. must be regarded as doubtfully a synonym of *H. horrida*. The original specimens of *H. acuminata* (a name first applied by Klotzsch) are said to have been collected near Galipan, Colombia, by Moritz (no. 290) and were listed<sup>3</sup> as *H. horrida*. These and Valentini's Costa Rican specimens, mentioned by Schlechtendal,<sup>4</sup> have not been seen; but that *H. horrida* really occurs in Costa Rica is evident to the writer from an examination of the two Costa Rican collections listed below. There is no reason to suppose that the species may not extend also to Colombia. The presence of scales, mentioned by Schlechtendal, suggests some doubt as to the reference of *H. acuminata* to *H. horrida*, however; for in undoubted *H. horrida* the presence of any scales whatever, even in the most immature fronds, is exceedingly rare. Except for their very delicate, thin, and readily abraded whitish-tomentulose covering, the vascular parts of the pinnae are normally glabrous. Indeed, even the thin arachnoid covering is sometimes wholly wanting.

Fée's *Hemistegia repanda*, as redescribed some fourteen years after its original publication, is without much doubt also referable to *H. horrida*.

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

SANTO DOMINGO: Near Barahona, altitude 600 meters, von Türckheim 2707. Loma Isabel de Torre, altitude 600 meters, Eggers 2738. Without definite locality, Jaeger 203.

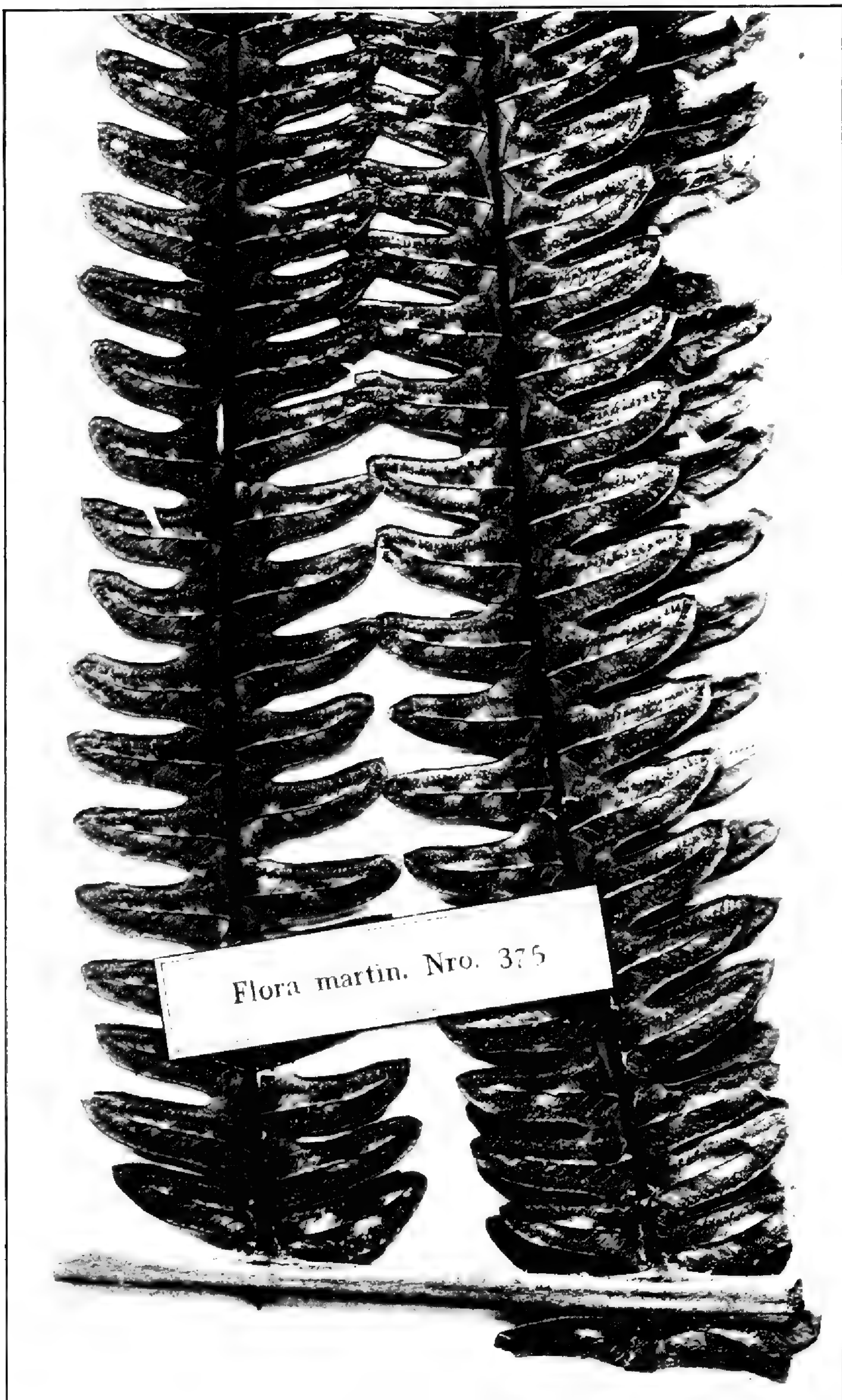
JAMAICA: Road to Mooretown, above Port Antonio, Underwood 3479. Near Castleton, Underwood 86. Near Port Antonio, Fredholm 3340. John Crow Mountains, Britton 3986; Harris & Britton 10697, 10709. Cuna Cuna Gap, altitude 750 meters, Clute 266. Second Breakfast Spring, near Tweedside, altitude 600 meters, Maxon 869. Wet rocky banks of stream and ravines in

<sup>1</sup> Bot. Zeit. 14: 449-454; 465-475. 1856.

<sup>2</sup> Schlechtendal, in error, gives *H. imrayana* as from Santo Domingo, instead of from Dominica.

<sup>3</sup> Linnaea 20: 440. 1847.

<sup>4</sup> Bot. Zeit. 14: 465. 1856.



HEMITELIA KOHAUTIANA (PRESL) KUNZE

forest, Mansfield, altitude 300 to 500 meters, *Maxon* 2387, 2456. Without definite locality, *Hart* 174.

CUBA: Mountains near Taco Taco, *Baker* 3835. Arroyo Trinitario, Rio Negro, Trinidad Mountains, Santa Clara, altitude 550 meters, *Britton & Britton* 5187. El Yunque Mountain, near Baracoa, altitude 300 to 600 meters, *Underwood & Earle* 626; *Pollard & Palmer* 118, 154. Pinal de Santa Ana, Yateras, Oriente, altitude 800 meters, *Eggers* 5030. Upper slopes and summit of Gran Piedra, Oriente, altitude 900 to 1,200 meters, *Maxon* 4034. Josephina, north of Jaguey, Yateras, Oriente, altitude 575 meters, *Maxon* 4104. Santa Ana, about 6 miles north of Jaguey, Yateras, Oriente, altitude 600 to 625 meters, *Maxon* 4187. Monte Verde, Yateras, Oriente, altitude 575 meters, *Maxon* 4336. Without definite locality, *Wright* 888.

PORTO RICO: Maricao, *Sintenis* 417. Mount Jimenez, Sierra de Luquillo, *Sintenis* 1507. Cayey, in forests, *Sintenis* 2490b. Adjuntas, in forests of Mount Cienega, *Sintenis* 4168. Lares, in forest at Buenos Aires, *Sintenis* 6088. Road from Utuado to Lares, *Underwood & Griggs* 71. Hacienda Perla, north side of Sierra de Luquillo, altitude 150 meters, *Heller & Heller* 1043. Mount Morales, near Utuado, *Britton & Cowell* 831. Near Mayaguez, *Britton & Marble* 551; *Cowell* 581. Barranquitas, *Hioram* 277.

COSTA RICA: Banks of a stream near Santa Barbara, *Pittier* 1679. Alajuela, altitude 900 meters, *Alfaro* 108.

**20. *Hemitelia kohautiana* (Presl) Kunze, Bot. Zeit. 2: 298. 1844. PLATE 26.**

*Cnemidaria kohautiana* Presl, Tent. Pterid. 57. 1836, name and figure.

*Hemistegia kohautiana* Presl, Abh. Böhm. Ges. Wiss. V. 5: 355. 1848, name only.

*Hemistegia grandifolia* Presl, Abh. Böhm. Ges. Wiss. V. 5: 355. 1848, in part, as to Plumier reference, not *Hemitelia grandifolia* (Willd.) Spreng. 1827.

Low-arborescent, the caudex up to 1.4 meters long and closely covered (at least below) with long dark adventitious roots; fronds numerous; lamina ample, probably 1.5 meters long or more, about 60 cm. broad, deeply bipinnatifid, acuminate, the rachis stout, brownish-stramineous, deeply trisulcate above, lightly and obtusely sulcate below, conspicuously but deciduously paleaceous, the scales linear-lanceolate to elongate-deltoid, all very long-attenuate, finely erose-fimbriate, whitish, or the larger ones with a narrow bright brown median stripe; rachis also yellowish scabrid pilose below, very rough; pinnæ opposite or nearly so, 5.5 to 7 cm. apart, very narrowly oblong-lanceolate, 30 to 33 cm. long, 4 to 5 cm. broad, spreading, sessile, not narrowed at the base, here slightly apart from the rachis at the upper side, subcordate below and either contiguous to the rachis or partially overlying it, deeply and almost equally pinnatifid throughout, the costal wing 4 to 5 mm. broad upon each side, scarcely broader below the crenate and ultimately serrulate acuminate apex; costæ stout, yellowish brown, sulcate and glabrous above, below faintly canaliculate, 1 to 2 mm. broad, copiously clothed with spaced spreading scales similar to those of the rachis or relatively broader, falcate, subflexuous, whitish and without a median stripe; segments close, about 28 pairs, nearly oblong, slightly broadest at the base, 9 to 11.5 mm. broad at the very narrow and sharply acute sinuses, subfalcate, subentire in the lower half, faintly serrulate above the middle, sharply so at the rounded apex; costules elevated, glabrous above, copiously paleaceous below, the scales minute, whitish, bullate, ending in a capillary point; veins 13 to 16 pairs, elevated, mostly once-forked, the basal branch of each basal vein joined by a short transverse veinlet to the opposed basal branch of the basal vein of the adjacent segment, a narrowly elongate basal areole thus formed along the costule, all four branches excurrent to the sinus; second pair and succeeding veins mostly once-forked at or near the base (sometimes twice-forked), the branches rather close, oblique, soriferous beyond their middle; sori relatively small but contiguous, extending in a close subflexuous supramedial line from the apex downward to

a point on the costal wing usually about one-third the distance from costa to sinus, there meeting obtusely the sori of the adjacent segment; indusium membranous, yellowish brown, semicircular or dimidiate, subentire to deeply and irregularly crenate, repand, shallow; receptacle globose-capitate, setiferous; leaf tissue herbaceous, dark green and lustrous above, yellowish and much paler below.

TYPE LOCALITY: Martinique, *Sieber* (Fl. Mart. 375).

DISTRIBUTION: Mountains of Martinique and Guadeloupe, at from 500 to 1,480 meters elevation.

ILLUSTRATIONS: Plumier, *Traité Foug. pl. 26*; Petiver, *Pter. Amer. pl. 2. f. 10*; Presl, *Tent. Pterid. pl. 1. f. 18*; Hook. *Sp. Fil. 1: pl. 14 B* (as *H. grandifolia*).

Plumier's plate 26 above cited was mentioned by Willdenow as illustrating his *grandifolia*; but, as shown under the discussion of that species at page 42 *H. grandifolia* is preferably to be interpreted by means of the Willdenow type specimen, which is of the species known hitherto as *H. insignis* or *H. imrayana*.

On account of the white scales of the under surface, larger specimens of this species might be confounded with true *H. grandifolia*, except for the simpler venation and the obtuse or, at least, nonacuminate segments. Its white scales will at once distinguish it from *H. obtusa* which invariably has brown scales, and these of a very different character.

EXPLANATION OF PLATE 26.—From a photograph of a portion of *Sieber* 375, Martinique, the type collection. Natural size. (Specimen in herbarium of the Missouri Botanical Garden.)

**21. *Hemitelia obtusa* Kaulf. Enum. Fil. 252. 1824.**

*Cnemidaria obtusa* Presl, *Tent. Pterid. 57. 1836.*

*Hemistegia obtusa* Presl, *Abh. Böhm. Ges. Wiss. V. 5: 355. 1848.*

*Hemitelia bullata* Christ, *Bot. Jahrb. Engler 24: 81. 1897.*

Rhizome of mature individuals unknown, probably ascending or forming a short upright caudex; fronds apparently 2 to 2.5 meters long, the stipe stout, clothed at the base with bright yellowish brown linear-lanceolate long-acuminate scales, sharply short-aculeate, light castaneous to yellowish brown, muricate upwards, deciduously palaceous; lamina broadly oblong or ovate-oblong, apparently 1 to 1.5 meters long, 40 to 60 cm. broad, abruptly acuminate, bipinnatifid, the rachis stout, deeply sulcate and glabrescent above, below lightly and obtusely sulcate, smoothish, laxly yellowish-pubescent with long flexuous flaccid hairs; pinnæ numerous, close, the lower ones deflexed; middle pinnæ divergent, opposite or subopposite about 4 to 6 cm. apart, oblong-ligulate, 20 to 35 cm. long, 3 to 4 (rarely 4.5) cm. broad, not or scarcely narrower at the base, close to the rachis at the upper side, subcordate below and commonly overlying the rachis, sessile, straight or lightly falcate, gradually acuminate in the apical third or fourth, (the extreme apex sharply serrate,) pinnatifid two-thirds to three-fourths the distance to the costa, the costal wing about 3 to 5 mm. wide on each side or slightly broader toward the apex; costæ glabrous and minutely but sharply sulcate above, below yellowish to brownish, stout, conspicuously elevated, at first freely clothed (at least toward the base) with shining subbullate ovate or oblong-ovate ferruginous or yellowish brown flaccid scales with lighter fibrillose margins, some of the scales persistent at the sides; segments about 24 to 30 pairs, oblong, lightly falcate, 9 to 12 mm. broad at the base, mostly close, the sinuses narrow and sharply acute, or broader in drying and acutish, the margins usually revolute, lightly crenate-serrate above the sinus, toward the apex crenate-dentate, the teeth not prolonged; costules sharply elevated, glabrous above, below obscurely setulose-glandular and bearing numerous small bullate brownish fibrillose scales; veins 13 to 16 pairs, elevated, glabrous above, minutely glandular-setulose below, once-forked, the basal one having its basal branch connected with a similar branch from the adjacent segment by a short transverse veinlet, the costal areole very narrowly elongate, all four branches extending to the sinus or to a point immediately above; second

pair and succeeding veins once-forked close to the sinus, the branches divergent, distant, soriferous above their middle; sori rather small, adjacent (sometimes contiguous with age), forming a distinctly supramedial line extending one-half to two-thirds the distance to the apex (rarely to the apex) and downward to a point on the costal wing about equidistant between the costa and the sinus; indusium grayish brown, semicircular or dimidiate, subentire to crenately lobed, shallow; receptacle globose, squamulose-setiferous; leaf tissue rigidly herbaceous, dark green above, lighter below, lustrous on both surfaces.

TYPE LOCALITY: "Habitat in Antilles."

DISTRIBUTION: Apparently confined to Grenada and St. Vincent.

The present species has been misidentified with nearly as much frequency as has *H. grandifolia* (and usually under that name), although Kaulfuss's description is definite enough. In addition to Kaulfuss's original plant Presl cites specimens collected by Guilding in St. Vincent, in which on the basis of material at hand he is probably correct. Grenada specimens collected by Eggers (no. 6035) were first determined by Christ as *H. grandifolia*, but were subsequently made the type of his new species *H. bullata*. They are perfectly typical examples of *H. obtusa*, as here understood. In leaf outline and venation *H. obtusa* resembles *H. kohautiana* rather closely; but it is strikingly different in its fewer and distinctly brownish scales of the under surface and in its almost nonpaleaceous, smoothish, and yellowish pubescent rachises.<sup>1</sup>

The following specimens have been examined:

ST. VINCENT: *H. H. & G. W. Smith* 854, 1715; *Eggers* 6731.

GRENADA: *Eggers* 6035; *Sherring*; *Broadway*.

#### DOUBTFUL SPECIES.

##### 1. HEMITELIA CRUCIATA Desv. Mém. Soc. Linn. Paris 6: 320. 1827.

The original description is as follows:

"Pinnis oppositis, sessilibus, lineari-lanceolatis subacuminatis, patentibus, profunde crenatis: laciniis subimbricatis incurvis, obtusisque apici latere acutiusculis obscure denticulatis: costis rachique nudis; caudice arborescente?"

"Habitat in America calidiori. Media inter *H. grandifoliam* et *speciosam*."

An excellent photograph of the type specimen, which is preserved in the Muséum d'Histoire Naturelle at the Jardin des Plantes, Paris, indicates a species at least very closely allied to that here recognized under the name *H. spectabilis* Kunze. In the shape of its pinnæ and in venation the specimen appears to agree with the Trinidad plants here cited under *H. spectabilis* and to differ only in its subimbricate segments. Without a direct comparison of the specimen itself with *H. spectabilis* it appears inadvisable to substitute the earlier name; but it is more than likely that the two relate to phases of the same species. At any rate its relationship is clearly with *H. spectabilis*, as here understood.

##### 2. HEMISTEGIA ELEGANTISSIMA Fée, Mém.Foug. 8: 110. 1857.

Founded upon a Mexican specimen collected by Linden, without number; not identified by the writer. The description, brief though it is, does not accord with any of the species here recognized.

<sup>1</sup> The plant figured by Hooker, Sp. Fil. 1: pl. 14 A. as *H. obtusa* is neither *H. obtusa* nor any species closely related to it. The illustration agrees exactly with the Trinidad material here taken up under the name *H. spectabilis*, but it does not show any secondary areoles (i. e., along the costules of the segments). This, however, is not a constant feature of that species and is only observed here and there. See under *H. spectabilis*.

3. *HEMITELIA MUNITA* (Willd.) Hook.; Kuhn, *Linnaea* **36**: 162. 1869.

*Cyathea munita* Willd.; Kaulf. Enum. Fil. 260. 1824, nomen nudum.

*Hemitelia munita* Hook. Sp. Fil. **1**: 32. 1844, nomen nudum.

*Hemistegia munita* Presl, Abh. Böhm. Ges. Wiss. V. **5**: 355. 1848.

The present species, based upon Willdenow's no. 20168, was not described until 1869, by Kuhn, although mentioned by several earlier writers under different names as indicated above. Through the kindness of Dr. I. Urban the writer has examined a small portion of Willdenow's specimen, which has as its type locality simply "America." It conforms well with Kuhn's description and represents either a valid species or a nearly sterile state of *H. obtusa* Kaulf.; probably the latter, although it is not matched exactly by other specimens. The scales are brownish, as in that species, but very few and minute; also, the segments are more deeply serrate and the sinuses much narrower than usual. It is, at least, closely allied to *H. obtusa*, and the type should be compared closely with undoubted specimens of that species.

4. *HEMITELIA SPECTABILIS* Kunze, *Linnaea* **21**: 233. 1848.

*Hemistegia spectabilis* Fée, Gen. Fil. 351. 1850-52.

*Actinophlebia obtusa* Presl, Abh. Böhm. Ges. Wiss. V. **5**: 356. 1848, not *Hemitelia obtusa* Kaulf. 1824.

TYPE LOCALITY: Surinam, *Kappler* 1771.

DISTRIBUTION: French and Dutch Guiana, Trinidad, and Venezuela, according to Kunze.

ILLUSTRATION: Hook. Sp. Fil. **1**: *pl. 14A* (as *H. obtusa*).

So far as can be ascertained this species, which is here identified with some uncertainty, is wholly South American, the Trinidad flora being considered as belonging to that continent. Kunze included in his concept of the species plants from several widely separated regions: Material collected in French Guiana by Leprieur and at first<sup>1</sup> referred doubtfully to *H. obtusa*; better specimens received later from Dutch Guiana and Trinidad; and, finally, material collected near Caracas by Linden and by Karsten. Mettenius<sup>2</sup> subsequently redescribed the species in full, citing it only from Dutch Guiana. Principally on the basis of the latter diagnosis, which does not conflict with that of Kunze, the name is here applied with reservation to the following material in the National Herbarium:

TRINIDAD: Without locality, *Fendler* 25 (4 sheets). Near Valencia, Nov., 1883, *Eggers* 1423. Without locality, *ex herb. Bot. Gard. Trinidad*, 195.

VENEZUELA: El Valle, Island of Margarita, August 16, 1901, *Miller & Johnston* 164. San Juan Mountain, Island of Margarita, altitude 500 meters, July 16, 1903, *Johnston* 191 (in part).

Whether or not these specimens actually pertain to *H. spectabilis*, they at least represent a species distinct from any of the North American flora, and one to which no other name appears to apply. They accord well with the descriptions by Kunze and Mettenius already mentioned. Hooker's figure cited above also agrees perfectly. It was probably drawn from Lockhart's Trinidad material mentioned by him.<sup>3</sup> (See under *H. obtusa*.)

According to Christensen's Index Filicum *Hemistegia spectabilis* Fée is an equivalent of *Hemitelia subincisa*. Fée published no description of it but cited the following synonymy: "*Hemithelia obtusa*, Hook., *fragm.*, \*non Klffs.; *Hemithelia* [Cnemidaria] *subincisa*, Kze." Thus, although he apparently did not intend it to be a transfer of *Hemitelia spectabilis* Kunze to the genus *Hemistegia* and, in fact, makes no reference to Kunze's species, it is nevertheless on the basis of Hooker's illustration a probable synonym of *Hemitelia spectabilis*.

<sup>1</sup> Bot. Zeit. **2**: 297. 1844.

<sup>2</sup> Fil. Hort. Lips. 111. 1854.

<sup>3</sup> This is substantiated by a recent letter from the Director of the Royal Gardens, Kew.



Presl's *Actinophlebia obtusa* was founded wholly upon Hooker's plate 14A which was clearly a misidentification of *H. obtusa* Kaulf., 1824. Hooker's figure, moreover, which is here regarded tentatively as typifying *H. spectabilis*, is itself one of the several original elements of Kunze's *H. subincisa*; but it can scarcely apply to that species as typified here on the basis of Pöppig's Peruvian plant. Kunze, in publishing *H. spectabilis*, writes: "Est quasi media inter meam *H. subincisam* et *H. obtusam*,"—with mention of his earlier (1844) reference of Hooker's plate 14A.

5. *HEMITELIA SUBINCISA* Kunze, Bot. Zeit. 2: 296. 1844.

*Cnemidaria speciosa* Presl, Tent. Pterid. 57. pl. 1. f. 16. 17. 1836, not *Cyathea speciosa* H. & B.; Willd. 1810.

*Hemistegia speciosa* Fée, Gen. Fil. 351. 1850–52.

TYPE LOCALITY: Peru, Pöppig.

DISTRIBUTION: Venezuela to northern Brazil and Peru (according to Underwood MS.).

ILLUSTRATION: Presl, loc. cit. pl. 1. f. 16. 17.

The ground taken by Kunze, in his long review<sup>1</sup> of Hooker's treatment of *Hemitelia* in the *Species Filicum*, for establishing *Hemitelia subincisa* is essentially that taken by Presl, both authors agreeing that Kaulfuss erred in his identification of *Cyathea speciosa* H. & B. (See under *H. speciosa*, page 30). But just what herbarium material Kaulfuss had in hand in transferring *Cyathea speciosa* H. & B. to *Hemitelia* can not be stated, nor can the source of Presl's information. In the Presl herbarium at Prague, however, is a specimen of "*Cnemidaria speciosa*" collected in Peru by Pöppig. This very likely not only formed the basis of Presl's figures 16 and 17, but is probably a plant of the same Pöppig number which gave Kunze many of the data for his new *H. subincisa*. A fragment in the Underwood Fern Herbarium does not agree with Presl's figure 16, but accords perfectly with figure 17. Possibly figures 16 and 17 belong to different individuals or different species. In any case, it seems desirable for present purposes to typify the species on figure 17, which apparently represents Pöppig's Peruvian plant as found in Presl's own herbarium. The Brazilian plant, as represented by Martius's figure,<sup>2</sup> seems to be the same.

Hooker's plate 14A, published as "*H. obtusa*" is also cited by Kunze for his *H. subincisa*; but it is drawn from a Trinidad specimen and represents a species distinct from *H. subincisa*, as the latter is typified in this paper. It is here regarded as representing *H. spectabilis*.

*Hemitelia subincisa* has been credited to Guatemala and other parts of tropical North America, but so far as can be ascertained it is altogether South American.

### FURTHER NOTES ON THE WEST INDIAN SPECIES OF POLYSTICHUM.

Since the writer's revision of the West Indian species of *Polystichum* in the last paper of this series (1909) considerable additional material has been received, some of it showing extension of ranges, as here recorded. The single new species to be described is rather closely related to *P. dissimulans*, yet offers differences which seem to be specific.

*Polystichum ambiguum* Maxon, sp. nov.

PLATE 27.

Fronds 4 or 5, laxly arching, 60 to 74 cm. long, long-stipitate (the stipe as long as the lamina or longer). Rhizome decumbent, about 5 cm. long, 1.5 cm. in diameter, woody, bearing numerous coarse freely branched roots, and sparingly clothed with thin dark to light brown oblong-lanceolate scales about 1 cm. long; stipes stoutish, 31 to 38

<sup>1</sup> Bot. Zeit. 2: 294–299. 1844.

<sup>2</sup> Icon. Pl. Crypt. pl. 48. f. 2.

cm. long, stramineous, subquadrangular, sulcate, bearing a few large flaccid yellowish brown scales near the base, elsewhere nearly glabrous, or with a few linear or fibrillose tortuous scales above, these extending along the rachis but readily deciduous; lamina narrowly ovate, deeply bipinnatifid nearly throughout, 29 to 36 cm. long, 10 to 17 cm. broad, comprising 15 to 17 pairs of spreading mostly falcate pinnæ; middle and lower pinnæ 6 to 8.5 cm. long, 1.5 to 2 cm. broad at the middle, subpinnate, strongly inæquilateral at the base, the superior basal segment much the largest, free, rhombic-ovate from an unequal narrowly cuneate base, the inferior one minute, free, the next 5 to 8 pairs narrowly to broadly rhombic-ovate, 8 to 12 mm. long, very oblique (the distal margin lying close to the narrowly alate secondary rachis), the apical segments much narrower, fully adnate and strongly decurrent, finally evident only as deep serrations at the acuminate apex; all the segments sharply acuminate but scarcely spinescent; apical pinnæ 1 to 2 cm. long, inserted 1 to 1.5 cm. apart; leaf tissue membranaceous, the under surfaces very sparingly and minutely fibrillose-paleaceous, mainly along the veins; rachis stout, very narrowly alate in the upper part, terminating in a large viviparous bud 1 to 2 cm. above the apical pinnæ; venation concealed, mostly flabellate, repeatedly dichotomous, the segments without definite midribs; sori large, irregularly biserial, the larger segments with 2 to 5 pairs.

Type in the U. S. National Herbarium, nos. 520201 and 520202, collected upon rocky slopes bordering humid forests in the immediate vicinity of Holly Mount, Mount Diabolo, Jamaica, altitude about 750 meters, May 25 to 27, 1904, by William R. Maxon (no. 2283).

The relationship of the present species is clearly with *P. dissimulans*. From this it differs mainly in the paler scales of the rhizome, in its different leaf shape, fewer pinnæ and minute inferior basal pinnules, in its flagelliform (and not foliose) apex, and in its sharply acuminate, rather than rigidly spinescent, segments. *P. dissimulans* is the most rigidly coriaceous of all the West Indian allies of *P. triangulum* while *P. ambiguum* has singularly flaccid fronds for a member of this group. *P. heterolepis*, though superficially resembling *P. ambiguum* to a certain extent, differs in nearly all essential details.

EXPLANATION OF PLATE 27.—A middle section of the type specimen.

***Polystichum plaschnickianum* (Kunze) Moore.**

This species, known hitherto only from Jamaica, has been collected recently in Santo Domingo by von Türckheim (no. 3038). The specimens, which are typical, are from the vicinity of Constanza, altitude 1,350 meters.

***Polystichum polystichiforme* (Fée) Maxon.**

Known previously only from Cuba and Jamaica. Collected recently in Porto Rico by Brother Hioram, his specimens (no. 245) from Mount Torresilla, July, 1911.

***Polystichum triangulum* (L.) Fée.**

This species, mentioned in the last paper as inhabiting only Santo Domingo, Cuba, and Jamaica, occurs also in Guatemala. The record rests upon plants collected by von Türckheim near Coban, Alta Verapaz, altitude about 1,350 meters, on rocks, and distributed by Captain Smith as no. 851.

Specimens from the vicinity of Constanza, Santo Domingo, altitude 1,190 meters, February, 1910, von Türckheim 2933, distributed as *Polystichum triangulum* var. *ilicifolium* Fée are not *Polystichum ilicifolium* Fée. They are, rather, referable to *P. triangulum*, but represent an unusually spiny form of the species.

***Polystichum wrightii* (Baker) C. Chr. in herb.**

*Polypodium wrightii* Baker in Hook. & Baker, Syn. Fil. 304. 1867.

*Dryopteris sauvallei* C. Chr. Ind. Fil. 291. 1905.

*Polystichum longipes* Maxon, Contr. Nat. Herb. 13: 34. pl. 6. 1909.

The above synonymy relates wholly to a Cuban species known only upon Wright's no. 3924. Baker, strangely enough, first described the species under his section



POLYSTICHUM AMBIGUUM MAXON.



PTEROPSIS UNDERWOODIANA MAXON.

“Euphegopteris” of Polypodium. Christensen, supposing it from this incomplete description and wrong generic position to be a Dryopteris, transferred it to that genus as *D. sauvallei*, the new species name being necessary in Dryopteris because of an earlier *D. wrightii* of Kuntze (1891). Subsequently he examined specimens at Stockholm, and noting their true affinity, called them *Polystichum wrightii*, a name which must take precedence over *P. longipes*, published in ignorance of Baker’s diagnosis.

### THE AMERICAN SPECIES OF PTEROPSIS.

In publishing the new genus *Ananthacorus* several years ago<sup>1</sup> the writer indicated briefly the grounds upon which the generic name *Pteropsis* (Desvaux, 1827) should be taken up to replace *Drymoglossum* (Presl, 1836). Two species of this genus have been known previously from America, one from Ecuador, the other from Martinique. A third, from Costa Rica, was detected by Dr. L. M. Underwood in 1904, but apparently never named or described by him.

The three species are:

**1. *Pteropsis wiesbaurii* (Sodirol) Maxon.**

*Drymoglossum wiesbaurii* Sodirol, Vasc. Crypt. Quit. 419. 1893.

Known only from Ecuador, the type being from tree trunks along the Rio Chimbo, altitude 300 to 500 meters.

**2. *Pteropsis martinicensis* (Christ) Maxon.**

*Drymoglossum martinicense* Christ, Bot. Jahrb. Engler 24: 137. 1897.

Apparently confined to Martinique; the original specimens from trees and rocks near Vauclin, *Duss* 250b.

**3. *Pteropsis underwoodiana* Maxon, sp. nov.**

PLATE 28.

Rhizome sarmentose, very slender, about 1 mm. in diameter, sparingly paleaceous, the scales subappressed, grayish, about 1 to 1.5 mm. long, linear-oblong to oblong-ovate, acute, minutely erose, membranous, with thin cell walls. Sterile fronds sessile, lanceolate, acuminate, 8 to 13 cm. long, 2.2 to 3.8 cm. broad above the broadly cuneate, usually equilateral base, strongly costate, the stramineous midvein and slender irregularly reticulate veins elevated and evident upon both sides throughout; leaf tissue firmly membrano-chartaceous, inconspicuously whitish-glandular above, bearing upon both surfaces numerous but distant minute punctiform ovate to suborbicular scales, these centrally peltate, with narrowly erose-fimbriate whitish margins. Fertile fronds 9 to 11 cm. long, short-stipitate, the stipe (1 to 1.5 cm. long) stout, appressed-paleaceous, the lamina linear, narrowly long-cuneate, 8 to 9 cm. long, 4 to 5 mm. broad; sporangia arising in a dense line about midway between the costa and margin, spreading to the margin and at maturity almost completely obscuring the costa below the short linear-cuspidate apex.

Type in the U. S. National Herbarium, no. 827444, collected near Suerre, Llanuras de Santa Clara, Costa Rica, altitude 300 meters, February, 1896, by John Donnell Smith, no. 6941; distributed as “*Acrostichum amygdalifolium* Mett.” There are specimens of the same number in the Underwood Fern Herbarium, New York Botanical Garden.

The American species may be distinguished by the following key:

- Lamina of sterile fronds obovate, coriaceous, about 3 cm. long, 1 cm. broad, densely covered with minute appressed stellate scales; fertile fronds plicate..... 2. *P. martinicensis*.

<sup>1</sup> Contr. Nat. Herb. 10: 486. 1908.

Lamina of sterile fronds lanceolate to oval-lanceolate, membranous or membrano-chartaceous, 2 to 4 times as large, one or both sides bearing minute scattered suborbicular to ovate scales; fertile fronds not plicate.

Fertile fronds 3 to 4 mm. broad, long-stipitate, the stipe 3 to 5 cm. long; sterile fronds oval-lanceolate, 6 to 9 cm. long; 2 to 3 cm. broad . . . . . 1. *P. wiesbaurii*.

Fertile fronds 4 to 5 mm. broad, short-stipitate, the stipe 1 to 1.5 cm. long; sterile fronds lanceolate, 8 to 13 cm. long; 2.2 to 3.8 cm. broad. . . . . 3. *P. underwoodiana*.

### TWO UNUSUAL FORMS OF DICRANOPTERIS.

Under the head of "Doubtful or Extralimital Species" the writer, in treating recently the North American species of *Dicranopteris*,<sup>1</sup> made mention of two peculiar forms as follows:

*Mertensia gleichenioides* Liebm. Vidensk. Selsk. Skr. V. 1: 296. 1849. (*Gleichenia liebmanni* Moore, Index Fil. 379. 1862.) A remarkable form, accurately described by Liebmann from specimens collected by him near Cuaba, Vera Cruz, Mexico, and apparently not since collected. In general appearance the specimens differ widely from the usual type of *Dicranopteris* in the direction of *Gleichenia*, but not in venation and other characters. In minute characters they appear to represent a species not otherwise known, but in gross morphology the plant is almost certainly atypical and possibly indicates a reversion toward a general ancestral form. Plants similar in form, but very different in vestiture, have been collected in Jamaica by Professor Underwood and the writer; these were growing with *D. bifida*, and from their minute characters must be reckoned a form of that species.

The present note is for the purpose of directing further attention to the peculiar morphology of these plants.

Plate 29 represents at about two-fifths natural size the Jamaican plants referred to (*Maxon* 936). They were collected by the writer in company with Prof. L. M. Underwood upon the dryish, brushy slopes of an abandoned coffee plantation, altitude about 750 meters, above Tweedside, which is near Mount Moses, in the Blue Mountains. Surrounding them upon all sides was a typical growth of the common tropical American species called *Dicranopteris fulva* (Desv.) by Doctor Underwood<sup>2</sup> and recently redescribed<sup>3</sup> by the writer under an earlier species name as *D. bifida* (Willd.) Maxon. The unusual interest attaching to these specimens was perhaps not fully appreciated at the time; at any rate nothing was noted beyond the fact that they covered an area of only a few square feet in the midst of normal *D. bifida*. Plants of similar form were not encountered elsewhere in Jamaica, although *D. bifida* is the commonest species of the genus at mid-elevations. In minute characters the specimens are evidently identical with ordinary *D. bifida*, which in its several forms is one of the most readily recognized species of the genus in North America, its

<sup>1</sup> N. Amer. Flora **16**<sup>1</sup>: 53-63. 1909.

<sup>3</sup> N. Amer. Flora **16**<sup>1</sup>: 60. 1909.

<sup>2</sup> Bull. Torrey Club **34**: 255. 1907.



DICRANOPTERIS BIFIDA (WILLD.) MAXON.

(A monstrous form.)

segments being covered beneath by a rusty, usually dense, entangled tomentum, which, however, with age frequently becomes bleached and matted, or nearly disappears.

The peculiarity of the Jamaican form here figured consists mainly in its having its simple pinnæ very narrowly linear (3 to 5 mm. broad) and merely subentire to broadly crenate, instead of pectinate, as in the normal form. The veins, which are short, are once-forked, the branches either simple or one or both of them again forked. The sori are dorsal upon the veinlets, as in all species of *Dicranopteris*, instead of terminal, as in *Gleichenia*. A dull brownish rusty tomentum closely invests the under surface of the pinnæ throughout from the narrowly revolute margins to the rachis. The primary internodes which subtend the pinnæ are precisely like those of the normal fronds of the species (*Maxon 937*), which were collected at the same time and place, except that they have in several instances a crenate or crenately lobed wing on the *lower* side, as well as upon the upper. The presence or absence of reduced segments bordering the primary and secondary internodes of the lateral branches of *D. bifida* is, however, an unusually variable feature.

Of almost identical form, but of very different covering below, is the plant described by Liebmann as *Mertensia gleichenioides*, *Mertensia* being used by him as the equivalent of *Dicranopteris*, and the species name *gleichenioides* in allusion to the general resemblance which the plant offers to true Old World *Gleichenia*. The lightly but broadly crenate pinnæ are a little more slender than in the monstrous form from Jamaica, not exceeding 4 mm. in width, and the margins are for the most part strongly revolute. The rachises of the pinnæ are clothed below with delicately lacerate pale ferruginous scales, and the veinlets of the under surface are covered with minutely dissected subpersistent scales, their capillary divisions exceedingly delicate and in mass strongly suggesting a tomentum. The veins are mostly once-forked, each of the branches again once or twice forked, the veinlets thus subfasciculate, a group to each broad crenation.

That Liebmann's plants represent an abnormal state of some Mexican species, as the monstrous state here figured does of *D. bifida*, is entirely probable, but the writer is unable to identify it with any previously described. For a very careful sketch of the two specimens constituting Liebmann's type, and for a pair of pinnæ of the type, forwarded from the Botanisk Museum, Copenhagen, to the U. S. National Museum, the writer is indebted to the courtesy of Mr. Carl Christensen.

As to the significance of the peculiar form shown by these two collections of different species, speculation is perhaps idle; yet it seems not unlikely that they represent a reversion to a more generalized ancestral type, rather than a chance variation. And the supposition that they may, perhaps, be an atavistic expression is doubtless



strengthened by their separate occurrence in regions far apart. Minor variations in form, size, and vestiture of the segments, in the highly complex scheme of branching, and in the production of segments upon the internodes of the lateral branches—all of these being features observed commonly in the field—seem to indicate that the species of this genus are in a more or less unstable state; and this renders the more significant so pronounced a departure from the normal form. Members of this family are said to be difficult of cultivation, which, together with the usual incompleteness of herbarium material, may account for the scant attention they have received. Nevertheless, the group is one of the greatest interest and one which, in the writer's opinion, would well repay critical investigation of the living plants, more especially a comparative study of those species showing radically diverse methods of branching. Following such a study it is not unlikely that *Dicranopteris*, instead of being again merged in *Gleichenia*, will itself be subdivided into several genera.

#### THE AMERICAN SPECIES OF CIBOTIUM.

In working over *Cibotium* for the forthcoming second part of volume 16 (Pteridophyta) of the North American Flora, it has been found that the American species have, if anything, been more frequently misidentified than the Old World material of the genus. The main reason for this appears to be that no one has given the American species careful attention. Thus, Kuhn properly distinguished two new species, *C. guatemalense* and *C. wendlandi*, in 1869, but failed to point out that Hooker's illustration of "*Cibotium schiedei*," plate 30A of the *Species Filicum*, really pertained to one of these, *C. wendlandi*. The confusion attending the illustration of *C. regale*, itself a valid species, is explained farther on, under that species. As a matter of fact the material available at any one herbarium is probably scant; and the distinctive points of difference among the several species, if evident to individual students, have at least never been pointed out. Full descriptions of the four species already mentioned will appear shortly. In the meantime illustrations of these, with the notes here given by way of comparison, may be helpful. The *Cibotium horridum* of Liebmann is found not to belong to this genus or its tribe.

The genus *Cibotium* of Kaulfuss is often credited to his *Enumeratio Filicum* (1824). It was, however, published<sup>1</sup> four years earlier in a little pharmaceutical journal, the only file of which known to the writer is that in the Library of the Surgeon General, in the Army Medical Museum, Washington, D. C. The original description is as follows:

"Die Fruchthausen sind in gewölbten, an einem Punkte auf der Unterseite des Laubes befestigten, lederartigen Schleierchen eingeschlossen, die sich von oben

<sup>1</sup> Kaulfuss in Berl. Jahrb. Pharm. 21: 53. 1820.



CIBOTIUM SCHIEDEI SCHLECHT. & CHAM.

mit einem bleibenden, nach der Rippe der Lappchen zu sich neigenden Deckel öffnen. Nur Eine, wahrscheinlich baumförmige, Art, *Cibotium Chamissoi*, von der Südsee."

In America the genus is apparently restricted to the northern continent. The species may be distinguished by means of the following key:

## KEY TO THE SPECIES.

- Costæ glabrous or readily glabrescent; leaf tissue conspicuously ceraceo-pruinose below.
- Sori mostly distant or subdistant, usually extending beyond the margin in the plane of the segment..... 1. *C. schiedeii*.
- Sori contiguous to imbricate, appearing dorsal, i. e., not extending beyond the margin.
- Lamina deeply tripinnatifid; veins 7 to 9 pairs to the segment; sori nearly parallel to the costule..... 2. *C. regale*.
- Lamina tripinnate or subtripinnate; veins 8 to 15 pairs to the segment; sori obviously oblique to the costule, closer..... 3. *C. guatemalense*.
- Costæ thickly invested with long persistent antrorse hairs; leaf tissue not obviously ceraceo-pruinose below..... 4. *C. wendlandii*.

1. *Cibotium schiedeii* Schlecht. & Cham. Linnaea 5: 616. 1830. PLATE 30.

*Dicksonia schiedeii* Baker in Hook. & Baker, Syn. Fil. 50. 1866.

TYPE LOCALITY: Hacienda de la Laguna, Mexico, *Schiede* 801.

DISTRIBUTION: Humid mountains of Oaxaca and Vera Cruz, at 600 to 1,200 meters elevation.

ILLUSTRATIONS: Presl, Tent. Pterid. pl. 11. f. 9.

*Cibotium schiedeii*, which was the first species of this genus to be described from North America, is apparently confined to Mexico.<sup>1</sup> It has long been in cultivation and need not be confused with any other. The fertile segments, especially the larger ones, are manifestly dentate-crenate and contain only 6 to 8 pairs of veins, of which the fertile ones are almost invariably simple and the sterile ones usually once forked at a slight angle. The most distinctive feature lies in the distant or subdistant produced sori (2 to 7 pairs) which commonly extend outward in the plane of the lamina, but in a few instances (in extreme age) are bent back under the segment. This character, while helpful in distinguishing the species, is possibly not fundamental and is, no doubt, correlated directly with the thin, chartaceous leaf tissue. In all the other American species the sori are closer and have the appearance of being erect and dorsal, since the segments, on account of their coriaceous or at least herbaceous texture, have the margins strongly revolute at maturity or in drying.

The following specimens have been examined:

MEXICO: Hacienda de la Laguna, *Schiede* 801. San Francisco, Mirador, *Liebmann*. Orizaba, *Müller*. Cordoba, *Kerber* 90a; *Fink* 13; *Bourgeau* 2378. Barranca de Tenampa, Zacuapan, Vera Cruz, September, 1906, *C. A. Purpus* 1976. Zacuapan, Vera Cruz, November, 1908, *C. A. Purpus* 1976a. (Also numerous specimens from the Botanical Gardens of Kew, Berlin, and Leipsic.)

EXPLANATION OF PLATE 30.—*a*, Pinnule from a cultivated plant, *ex hort. Lips.*; *b*, portion of pinnule of type collection (*Schiede* 801), in Underwood Fern Herbarium; *c*, pinnule from very old specimen of *Purpus* 1976; *d-g*, *Purpus* 1976a, *d* representing one of the larger inferior pinnules, *e* and *f* two superior pinnules from near the base of the pinna (at a point opposite *d*), *g* a nearly sterile pinnule from near the middle of a pinna. Only *a* shows the upper surface. All are at natural size.

<sup>1</sup> Skinner's plant from Guatemala, referred here by Hooker, is *C. wendlandii*. See under that species, p. 57.

**2. *Cibotium regale*** Versch. & Lem. Ill. Hort. **15**: under *pl.* 548. 1868. PLATE 31.  
*Dicksonia regalis* Baker in Hook. & Baker, Syn. Fil. ed. 2. 461. 1874.

TYPE LOCALITY: Described from cultivated specimens collected in Mexico by Ghiesbreght, altitude 1,500 to 1,800 meters.

DISTRIBUTION: Chiapas, Mexico.

ILLUSTRATION: Ill. Hort. *pl.* 548, in part (colored figure; also fig. 5?).

The original description of this species states no exact locality for the specimens collected by Ghiesbreght, but gives the altitude as from 5,000 to 6,000 feet. Two large pinnae of Ghiesbreght's collection in the D. C. Eaton herbarium, however, have the following data: "No. 351. Terre tempérée. Etat de Chiapas. Fougère arborescente. Tronc de 3 à 4 pieds de haut. Frondes de 5 à 6 metres de longueur. Croix au bord des ruisseaux. Juillet et Aout."; all but the number being apparently in Ghiesbreght's hand. Three pinnules of this, which is doubtless the type collection, are shown in plate 31 and will give an excellent idea of the species.<sup>1</sup>

*Cibotium regale* has nearly the form of *C. wendlandi*, but differs conspicuously in its acuminate (not aristate) segments, in having the costae and costules very sparingly silky-pubescent below (the hairs long and very readily deciduous), and in having the under surface of the segments conspicuously pruinose (not greenish). In cutting it is quite dissimilar to *C. guatemalense*. It is more nearly related, perhaps, to *C. schiedeii*, but differs in many respects, notably in its more numerous pinnules, greater size, different texture, revolute margins, and the different direction and position of the sori, and in having the veins of the sterile segments mostly two or three times forked, not mostly once forked.

EXPLANATION OF PLATE 31.—Three pinnules of *Ghiesbreght* 351, from Chiapas. Natural size.

**3. *Cibotium guatemalense*** Reichenb.; Kuhn, *Linnaea* **36**: 152. 1869. PLATE 32, *f, g*.  
*Dicksonia guatemalensis* Baker in Hook. & Baker, Syn. Fil. ed. 2. 461. 1874.

TYPE LOCALITY: Guatemala, *Wendland*.

DISTRIBUTION: Apparently confined to the humid mountain region of eastern Guatemala, altitude 1,500 meters or less.

*Cibotium guatemalense* is readily distinguished from its allies by the key characters noted above. It has very large, nearly or quite tripinnate fronds, with both pinnae and pinnules very much larger than those of *C. scheideii*, from which it differs conspicuously also in its imbricate, differently placed sori and its more numerous veins (8 to 15 pairs). The oblique position and crowding of the sori separate it immediately from *C. regale*.

The species has been reported from Costa Rica upon the basis of two different collections. The first of these (*Warscewicz* 43), according to a pinnule in the Underwood Fern Herbarium, indicates an undescribed species very closely allied to *C. wend-*

<sup>1</sup> An illustration is practically essential to a clear understanding of this species, owing to the very faulty original figures and the confusion existing between Lemaire's legends for the detailed drawings and his "explanation of the analytical figures." Figure 5 of plate 548 is presumably "fig. 1" of the "explanation," and probably is intended to represent Ghiesbreght's plant, as is stated. Figures 1, 2, 3, and 4 of plate 548 apparently represent the two "pennules" and "a, b, & c" mentioned in the "explanation," which are said to be redrawn from Hooker's plate 30A of the *Species Filicum*, and are obviously copied from that. A comparison of plate 548 with Hooker's plate 30A shows that the disagreement of the numbers which really appear on plate 548, with the letters and numbers of Lemaire's "explanation," is due to an error of the artist, who copied not only Hooker's detailed illustrations but also the *identical numbers* which accompanied them in the original! The drawing labeled 5 in plate 548 is, as mentioned above, doubtless meant for *C. regale*; but its resemblance to Hooker's figure (fig. 1 of *pl.* 548) is too close to offer any distinctive features whatever. It should be borne in mind also that the plant of Hooker's plate 30A is not *C. schiedeii*, but *C. wendlandi*. (See under the latter species, p. 57.)



CIBOTIUM REGALE VERSCH. & LEM.



CIBOTIUM WENDLANDI METT. AND C. GUATEMALENSE REICHENB.

*landi*; it is, at any rate, not *C. guatemalense*. The second is of a plant collected by Wercklé and listed<sup>1</sup> by Christ as *Cibotium guatemalense*. Several specimens of this in the U. S. National Herbarium, received from Doctor Christ and so labeled in his hand, are *Dicksonia navarrensis* Christ. So far as can be ascertained, *C. guatemalense* is strictly confined to Guatemala.

The following specimens have been examined:

GUATEMALA: Santa Cruz, Alta Verapaz, altitude 1,380 meters, *John Donnell Smith* 1505 (5 sheets). Rio Frio, near Santa Cruz, Alta Verapaz, *von Türckheim* II. 2113 (4 sheets). Without locality, *Salvin & Godman* (ex herb. Kew).

4. *Cibotium wendlandi* Mett.; Kuhn, *Linnaea* 36: 151. 1869. PLATE 32, a-e.

*Dicksonia wendlandi* Baker, in Hook. & Baker, *Syn. Fil.* ed. 2. 460. 1874.

TYPE LOCALITY: Guatemala, *Wendland*.

DISTRIBUTION: Probably confined to Guatemala.

ILLUSTRATION: Hook. *Sp. Fil.* 1: pl. 30A (as *C. schiedei*).<sup>2</sup>

*Cibotium wendlandi* differs widely from the other American species of this genus in the persistent, appressed-hairy covering of the costæ and costules, and in its greenish under surfaces. A close examination, nevertheless, shows the underside of the leaf tissue to be very minutely papillate, though not pruinose.

Christ has reported<sup>3</sup> this species from Chiapas, Mexico, upon specimens collected by Munch, and has subsequently<sup>4</sup> given the further data: "El Zontehuitz, altitude 2,858 meters (*Munch* 104)." At the latter reference he lists also a "very similar" Costa Rican plant (*Tonduz* 10697) which, though referred to *C. wendlandi*, is said to "approach" *C. guatemalense*. This number (10697) is again mentioned<sup>5</sup> by him the following year, under *C. wendlandi*, as distinct from *C. guatemalense*; and again in 1907<sup>6</sup> (here incorrectly as no. 10797) as *C. wendlandi*, "distinguished from *C. guatemalense* by its hairy surface and greater dimensions." The plant in question (no. 10697) is represented by two excellent specimens in the U. S. National Herbarium, one of these received from Doctor Christ. It is not a *Cibotium*, but an apparently undescribed species of *Dicksonia*. Under the circumstances the Mexican record (*Munch* 104) must be considered as exceedingly doubtful, not only for the species *C. wendlandi* but for the genus *Cibotium* as well; the plant is probably a *Dicksonia*.

*Cibotium wendlandi* is apparently a species of the semiarid regions of the Pacific coast, which probably accounts for the denser vestiture of the leaf surfaces. The following specimens have been examined:

GUATEMALA: Without locality, *Skinner* 22 (ex herb. Kew); *Wendland* (ex herb. Berol.). Guatemala, Depart. Guatemala, altitude 1,350 meters, *John Donnell Smith* 2423 (4 sheets).<sup>7</sup>

EXPLANATION OF PLATE 32.—a-e, *Cibotium wendlandi*; a, fragment (from Kew) of *Skinner's* Guatemalan specimen; b, fragment (from Berlin) of *Wendland's* Guatemalan specimen (type collection); c-e, Guatemala, *John Donnell Smith* 2423, c being a small subapical pinnule, d and e the fifth pair from the base (inferior and superior, respectively); f, g, *Cibotium guatemalense*; f, Guatemala, *John Donnell Smith* 1505, a middle inferior pinnule; g, Guatemala, *von Türckheim* II. 2113, one of the larger superior pinnules.

All at natural size.

<sup>1</sup> Bull. Herb. Boiss. II. 5: 251. 1905.

<sup>2</sup> This illustration has such slight resemblance to *C. schiedei* that the writer wrote to Kew, asking the source of the material figured. The reply (May 2, 1910) states that the figure was probably drawn from *Skinner's* no. 22. A pinnule of this, forwarded at the same time, is *C. wendlandi*.

<sup>3</sup> Bull. Herb. Boiss. II. 5: 251. 1905.

<sup>4</sup> Loc. cit. II. 5: 734. 1905.

<sup>5</sup> Loc. cit. II. 6: 189. 1906.

<sup>6</sup> Loc. cit. II. 7: 273. 1907.

<sup>7</sup> Captain *Smith* states in a recent letter that the exact locality is a barranca or deep ravine bounding a little hacienda called Aceituno, not far outside Guatemala City.

## EXCLUDED SPECIES.

*CIBOTIUM HORRIDUM* Liebm. Vid. Selsk. Skr. V. 1: 279. 1849.

This species is represented in the U. S. National Herbarium by three pinnules and part of a secondary rachis of Liebmann's original material, forwarded from Copenhagen, and said to have been collected by Liebmann in June, 1842, "in sylva montana prope Teotalcingo, Chinantla, Dept. Oaxaca, alt. 4-5000'." The most cursory examination of the scales of the rachis shows them to be relatively short, rigid, spinescent-ciliate, 5 to 10 cells broad, and thus of a totally different type from those of *Cibotium*, which are capillary, flaccid, and only a single cell broad. Their agreement with scales of the secondary rachis of *Cyathea princeps* (Linden) E. Meyer is so close, and the secondary rachis and the pinnules agree so closely in every particular, that Liebmann's species must undoubtedly be written as a synonym of *Cyathea princeps* as recently redescribed by the writer.<sup>1</sup> Liebmann's specimens, according to his description and the fragments received, are sterile, as might be expected in young plants of a *Cyathea* attaining the great size of *C. princeps* and in plants of such small size as that attributed by Liebmann to *Cibotium horridum*.

## TWO NEW SPECIES OF NOTHOLAENA.

In a recent examination of the Mexican material of *Notholaena* in the U. S. National Herbarium the following two new species were detected:

***Notholaena leonina*** Maxon, sp. nov.

Fronde 4 to 8 in number, 4 to 11 cm. high, fasciculate. Rhizome relatively stout, creeping or ascending, 1 to 1.5 cm. long (incomplete), about 4 mm. in diameter, very thickly clothed with densely imbricate, lance-acuminate to linear-subulate, dark brown scales (2.5 to 3.5 mm. long) with yellowish brown borders, the margins distantly and delicately glandular-papillate (especially toward the apex), otherwise subentire; stipes 2.5 to 7 cm. long, very slender, blackish, terete, slightly scaly toward the base, the scales broader than those of the rhizome, ovate, long-acuminate, yellowish brown, concolorous or with darker tips; lamina deltoid to deltoid-oblong, acute or slightly produced, 2 to 4.5 cm. long, 1.7 to 3.5 cm. broad, bipinnate or rarely tripinnatifid in the basal part, simple above, the apex simply pinnatisect, the rachis similar to the stipe but lightly sulcate ventrally; major pinnae 3 to 5 pairs (those above simple, linear-oblong to oblong), subopposite, inserted 7 to 12 mm. apart, the basal ones deltoid, with 2 to 4 pairs of spreading pinnules (or segments) below the usually trilobate apex, these elongate-oblong, simple and at least partly adnate, or the basal ones sessile and with 1 or 2 pairs of minute segments or lobes; pinnules or segments in general 1.5 to 2 mm. broad, flat, rigidly herbaceous, grayish green, together with the rachises densely ceraceo-papillate throughout; costae of the segments wholly concealed above, evident below only toward the base; margins closely revolute about one-third the distance to the costa (or less at maturity), unchanged, only partially concealing the dark brown sporangia.

Type in the U. S. National Herbarium, no. 834605, collected near Monterey, State of Nuevo Leon, Mexico, February 17 to 26, 1880, by Dr. Edward Palmer (no. 1381); the specimens received from Capt. John Donnell Smith.

Known to the writer only from the type number, which apparently was not generally distributed to herbaria; at least it is wanting in the National Herbarium set received originally, and is not cited by Baker,<sup>2</sup> who does, however, list numbers 1382 and 1383 of the same collection as *N. pringlei*. Eaton<sup>3</sup> listed no. 1381 as *N. candida* Hook.

<sup>1</sup> N. Amer. Flora **16**<sup>1</sup>: 78. 1909.

<sup>3</sup> Proc. Amer. Acad. **18**: 185. 1883.

<sup>2</sup> Annals of Botany **5**: 482. 1891.



The systematic position of *N. leonina* is next to *N. pringlei* Davenp. and *N. bryopoda* Maxon. From the former, which it resembles superficially, it differs in the delicately glandular-papillate (not coarsely and irregularly denticulate) tips of the rhizome scales, in its very slender terete blackish (not stout sulcate yellowish brown) stipes, in the lesser degree of subdivision of the lamina, and in its flat segments and less coriaceous leaf tissue. *N. pringlei* is usually much larger, and has shorter segments; and even in its younger states commonly has the lamina tripinnate in the lower part. The difference in color and thickness of the stipes is marked.

*Notholaena bryopoda* differs from both species in the complete absence of any ceraceous covering to the lamina, and in numerous other particulars.

***Notholaena rosei* Maxon, sp. nov.**

Fronds 6 to 8, rigidly erect, 30 to 48 cm. high, loosely fasciculate. Rhizome suberect, stout, multicapital, 1.5 to 3 cm. in diameter, 4 to 5 cm. long, densely paleaceous, freely radiceous, and bearing numerous imbricate stipe-bases of old fronds; scales of the rhizome closely imbricate, lance-acicular, 2 to 2.5 mm. long, very rigid, the center yellowish brown, the apex and sides lustrous blackish brown and strongly thickened, with a delicate lax yellowish white araneose-ciliate outer border; stipes stout, 1.5 to 2 mm. in diameter, 8 to 13 cm. long, brownish stramineous from a dull castaneous brownish flexuous base, subterete, lightly canaliculate along the anterior face, sparingly and deciduously scaly, densely puberulous with glandular-capitate hairs; lamina 20 to 35 cm. long, 7 to 10 cm. broad near the middle, lanceolate, acuminate, deeply tripinnatifid nearly throughout, the rachis similar to the stipe but with a conspicuous narrow ventral furrow; pinnæ few, distant, of a deltoid type, mostly inequilateral, ascending, stalked (1 to 3 mm.), the basal pair subopposite and reduced (about 2 cm. long), the second pair 5 to 6 cm. distant; middle pinnæ subopposite, 3 to 5 cm. apart, deltoid-ovate, 4 to 5 cm. long, 1.8 to 2.3 cm. broad, comprising about 8 to 10 pairs of distant subsessile to adnate pinnules below the pinnately lobed acuminate apex; larger pinnules oblong-acuminate to narrowly deltoid-oblong and subcaudate, 10 to 15 mm. long, 3 to 5 mm. broad, pinnatifid (often nearly to the midvein), the lobes about 4 to 6 pairs; upper pinnæ simply pinnate, 1 to 2 cm. apart; leaf tissue herbaceous, bright yellowish green and glabrous above, below densely white-ceraceous, partially concealing the costæ of the pinnules; margins yellowish, a very narrow border slightly metamorphosed and partly covering the sporangia before maturity, early thrust back; sporangia dark brown, relatively thick.

Type in the U. S. National Herbarium, no. 451280, collected on a rocky hillside near Chapala, State of Jalisco, Mexico, October 5, 1903, by J. N. Rose and J. H. Painter (no. 7665).

The only other specimens seen are very immature plants of no. 701 of Dr. Edward Palmer's 1886 collection, from the same place. These are mentioned by Davenport<sup>1</sup> as identical with Pringle's "2830," which is there described as *Notholaena lemmoni* var. *straminea* Davenport, var. nov. Mr. Pringle's type specimens ("2830"), which are said to have come from rocky hills near Guadalajara, Jalisco, December, 1888, have not been seen by the writer. They are not at the Gray Herbarium, nor at the Davenport Herbarium in Boston; moreover the number 2830 was given by Mr. Pringle (perhaps subsequently) to a flowering plant (*Asclepias mexicana*) which was actually distributed in his regular series. Judging from the brief description, *Palmer 701* is the same as *Pringle "2830,"* the type of var. *straminea*; but this is by no means certain. Possibly no. "2830" may be contained in the Pringle Herbarium. This is now the property of the University of Vermont and available for study only to investigators who will consult it in Burlington, Vt. Under the circumstances it seems advisable not to make up the varietal name for this species.

*Notholaena rosei* is so dissimilar in every respect from *N. lemmoni* that one wonders upon what common ground the comparison of relationship could have been instituted

<sup>1</sup> Garden and Forest 4: 519. 1891.

by Mr. Davenport. In general leaf shape only it resembles somewhat *N. rigida*, but the lamina is subtripinnate, instead of bipinnate. In most other characters, and particularly in its puberulous, dull stramineous (not lustrous dark castaneous) stipes and rachis, it is widely different. The rhizome and rhizome scales of the two species are wholly unlike. *N. rosei* appears to have no very near relatives.

### MISCELLANEOUS NOTES AND CHANGES OF NAME.

**Adiantopsis rupicola** Maxon, Contr. Nat. Herb. 10: 485. 1908.

Two recent collections of this very distinct Cuban species may be reported, as follows: Baños San Vicente, province of Pinar del Rio, September 12-16, 1910, *Britton, Britton & Gager* 7497; trail from Buenaventura to San Juan de Guacamalla, on rocky hillside, December 16, 1910, *P. Wilson* 9349.

**Cheilanthes aurea** Baker in Hook. & Baker, Syn. Fil. ed. 2. 476. 1874.

TYPE LOCALITY: Matagua Valley, Guatemala, *Salvin & Godman*.

DISTRIBUTION: Apparently known only from Guatemala.

ILLUSTRATION: Hook. Icon. Pl. pl. 1637.

The original specimens have not been seen by the writer, but the following plant accords perfectly with the diagnosis and later plate:

Along the Rio Carracal, near Quetzaltepeque, Guatemala, altitude 1,000 meters (rare), 10, 7, 1882, *Lehmann* 1689. This number seems to have been omitted by Hieronymus from his report on this collection.

The specimen at hand, received from Captain Smith, was determined by Christ as *Cheilanthes microphylla* Sw.

**Cheiroglossa palmata** (L.) Presl.

In addition to the illustrations for this species cited in the North American Flora<sup>1</sup> may be mentioned plate 4 of Hooker's Icones Plantarum (1837), which shows a small plant said to have come from the island of Bourbon, off the East African coast. In America the plant ranges from southern Florida throughout the West Indies to Mexico and Brazil. Its unusual distribution, which is common to a few other species of pteridophytes, is discussed by Doctor Christ in his recent work, Die Geographie der Farne, 1910.

**Dryopteris germaniana** (Fée) C. Chr.

Christensen, in his second paper on the ferns of the group of *Dryopteris opposita*,<sup>2</sup> has extended the range of *D. germaniana* to Cuba, the species having been known previously only from Guadeloupe. Agreeing exactly with this Cuban specimen (*Maxon* 4059) is a plant received recently from Porto Rico, collected at Barranquitas, July, 1911, by Brother Hioram (no. 270).

**Goniophlebium eatoni** (Baker) Maxon.

PLATE 33.

*Polypodium ghiesbreghtii* D. C. Eaton, Proc. Amer. Acad. 8: 618. 1873, not Linden, 1867.

*Polypodium eatoni* Baker, in Hook. & Baker, Syn. Fil. ed. 2. 511. 1874.

*Goniophlebium pringlei* Maxon, Proc. U. S. Nat. Mus. 27: 953. pl. 48. 1904.

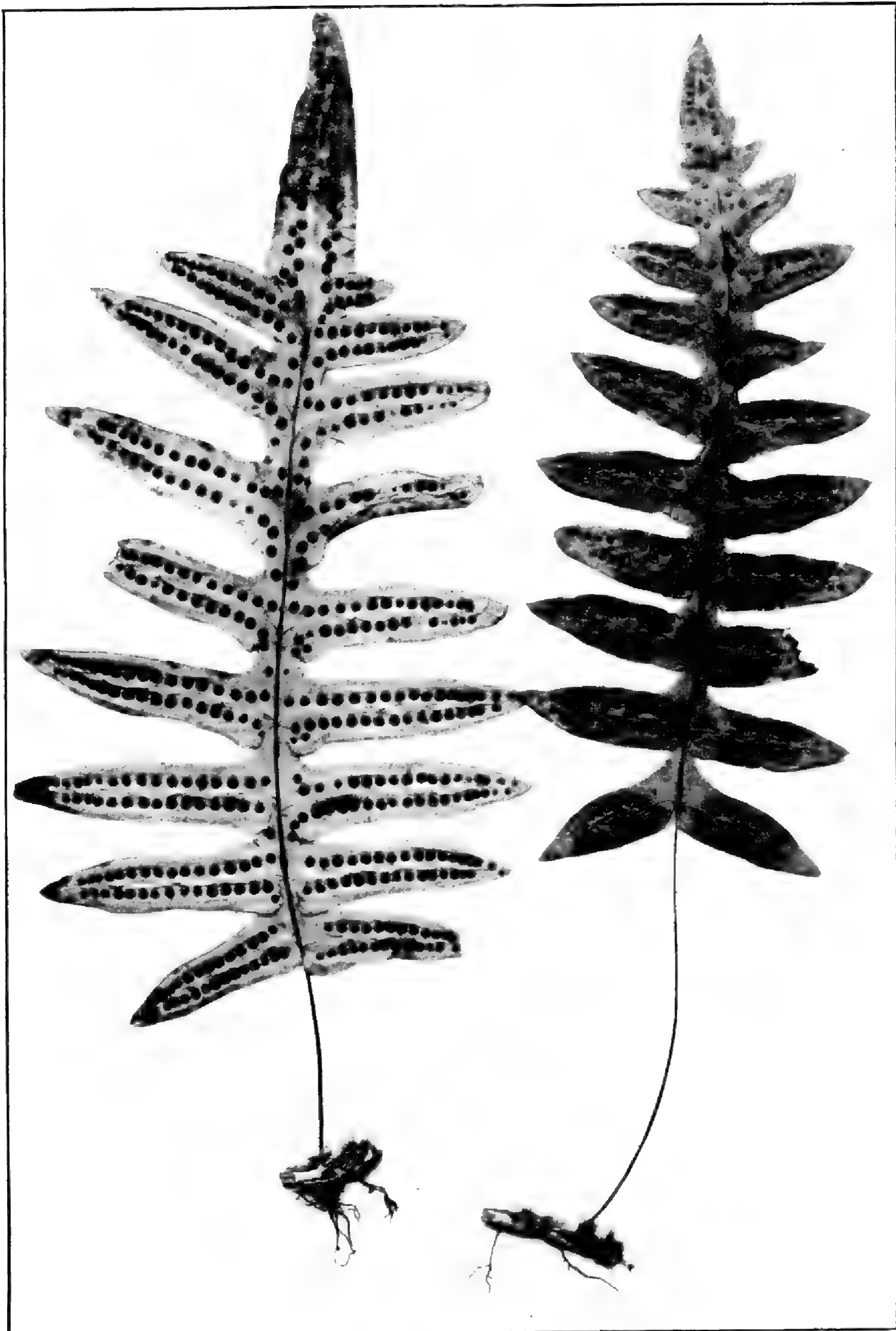
An examination of the type specimens of *P. ghiesbreghtii* D. C. Eaton in the Eaton Herbarium, collected in Chiapas by Ghiesbreght (no. 273), shows them to be identical with *G. pringlei*, described several years ago upon specimens from the vicinity of Jalapa, Vera Cruz, *Pringle* 11855.

In publishing *G. pringlei* the writer commented upon the peculiar character of one or more pairs of the basal pinnæ, as follows:

"Two additional sheets in the United States National Herbarium differ in having the second pair of pinnæ like the first—that is, free and cordate-clasping at the base

<sup>1</sup> 16: 13. 1909.

<sup>2</sup> Smiths. Misc. Coll. 52: 365-396. 1909.



GONIOPHLEBIUM EATONI (BAKER) MAXON.



GONIOPHLEBIUM RHACHIPTERYGIUM (LIEBM.) MOORE.

below the midvein and fully adnate above, the adnate upper portion of the first pair overlapping the clasping base of the second, there being only a very slight connecting foliar wing along the rachis. In one of these (no. 460766), moreover, this condition occurs in the case of the third pair of pinnæ also, and the foliar wing becomes well developed only between the third and fourth pairs of pinnæ and between succeeding pinnæ. In all four sheets examined the superabundance of leafy tissue, which must have given a remarkable fluted appearance to the living fronds, is very noticeable.”

One of the Ghiesbreght plants shows this peculiar condition so admirably that a photographic illustration is given herewith (pl. 33).

The species has been reported<sup>1</sup> by Doctor Christ also from Chiapas, the specimen collected by G. Munch.

**Goniophlebium rhachipterygium** (Liebm.) Moore, Index Fil. 396. 1862. PLATE 34.

*Polypodium rhachipterygium* Liebm. Vid. Selsk. Skr. V. 1: 191. 1849.

*Polypodium stenoloma* D. C. Eaton, Proc. Amer. Acad. 8: 618. 1873.

*Polypodium donnell-smithii* Christ, Bull. Herb. Boiss. II. 6: 291. 1906.

Doctor Christ has recently<sup>2</sup> pointed out the identity of *P. donnell-smithii*, described from Guatemalan specimens collected by von Türckheim (*Donnell Smith* 8823), with the earlier *P. stenoloma* D. C. Eaton, founded upon *Ghiesbreght* 386, from Chiapas, Mexico. A still earlier publication of the species is that by Liebmann, mentioned above, whose specimens came from Teotalcingo, Chinantla, Oaxaca, Mexico, June, 1842. A very complete sketch of these, together with a fragment, both sent by Mr. Christensen at the writer's request, leaves no doubt as to their identity with the plants described subsequently by Professor Eaton and by Doctor Christ.

The illustration presented herewith (pl. 34) is of the type specimens of *P. stenoloma* (herb. D. C. Eaton), showing the plants at about one-half natural size.

**Lycopodium dichaeoides** Maxon, Proc. Biol. Soc. Washington 18: 231. 1905.

Besides the two collections from Alta Verapaz originally mentioned, this species is known to the writer only upon Captain Smith's no. 958, collected at Pansamalá, Alta Verapaz, Guatemala, at about 1,200 meters elevation, by von Türckheim, in July, 1886. The species, though obviously related to *L. aqualoupianum*, is well marked by its short strobiles and its short, rigid, achene-like sporophylls.

**Notholaena rigida** Davenp.

The original specimens are from limestone ledges, Sierra de la Silla, Nuevo Leon, Mexico, May 31, 1889, *Pringle* 2599. The only other plants of this species seen by the writer are those collected near Victoria, Tamaulipas, Mexico, altitude 320 meters, February to April, 1907, by Dr. Edw. Palmer (no. 142). The species is strongly characterized by its lustrous, dark castaneous stipes and rachis and by its branched, ligneous rhizome, the latter closely invested with very rigid, opaque, blackish scales.

**Pellaea notabilis** Maxon, Contr. Nat. Herb. 10: 500. 1908.

A second record for this species rests upon two dwarfed fronds in the herbarium of the New York Botanical Garden. These were collected near San José, Tamaulipas, Mexico, altitude 600 to 1,100 meters, by Prof. James F. Kemp, of Columbia University, in 1902. They measure only 8 and 12 cm. high, respectively, and are thus much smaller than the original specimens, which are also from Tamaulipas.

**Polypodium duale** Maxon, nom. nov.

*Acrostichum serrulatum* Swartz, Prodr. Veg. Ind. Occ. 128. 1788.

*Polypodium serrulatum* Mett. Fil. Hort. Bot. Lips. 30. 1856, not Swartz, 1801.

The above change of name for the diminutive tropical fern described from Jamaica by Swartz in 1788 as *Acrostichum serrulatum* is made necessary by the use of the same

<sup>1</sup> Bull. Herb. Boiss. II. 7: 413. 1907.

<sup>2</sup> Bull. Soc. Bot. Genève 1: 220. 1909.

species name under *Polypodium* by Swartz (in 1801) for a plant now known as *Dryopteris serrulata*. The synonymy will be indicated in full in some notes on *Polypodium duale* and related species, to be published in the next paper of this series. Two other species names<sup>1</sup> subsequently applied are not valid under *Polypodium*.

***Polypodium heterotrichum* Baker.**

A rare species hitherto recorded, apparently, only from Jamaica, where it occurs on trees in the higher forested slopes of the Blue Mountains, at 2,100 meters. Specimens have been received recently from Barranca Trinidad, State of Hidalgo, Mexico, May 10, 1904 (*Pringle* 13494).

***Polypodium jenmani* Underw. nom. nov.**

"*Polypodium lasiolepis*" Jenman, Bull. Bot. Dept. Jamaica II. 4: 118. 1897, not Mett. 1869.

The Jamaican plant described by Jenman as "*Polypodium lasiolepis* Mett." is not very closely related to *P. lasiolepis* of the Lesser Antilles, which is itself (together with *P. grenadense* Jenman) apparently a synonym of *P. tenuiculum* Fée. Jenman's description is very complete. He compares the species with *P. pendulum* Swartz, pointing out, in part, that it differs from that species in its stronger rhizome, close and more decurrently adnate, ciliate segments, slightly hairy surface, terminal superficial sori, absence of glands, and different apex and base. He adds: "It is also erect in growth, and the veins and midrib of the pinnæ are not raised on the upper side."

As a matter of fact, the relationship to *P. pendulum* is not very close, but that is a species very much misunderstood.

The following specimens of *P. jenmani* are in the National Herbarium:

JAMAICA: At base of tree, slopes above Tweedside, altitude about 900 meters, *Maxon* 961. On trees, near Mabess River, altitude 900 meters, *Maxon* 1535 (= *Underwood* 2606).

***Polypodium leptostomum* Fée, Mém. Foug. 7: 58. pl. 2. f. 2. 1857.**

?*Polypodium productum* Maxon, Contr. Nat. Herb. 13: 11. 1909, not Christ, 1907.

In assigning the name *P. productum* to a supposed new Guatemalan species in 1909 the writer overlooked the earlier use of this name for a Philippine species by Christ.<sup>2</sup> A new name for the Guatemalan plant does not appear necessary at present, however, inasmuch as it resembles very closely *P. leptostomum* Fée, founded upon plants from Orizaba (*W. Schaffner* 210) and may prove identical with it. Specimens of the type collection have not been seen by the writer.

<sup>1</sup> *Micropteris orientalis* Desv. Mém. Soc. Linn. Paris 6: 217. 1827, not *P. orientale* Gmel. 1791. *Xiphopteris extensa* Fée, Mém. Foug. 11: 14. 1866, not *P. extensum* Forst. 1786.

<sup>2</sup> Philippine Journ. Sci. C. Bot. 2: 178. 1907.

# THE NORTH AMERICAN SPECIES OF NYMPHAEA.

By GERRIT S. MILLER, Jr., and PAUL C. STANDLEY.

## INTRODUCTION.

### NOTE BY J. N. ROSE.

There are some groups of plants whose taxonomy can be fairly well understood almost solely from ordinary herbarium material. There are others in which it is impossible to understand the true relationships from such material alone, and some even in which herbarium specimens are almost useless. Among the last are the Cactaceae, many of the tropical Euphorbias, the Crassulaceae, and in general all the succulent plants. To be properly understood such plants should be seen growing, or should be studied from material preserved in alcohol or formalin, since in dry specimens most of the important characters are distorted beyond all possibility of recognition. Among plants of this kind the Nymphaeaceae must be included. Most of our knowledge of the genus *Nymphaea*, judging from the literature of the North American species at least, has been derived from the study of dried herbarium material. As a result, different authors have arrived at very different conclusions. Important peculiarities of habit and structure not discernible in such specimens have been overlooked, and our knowledge of the genus has not kept pace with the advances made in some other groups.

About ten years ago Mr. Gerrit S. Miller, jr., became interested in the genus *Nymphaea* from field observations of the plants occurring in central New York and in the vicinity of Washington, currently regarded as belonging to one species. Study of fresh and formalin-preserved material showed that there were important and easily recognizable differences between the northern form and that found farther south, differences in habit, color, and structure, scarcely to be detected in dried specimens. He published a brief paper in 1902<sup>1</sup> stating these differences and recognizing the northern plant as a distinct species. About the same time he began to bring together fresh material from all parts of North America to facilitate complete knowledge of the genus as represented there. This attempt was remarkably successful. The plants wherever they occur are well known as "yellow pond lilies," hence, not only professional botanists,

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<sup>1</sup> Proc. Biol. Soc. Washington 15: 11-13.

but those with little or no botanical knowledge, were able to secure the specimens desired. Numerous persons connected with the various branches of scientific work in Washington as well as botanists and others throughout the country assisted, so that finally a very large suite of specimens was brought together. This material consists at present of about two hundred and twenty jars of specimens preserved in formalin, besides an exhaustive series of dried specimens, the whole being deposited in the National Herbarium. Canada, Alaska, and practically every State in the Union are represented, except the Territories of New Mexico and Arizona, where the genus is not known to occur. This material was forwarded to Washington, sometimes in formalin, but more often fresh and merely wrapped in oiled paper. As soon as specimens were received careful notes were made on the color of the various parts. Tracings of some of the leaves were drawn, seeds were selected from the ripe fruits and dried, and in general a careful study was made of any peculiarities exhibited by the fresh plants. All but one of the species finally recognized were thus studied in the fresh condition. By the year 1904 enough material had been brought together to permit the determination of all but two of the nineteen forms of *Nymphaea* now known to occur in America. At this time pressure of other duties, necessitating several prolonged absences from Washington, made it impossible for Mr. Miller to continue the task of completing and publishing a revision of the genus, though he had written out the key to the species essentially in the form in which it now stands. At Mr. Miller's request, Mr. J. H. Painter prepared to take up the work of elaborating the paper and procuring such additional material as was needed, but in December, 1908, this was interrupted by Painter's tragic death. During the past year it has been resumed and brought to completion by Mr. Paul C. Standley, under whose authorship jointly with Mr. Miller's the paper is now printed.

#### AUTHORS' INTRODUCTION.

##### MATERIAL STUDIED.

As stated by Doctor Rose, dry herbarium material is of little value for the study of this genus. When the species are once known, however, most of them can be recognized in the dried state. Consequently, we have examined all the herbarium material available, with the result that we are able to map the areas of distribution of the better known species with some detail. In addition to showing the distribution of the various species upon outline maps, we have listed, with name of collector and date and locality of collection, all the specimens examined. These include all the material in the herbaria



of the University of Pennsylvania, the Philadelphia Academy of Natural Science, the New York Botanical Garden and Columbia College, the Gray Herbarium, and the Missouri Botanical Garden (this containing the types of the Engelmann Herbarium), together with certain material from the University of California, that in the private herbarium of Dr. E. L. Greene, and, finally, all that in the National Herbarium. To those who have charge of these collections we are deeply indebted, either for the loan of the specimens or for facilities for their study. In addition, we are under obligations to the dozens of people all over the country who have responded to requests for living material. Their names, which are so numerous as to prohibit their full enumeration here, will be found in the lists of specimens examined. Without their assistance the work could not have been completed.

#### HISTORY OF NAMES.

##### NAMES APPLIED TO GENERA.

**Blephara** J. E. Smith, Mem. & Corr. 1: 577. 1832.

Before publishing the name *Nuphar*, Smith sent a diagnosis of the genus under the name *Blephara* to the Bishop of Carlisle in a letter dated November 17, 1808. This letter is printed in the "Memoir and Correspondence," thus giving the name *Blephara* a definite status. The type is given as *Nymphaea lutea*.

**Nuphar** J. E. Smith in Sibth. Fl. Graec. Prodr. 1: 361. 1808 or 1809 (title page dated 1806, but part containing this name not printed before December, 1808).

Type, by monotypy, *Nymphaea lutea* L. A synonym of *Nymphaea* L., as restricted by Salisbury in 1806, and of *Nymphozanthus* L. C. Richard, May, 1808.

**Nymphaea** L. Sp. Pl. 510. 1753.

Type, *N. lutea* L. The genus originally contained the species *lutea* (misprinted *lusea*), *alba*, *lotos*, and *nelumbo*, representing the modern genera *Nymphaea* (*lutea*), *Castalia* Salisb., 1806 (*alba* and *lotos*), and *Nelumbo* Adans., 1763 (*nelumbo*). No type was designated, nor was any clue furnished to the author's intention.

Under the American code of Botanical Nomenclature the types of the genera of Linnæus' *Species Plantarum* are to be determined through the citations given in his *Genera Plantarum* (1754). On page 227 of this work are cited under *Nymphaea* Tournefort's plates 137 and 138. These represent the white-flowered *Castalia alba* and the yellow-flowered *Nymphaea lutea*. Since Linnæus gives no specific indication that either was the type of his genus, the first of the Linnæan species common to the two works is to be regarded as the type. This is *Nymphaea lutea* L.

In 1806 Salisbury,<sup>1</sup> the first reviser of the genus *Nymphaea* restricted the name to a group containing *lutea* only of the original Linnæan species, thus fixing the type, according to the practice of zoologists. Two years later J. E. Smith,<sup>2</sup> deliberately setting aside Salisbury's perfectly valid action, and overlooking the *Nymphozanthus* of Richard, May, 1808, re-restricted *Nymphaea* to the group represented by *alba* and *lotos*, and applied a new name, *Nuphar*, to *lutea* and its allies. Although not justified by any rules of nomenclature, Smith's treatment of the subject received the general sanction of botanists for nearly eighty years. In 1887 and 1888, however, Greene<sup>3</sup> and Britten<sup>4</sup> called attention to the errors and restored the correct names.

**Nymphona** Bubani, *Flora Pyrenaea* 3: 259. 1901.

A substitute for *Nuphar* proposed on account of philological prejudices, the ancients having applied the word "nuphar" to the plant's root. It is a synonym of *Nymphaea*.

**Nymphozanthus**<sup>5</sup> L. C. Richard, *Démonstr. Bot.* 68. 1808.

A name based on the yellow-flowered species of the Linnæan genus *Nymphaea*. As it was published in May, 1808, it antedates the *Nuphar* of Smith by at least seven months (see Britten, *Journ. Bot.* 26: 7. January, 1888).

**Ropalon** Raf. *New Fl. N. Amer.* 2: 17. 1836.

A synonym of *Nymphaea* based on *Nymphaea sagittata* Pers.

#### NAMES APPLIED TO SPECIES.

In addition to the names *lutea* and *pumila* originally applied to European members of the genus and erroneously used for American species, thirty names, including the ten published here for the first time, have been based on American plants. They are as follows:

**Advena.** *Nymphaea advena* Ait. *Hort. Kew.* 2: 226. 1789.

This is the first name based on an American member of the genus. It was applied to a plant brought to the Kew Gardens in 1772 by William Young. As Young collected in South Carolina and in the neighborhood of Philadelphia, Pennsylvania,<sup>6</sup> there can be no question as to the applicability of the name to the common erect species characteristic of the Upper Austral zone. It has been more commonly misapplied, however, to the floating-leaved Boreal plant.

<sup>1</sup> *Ann. Bot.* 2: 71.

<sup>2</sup> See *Memoir and Correspondence of Sir J. E. Smith.* 1: 575, 577-581. 1832.

<sup>3</sup> *Bull. Torrey Club* 14: 177-179. September, 1887; 257-258. December, 1887; *ibid.*, 15: 84-85. March, 1888.

<sup>4</sup> *Journ. Bot. Brit. & For.* 26: 6-11. January, 1888.

<sup>5</sup> Spelled *Nymphozanthus* on p. 63 and in the index, *Nymphosanthus* on p. 68 where the genus is defined. The second form may be regarded as an obvious misprint.

<sup>6</sup> See Britten, *Journ. Bot. Brit. & For.* 32: 332. November, 1894.

**Americana.** *Nuphar americana* Provancher, Fl. Canad. 1: 28. 1862.

Although intended merely as a substitute for *advena* this name is available for the Boreal species now better known as *variegata*. The diagnosis clearly refers to the northern plant, and the type locality, Lake St. Jean-Georgie, Quebec, is far beyond the range of *Nymphaea advena*.

**Arifolia.** *Nymphaea arifolia* Salisb. Ann. Bot. 2: 71. 1806.

Another substitute for *advena*.

**Bombycina.** See page 102.

**Chartacea.** See page 94.

**Erythraea.** See page 91.

**Fletcheri.** *Nymphaea fletcheri* Lawson, Proc. & Trans. Royal Soc. Canada 6: 119. 1888.

A name applied to *Nymphaea rubrodisca*. The author did not, however, regard the plant as a distinct species, but as a hybrid between *N. kalmiana* and *N. americana* ("advena").

**Fluviatilis.** *Nymphaea fluviatilis* Harper, Bull. Torrey Club 33: 234. April, 1906.

The only name based on a certain well-marked species, confined, so far as now known, to the State of Georgia. Type locality, near Groveland, Bryan County, Georgia.

**Fraterna.** See page 82.

**Hastata.** *Nymphaea hastata* Steud. Nom. Bot. ed. 2. 200. 1841.

The entry is as follows: "[*Nymphaea*] *hastata* Michx. *Nuphar sagittaeifolia*."

**Hybrida.** *Nuphar advena* var. *hybrida* Peck, Ann. Rep. N. Y. Mus. Nat. Hist. 34: 53. 1881.

This is the earliest name for the peculiar Boreal plant better known as *rubrodiscum* and *minor*. In accordance with the American Code of Botanical Nomenclature it is at present set aside in favor of its synonym *rubrodiscum*. Type locality, Forked Lake, Hamilton County, New York.

**Kalmiana.** *Nymphaea lutea*  $\beta$  *kalmiana* Michx. Fl. Bor. Amer. 1: 311. 1803.

The first name applied to the smallest of the three eastern Canadian species, but for the present displaced by the later *microphylla*. No locality further than "Canada" mentioned.

**Longifolia.** *Nymphaea longifolia* Michx. Fl. Bor. Amer. 1: 312. 1803.

A synonym of *N. sagittifolia* Walt. 1788, as suspected by Michaux himself. "Hab. in omnibus Carolinae sept. et merid."

**Ludoviciana.** See page 92.

**Macrophylla.** *Nymphaea macrophylla* Small, Bull. Torrey Club 25: 465. September, 1898.

The local race of *advena* occurring in northern and central Florida. Type locality, Eustis, Lake County.

**Microphylla.** *Nymphaea microphylla* Pers. Syn. Pl. 2: 63. 1807.

Although published later than *kalmiana* Michx. 1803, this name, under the American Code, stands for the plant to which it was applied.

**Minor.** *Nuphar advena* var.? *minor* Morong, Bot. Gaz. 11: 167. July, 1886.

A name originally applied to depauperate specimens of *Nymphaea americana* from Smith's Pond near Litchfield, Herkimer County, New York, but afterward transferred by Watson and Coulter to *N. rubrodisca* (Gray's Manual, ed. 6. 56. 1889).

**Orbiculata.** *Nymphaea orbiculata* Small, Bull. Torrey Club 33: 128. April 30, 1896.

The only name for a strikingly characterized, large-leaved species known from southern Georgia only. Type locality, a small lake near Thomasville, Thomas County.

**Ovata.** See page 97.

**Ozarkana.** See page 91.

**Pictum.** *Nuphar polysepalum pictum* Engelm. Trans. Acad. St. Louis 2: 285. 1868.

A synonym of *polysepalum*.

**Polysepalum.** *Nuphar polysepalum* Engelm. Trans. Acad. St. Louis 2: 282. 1868.

The first name based on the large-fruited western member of the genus. After mentioning specimens from various localities Engelmann says: "\* \* \* And finally, Dr. Parry gathered ample material and full notes, which have been largely used in the following description, in Osborn's Lake in the same region [near Longs Peak, Colorado] at an altitude of 8,800 feet, where it grows with *Menyanthes trifolium* \* \* \*." As the description is almost wholly based on the Parry material, Osborn's Lake must be accepted as the type locality of *polysepalum*. On page 285, however, the plant from the same lake receives a second name: "The flowers of Dr. Parry's plant are more highly colored than that of Dr. Hayden's [from a small lake between Henry's Fork and Snake Fork of the Columbia River] and may preserve the name of var. *pictum*, which the discoverer has applied to the species." The name *pictum* is thus an exact synonym of *polysepalum*.

**Puberula.** See page 99.

**Rubrodiscum.** *Nuphar rubrodiscum* Morong, Bot. Gaz. 11: 167. 1886.

The first specific name given to the plant originally described as a subspecies under the name *hybrida*. The author apparently regarded the plant, which he found on the Vermont shore of Lake Champlain, as a species in process of formation from a hybrid. "Intermediate between *N. advena* [= *americana*] and the following [*microphylla*], and produced from a hybrid between them. Still a hybrid in many localities."

**Sagittaeifolia.** *Nuphar sagittaeifolia* Pursh, Fl. Amer. Sept. 2: 370. 1814.

Substitute for *sagittifolia* Walt. 1788.

**Sagittata.** *Nymphaea sagittata* Pers. Syn. Pl. 2: 63. 1807.

This is merely another name for *Nymphaea sagittifolia*.

**Sagittifolia.** *Nymphaea sagittifolia* Walt. Fl. Carol. 155. 1788.

The first name based on the plant to which it is currently applied. No type locality is mentioned, but the preface to the Flora is subscribed: "Carolinae Meridionalis, ad Ripis Fluvii Santee."

**Tomentosum.** *Nuphar advena*  $\beta$  *tomentosum* Torr. & Gr. Fl. N. Amer. 1: 58. 1838.

This name was based on a specimen of *Nymphaea advena* collected by Thomas Nuttall in the vicinity of Philadelphia, Pennsylvania, and labeled by him *Nuphar tomentosum*. It is still extant in the herbarium of the Academy of Natural Sciences of Philadelphia. The supposed pubescence of the petioles and lower surface of the leaves is merely a dense growth of algæ.

**Ulvacea.** See page 97.

**Variegata.** *Nuphar advena* var. *variegatum* Engelm. in A. Gray, Man. ed. 5. 57. 1867.

Under this name, based apparently on specimens from Michigan, *Nymphaea americana* was first, though imperfectly, distinguished from *N. advena*. Later it was used in binomial form for the same plant by G. S. Miller.<sup>1</sup>

## SYSTEMATIC TREATMENT.

### NYMPHAEA L.

1753. **Nymphaea** L. Sp. Pl. 510. Type, *Nymphaea lutea* L. (Salisbury, Ann. Bot. 2: 71. 1806.)
1808. **Nymphozanthus** L. C. Richard, Démonstr. Bot. 63–68. Type, *Nymphaea lutea* L. (Misprinted *Nymphosanthus*; the correct spelling on p. 63 and in index.) May, 1808.
- 1808 or 1809. **Nuphar** J. E. Smith in Sibth. Fl. Graec. Prodr. 1: 361. December, 1808, or early in 1809. Type, *Nymphaea lutea* L.
1832. **Blephara** J. E. Smith, Mem. & Corr. 1: 576. (Substitute for *Nuphar* suggested but not adopted.)
1836. **Ropalon** Raf. New Fl. N. Amer. 2: 17. Type, *Nymphaea sagittata* Pers.
1887. **Nymphaea** Greene, Bull. Torrey Club 14: 177–179. September, 1887; 257–258. December, 1887.
1901. **Nymphona** Bubani, Fl. Pyr. 3: 259. (Substitute for *Nuphar*.) Type species, *Nymphaea lutea* L.

**DISTRIBUTION:** Fresh-water ponds and sluggish streams (rarely in damp ground away from water) of the Holarctic Region from northern Europe and Asia to the Mediterranean and Japan and from Alaska and northern Canada to Cuba and north-eastern Mexico.

**DESCRIPTION:** Perennial aquatics with stout, creeping rootstocks; leaf blades entire, with a deep sinus at the base, narrowly lanceolate to orbicular, floating or emersed, on slender or stout, cylindric or flattened petioles; submersed leaves often present, these thin and delicate; sepals 5 to 12, orbicular to oblong or spatulate, concave, greenish, tinged with yellow or red; petals numerous, linear to oblong, thick, stamen-like or scale-like, inserted with the very numerous stamens on the receptacle under the ovary; stigma disk-like, with few to many rays; fruit ovoid to columnar, usually ripening above the water; seeds mostly ovoid, yellow or brown, smooth and shining, numerous.

The Old World forms of *Nymphaea* are so imperfectly known that it is impossible to make any satisfactory estimate of the number of species in the genus. The Old World species are recognized by Engler and Prantl as about five. Half a dozen

<sup>1</sup> Proc. Biol. Soc. Washington 15: 13. February 18, 1902.

forms have until recently been supposed to represent the specific differentiation of the American members of the group. Their number is now increased to nineteen.

## KEY TO THE AMERICAN SPECIES.

- Width of leaf blade less than half the length; sinus less than one-fourth the length of the blade.
- Sinus usually closed; length of blade 2.5 times the breadth or less; fruit about 2 cm. long; seeds 3 mm. long; stigma rays elliptical; leaves acutish..... 11. *N. ulvacea*.
- Sinus usually open; length of blade over 3 times the breadth; fruit about 3 cm. long; seeds 4 mm. long; stigma rays linear; leaves obtuse..... 10. *N. sagittifolia*.
- Width of leaf more than one-half its length; sinus one-half to one-fourth the length of the blade.
- Calyx of more than 6, usually 9, parts..... 17. *N. polysepala*.
- Calyx of usually 6 parts.
- Petioles conspicuously flattened; leaves floating.
- Anthers shorter than the filaments.
- Stigma rays less than 10; flowers less than 20 mm. in diameter; sepals narrow..... 1. *N. microphylla*.
- Stigma rays more than 10; flowers about 30 mm. in diameter; sepals broad..... 2. *N. rubrodisca*.
- Anthers at least equaling the filaments.
- Capsules about 40 mm. high and 30 mm. in diameter; flowers about 45 mm. in diameter; leaves broadly rounded..... 3. *N. americana*.
- Capsules about 25 mm. high and 18 mm. in diameter; flowers 22 to 26 mm. in diameter; leaves acutish..... 4. *N. fraterna*.
- Petioles subterete; leaves erect or floating.
- Lower surface of leaves glabrous.
- Leaves of an orbicular type..... 8. *N. fluviatilis*.
- Leaves conspicuously longer than broad.
- Submersed leaves present; leaves and sepals very thin..... 9. *N. chartacea*.
- Submersed leaves wanting; leaves and sepals thick.
- Sinus closed; stigma rays usually more or less confluent at the base, broad; disk usually oval..... 7. *N. ludoviciana*.
- Sinus usually open; stigma rays not confluent at the base, narrower; disk orbicular.

- Fruit not tinged with red when mature.
  - Leaves 15 to 35 cm. long; rounded at the apex..... 5. *N. advena*.
  - Leaves 25 to 50 cm. long, acutish... 5a. *N. advena macrophylla*.
- Fruit conspicuously tinged with red at maturity.
  - Leaves large, 25 to 40 cm. long, acutish; seeds very numerous..... 5b. *N. advena erythraea*.
  - Leaves smaller, 12 to 20 cm. long, broadly rounded at the apex; seeds few (15 to 30)..... 6. *N. ozarkana*.
- Lower surface of the leaves more or less pubescent.
  - Leaf blades of an oval type; pubescence dense..... 12. *N. ovata*.
  - Leaf blades orbicular in outline, or nearly so.
  - Lower surface of leaves with little pubescence; petioles nearly glabrous; leaves 16 to 21 cm. wide..... 13. *N. puberula*.
  - Lower surface of leaves and petioles covered with a dense, silvery, silky pubescence.
  - Fruit small, 18 to 24 mm. in diameter; stigma rays about 12 (9 to 14); leaves 16 to 24 cm. wide..... 14. *N. microcarpa*.
  - Fruit larger, 45 to 50 mm. in diameter; stigma rays much more numerous; leaves 30 to 50 cm. wide.
  - Sinus closed; stamens in 9 or 10 rows; diameter of flowers about 50 mm.; seeds about 4 mm. long and 3 mm. thick..... 15. *N. orbiculata*.
  - Sinus open; stamens in 6 or 7 rows; diameter of flowers about 70 mm.; seeds about 6 mm. long and 4.6 mm. thick..... 16. *N. bombycina*.

1. *Nymphaea microphylla* Pers.<sup>1</sup>

*Nymphaea lutea* L. Sp. Pl. 810. 1753, in part.

*Nymphaea lutea*  $\beta$  *kalmiana* Michx. Fl. Bor. Amer. 1: 311. 1803.

*Nymphaea microphylla* Pers. Syn. Pl. 63. 1807; Robins. & Fern. in Gray, Man. ed. 7. 391. 1908.

*Nymphaea kalmiana* Sims, Curtis's Bot. Mag. pl. 1243. 1809; Britton, Man. ed. 2. 407. 1905.

*Nuphar kalmiana* Ait. Hort. Kew. ed. 2. 3: 295. 1811.

*Nuphar lutea kalmiana* Torr. Fl. N. Y. 1: 40. 1843.

TYPE LOCALITY: Eastern Canada.

DISTRIBUTION.—Eastern Canada, south through New York to eastern Pennsylvania and northern New Jersey.

## DESCRIPTION.

Floating leaves oval to broadly oblong or suborbicular, thin, broadly rounded at the apex, 35 to 100 mm. long and 35 to 75 mm. wide, the sinus 15 to 35 mm. deep, two-

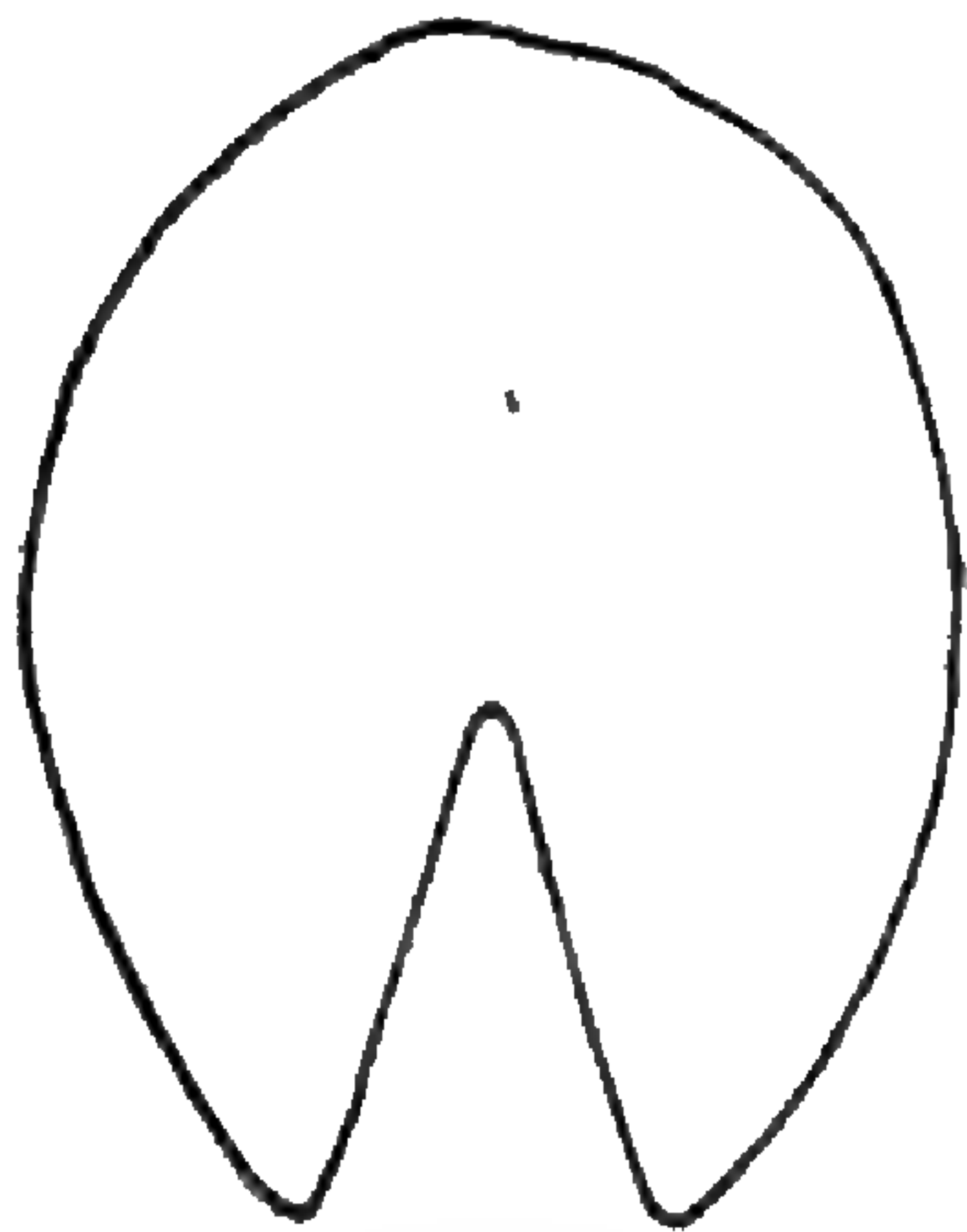


FIG. 2.—Leaf outline of *Nymphaea microphylla*. Scale  $\frac{1}{4}$ .

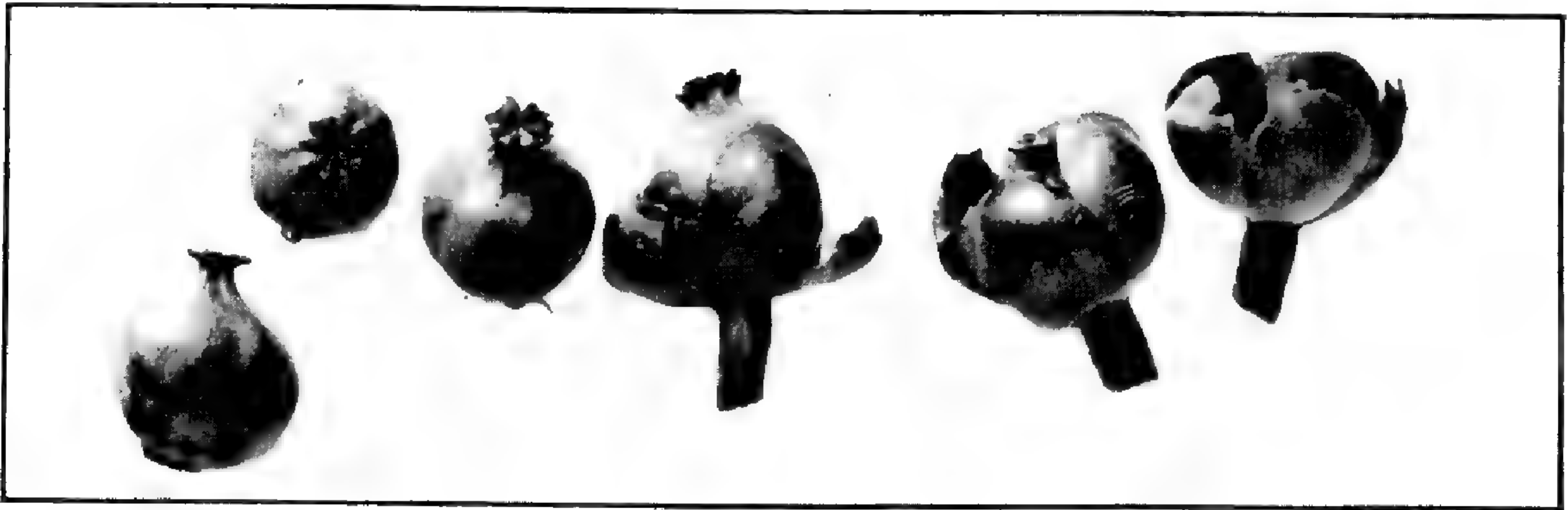
thirds as long as the midrib or more; sinus narrowly triangular, or closed, the lobes just meeting, these triangular, acutish; veins rather inconspicuous, glabrous above, generally somewhat pubescent beneath, especially when young; submersed leaves orbicular, very thin, somewhat crispate, of about the same size as the floating ones, their sinuses usually more open; peduncles and petioles terete, very slender; flowers depressed-obovoid, about 18 mm. in diameter and 12 mm. high when normally open, the perianth when spread measuring about 30 mm.; sepals 5, obovate or elliptical, about 10 mm. long and 6 to 8 mm. wide, scarcely overlapping when expanded, obtuse at the apex, not contracted into a claw at the base; petals 7 to 10, broadly spatulate, 6 mm. long and 3 mm. wide; stamens in 3 rows, about 15 to the row; filaments linear, cuneate, 5 mm. long, 1 mm. wide; anthers one-half as long as the filament; sepals gamboge yellow throughout, except those parts exposed in the bud, these apple green; petals orange, narrowly edged with gamboge yellow; anthers maize yellow, filaments gamboge; ovary pale apple green slightly variegated with yellow and much tinged with burnt carmine, especially on the ridges and at the base, the disk burnt carmine; fruit very small, ovoid, strongly constricted above into a neck 3 mm. long, the whole about 14 mm. high and 11 mm. in diameter, smooth except near the top, there faintly ribbed; stigmatic disk orbicular or oval, crenate, plane, 4 or 5 mm. in diameter; stigma rays 6 to 10, extending almost to the edge of the disk, somewhat confluent in the center, with no trace of a median groove; color of fruit oil green, the disk bright red, often edged with yellow, the body of the fruit usually with more or less of red; seeds oblong, 3 mm. long and 2 mm. in diameter, yellowish brown, shining. (PLATES 35, A; 36, A. FIGURES 2, 3, 4, c.)



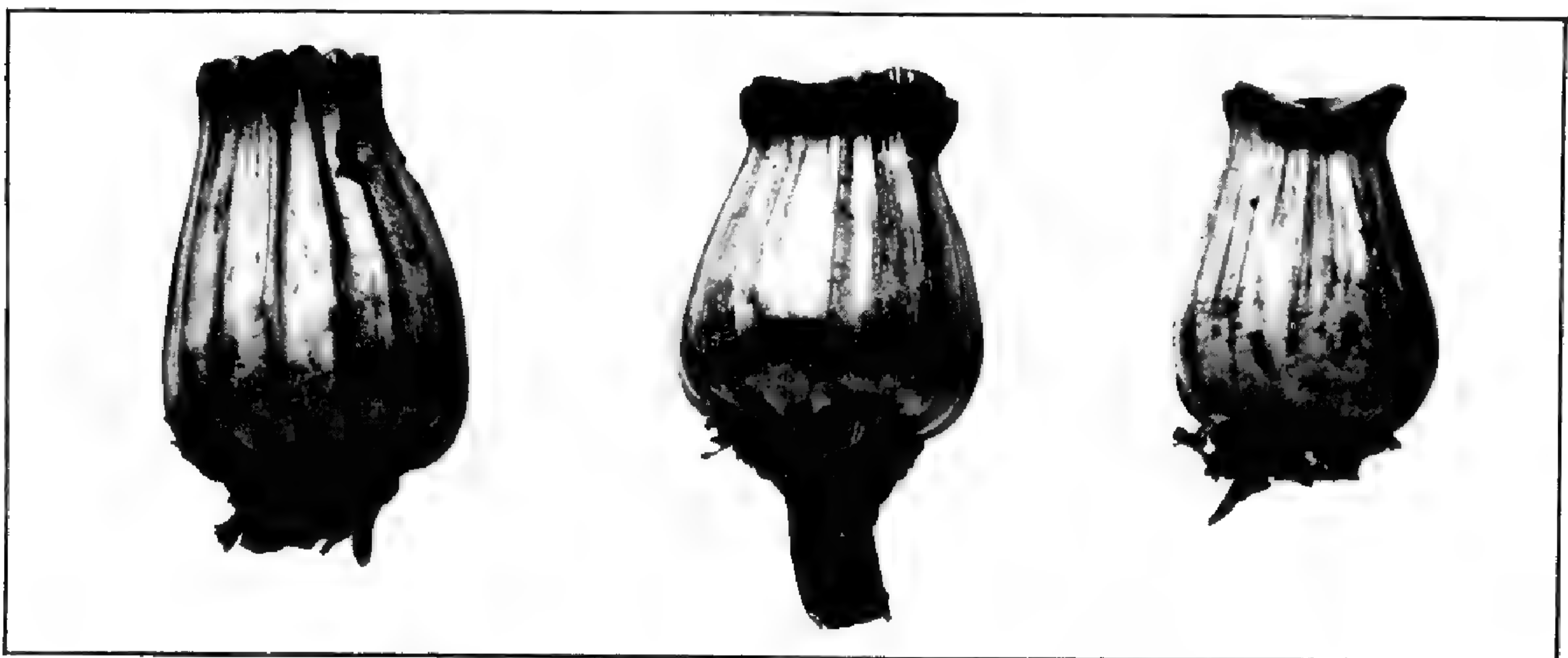
FIG. 3.—Stigmatic pattern of *Nymphaea microphylla*. Natural size.

<sup>1</sup> The use of the synonym *microphylla* in place of the original name *kalmiana* is in conformity with article 49 of the Vienna Code, which provides that "when a tribe becomes a family \* \* \* a subdivision of a species becomes a species, or the reverse \* \* \* the earliest name (or combination of names) received by the group in its new position must be regarded as valid, if it is in conformity with the rules, unless there exist any of the obstacles indicated in the articles of section 7." Although "this

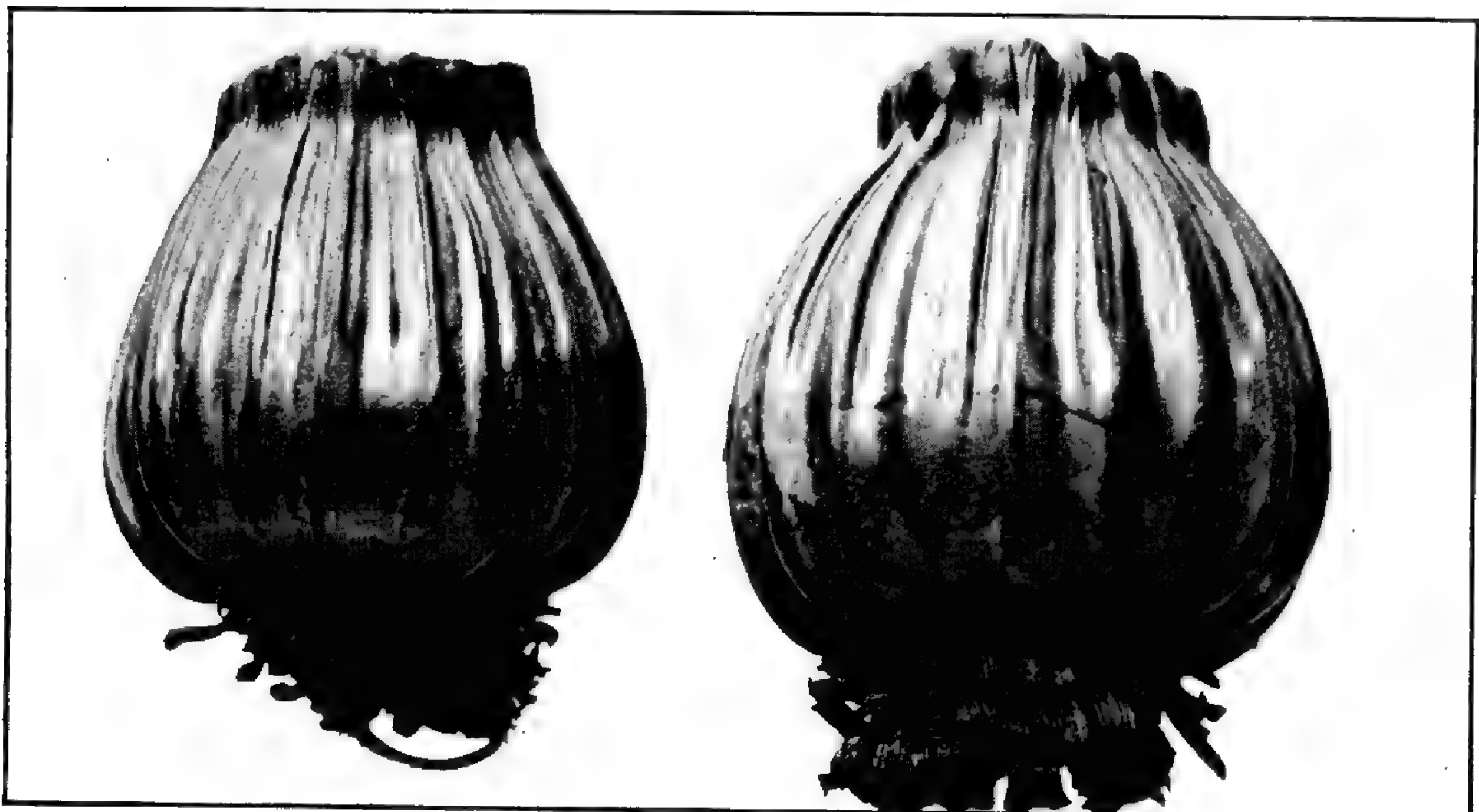




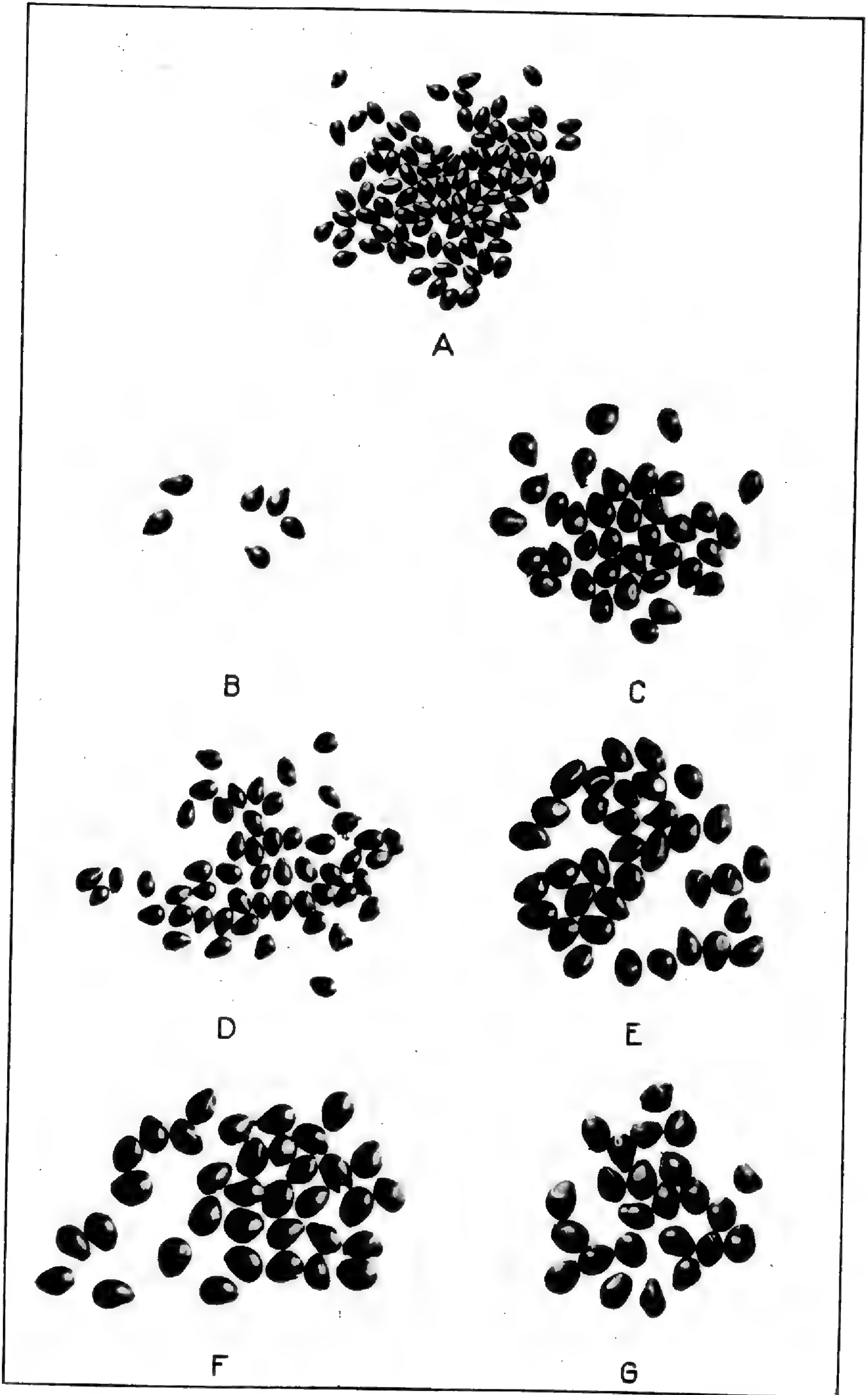
A. FRUIT OF NYMPHAEA MICROPHYLLA PERS.



B. FRUIT OF NYMPHAEA FRATERNA MILLER & STANDLEY.



C. FRUIT OF NYMPHAEA ADVENA AIT.



SEEDS OF SEVERAL SPECIES OF NYMPHAEA.

EXPLANATION OF PLATE 35.—A. Fruit of *Nymphaea microphylla*. B. Fruit of *Nymphaea fraterna*, type collection. C. Fruit of *Nymphaea advena*. All natural size.

EXPLANATION OF PLATE 36.—Seeds of (A) *Nymphaea microphylla*, (B) *N. rubrodisca*, (C) *N. americana*, (D) *N. fraterna*, (E) *N. advena*. (F) *N. advena macrophylla*, (G) *N. ozarkana*. All natural size.

*Specimens examined:*

In formalin—

MAINE: Birch Brook near north end of Cross Lake, Eagle Lake Chain, Aroostook County, 1903, *W. C. Kendall*.

NEW HAMPSHIRE: Cambridge River near Lake Umbagog, 1905, *Kendall*.

NEW YORK: Piseco, 1901, *W. L. Ralph*; Gray, 1901, *J. Perkins*; Lake Champlain, 1901, *Eggleston*.

Dried<sup>1</sup>—

CANADA: Fredericton, New Brunswick, 1892, *Fowler* (Gray); Amqui Station, Metapedia River, 1882, *Macoun* 97; Otter Slide Lake, Ontario, 1900, *Macoun* 21699; St. Johns County, New Brunswick, 1869, *Fowler*; near Quebec, *Mrs. Percival* (C.); St. Johns River, New Brunswick, 1885, *G. U. Hay* (C.); Saguenay River, 1890, *T. F. Allen* (C.); Moose River Basin, Northern Ontario, 1903, *J. M. Bell*; Punk Island, Lake Winnipeg, 1884, *Macoun*.

MAINE: Moosehead Lake, 1875, *Charles E. Smith*; Cabossucontu Lake, Monmouth, 1899, *W. C. Kendall*; shallow pond, St. Francis, Aroostook County, 1893, *Fernald* 10; Sunkhaze Stream, Milford, 1892, *Fernald* (N. E.); West Baldwin, Cumberland County, 1894, *Furbish* (N. E.); Piscataquis River, Dover, 1894, *Fernald* (N. E.); Orono, 1878, *Scribner* (Greene); Penobscot River, Somerset County, 1882, *Charles E. Smith* (Phila.); near the east branch of the Penobscot, 1847, *A. Young, jr.* (C.); without locality, 1847, *Thurber* (Gray); Green, 1878, *Scribner* (Mo.); Winthrop, 1862, *Sturtevant* (Mo.).

VERMONT: Shelburn, 1879, *Pringle*; Winooski River, Colchester, 1876, *Pringle*; Joes Pond, Danville, 1894, *Grant & Eggleston* (C.); Lake Memphremagog, 1860 (N. Y.); Little Otter Creek, Ferrisburg, 1880, *E. & C. E. Faxon* (Gray); Shoreham, 1878, *Brainerd* (Mo.); Burlington, 1841, *John Carey* (Mo.).

NEW HAMPSHIRE: Ponds, no locality, *Oakes Herbarium*.

action is in the highest degree arbitrary, as contravening a cardinal principle" (more specifically article 15 of the Vienna Code itself: namely, that the only valid designation of a group of plants is the earliest name applied to it within certain clearly defined limitations) article 49 is one of the portions of the Vienna Code accepted by the Nomenclature Commission of the Botanical Club of the American Association for the Advancement of Science, and thus incorporated in the American Code of 1907 now used as the standard by writers in the Contributions from the United States National Herbarium. Apart from its contravention of the "cardinal principle" which lies at the base of all stability in nomenclature, article 49 is further objectionable on account of the encouragement which it offers to slovenly and incomplete study of the literature, and to the multiplication of useless new names; while finally, though here the situation is brightened by a note of comedy, it rests on the tacit assumption that between tribe and family, or subgenus and genus, or subspecies and species, there is an actual, knowable difference of kind.—G. S. M.

<sup>1</sup> The letters in parentheses refer to the herbaria where the species are to be found. "Gray" denotes the Gray Herbarium; "N. Y.," that of the New York Botanical Garden; "C.," the herbarium of Columbia College, deposited at the New York Botanical Garden; "Mo.," the Missouri Botanical Garden; "N. E.," the herbarium of the New England Botanical Club, deposited with the Gray Herbarium; "Greene," the private herbarium of Dr. E. L. Greene; "Phila.," the herbarium of the Academy of Natural Sciences of Philadelphia. All specimens not marked thus are in the National Herbarium.

*Specimens examined*—Continued.

## Dried—Continued.

MASSACHUSETTS: Holyoke, 1883, *G. R. Lumsden*; Concord River, Concord, 1886, *H. S. Richardson* (N. E.); Northampton, 1871, *Jesup*.

CONNECTICUT: Milford Pond, in river meadow, 1895, *Eames*; Derby, *Oakes* (Phila.); North Haven, 1899, *C. H. Bissell* 335 (N. Y.); Reynolds Bridge, 1898, *E. B. Harger* (N. E.)

NEW YORK: Troy, *Dr. W. E. A. Aikin* (Phila.); near Niagara, *Doctor Eddy* (C.); Raquette Lake, 1896 (C.); Penn Yan, *Sartwell* (Gray); Albany Lake, 1879, *Ward*; Gray, Herkimer County, 1901, *House*; McDonough, 1884, *A. L. Coville*.

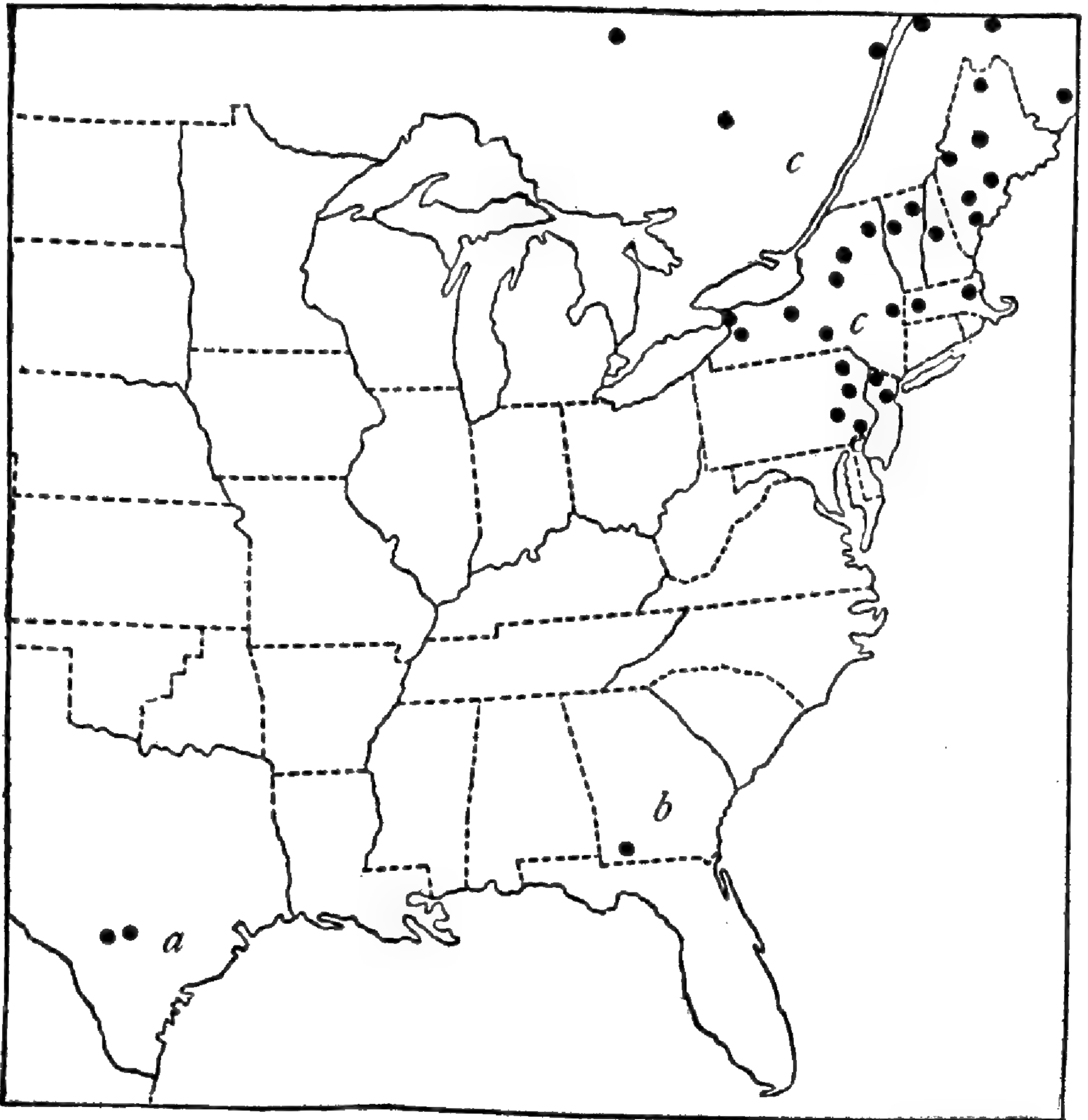


FIG. 4.—Map showing distribution of (a) *Nymphaea microcarpa*; (b) *N. orbiculata*; (c) *N. microphylla*.

PENNSYLVANIA: Colliers Ferry, Lancaster County, 1863, *Porter* (Gray); Tobyhanna Creek, Pocono Mountains, 1858, *Traill Green* (Gray); Naomi Pines, Monroe County, 1893, *Dr. & Mrs. Britton*; Monroe County, *Traill Green*; Silver Lake, Pike County, 1899, *Stewardson Brown* (Phila.); Bristol, 1865, *C. F. Parker* (Phila.); Philadelphia, *Nuttall* (Phila.); head of Naomi Pines Lake, 1904, *Harshberger* (Mo.).

NEW JERSEY: Closter, 1860, *Austin* (C.); Pompton Lake, Pompton, 1892, *Morong* (C.).

This, the smallest of our *Nymphaeas*, is the American representative of the Palearctic *N. pumila*. Indeed it has often been considered identical with that species. The

leaves of the two are much alike, so too the flowers, in size at least. The anthers of our plant are oblong, while in *N. pumila* they are cubical. In the European species the stigmatic disk is only partially tinged with orange-red, while in our plant the whole disk is a dark carmine.

Michaux, in the original description of the plant, says: "Quamvis differentiam specificam verbis notare non possim; diverse tamen videtur." Evidently he had only dried specimens, otherwise it would have been very easy to separate it from *Nymphaea lutea*, of which he considered it a subspecies.

## 2. *Nymphaea rubrodisca* (Morong) Greene.<sup>1</sup>

*Nuphar advena hybrida* Peck, Ann. Rep. N. Y. Mus. Nat. Hist. **34**: 53. 1881.

*Nuphar rubrodiscum* Morong, Bot. Gaz. **11**: 167. 1886.

*Nymphaea rubrodisca* Greene, Bull. Torrey Club **15**: 84. 1888; Robins. & Fern. in A. Gray, Man. ed. 7. 391. 1908.

*Nymphaea fletcheri* Lawson, Proc. & Trans. Roy. Soc. Canada **64**: 119. 1888.

*Nuphar advena minus* Wats. & Coult. in A. Gray, Man. ed. 6. 56. 1889, not Morong.

*Nymphaea hybrida* Peck, Bull. N. Y. State Mus. **6**: 75. 1899; Britton, Man. ed. 2. 407. 1905.

TYPE LOCALITY: Lake Champlain, Vermont.

DISTRIBUTION: Quebec and Ontario, through New York and the New England States to eastern Pennsylvania and northern New Jersey, also in eastern Minnesota and western Wisconsin.

### DESCRIPTION.

Floating leaves 75 to 200 mm. long, 55 to 145 mm. wide, oval or ovate, rounded at the apex; sinus about half as long as the midrib or slightly longer, closed or very narrow; blades rather thin, glabrous, their lobes oblong-triangular or rounded-triangular, obtuse; submersed leaves well developed, very thin, crispate, broadly oblong or ovate, broadly rounded and retuse at the apex, of about the same size as the floating ones, their sinuses broader and more open; rootstocks comparatively slender, somewhat flattened, about 25 mm. in their longest diameter, the leaf scars elliptical or oval, 8 to 10 mm. long; flowers 25 to 35 mm. in diameter, 20 mm. high, depressed-globose; sepals usually 5, glabrous, rather thin, all similar, oblong or oval or almost orbicular, obtuse or truncate, only slightly narrowed at the base; petals spatulate, truncate, 8 or 9 mm. long; stamens in 4 or 5 rows, their anthers about one-half as long as the filaments, sometimes longer, but always shorter than the filaments; sepals canary yellow, with or without red on their inner surfaces, the red when present less vivid than in *americana*; petals clear yellow or slightly tinged with green; stamens yellow, the anthers light buff; ovary greenish yellow, lighter than the sepals and stamens, faintly marked

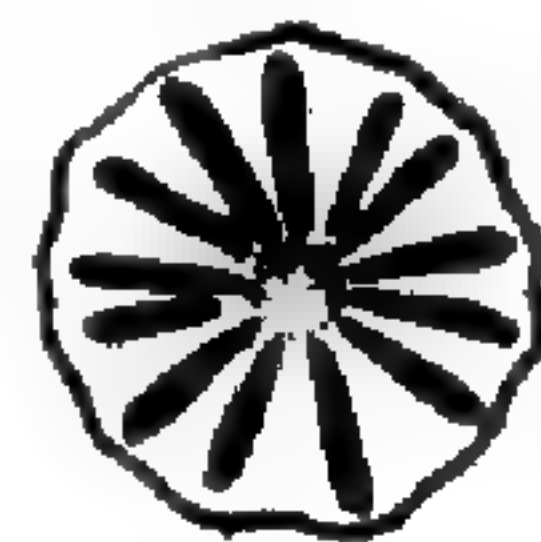


FIG. 6.—Stigmatic pattern of *Nymphaea rubrodisca*. Natural size.

<sup>1</sup> The use of the synonym *rubrodisca* in place of the original name *hybrida* is in accordance with article 49 of the Vienna Code. See footnote under *Nymphaea microphylla*, p. 72.—G. S. M.

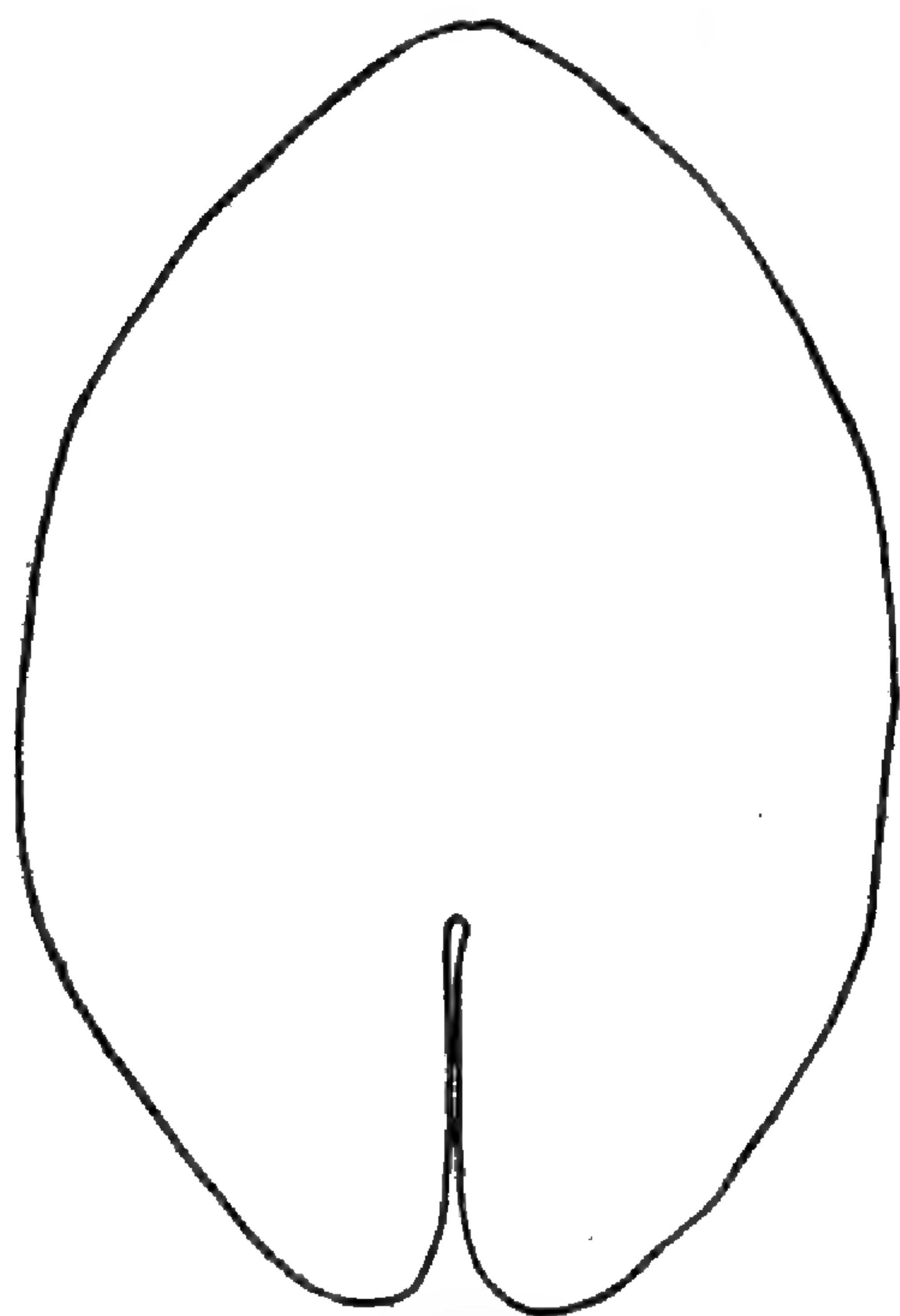


FIG. 5.—Leaf outline of *Nymphaea rubrodisca*. Scale  $\frac{1}{2}$ .

with carmine beneath the disk, the disk carmine; fruit ovoid, slightly constricted above, about 22 mm. high and 10 mm. in diameter, rather strongly and coarsely ribbed; disk when mature about 11 mm. in diameter, orbicular, its edge undulate; stigma rays 8 to 13, usually 10 to 12, linear, 3 mm. long, extending almost to the edge of the disk, distinct, with no trace of a median line, the center deeply depressed, smooth; fruit when mature dark purplish brown; seeds ovoid, 2.5 to 3 mm. long, 1.5 to 2 mm. in diameter, light brown, shining. (PLATE 36, B, facing p. 73. FIGURES 5, 6, 7, b.)

*Specimens examined:*

In formalin—

CANADA: Ottawa, 1901, *Fletcher*.

NEW HAMPSHIRE: Cambridge River near Lake Umbagog, 1905, *W. C. Kendall*.

NEW YORK: Smiths Pond; Gray, 1901, *J. Perkins*; Blind Bay near Fishers Landing, Jefferson County, 1902, *Maxon*; Thousand Island Park, 1902, *Maxon*; Lake Champlain, 1901, *Eggleston*.

WISCONSIN: West Superior, 1902, *Charles Bullard*.

Dry—

CANADA: Danville, Quebec, 1894, *Berg* (C.); near Pictou, Nova Scotia, 1901, *Howe & Lang* 610 (N. Y.); Red Pine Lake, 1900, *Macoun* 23261 and 23262 (N. Y.); Whites Lake, 1900, *Macoun* 21698 (N. Y.); Brigham Creek, Ottawa River, 1882, *Fletcher*; Ottawa, 1902, *Fletcher*; St. Francis River, Quebec, *Eggleston* 3010.

MAINE: Androscoggin River, Auburn, 1896, *Merrill* 4430 (N. E.); Birch Brook, north end of Cross Lake, Eagle Lake Chain, Aroostook County, 1903, *W. C. Kendall*; Hartford, 1886, *Parlin* (Gray); Milford, 1892, *Fernald* (Gray); Valley of the St. Francis River, Aroostook County, 1902, *Eggleston & Fernald* (N. E.); Mattawamkeag Lake, Aroostook County, 1897, *Fernald* (N. E.); Bradley, 1890, *Fernald* (N. E.).

NEW HAMPSHIRE: Gilmore Pond, Jaffrey, 1897, *Robinson* 263 (Gray).

VERMONT: Joes Pond, Danville, 1894 (C.); Lake Champlain, Ferrisburg, 1879, *Brainerd* (C.); Burlington, 1878, *Pringle* (N. Y.); Manchester, 1898, *M. A. Day* (Gray); Williamstown, 1881, *E. & C. E. Faxon* (Gray); Lake Champlain, 1873, *H. G. Jesup* (Gray); sluggish tributaries of Lake Champlain, 1879, *Pringle*.

MASSACHUSETTS: Woburn, 1909, *Wm. Boott* (Gray); Ashburnham, 1896, *Sydney Harris* (N. E.).

NEW YORK: Wilmurt Lakes, Herkimer County, 1901, *House*; vicinity of Fishers Landing, Jefferson County, 1902, *Robinson & Maxon* 75; Carpenters Pond, Onondaga County, 1903, *House*; Troy, 1876, *J. H. Wibbe* (Greene); Raquette Lake, 1896 (C.); Troy, 1829, *Doctor Aikin*; Bronx River, Williams Bridge, 1890, *Bicknell* (C.); ponds in the Adirondacks, 1884, *Morong* (N. Y.); Westchester County, Williams Bridge, *Dr. T. P. Allen* (N. Y.); Smiths Pond, Herkimer County, 1855 (Gray); Gorham, *Doctor Torrey*.

NEW JERSEY: Barrack Creek, Burlington, *Solomon Conrad* (Phila.); Pompton Lake, Pompton, 1892, *Morong* (C.); Green Pond, Morris County, 1894, *Wm. Van Sickle*.

PENNSYLVANIA: Pocono Plateau, Monroe County, 1893, *Dr. & Mrs. Britton*.

WISCONSIN: West Superior, 1902, *Charles Bullard*.

MINNESOTA: Daniels Lake, 1891, *F. F. Wolf*; Vermilion, 1891, *Sandberg* 500.

This species is so readily distinguishable from the other American members of the genus, and particularly from those which occupy the same general region, that no special comparisons are required. By many authors the plant has been regarded as a hybrid between *Nymphaea americana* and *N. microphylla*. Its characters are for the most part intermediate between those of the two better-known plants. It shows a less degree

of fertility than other members of the genus, so much so that ripe fruit with well-developed seeds is not easily obtained. In geographic range it appears to be a boreal form, occurring therefore in the same region as *N. microphylla*, and in that part of the range of *N. americana* which extends north of the Transition Zone and overlaps that of the smaller plant. All of these facts might readily be construed as indicating a hybrid origin. On the other hand the characters of *Nymphaea rubrodisca* are quite as constant as in other American species, and no specimens are yet known which show any tendency to reversion toward either of the supposed parents. The plant is by no means invariably found locally associated with both *N. americana* and *N. microphylla*, as

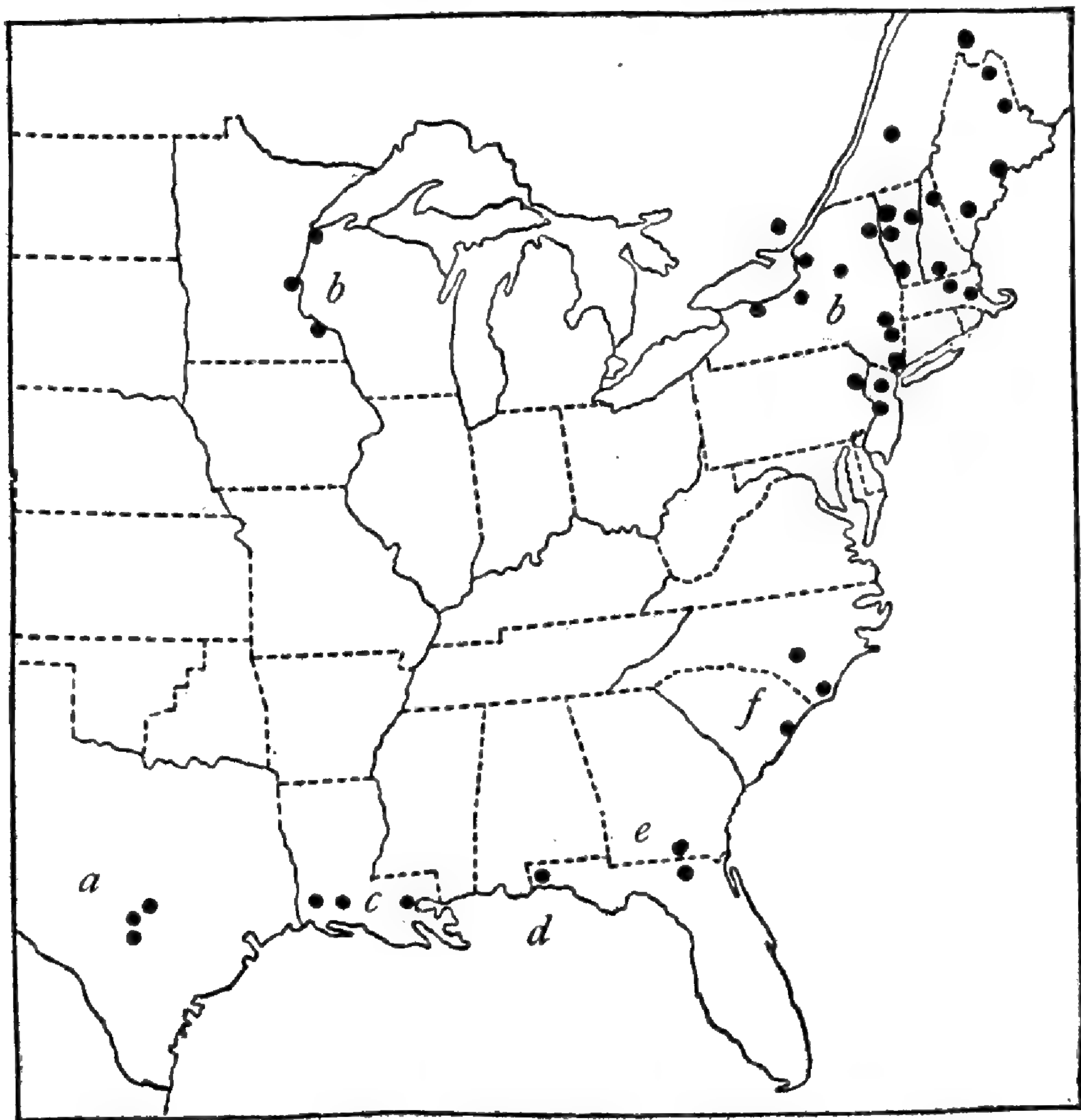


FIG. 7.—Map showing distribution of (a) *Nymphaea ovata*; (b) *N. rubrodisca*; (c) *N. ludoviciana*; (d) *N. ulvacea*; (e) *N. bombycina*; (f) *N. sagittifolia*.

either or both of these may be absent from the particular stream or pond in which it grows;<sup>1</sup> while in general distribution it extends decidedly beyond the western limit of the range of *N. microphylla* as now known. Finally, it is not unusual among plants for certain members of a genus to produce fruit less abundantly than others, particularly in groups where asexual reproduction and dispersal can readily occur. The hypothesis of hybrid origin seems, therefore, to present the greater number of difficulties, and until more facts can be brought to its support we prefer not to accept it.

<sup>1</sup> It was found thus alone by Peck at the type locality of *hybrida*.

3. *Nymphaea americana* (Provancher) Miller & Standley.

*Nuphar americana* Provancher, Fl. Canad. 29. 1862, excluding synonyms.

*Nuphar variegatum* Engelm.; Peck, Ann. Rep. Univ. N. Y. 19: 73. 1866.

*Nuphar advena variegatum* Engelm. in A. Gray, Man. ed. 5. 57. 1867.

*Nuphar advena minor* Morong, Bot. Gaz. 11: 167. 1886.

*Nymphaea variegata* G. S. Miller, Proc. Biol. Soc. Washington 15: 13. 1902.

"*Nymphaea advena* So-land." Small, Fl. Southeast. U. S. 456. 1903, in part; Britton, Man. ed. 2. 407. 1905, in part.

*Nymphaea advena variegata* Fernald, Rhodora 10: 49. 1908.

TYPE LOCALITY: Lake St. Jean-Georgie, Quebec.

DISTRIBUTION: Eastern Canada westward to British Columbia, south to Montana, Nebraska, northern Indiana, and Ohio, eastern Pennsylvania, and New Jersey.

## DESCRIPTION.

Floating leaves usually 17 to 28 cm. long and 11 to 22 cm. wide, oblong or oval, the blades averaging narrower

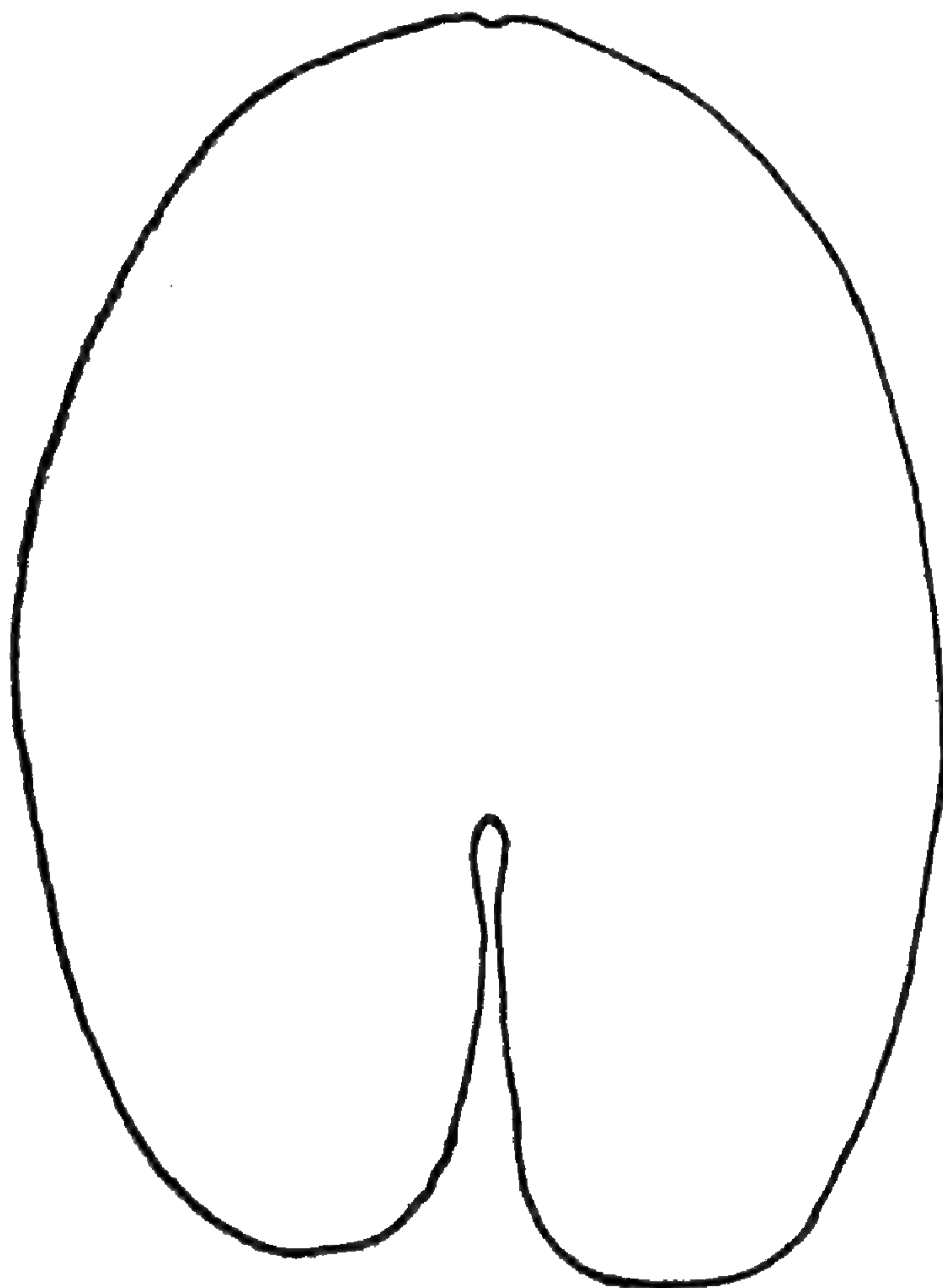


FIG. 8.—Leaf outline of *Nymphaea americana*. Scale,  $\frac{1}{2}$ .

and smaller than in *advena*, slightly but noticeably narrowed towards the apex, the sinus 50 to 75 mm. deep, closed or very narrow, the lobes semiorbicular or oblong; submersed leaves sometimes but not always present, similar in form to the floating ones but broader, very thin and membranous; petioles slender, conspicuously flattened, with a conspicuous median ridge forming a prolongation of the midrib; peduncles terete, slender, glabrous; flowers about 45 mm. in diameter, 30 mm. high, the perianth when spread measuring about 100 mm., in other particulars similar to those of *advena*; petals about 16, the largest 8 mm. wide at the apex and sometimes almost spatulate; stamens usually in 6 rows, about 26 to the row; filaments often 4 mm. wide; color of flowers variable but usually quite distinct from that of *N. advena*; outside of outer sepals oil green, the inner ones lemon yellow outside; lower half of inner surface of all sepals usually, although not invariably, red, this color sometimes covering the whole inner side of the smaller sepals, the exact shade varying in different specimens from a mere indefinite tinge in the yellow to a bright pure maroon; petals clear yellow or sometimes bright parrot green, usually tipped with green, and

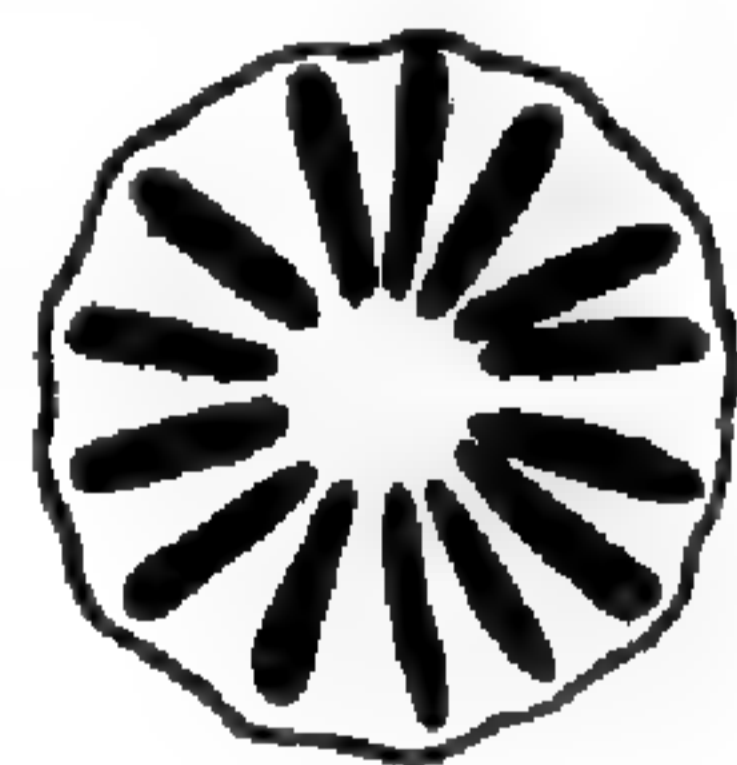
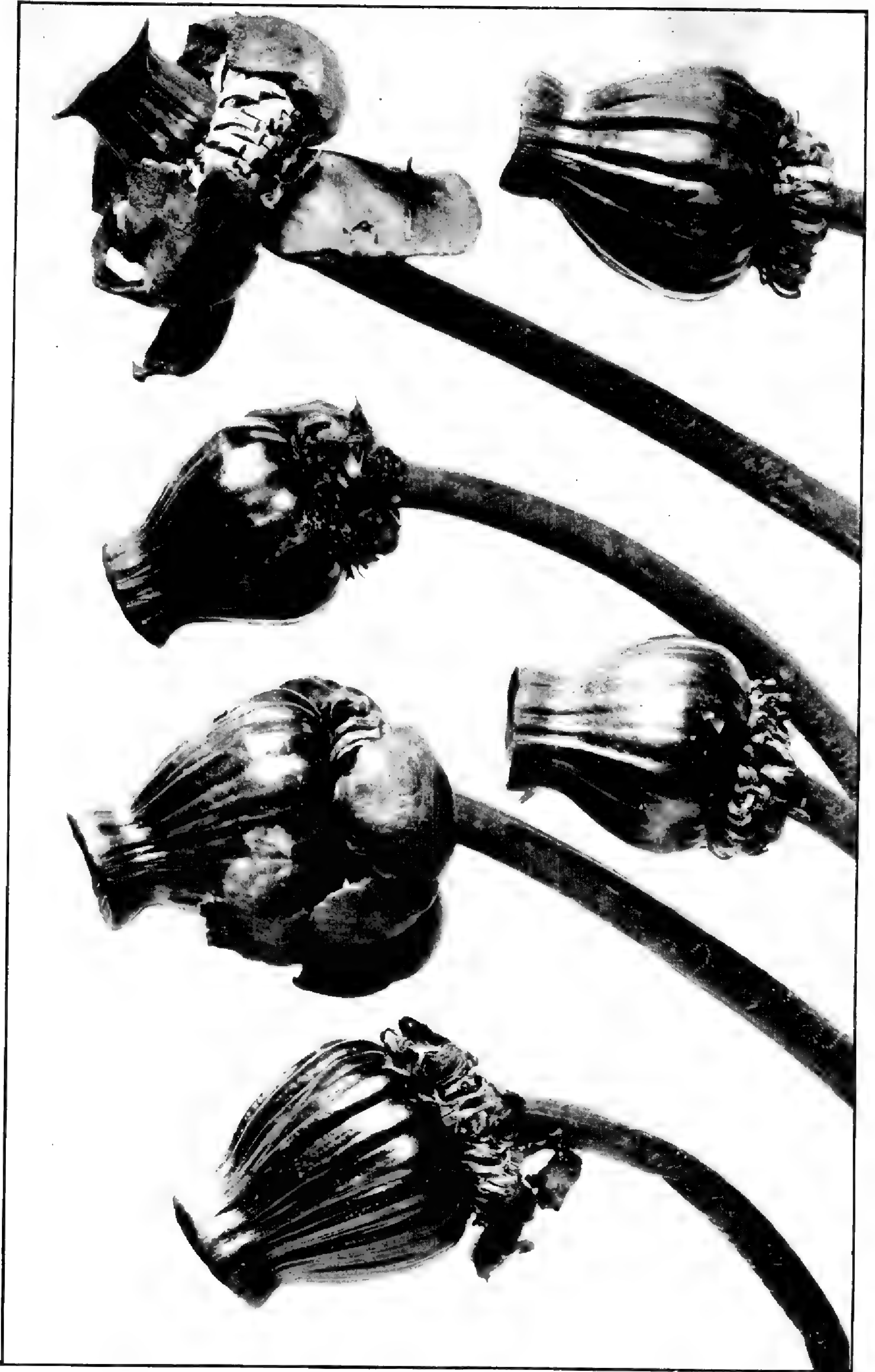


FIG. 9.—Stigmatic pattern of *Nymphaea americana*. Natural size.





NYPHAEA AMERICANA (PROVANCHER) MILLER & STANDLEY, IN FLATHEAD LAKE, MONTANA.



FRUIT OF NYMPHAEA AMERICANA (PROVANCHER) MILLER & STANDLEY, FROM SPRINGFIELD, MASSACHUSETTS.

occasionally tinged or tipped with red; stamens clear, bright lemon yellow throughout; fruit smaller than that of *advena*, 40 mm. high and 30 mm. in diameter, ovoid, conspicuously constricted above, the ribs less prominent and the crater more shallow than in that species, the crater usually about 5 mm. deep; margin of the disk definitely although not deeply crenate; stigma rays 7 to 25, usually 12, 13, or 14, extending to within 1 mm. or less of the edge of the disk; capsule oil green, usually tinged with red, and often becoming a bright red with age; in the brightest colored fruits the stigmatic region usually remaining greenish yellow in striking contrast; seeds similar to those of *N. advena* but smaller, about 5 mm. long, the greater diameter 3.6 mm., the lesser diameter 3.2 mm., less compressed and with a less prominent raphe. (PLATES 36, C, facing p. 73; 37, 38. FIGURES 8, 9, 10,c.)

EXPLANATION OF PLATES 37, 38.—Pl. 37, *Nymphaea americana*, in Flathead Lake, Montana. Photographed by Prof. M. J. Elrod. Pl. 38, fruit of *Nymphaea americana*, collected at Springfield, Massachusetts, by Mr. Frederick Knab. Natural size.

*Specimens examined:*

Formalin—

CANADA: Port aux Basques, Newfoundland, 1901, *F. W. True*; 150-mile House, Cariboo, British Columbia, 1901, *A. C. Brooks*; near Toronto, 1901, *J. H. Fleming*; Lake Joseph, Muskoka, Ontario, 1902, *Fleming*; Ottawa, 1902, *Fletcher*; Pointe à Pic, 1902, *D. G. Elliott*; St. Clair River near Walpole, Ontario.

MAINE: Maneskootuck, Rangeley, 1901, *F. S. Dickson*; Green Lake, 1901, *E. E. Race*; Cape Niddick, 1901, *Charles Bullard*; Little Sebago Lake; Birch Brook, Eagle Lake Chain, Aroostook County, 1903, *W. C. Kendall*.

NEW HAMPSHIRE: Intervale, 1901, *G. M. Allen*; Mud Pond, tributary to first Connecticut Lake, Coos County, 1904.

VERMONT: Lake Champlain, 1901, *Eggleston*.

MASSACHUSETTS: Springfield, 1901, *Frederick Knab*; Wareham, 1901, *O. Bangs*; Stockbridge, 1903, *J. A. Loring*.

CONNECTICUT: Pembroke Lake near Bridgeport, 1902, *G. A. Meeker*.

RHODE ISLAND: Lymanville, 1901, *Angell & Cash*; without locality, 1900, *Mearns*.

NEW JERSEY: New Bedford, Monmouth County, 1902, *M. W. Lyon*; Clementon, 1902, *S. N. Rhoads*; Spring Lake, 6 miles south of Ocean Grove, 1902, *Lyon*.

PENNSYLVANIA: Three and one-half miles east of Lopez, Sullivan County, 1901, *Witmer Stone*; pond near Lehigh River at Lehigh Gap, Lehigh County, 1901, *J. A. G. Rehn*; Shady Nook.

NEW YORK: Chautauqua Lake, 1901, *M. Schlegel*; Peterboro, 1901, *B. D. Miller*; Piseco, 1901, *W. L. Ralph*; Lake Titus, 1901, *E. W. Nelson*; South Mountain Lake, Catskill Mountains, 1903, *Shull*; Fish Creek, Oneida Lake, 1901, *Maxon*; Thousand Islands, 1902, *Maxon*; Machias, 1901, *F. E. Ferris*; Sodus Bay, 1901, *G. B. Turner*; Smiths Pond, *B. D. Gilbert*.

OHIO: Sandusky, 1902, *W. A. Kellerman*; Sandusky, 1903, *M. T. Cook*; Squaw Bay, Put in Bay Harbor, 1901, *U. S. Fish Commission*.

MICHIGAN: Belle Isle Park, Detroit, 1907, *Farwell*; St. Clair Flats, 1901, *U. S. Fish Commission*.

WISCONSIN: Lake Superior, 1901, *H. V. Ogden*; Green Bay, 1903, *J. H. Schuette*; Upper Nemahin Lake, Waukesha County, 1901, *H. V. Ogden*; Milwaukee, 1902, *Ogden*; West Superior, 1902, *Charles Bullard*.

INDIANA: Wolf Lake, 1903, *Shull*.

IOWA: Manchester, 1901, *R. S. Johnson*.

MINNESOTA: Lake Itasca, 1902, *T. S. Robertson*; St. Louis River near Duluth, 1901, *L. E. Balbridge*.

MONTANA: Big Fork, 1902, *M. J. Elrod*; Big Fork, 1901, *W. C. Barr*.

*Specimens examined*—Continued.

## Dry—

CANADA: On an island of the Simpson Group 40 miles northeast of Fort Resolution, Mackenzie Territory, 1903, *Preble* 242; St. Francis River, Quebec, 1902, *Eggleston* 3011; Canso, Nova Scotia, 1901, *Fowler*; Golden Lake, Renfrew County, Ontario, 1899, *Umbach*; Gananoque, Ontario, 1887, *Fowler*; Cache Lake, Algonquin Park, Ontario, 1900, *Macoun* 21697; Port aux Basques, Newfoundland, 1901, *A. W. Prentiss*; North Sidney, British Columbia, 1883, *Macoun* 8 (Gray); pond near Whitbourne, Newfoundland, 1894, *Robinson & Schrenk* (Gray); Seven Islands, 1907, *C. B. Robinson* 889 (N. Y.); Channel,

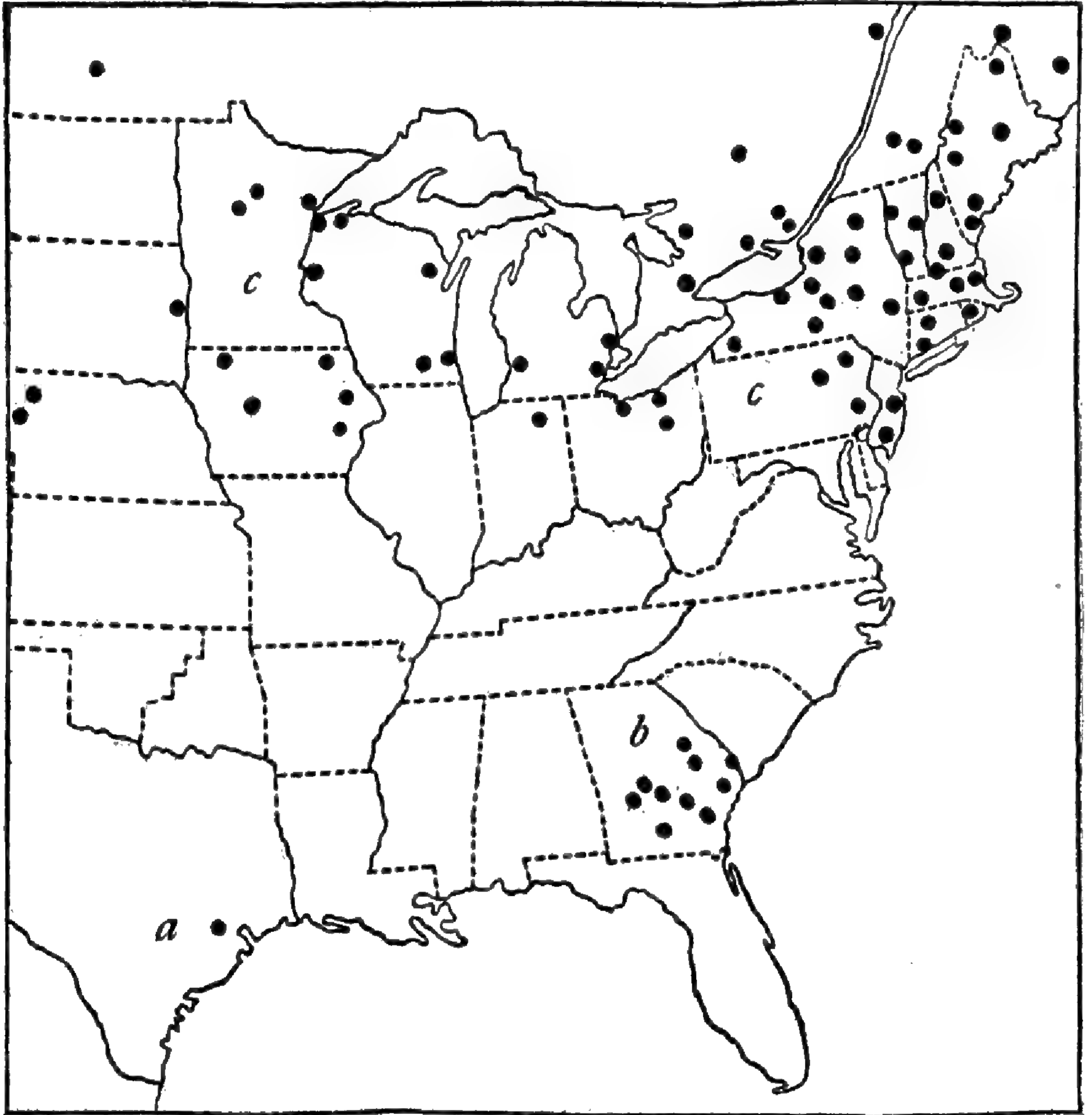


FIG 10.—Map showing distribution of (a) *Nymphaea puberula*; (b) *N. fluviatilis*; (c) *N. americana*.

Newfoundland, 1901, *Howe & Lang* 870, 944 (N. Y.); near Digby, Nova Scotia, 1901, *Howe & Lang* 313 (N. Y.); St. Jean l'Evangeliste, Nouvelle, Quebec, 1904, *Collins & Fernald* (Gray); Belleville, Ontario, 1883, *Macoun* 95; Cross Lake, Renfrew County, Ontario, 1899, *Umbach*; Killarney, Manitoba, 1896, *Macoun*, (Greene); Kaministigma River, 1889, *Dr. & Mrs. Britton* (C.); Fredericton, New Brunswick, 1880, *Fowler*.

*Specimens examined*—Continued.

## Dry—Continued.

MAINE: Valley of Saint Francis River, 1902, *Eggeston & Fernald* (Gray); Petti-  
quaggamas Lake, Aroostook County, 1893, *Fernald* 9; Orono, Penobscot  
County, 1897, *Fernald* (N. E.); Industry, Franklin County, 1894, *Fernald*  
(N. E.); Manchester, 1874, *Scribner* (N. E.); West Auburn, 1896, *Merrill*  
4429 (N. E.); Westbrook, 1899, *Ricker* 605; Clear Pond, Pleasant Ridge Town-  
ship, Somerset County, 1906, *Chamberlain*; Winthrop, 1862, *Sturtevant*.

NEW HAMPSHIRE: Frost Pond, Jaffrey, 1898, *B. L. Robinson* 495 (Gray); White-  
field, Coos County, 1896, *Deane* (N. E.).

VERMONT: Johnson, 1893, *Grout* (C.); Willoughby, 1892, *Rusby* (C.); La Plot  
River, Shelburn, 1879, *Pringle*; Barnumville, Manchester, 1898, *M. A. Day*  
(Gray).

MASSACHUSETTS: Vicinity of Cambridge, 1891, *Underwood* 2694 (C.); without  
locality, 1865, *Gray*; South Framingham, 1888, *Sturtevant*; Dartmouth, 1889,  
*Sturtevant*; Ashland, 1879, *Morong*; Waverly, 1895 (Gray); Melrose, 1880,  
*R. Frohock* (N. E.); Malden, 1872, *H. L. Wordy* (N. E.); Beaver Brook Reser-  
vation, west of Kame, 1896, *Deane* (N. E.); Eastham, 1907, *F. S. Collins* (N.  
E.); Stockbridge, Berkshire County, 1902, *R. Hoffmann* (N. E.); Stony Brook,  
1895, *W. H. Manning* (N. E.); Great Barrington, 1894, *Pollard*.

CONNECTICUT: West Goshen, 1891, *Underwood* 3208, 3210, 3210a (C.); Southing-  
ton, 1899, *L. Andrews* (N. E.); Tranquility Farm, Middlebury, 1896, *W. M.*  
*Shepardson* (N. E.); New Haven, 1884, *Safford* 164.

NEW JERSEY: Swartzwood Lake, 1906, *C. S. Williamson* (Phila.); New Bedford,  
Monmouth County, 1902, *M. W. Lyon*; Egg Harbor City, 1882, *J. H. Red-  
field* 243; Inskip, 1894, *Brinton & Keller*; Mays Landing, *Isaac Burk*.

PENNSYLVANIA: Pocono Plateau, 1904, *Harshberger* (Phila.); Shady Nook, Sulli-  
van County, 1901, *Stewardson Brown* (Phila.).

NEW YORK: Steeres Pond, Preston, 1886, *F. V. Coville*; South Mountain Lake,  
Catskills, 1903, *Shull*; Smiths Pond, Litchfield, Herkimer County, 1903,  
*House*; Peterboro, Madison County, 1904, *G. S. Miller*; Brisben Station,  
Chenango County, 1887, *F. V. Coville*; Geneganslet Lake, McDonough, 1886,  
*F. V. Coville*; South Bay, Wellesley Island, Jefferson County, 1902, *Robinson  
& Maxon* 74; Troy, *Schweinitz Herbarium*; Gorham, *Torrey*; Raquette Lake,  
1896 (C.); Lake Ontario, 1892, *Britton* (C.); Great Otter Lake, Lewis County,  
1884, *O. R. Willis* (C.); Sylvan Beach, Oneida County, 1900, *House*; Little  
York, Cortland, 1905, *G. T. Hastings*; South Bay, eastern end of Oneida Lake,  
1910, *Maxon* 4616.

OHIO: Sandusky Bay, 1902, *J. H. Schuette*; Sandusky, 1902, *Kellerman*; Black  
River, Lorain County, 1892, *J. W. Beach*; Sandusky, 1903, *Mel T. Cook*; Fox  
Lake, Wayne County, 1899, *Selby & Duvel*.

WISCONSIN: Mirror Lake, 1903, *Eggert*; Waupaca, 1907, *E. F. Garerche*; St. Croix  
Falls, Polk County, 1899, *Baker* (Gray); near Milwaukee, 1902, *H. V. Ogden*;  
De Pere, 1888, *T. S. Kellogg*.

MICHIGAN: Iron River, 1902, *Rydberg* (N. Y.); west end of Swan Lake, Allegan  
County, 1902, *Wight* 5; Bloody Run, Detroit, 1865, *Bigelow* (Mo.); Parkhouse  
Marsh, Detroit, 1866, *Bigelow* (Mo.); Connors Creek, Detroit, 1866, *Bigelow*  
(Mo.); Belle Isle, Detroit, 1865, *Bigelow* (Mo.).

MINNESOTA: Silver Lake, 1887, *Cratty*; Lake Itasca, 1902, *T. S. Roberts*; Lake  
Kilpatrick, Cass County, 1893, *Ballard*; Minnetonka, 1891, *Sandberg* 631.

NEBRASKA: Weigand, 1893, *Fred Clements* 2686; Lake Region of Grant County,  
30 miles south of Whitman in Swan Lake, 1893, *Rydberg* 1650; Cherry County,  
1892, *Smith & Pound* 168 (Mo.).

*Specimens examined*—Continued.

## Dry—Continued.

IOWA: Iowa City, *Hitchcock* (Mo.); Hamilton County, 1891, *P. H. Rolfs* (Mo.); Armstrong, Emmet County, 1887, *Cratty* (Mo.); Iowa and Minnesota Line, 1897, *Pammel* 520 (Mo.); Winnesheik County, 1895, *Fitzpatrick* (Mo.).

SOUTH DAKOTA: White, 1893, *Thorner*; Six Mile Creek, west of White, 1902, *A. G. Johnson*; White, 1893, *T. A. Williams*; Aurora Creek southeast of Brookings, 1904.

MONTANA: Rost Lake, 1901, *MacDougal* 652; Columbia Falls, 1892, *R. S. Williams* 869.

For comparison of this plant with *Nymphaea advena* see page 88.

4. *Nymphaea fraterna* Miller & Standley, sp. nov.

Type in the U. S. National Herbarium, no. 441399, collected in Toms River, New Jersey, August 6, 1903, by M. W. Lyon.

DISTRIBUTION: East-central New Jersey.

## DESCRIPTION.

Petioles flattened, with a median ridge along the inner side, glabrous; floating leaf blades oblong-ovate or ovate, 10 to 22 cm. long and 8 to 15 cm. wide, broadest at or below the middle, conspicuously narrowed and acutish towards the apex, rather thin, glabrous; sinuses open and very narrow, or closed and the lobes partly overlapping, 20 to 65 mm. deep, the lobes rounded; submersed leaves very thin and delicate, numerous, broader than the floating ones, broadly ovate or almost orbicular in outline, 85 to 155 mm. long and 70 to 135 mm. wide, broadly rounded or slightly narrowed at the apex, the sinus 25 to 50 mm. deep, usually open,

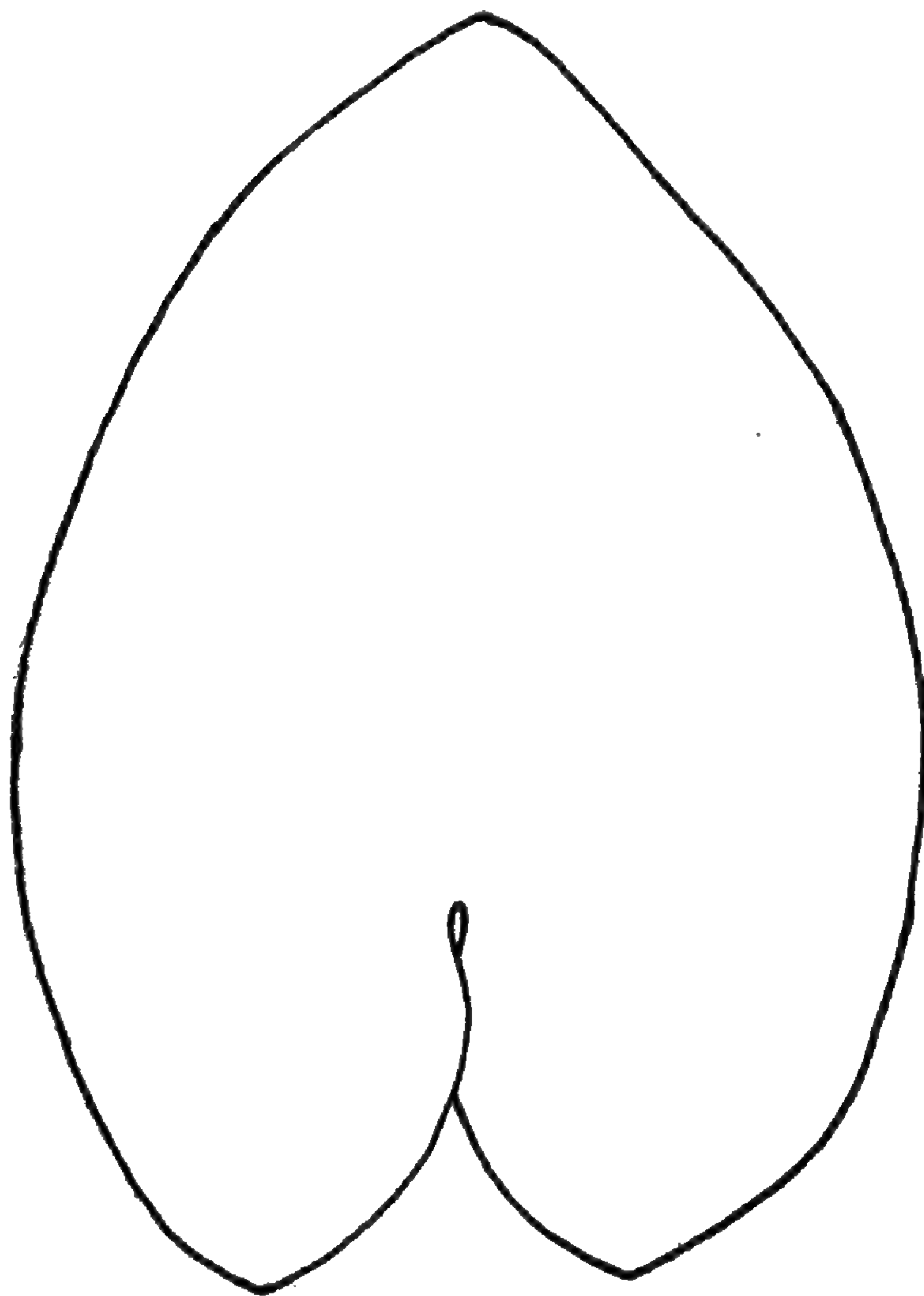


FIG. 11.—Leaf outline of *Nymphaea fraterna*. Scale  $\frac{1}{2}$ .

rather narrow, the lobes broadly rounded, the margins somewhat plicate; flowers depressed-globose, 22 to 26 mm. in diameter, only slightly depressed at the base; sepals 6, when spread measuring 50 to 65 mm.; outer ones thin, glabrous, rather narrowly oblong, 16 to 21 mm. long and 11 to 13 mm. wide, rounded at the apex; inner sepals deltoid-cobovate, shallowly emarginate, 18 to 23 mm. long, gradually narrowed to the base; stamens in usually 4 rows, their anthers slightly longer than the

filaments; petals narrowly oblong, truncate, 6 or 7 mm. long; fruit ovoid, gradually narrowed above to a short neck, 21 to 30 mm. high and 17 to 20 mm. in diameter, inconspicuously ribbed above, almost smooth near the base; rim of the disk 3 mm. high, divergent or erect; disk 12 to 14 mm. in diameter, orbicular, entire or slightly crenate, the crater usually shallow, 2 to 4 mm. deep; rays 11 to 16, usually 14, linear, 3 or 3.5 mm. long, narrow, extending to within 1 or 2 mm. of the edge of the disk, distinct, the center 3 or 4 mm. in diameter, smooth; seeds 3.5 to 4 mm. long, ovoid, pointed, with an acutish and rather conspicuous raphe. (PLATES 35, B, facing p. 72; 36, D, facing p. 73. FIGURES 11, 12, 13, b.)

Described from material preserved in formalin collected by W. M. Lyon, jr., in Toms River, New Jersey, August, 1902, July 27, 1903, August 6, 1903, and August 15, 1902. Dried specimens collected August 6, 1903, are mounted on sheets 441395 to 441399, inclusive, in the National Herbarium.

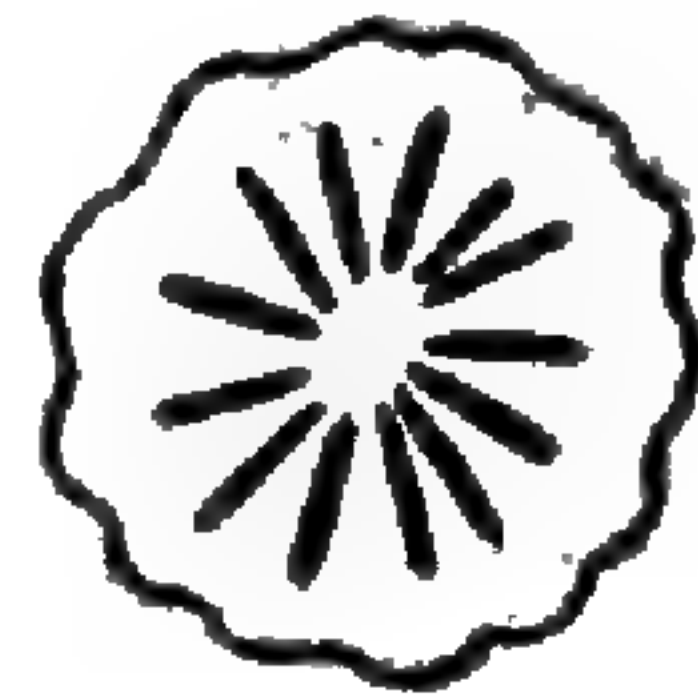


FIG. 12.—Stigmatic pattern of *Nymphaea fraterna*. Natural size.

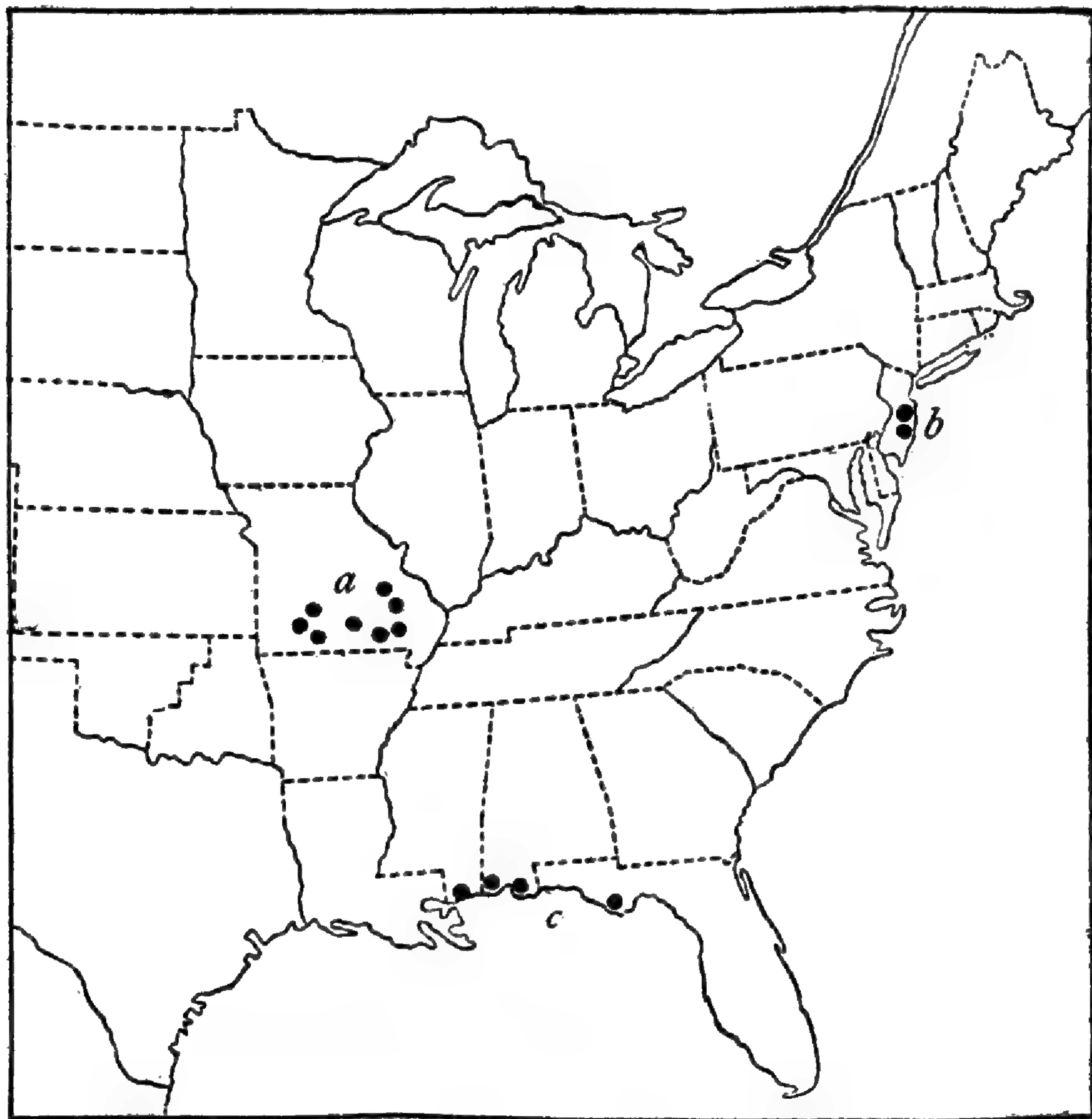


FIG. 13.—Map showing distribution of (a) *Nymphaea ozarkana*; (b) *N. fraterna*; (c) *N. chartacea*.

*Additional material seen:*

In formalin—

NEW JERSEY: Pemberton, June 24, 1900; Speedwell, Burlington County, June 20, 1901, *Witmer Stone*.

*Additional material seen*—Continued.

Dry—

NEW JERSEY: Toms River, July 26, 1903, *Lyon*; same locality, August 11, 1902, *Lyon*; New Bedford, Monmouth County, August 14, 1902, *Lyon*; Forked River, May 29 to June 2, 1896, collected on an excursion of the Torrey Botanical Club.

This species comes from a region long known to botanists as one producing many interesting plants. Although closely related to *Nymphaea americana* it seems amply distinct in its much smaller flowers, smaller, greenish fruit, pointed leaves, smaller seeds, and numerous and conspicuous submersed leaves. While submersed leaves are occasionally found in *N. americana* they are never so numerous or conspicuous as in the New Jersey plant.

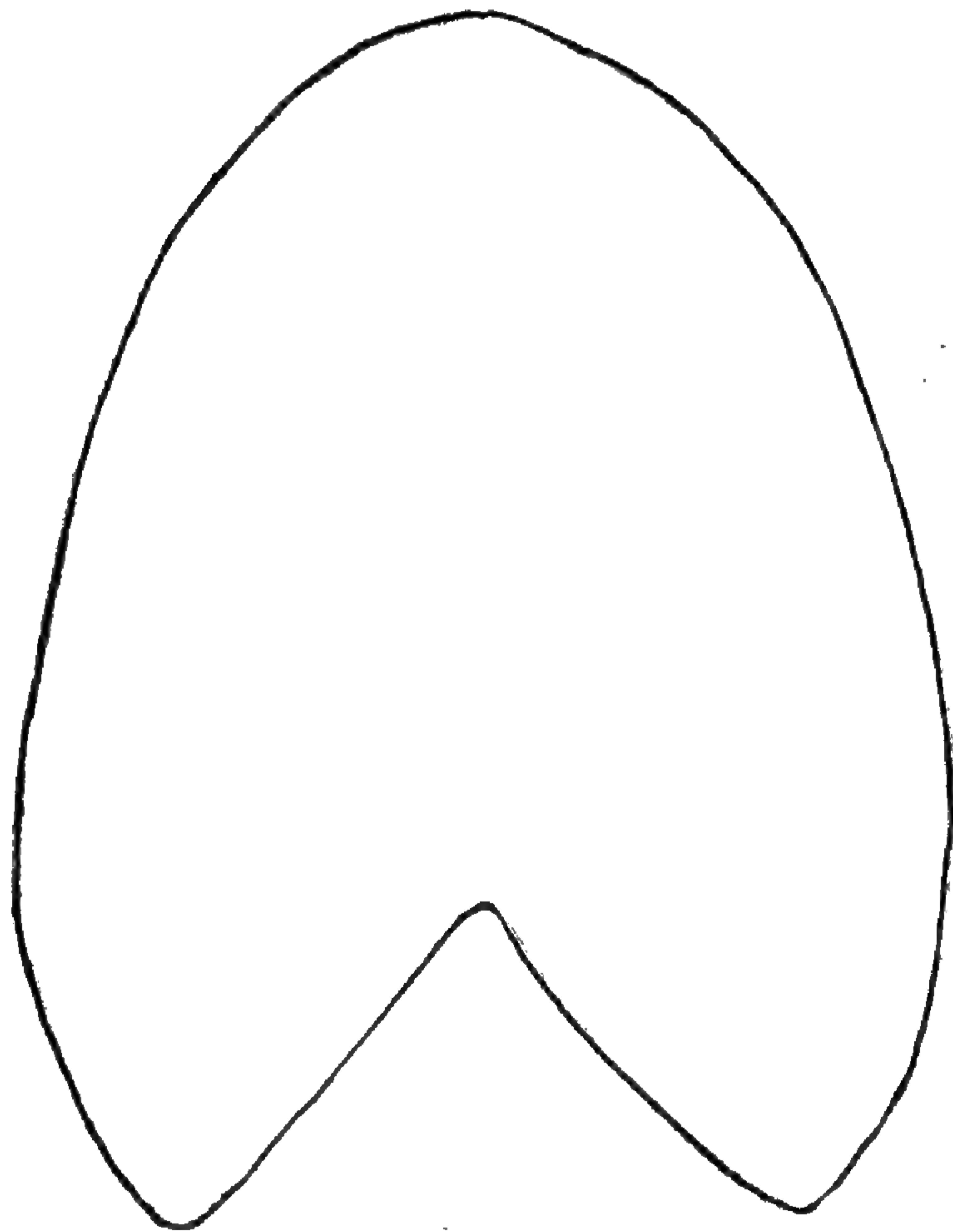


FIG. 14.—Leaf outline of *Nymphaea advena*. Scale  $\frac{1}{4}$ .

**5. *Nymphaea advena***  
Ait.

*Nymphaea advena* Ait.

Hort. Kew. **2**: 226.

1789; G. S. Miller,

Proc. Biol. Soc. Wash-

ington **15**: 12. 1902;

Small, Fl. Southeast.

U. S. 456. 1903, in part;

Britton, Man. ed. 2.

390. 1908, in part; Rob-

ins. & Fern. in A. Gray,

Man. ed. 7. 390. 1908.

*Nymphaea arifolia* Salisb.

Ann. Bot. **2**: 71. 1806.

*Nuphar advena* Ait. Hort.

Kew. ed. 2. **3**: 295.

1811.

*Nuphar advena tomento-*

*sum* Torr. & Gr. Fl. N.

Amer. **1**: 58. 1838.

TYPE LOCALITY: Vicinity  
of Philadelphia, Pennsyl-  
vania.

DISTRIBUTION: Eastern  
Wisconsin and Southern  
Michigan and New York to

eastern Nebraska and Kansas, southern Missouri, Kentucky, and North Carolina. Northern limit coinciding with that of Upper Austral zone.

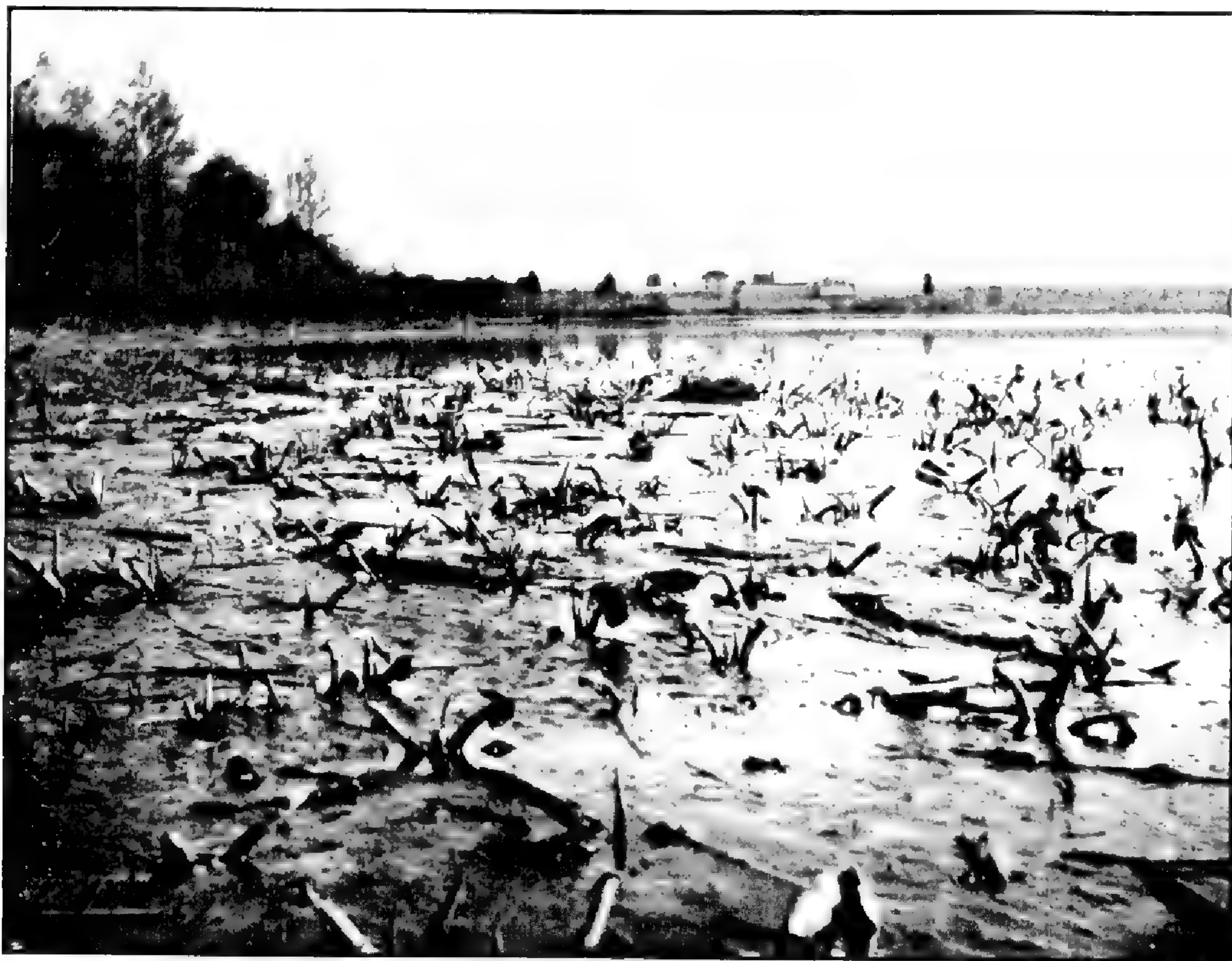
DESCRIPTION.

Leaves erect, usually borne above the surface of the water, occasionally floating in deep water; blades ovate to rounded oblong or oval, rather thick and firm, oil green, glabrous, 16 to 33 cm. long and 14 to 25 cm. broad, usually very broadly rounded at the apex; sinus 4.5 to 10 cm. deep, open, the lobes usually diverging at an angle of about 80°; lobes mostly triangular, often acutish; peduncles stout, glabrous; petioles stout, subterete, glabrous; flowers depressed-globose, 30 to 40 mm. in diameter, about 23 mm. high when normally spread, the perianth when spread measuring about 80 mm.; sepals usually 6, the 3 outer broadly ovate, about 35 mm. long and 25 mm. wide, obtuse, the three inner suborbicular, about 35 mm. long and 45 mm. wide,





NYPHAEA ADVENA AIT., IN MONTEERS POND, KNOX COUNTY, INDIANA.



A. EARLIER VERNAL STAGE OF NYMPHAEA ADVENA AIT., FOUR MILE RUN, VIRGINIA.



B. LATER VERNAL STAGE OF NYMPHAEA ADVENA AIT., FOUR MILE RUN, VIRGINIA.

their bases abruptly narrowed to a short claw about 6 mm. wide, truncate or retuse at the apex; petals about 20, cuneate-oblong, 8 mm. long and 3 to 5 mm. wide, truncate or retuse at the apex; stamens usually in 7 rows, varying from 5 to 8, about 35 to the row; filaments cuneate-linear, 10 mm. long, 2 mm. broad at the tip; anthers a little more than half as long as the stamen; outer sepals rich oil green outside, lighter within and occasionally but rarely tinged with red; inner sepals clear yellow throughout except at the tips, there tinged with green, the inner side occasionally tinged with purplish red;<sup>1</sup> petals yellow like the inner sepals, usually tinged with red; filaments dull red except the exposed tip, this yellow; anthers and pollen yellow; stamens occasionally clear yellow throughout, all becoming dull red throughout in age; fruit subglobose, about 40 mm. high and 50 mm. in diameter (the height usually less than the diameter, but this character not constant), with conspicuous longitudinal ribs extending its entire length; stigmatic disk orbicular, entire, faintly undulate, strongly concave; stigma rays distinct, varying in number from 9 to 23, but usually 15, 16, 17, or 18, 7 to 8 mm. in length and about .75 mm. wide, extending to within about 2 mm. of the edge of the disk, without a median furrow; capsule oil green, the stigmatic region abruptly lighter and more yellowish; seeds elliptical or obovate, slightly flattened laterally, with a prominent raphe, 6 mm. long, greater diameter 5 mm., lesser diameter 4 mm. (PLATES 35, C, facing p. 72; 36, E, facing p. 73; 39, 40. FIGURES 14, 15, 16, b.)

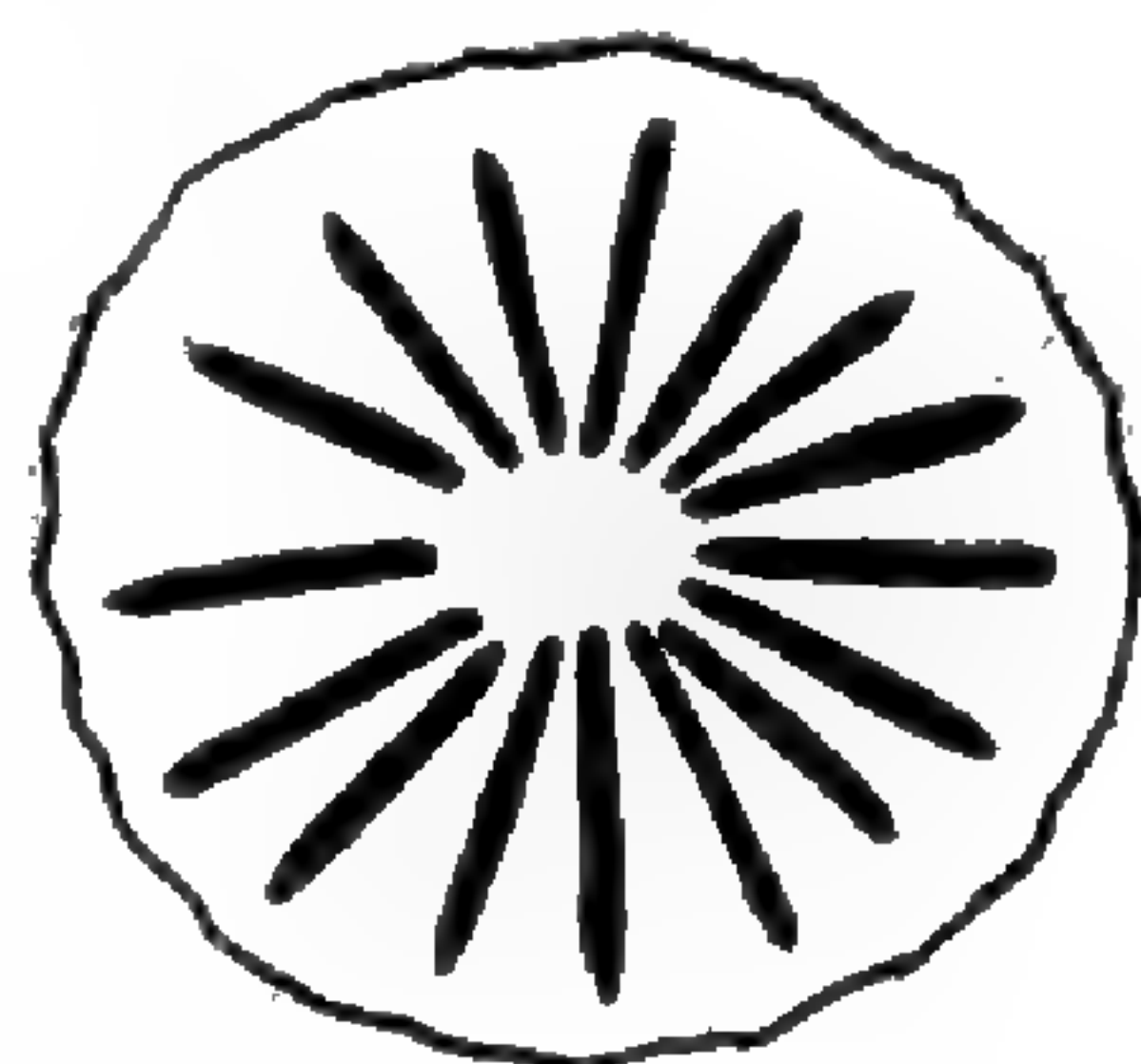


FIG. 15.—Stigmatic pattern of *Nymphaea advena*. Natural size.

EXPLANATION OF PLATES 39, 40.—Pl. 39, *Nymphaea advena*, at Monteurs Pond, Indiana, photographed by Mr. Robert Ridgway. Pl. 40, vernal stage of *Nymphaea advena*, at Four Mile Run, Alexandria County, Virginia; photographed by Mr. Gerrit S. Miller, jr., (A) April 20, (B) May 4, 1902.

*Specimens examined:*

In formalin—

NEW YORK: Lake Grove, Long Island, 1901, *A. H. Howell*; Sing Sing, 1901, *E. Acker*; near Croton, 1901, *Van Cortlandt*.

NEW JERSEY: Whale Pond Creek, Monmouth County, 1902, *M. W. Lyon*; Milburn, Essex County, 1902, *Lyon*; arm of Newton Creek, Collingswood, Camden County, 1902, *S. N. Rhoads*; Centerton, 1900, *G. S. Miller*; Haddonfield, 1907, *Rhoads*.

PENNSYLVANIA: Erie, 1906, *S. E. Bacon*; same locality, 1902, *Bacon*; Philadelphia, 1901, *Witmer Stone*; Meadville, 1902, *H. C. Kirkpatrick*.

MARYLAND: Pocomoke City, 1902, *W. P. Hay*; Havre de Grace, 1902, *Shull*.

VIRGINIA: Holmes Run, Fairfax County, 1901, *G. S. Miller*; Luray, 1901, *Lewis Willis*; Clifton, 1901, *Miller*; Four Mile Run, Fairfax County, 1901, *Miller*.

WEST VIRGINIA: Marlinton, 1902, *W. B. Kellerman*.

NORTH CAROLINA: Raleigh, 1901, *Brimley Brothers*; Hendersonville, 1901, *Clayton*.

TEXAS: Fort Clark, 1901; Del Rio, 1901, *Franks*.

OHIO: Buckeye Lake, Licking County, 1902, *W. A. Kellerman*; Cadiz Junction, Harrison County, 1902, *W. A. Kellerman*; Sandusky, 1903, *M. T. Cook*.

INDIANA: Merrillville, 1903, *Shull*; Winona Lake, 1902, *C. A. King*.

ILLINOIS: Mount Carmel, 1901, *Schneck*.

MICHIGAN: Northville, 1901, *U. S. Fish Commission*; Washtenaw County, *J. B. Steere*.

<sup>1</sup> Among 137 flowers collected at Four Mile Run, Virginia, May 18, 1902, there were 16 with purplish-blotched sepals, 121 with red on stamens, and none with red on the disk.

*Specimens examined*—Continued.

## Dry—

- NEW YORK: Ponds near New York, *M. Ruger* (Greene); Dougan Hills, Staten Island, 1890, *Britton* (C.); Valley Stream, Long Island, 1903, *L. T. Hanks* (N. Y.); Van Cortlandt Swamp, 1893, *Pollard*; Catskills, 1903, *Shull*; without locality, 1841, *H. R. Browne*.
- PENNSYLVANIA: Schuylkill River below South Street Bridge, Philadelphia, 1888, *McElwee* 301 (Phila.); Neshonning, Bucks County, 1891, *McElwee* (Phila.); McCalls Ferry, York County, 1904, *Rose & Painter* 8167; Meadville, 1902, *H. C. Kirkpatrick*; Mahoning, Carbon County, 1906, *Krautter*; Conewago Creek, eastern Pennsylvania, 1898, *C. W. Eisenhower* (Mo.); in fluvio Lecha Pennsylvaniae, 1832, *C. J. Moser* (Mo.); York, 1895, *Glatfelter* (Mo.).
- NEW JERSEY: Newton Creek near Collingwood, Camden County, 1902, *S. N. Rhoads*; Milburn, Essex County, 1902, *Lyon*; Springfield, Essex County, near Rahway River, 1902, *Lyon*; Spring Lake near Ocean Grove, 1902, *Lyon*; Lake Hopatcoug, 1890, *Nash* 1004; Belleville, Essex County, 1902, *Lyon*; Delawanna Station below Passaic, 1902, *Lyon*; Clementon, 1902, *Rhoads*; Newark, 1878, *C. H. Harding*; Cedar Swamp, *S. Conrad* (Phila.).
- OHIO: Cincinnati, *R. Buchenau* (Phila.); Chapelle Creek, Florence, 1903, *Moseley*; Salem, Columbiana County, 1903, *H. S. Fawcett*; Cadiz Junction, Harrison County, 1902, *W. A. Kellerman* 3882; near Canton, *Nicholas Riehl* (Mo.); Sandusky Bay, 1902, *J. H. Schuette*; near Salem, 1906, *Fawcett*.
- MICHIGAN: Detroit, 1855, *Bigelow* (Mo.); Coldwater, 1877, *Milligan*; Bloody Run, Detroit, 1866, *Bigelow* (Mo.); Connors Creek, Detroit, 1866, *Bigelow* (Mo.).
- INDIANA: Sanford Lake, Orange Township, Noble County, 1905, *Deam* 301; Lost Lake, Marshall County, 1903, *Paul Bartsch*; Merrillville, 1903, *Shull*; Winona Lake, 1902, *C. A. King*; Lake Maxinkuckee, 1900, *Scovell & Clark* 1261.
- ILLINOIS: Bluffs Lake, 1876, *Eggert*; north end of Clover Lake, 1888, *J. W. Davie* (N. Y.); DuPage River near Naperville, 1897, *Umbach*; near Woodlawn, Washington County, 1898, *Eggert* (Mo.); Iuka, 1904, *Jensen* (Mo.); lakes in the American Bottom opposite St. Louis, 1838, *Engelmann* 771 (Mo.).
- MISSOURI: Near Poplar Bluff, 1893, *Eggert* (Mo.); St. Francois River, Dunklin County, 1897, *Trelease* 13 (Mo.); Carterville, 1906, *E. J. Palmer* 888; Barton County, *Broadhead Herbarium* (Mo.).
- WISCONSIN: Delavan, 1907, *Ned Hollister*; Green Bay, 1903, *J. H. Schuette*.
- NEBRASKA: Wiegand, 1893, *Fred Clements* 2686.
- KANSAS: Chautauqua County, 1896, *Hitchcock* 607.
- KENTUCKY: Bear Creek, Edmonson County, 1901, *Miss Price*.
- DISTRICT OF COLUMBIA: Eastern Branch, 1873, *Ward* 30; without locality, 1869, *H. Brummell*; without locality, 1885, *McCarthy*; Jackson City, 1897, *Steele*; Washington, 1878, *Chickering* (Mo.).
- MARYLAND: Patuxent, Anne Arundel County, 1905, *House*; Ardwick, Prince George County, 1903, *Lyon*; 9 miles southeast of Pocomoke City, 1902, *W. P. Hay*.
- VIRGINIA: Ashland, *De Chalmot*; Alexandria, 1874, *George Vasey*; Ocean View, Norfolk County, 1898, *Kearney* 1464; Dismal Swamp, 1898, *Kearney* 1611; Great Falls, 1902, *A. H. Howell*; Passage Creek, Warren County, 1897, *G. S. Miller*; Washington Canal near Duke, Dismal Swamp, 1893, *Boettcher*.
- NORTH CAROLINA: Swamps near Hendersonville, 1897, *Biltmore Herbarium* 4231a.
- TEXAS: Devils River, *Mexican Boundary Survey*; Fort Clark, Kinney County, 1893, *Mearns* 1365.
- MEXICO: Tamesin River, Alta Mira, Tamaulipas, 1898, *Goldman* 95.

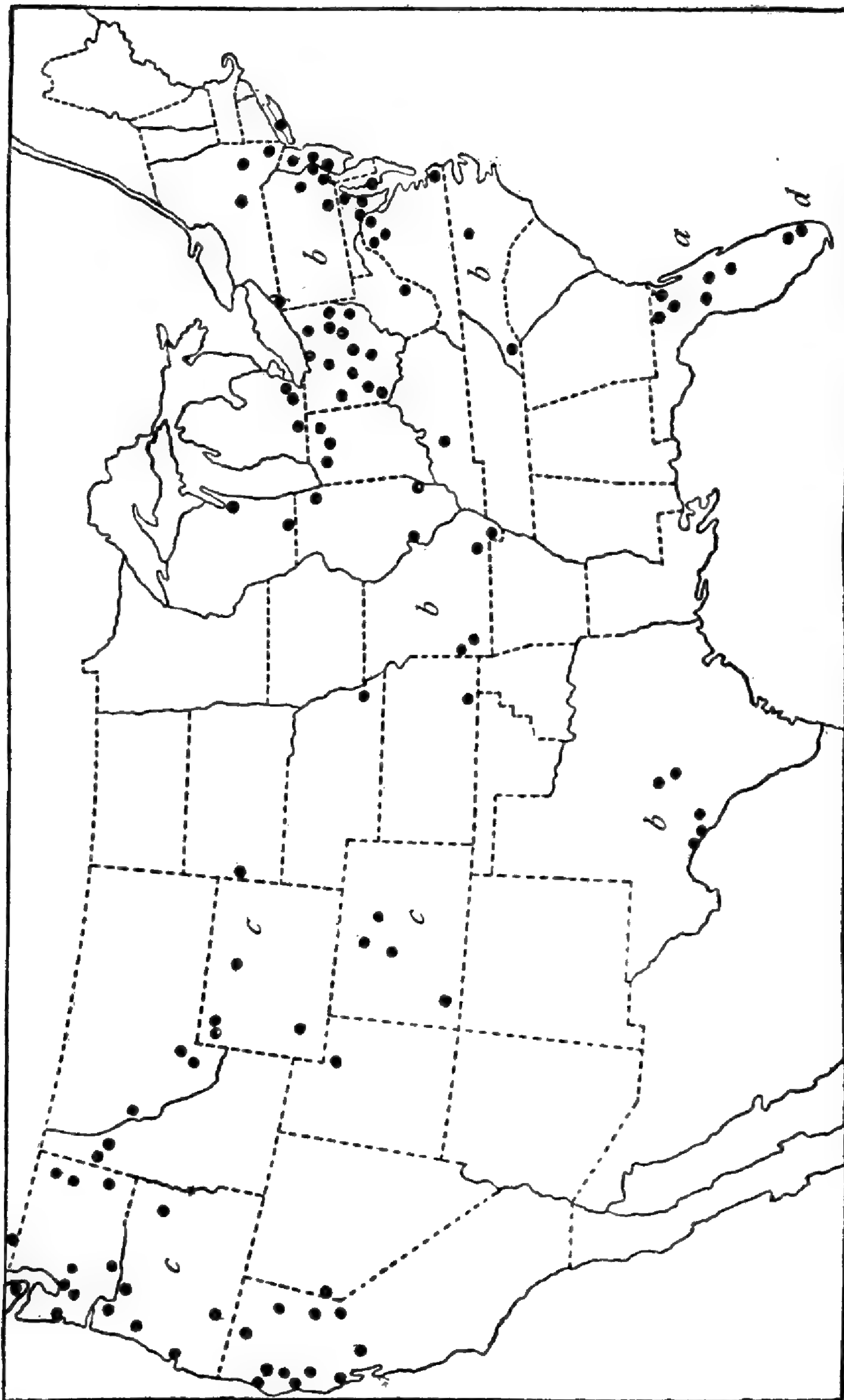


FIG. 16.—Map showing distribution of (a) *Nymphaea advena macrophylla*; (b) *N. advena*; (c) *N. polysepala*; (d) *N. advena erythraea*.

The differences between *Nymphaea advena* and *N. americana* (under the specific name of *variegata*) have been discussed by Miller in the Proceedings of the Biological Society of Washington, but it is worth while to repeat them here. The most striking difference existing between the two is found in the shape of the petioles. In *N. advena* these are subterete; in *americana* they are conspicuously flattened and there is a median ridge, a continuation of the midrib, running along the dorsal surface. This difference in petiole structure has an important effect upon the leaf habit of the two species. When the leaves of *advena* first appear in the spring the petioles are comparatively weak and the blades are often found floating upon the water; sometimes, however, when the plants are growing in mud or in very shallow water, especially when subjected to the action of tides, the blades are erect from the first. Almost invariably in the typical form, as the leaves become older the blades are held stiffly erect. In *americana* the weakness of the petioles, due to their flattening, makes it impossible for the blades to be held erect, hence they are always floating, or, if the water in which they are growing is lowered, they lie flat upon the mud. As a consequence of this difference in habit, *americana*, driven away from very shallow water probably by injury following its drying up, is usually found in comparatively deep water; while *advena*, able to live in ground which is even moderately moist, clings to the shores, or even retreats to the moist meadows bordering streams and ponds.

Habit is not the only respect in which the two plants differ. The outline of the leaf blades is so striking that it is almost always possible to separate the two plants certainly from herbarium material. In *advena* the lobes of the leaves are always pointed while in *americana* they are broadly rounded. The flowers, too, show apparently constant differences. Those of the latter species are usually somewhat larger. In addition to this the flowers of *americana* have the inner surface of the sepals blotched with red near the base, while in *advena* the corresponding region is normally shaded with green, and only in rare instances tinged with red.

The fruit of *americana* is smaller, less strongly ribbed, and is usually tinged with red, while that of *advena* is uniformly green throughout. In the former the most common number of stigma rays is 12 while in the other species it is 16.

The ranges of the two plants, as well, are rather clearly marked. *Nymphaea americana* is confined to the northern part of the United States and eastern Canada, extending as far south as Pennsylvania. *Nymphaea advena* is confined to the southern United States, extending northward into New Jersey and southern New York. In the central States we know less of the ranges but all the data accessible indicate that the ranges there are what we would expect from conditions in the east. Thus it will be seen that *americana* is usually restricted to the Boreal and Transition zones while *advena* occurs in the Upper Austral.

The range of *advena* in the extreme Southern States seems rather peculiar. Perhaps it would appear less so if we had fuller material from all parts of the range. The species is most common from eastern Pennsylvania south through Maryland and Virginia to northern Florida. We have seen no true *advena* from any of the Gulf States west of Florida. The plant has been reported from most of these States, but such material as we have seen is referable to species here described for the first time. In fact we are not certain that the plant appears again until we reach the Rio Grande region of western Texas. Here this same species is found in at least two localities. Fresh material which we have secured offers no means of separating this extreme western plant from the form so common in Pennsylvania and Virginia. Farther south, in Mexico, a plant is found which is apparently the same, though the dried material that we have seen shows that the leaves of the Mexican plant are more acute than those of the typical form.

Still farther west the plant has been reported again, this time in California. We have seen only dried material from that State, hence can not be sure as to its identity. It is probable that it is merely an abnormal form of *Nymphaea polysepala*.

In the National Herbarium there is an interesting specimen collected at Lake Ellis, North Carolina, July 3, 1908, *W. H. Brown* 72. The leaf blades are 11 to 17 cm. long and only 6.5 to 10 cm. wide; in outline they are lance-ovate and very acute at the apex; the sinus is very narrow or closed; flowers 35 mm. in diameter. Unfortunately the material is too scanty to show whether the form is anything more than an individual variation.

Torrey and Gray's subspecies *tomentosum* was based upon a specimen collected by Thomas Nuttall in the vicinity of Philadelphia and labeled by him *Nuphar tomentosum*. We have examined this specimen in the herbarium of the Philadelphia Academy of Science.

The "pubescence" consists merely of algæ or some similar low organisms which cover the lower surfaces of the leaves and the petioles. At present a part of the surface has become completely glabrous, owing to the falling away of the artificial covering. This same phenomenon we have observed in other herbarium specimens. In the National Herbarium is a specimen of some cultivated *Castalia*, which at first glance appears to have coarsely dentate leaves. On closer inspection it is seen that the teeth are masses of algæ which have adhered to the edge of the blade.

**5a. *Nymphaea advena macrophylla* (Small)  
Miller & Standley.**

*Nymphaea macrophylla*  
Small, Bull. Torrey Club  
25: 465. 1898.

**TYPE LOCALITY:** The type, in the herbarium of Columbia College, was collected in August, 1894, in the vicinity of Eustis, Lake County, Florida, by Geo. V. Nash (no. 1751).

**DISTRIBUTION:** Northeastern Florida.

**DESCRIPTION.**

Habit of leaves as in *N. advena*; blades 28 to 40 cm. long and 20 to 27 cm. wide, glabrous, ovate, acute or at least acutish, with a V-shaped sinus 8 to 13 cm. deep, the lobes triangular, acutish; no submersed leaves known; flowers depressed-globose, 32

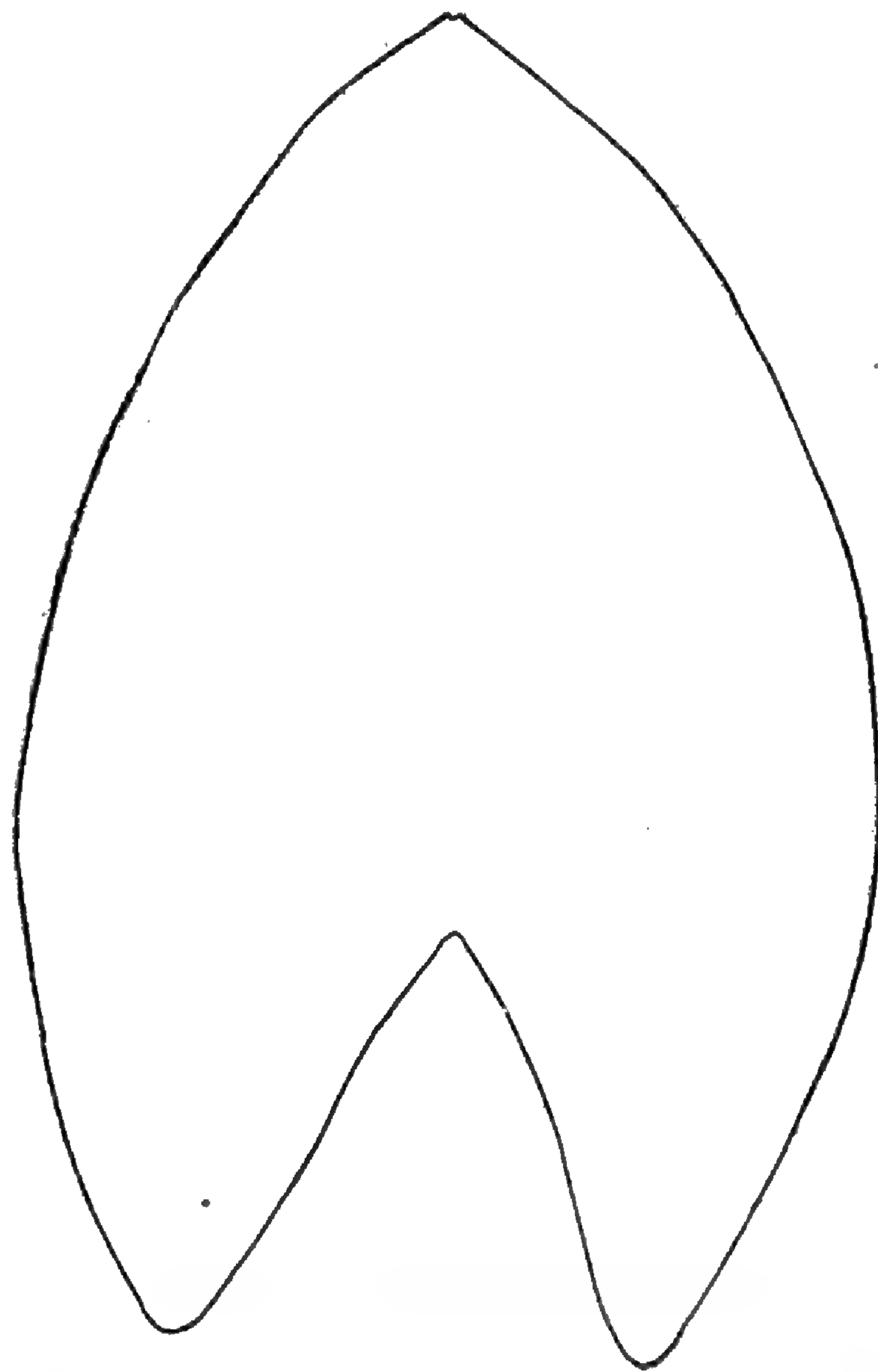


FIG. 17.—Leaf outline of *Nymphaea advena macrophylla*. Scale  $\frac{1}{2}$ .

to 38 mm. in diameter, about 22 mm. high; sepals 6, glabrous; the outer ones obovate, rounded, somewhat narrowed at the base, about 32 mm. long and 20 mm. wide; inner sepals thinner, deltoid-obovate, retuse; petals broadly cuneate, 10 mm. long, truncate or retuse; stamens in 6 rows, their anthers almost twice as long as the filaments; color of sepals as in *N. advena*; disk when young of the same color as the sepals; stamens lemon yellow; petals a slightly lighter yellow throughout; fruit narrowly ovoid, 35 mm. high and 25 mm. in diameter in the largest specimens, only slightly constricted above, coarsely ribbed above but almost smooth at the base; stigmatic disk orbicular, 20 mm. in diameter, depressed about 4 mm. in the center, its edge entire or slightly undulate; stigma rays linear, distinct, unequal, with slight traces of a median groove, 6 mm. long, extending to within 2 mm. of the edge of the disk, 10 to 15 in number, usually 12 or 14; body of fruit apple green, the disk chrome yellow. (PLATE 36, F, facing p. 73. FIGURES 16, a, 17.)

*Specimens examined:*

In formalin—

FLORIDA: Santa Fe River, southern edge of Columbia County, 1902, *T. Wayland Vaughan*; Dade City, *H. S. Fawcett*; Whitfield, 1903, *W. E. C. Todd*; Jacksonville, 1901, *Curtiss*; Kissimmee River, 1901, *Mearns*.

Dry—

FLORIDA: Vicinity of Eustis, type; in the Everglades near the unfinished railroad grade between Cocoanut Grove and Cutter, 1903, *Small & Carter* 665 (N. Y.); vicinity of Eustis, 1894, *Hitchcock*; Kissimmee River, 1874, *E. Palmer* 7; Alligator Lake near Lake City, 1907, *H. S. Fawcett*; Jacksonville, 1901, *Curtiss* 6844; Jacksonville, 1894, *Curtiss* 4684; Southport Canal, Kissimmee Valley, *Mearns*; North Santee, 1837, *G. Maurigault* (N. Y.).

CUBA: Without locality, 1860-64, *Wright* 1858 (Gray); Provincia de Pinar del Rio, 1904, *Earle & Wilson* 1656 (N. Y.); San Cristobal, 1905, *M. T. Cook* 130; Herradura, 1905, *M. T. Cook* 132; without locality, 1906, *M. T. Cook* 1, 6 (N. Y.).

Dr. J. K. Small in the original description of this plant compares it with so-called *Nymphaea advena*, pointing out numerous differences. The plant with which it was compared was not *advena* but the northern *Nymphaea americana*. In the herbarium of the New York Botanical Garden at that time there were practically no specimens of *N. advena*, nearly all of those so labeled being *americana*. Evidently the Florida plant is amply distinct from the latter. The description of *Nymphaea advena* in Doctor Small's Flora of the Southeastern United States applies to *N. americana* and the key separates *americana* (under the name *advena*) from *advena* (under the name *macrophylla*). It can readily be seen by examination of the key that the characters used for separating the two species will not hold for separating true *advena* from the Florida plant.

The material at our command, and it seems to be ample, does not warrant us in maintaining *macrophylla* as a separate species. The only difference that we can see lies in the larger size of the Florida plant and the longer, more acute, thicker leaves whose lobes are rather narrower.<sup>1</sup>

It is not certain whether the Cuban specimens belong here. The leaf outline seems to be the same. Fresh material collected in 1910 in the vicinity of Havana by Brother León shows that the outer edge of the stigmatic disk is tinged with a dull purplish red. This color does not extend to the interior of the crater and is very different from the bright geranium red of the following subspecies.

<sup>1</sup> Under the provisions of the American Code we would be justified in substituting a new name for the somewhat inappropriate *macrophylla*.—G. S. M.



**5b. *Nymphaea advena erythraea* Miller & Standley, subsp. nov.**

Type in the U. S. National Herbarium, in formalin, collected at Miami, Florida, by Mr. E. A. Brewer, April 17, 1902.

DISTRIBUTION: Southern Florida.

This appears to differ in no way from typical *macrophylla* except in having the disk of the fruit of a bright geranium red. Our material consists of plants preserved in formalin, collected by E. A. Brewer near Miami, April 17, 1902. Probably the same, although it is impossible to tell from material which has faded in drying, are specimens collected by J. H. Simpson in the Miami River, March 7, 1892 (no. 555). It is possible that some of the specimens listed under *macrophylla* belong here, but we are unable to tell from dried material. (FIGURE 16, *d.*)

**6. *Nymphaea ozarkana* Miller & Standley, sp. nov.**

Type in the U. S. National Herbarium, no. 615581, collected by Mr. Otto M. Smith in southern Missouri along White River, in August, 1910. The material was received fresh. Additional material is mounted on sheet no. 615582.

DISTRIBUTION: Ozark region of southern Missouri, probably also in northern Arkansas.

## DESCRIPTION.

Rootstock slender; leaf blades apparently floating in most cases but sometimes erect; petioles terete, glabrous, 3 to 11 mm. in diameter; leaves orbicular to oblong, bright yellowish green, glabrous and smooth, 12 to 20 cm. long and 7 to 19 cm. wide, or even larger, those of average size measuring about 14 by 12 cm., broadly rounded at the apex, the sinus about one-third the length of the blade, open, triangular, the lobes deltoid-orbicular or semiorbicular, rounded; peduncles stout, glabrous; flowers depressed-globose, 30 mm. in diameter or less; sepals thin, glabrous, pale green, often yellowish toward the tips, the inner thinner and sulphur yellow,

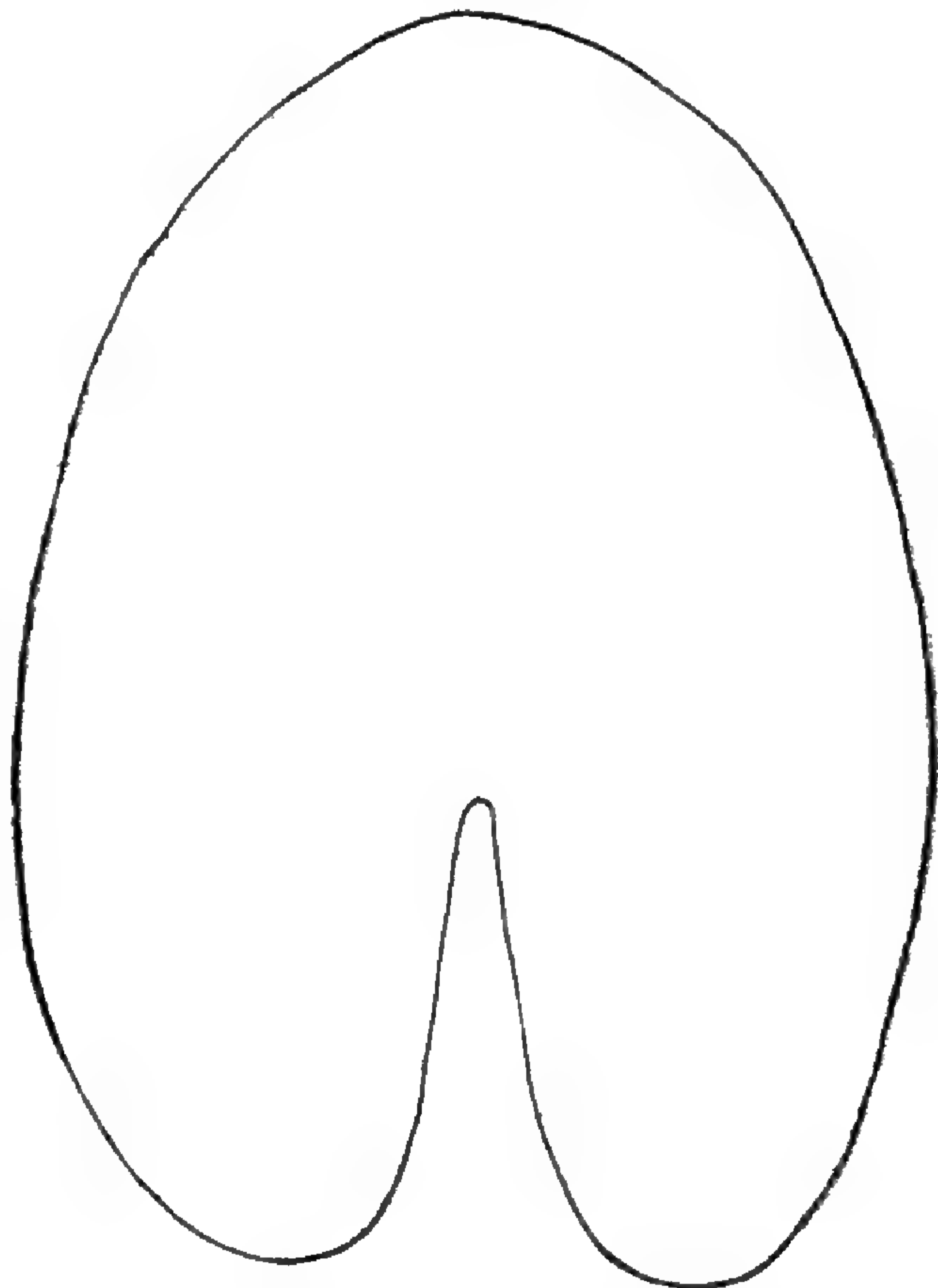


FIG. 18.—Leaf outline of *Nymphaea ozarkana*. Scale  $\frac{1}{2}$ .

all red within or at least tinged with red; stamens in about 5 rows, the anthers longer than the filaments; stigma rays 10 to 12, broadly linear, distinct, extending to within 1.5 mm. of the edge of the disk; fruit subspherical, abruptly constricted above, 15 to 25 mm. high and 14 to 20 mm. in diameter, smooth; disk 8 to 12 mm. in diameter, slightly depressed, the edges vertical; seeds few, 15 to 30, large, 5 mm. long and 3.5 mm. in the greatest diameter, ovoid, scarcely pointed, with a rather obtuse and conspicuous raphe, pale brown, shining; body of fruit bright yellowish green, the stigmatic disk strongly tinged with orange red. (PLATE 36, G, facing p. 73. FIGURES 13, *a*, 18.)

*Additional specimens examined:*

MISSOURI: Swan, Taney County, 1897, *Trelease* 14; Little Black River near Pleasant Grove, 1897, *Mackenzie* 370; Swan Creek near Swan, 1899, *Bush* 749; Shannon County, September 16, 1888, *Bush*; Ironton, Iron County, September, 1897, *Colton Russell*; Current River, Carter County, 1897, *Trelease* 12; Mineral Point, Washington County, May 29, 1892, *Eggert*; Greene County, June 2, 1888, *Blankinship*.

All of the specimens listed above, with the exception of the type, are in the herbarium of the Missouri Botanical Garden. We have seen no material elsewhere, chiefly for the reason that so few plants from southern Missouri are to be found in eastern herbaria.

The plant appears to be not uncommon in the Ozark region. All our specimens are Missourian, but the range of the species must extend south into Arkansas. We have seen the plant growing abundantly in the James River south of Springfield, and in the same stream farther south in Christian County. Mr. B. F. Bush has also written us concerning its occurrence in the region.

Most of the specimens cited were labeled in the herbarium as *N. hybrida*, evidently because of the characteristic color of the fruit. There seems to be no very close relationship between the two species, that of the Ozarks being more closely connected with *N. advena* and *N. americana*. From the former it differs in the coloring of the flowers and fruit and in the shorter leaves more rounded and obtuse at the apex; from the second of these species it differs in the terete petioles and the open sinuses of the leaves. With both it disagrees decidedly in the small number of seeds, this being one of the most striking characteristics of our plant.

### 7. *Nymphaea ludoviciana* Miller & Standley, sp. nov.

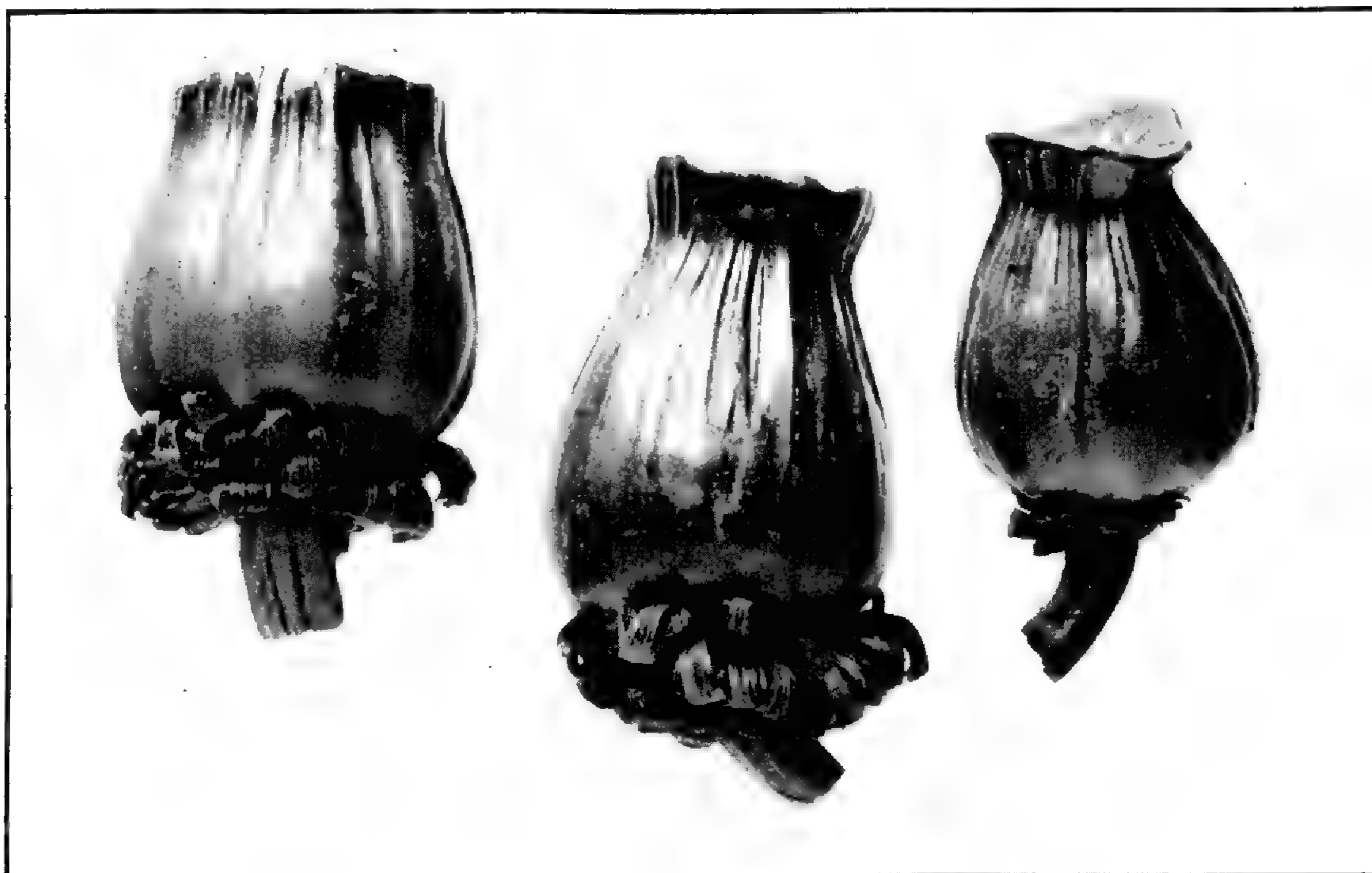
Type in the U. S. National Herbarium, no. 441413; also material preserved in formalin, collected by R. S. Cocks, early in April, 1903, "in stagnant ponds, dug out in making the railroad track, two miles from a place known as North Shore on Lake Ponchartrain, about 27 miles from New Orleans," Louisiana. In the National Herbarium other dried material of this collection is mounted on sheets 441410 to 441414 inclusive.

DISTRIBUTION: Southern Louisiana, near the coast.

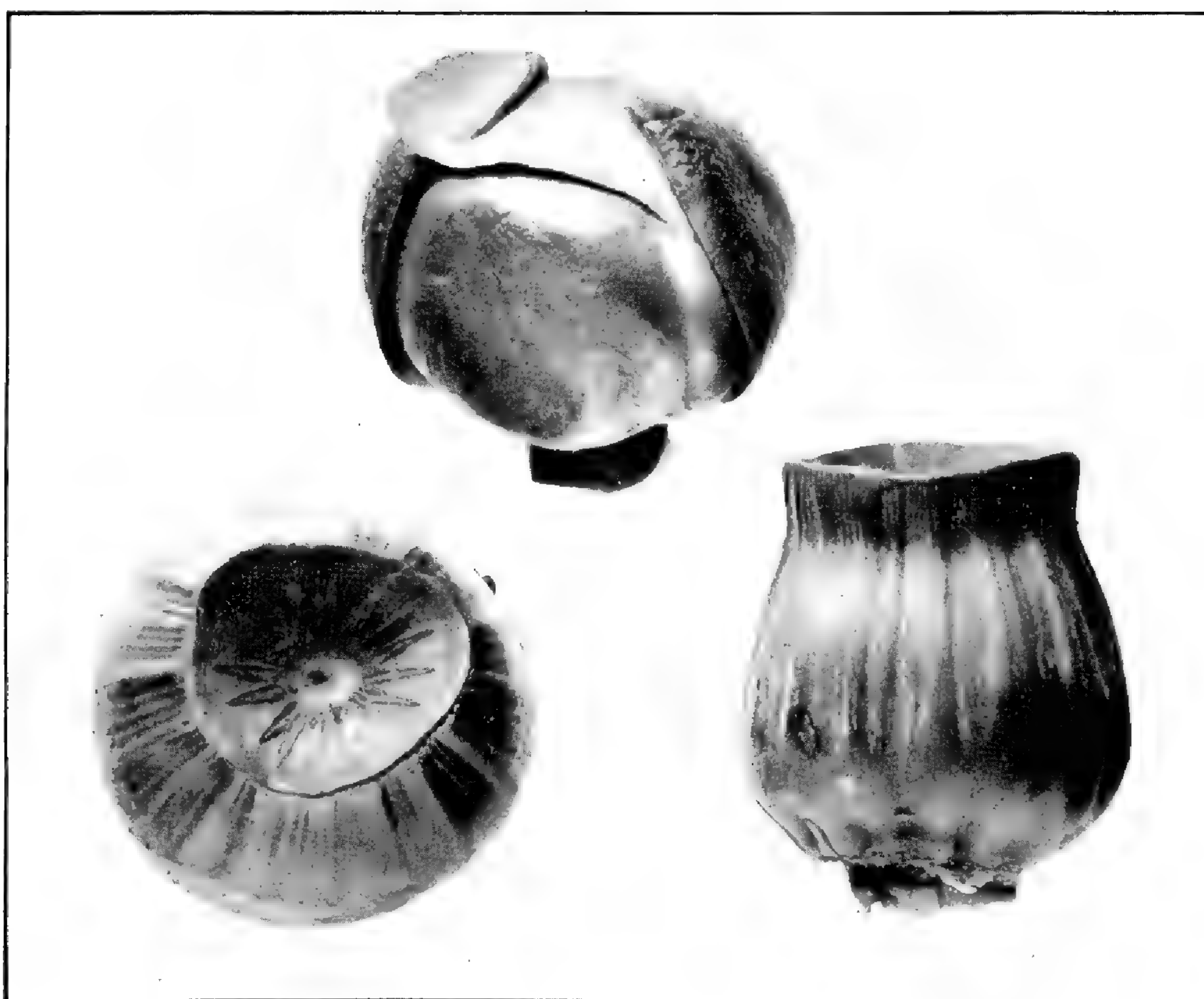
#### DESCRIPTION.

Leaf blades floating, oblong-ovate, somewhat narrowed towards the apex, rather thin, 29 to 38 cm. long and 20 to 27 cm. wide, widest about the middle; sinuses closed, 9 to 12 cm. deep; lobes rounded, slightly overlapping; blades glabrous throughout like the petioles, the lateral veins 23 to 25 on each side, about parallel for three-fifths their length, then branching dichotomously; petioles and peduncles subterete; flowers depressed-globose, 30 to 35 mm. in diameter, the sepals when spread measuring about 65 mm.; outer sepals oblong or obovate, 25 to 32 mm. long, rounded, somewhat narrowed to the base; inner sepals orbicular to obovate, narrowed at the base into a short claw, slightly longer than the outer ones and thinner; stamens in about 5 rows, the anthers 2 to 3 times as long as the filaments; no mature fruit with the type material but the immature capsules ovoid, 20 mm. high and 25 mm. in diameter, rather conspicuously ribbed; stigmatic disk strongly depressed, oval or almost orbicular, 16 mm. in diameter; stigma rays 13 to 19, usually 17, extending to within 1.5 mm. of the edge of the disk, about 1.3 mm. wide, usually confluent at the base; edge of the disk shallowly crenate; color of sepals rather dark chrome yellow at the apex, becoming green below; petals deep chrome yellow growing paler towards the base; anthers maize yellow, the filaments pale cream; disk deep chrome with its rays light purplish brown. (PLATE 41, B. FIGURES 7, c, 19, 20.)

EXPLANATION OF PLATE 41.—A. Fruit of *Nymphaea microcarpa*. B. Fruit and unopened flower of *Nymphaea ludoviciana*. Both natural size.



A. FRUIT OF *NYMPHAEA MICROCARPA* MILLER & STANDLEY.



B. FRUIT AND UNOPENED FLOWER OF *NYMPHAEA LUDOVICIANA* MILLER & STANDLEY.

Mr. Andrew Allison, on June 28, 1904, collected in Lake Charles, Louisiana, mature fruit that undoubtedly belongs to this species; its description is as follows:

Subglobose, abruptly constricted above, 35 to 40 mm. high and of the same diameter, smooth at the base, rather conspicuously ribbed above; edge of the disk 5 or 6 mm. high, diverging; disk usually oval, its center mostly umbonate, depressed 6 or 7 mm.; stigma rays linear, or widened at the base, usually slightly confluent at the base, with a distinct median groove; seeds about 4 mm. long and 3 mm. in diameter, the raphe only acutish and not conspicuous.

*Additional specimens examined:*

Dry—

In bayou, Vermilion, Lafayette County, May 27, 1883, *Langlois* (Greene); near Lake Charles, July 10, 1893, *Langlois* (Greene); vicinity of Lake Charles, 1904, *Andrew Allison* 219 and 323.

The collector writes further: "The plants can nearly always be found in the ponds or very slow-flowing streams of the pine barrens. The leaves are always floating on the surface with stems sometimes a foot or two long. The plant can be found blooming from March to December."

Not all the material from the vicinity of New Orleans belongs to this species, as noted elsewhere.

In the National Herbarium there are two sheets of a *Nymphaea* collected at the south end of Long Pond, Lowndes County, Georgia, September 4, 1902, *Harper* 1611. These specimens represent a plant resembling *N. ludoviciana*, and possibly identical with it. The leaves are floating, the sinuses closed, and their outlines similar to those of this species. Unfortunately Mr. Harper was unable to secure fresh material.

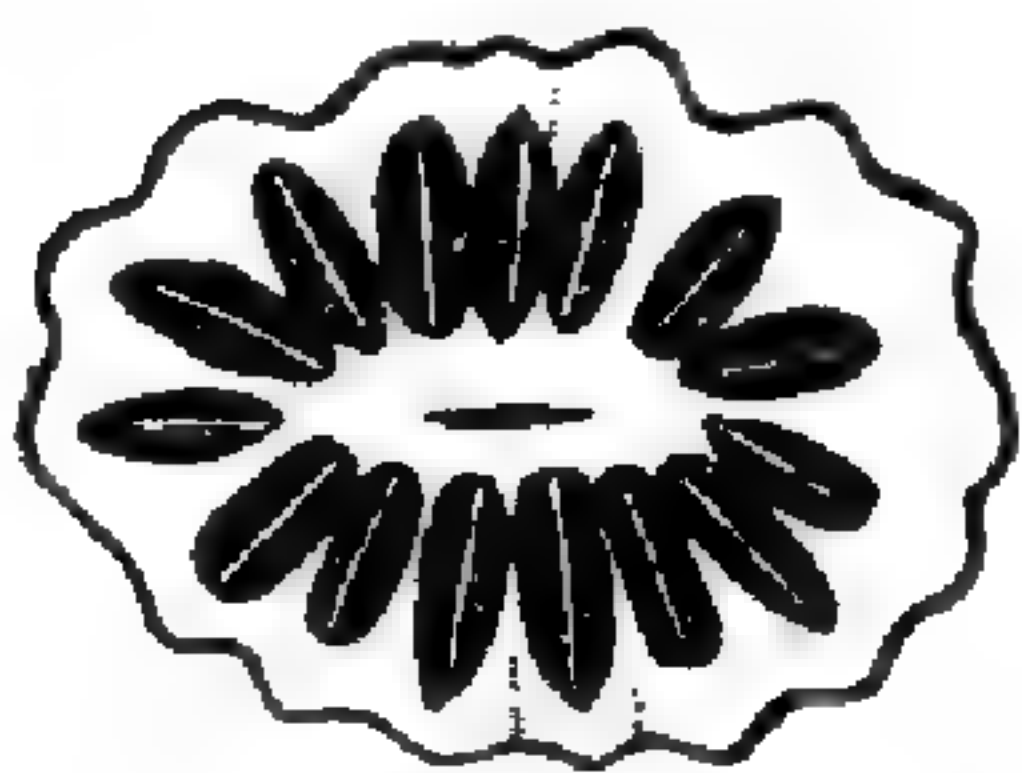


FIG. 20.—Stigmatic pattern of *Nymphaea ludoviciana*. Natural size.

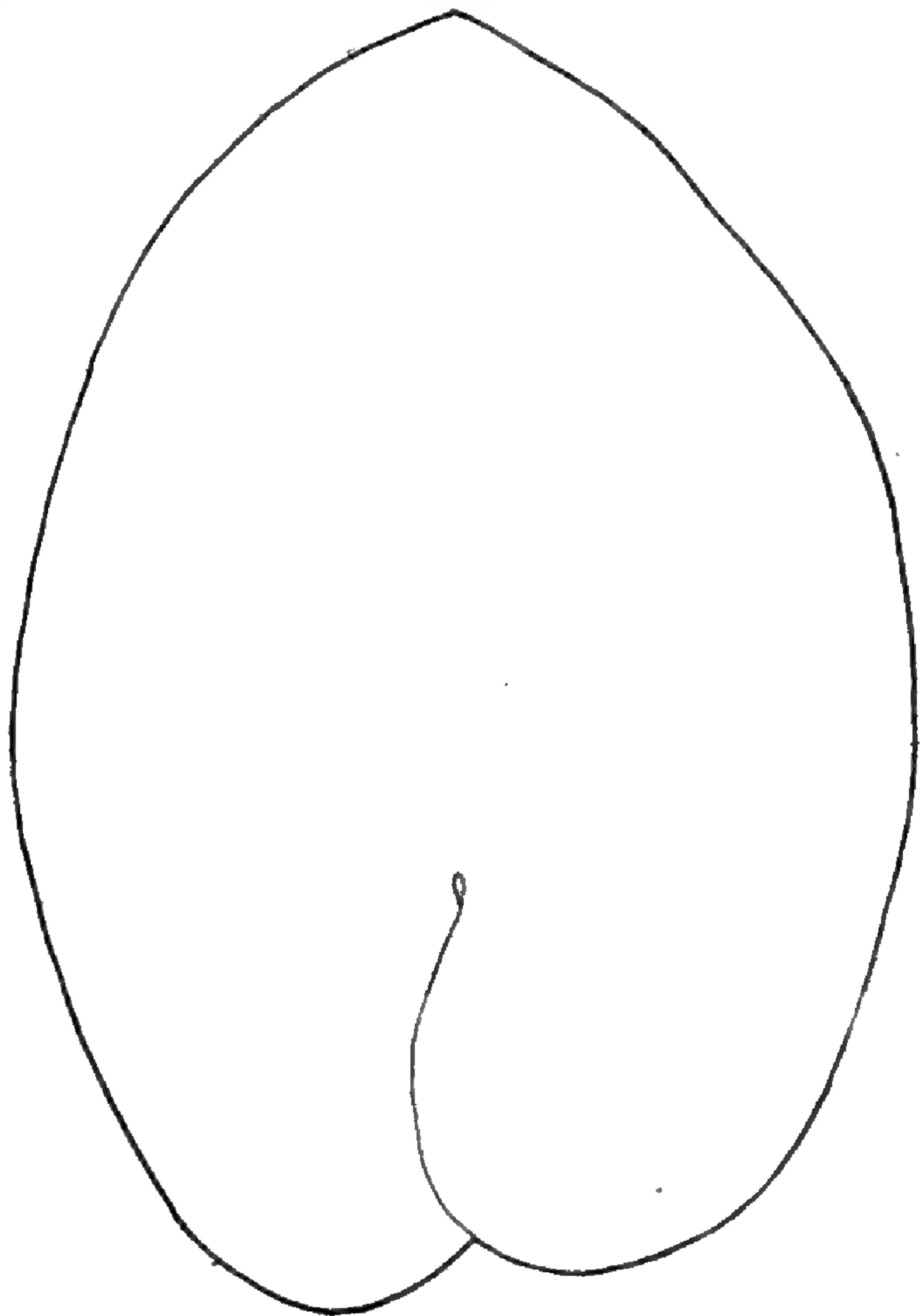


FIG. 19.—Leaf outline of *Nymphaea ludoviciana*. Scale  $\frac{1}{2}$ .

### 8. *Nymphaea fluviatilis* Harper.

*Nymphaea fluviatilis* Harper, Bull. Torrey Club 33: 234. 1906.

TYPE LOCALITY: "In sloughs of the Canoochee River near Groveland, in the north-western corner of Bryan County," Georgia.

DISTRIBUTION: Coastal plain of Georgia, perhaps also in northern Florida.

## DESCRIPTION.

Floating leaves thin, glabrous, 18 to 25 cm. long and 16 to 22 cm. wide, almost orbicular in outline or broadly rounded-oblong, rounded and slightly emarginate at the apex; sinuses 5 to 8 cm. deep,

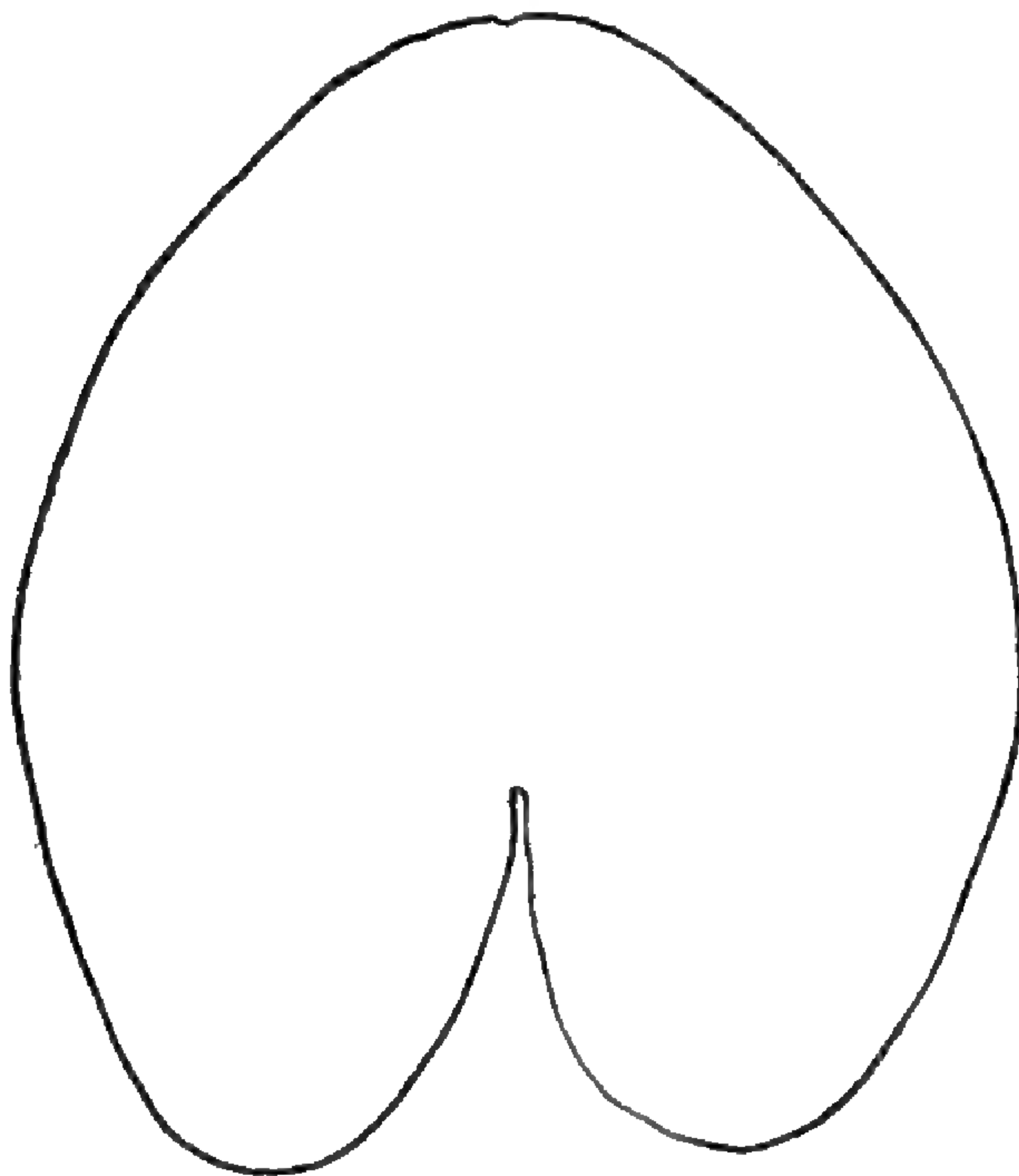


FIG. 21.—Leaf outline of *Nymphaea fluviatilis*. Scale  $\frac{1}{2}$ .

narrow; lobes rounded; submersed leaves very thin and delicate, crisped, similar in outline to the floating ones, 9 to 19 cm. long and 10 to 12 cm. wide; rootstock comparatively small and slender, about 3 cm. in diameter in the specimens examined, the leaf scars oval, about 10 mm. long and 7 mm. wide; flowers depressed-globose, about 25 mm. in diameter and 50 mm. when spread; sepals glabrous, very thin, the outer oblong, 16 to 18 mm. long and 15 or 16 mm. wide, obtuse, very slightly narrowed at the base; inner sepals obovate, slightly longer than the outer, rounded at the apex, narrowed at the base into a claw about 8 or 10 mm. wide and 6 or 7 mm. long; stamens in usually 4 rows; no mature fruit seen, but the im-

mature ovoid, the stigma rays about 12, broadly linear, with a distinct median line, extending almost to the edge of the disk; center of the crater smooth. (FIGURES 10, b, 21, 22.)

*Specimens examined:*

In formalin—

GEORGIA: Rather scanty material from the Canoochee River near Groveland, June 22, 1903, *Harper*.

Dry—

GEORGIA: In Canoochee River near Groveland, June 22, 1903, *Harper* 1849 (type collection); Savannah, a sheet in the Herbarium of the Missouri Botanical Garden, labeled in Nuttall's handwriting.

With regard to this plant Mr. Harper writes as follows: "*Nymphaea fluviatilis* seems to be quite common in creeks, small rivers, and the swamps of large rivers, but apparently never in ponds, in the coastal plain. I have seen it in the Savannah River swamp in the southeastern corner of Effingham County, in Rocky Comfort Creek near Louisville, in Buckhead Creek near Millen, in the Ogeechee River near Chalker, Millen, Rocky Ford, Dover, and Meldrim, in the Canoochee at the type locality, in the Ohoopce near Ohoopce and Reidsville, in the swamps of the Altamaha near Doctortown and Barrington, in the Oconee swamps near Mount Vernon, in the little Ocmulgee near Lumber City, in Echeconnee Creek near its mouth (on the line between Bibb and Houston Counties), in the Ocmulgee River swamps near Abbeville, in the Withlacoochee near Nashville, and in the Flint River swamps in Crawford County near Everett."

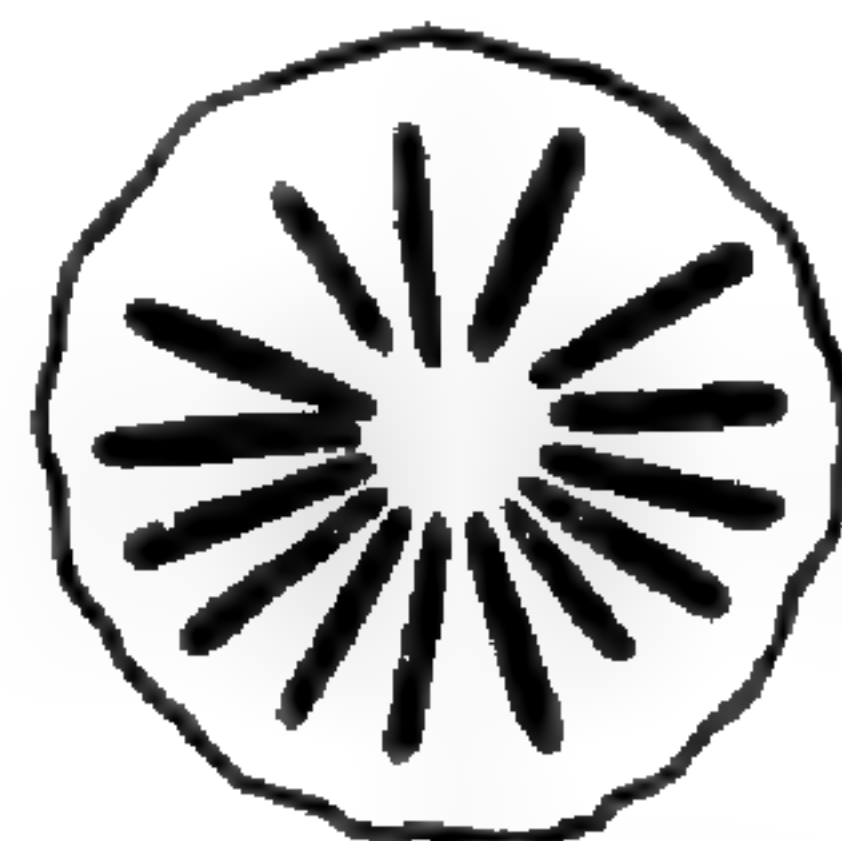


FIG. 22.—Stigmatic pattern of *Nymphaea fluviatilis*. Natural size.

**9. *Nymphaea chartacea* Miller & Standley, sp. nov.**

Type in the U. S. National Herbarium, no. 592491, collected at Mobile, Alabama, June 14, 1885, by Dr. Charles Mohr.

DISTRIBUTION: Mississippi, Alabama, and western Florida, near the Gulf coast.

## DESCRIPTION.

Petioles and peduncles slender, glabrous; floating leaves glabrous, thin, ovate, 14 to 23 cm. long and 8 to 14 cm. wide, conspicuously narrowed at the apex, broadest at or just above the base; sinuses 3.5 to 6 cm. long, very narrow or closed, the lobes somewhat unequally rounded; submersed leaves similar in outline, 15 to 23 cm. long, rounded at the apex, crisped, very thin and delicate; flowers 30 to 35 mm. in diameter; sepals 6, 12 to 20 mm. long, oblong, obtuse; fruit not seen. (FIGURES 13, c, 23.)

In Mohr's Plant Life of Alabama this is listed as *Nymphaea sagittifolia*. The distribution of this species in Alabama is given as the "Central Pine belt to Coast plain. Still-flowing water. Most frequent in the coast region. Tuscaloosa County (E. A. Smith). Montgomery, Mobile, and Baldwin Counties. Flowers lemon yellow. June, July; not rare." Just how many of the plants thus listed belong to our new species it is impossible to tell. Probably most of them belong here. At any rate, none of the plants thus referred to are *N. sagittifolia*. We are reluctant to describe a *Nymphaea* from dried material, but in this case there can be no doubt about the distinctness of the plant. The leaves, while resembling those of *N. ulvacea* and *N. sagittifolia* in texture, are very different in outline. From our studies in this genus we may confidently expect that when fresh material of this plant is secured it will present other marks of distinction.

We have seen the following additional dried material that seems to belong here. The leaves of the Florida specimens are somewhat more obtuse than those from farther west, but they are equally thin; the flowers have the very thin sepals so characteristic of this and *Nymphaea fluviatilis*.

*Additional specimens examined:*

MISSISSIPPI: Biloxi, March 26, 1898, *Tracy* 5012; Ocean Springs, April 5, 1889, *Tracy*; ponds and bayous near the coast, May, 1859, *Hilgard*; Wells Ferry, April 22, 1895, *Skehan*.

FLORIDA: Without locality, *Chapman Herbarium*; Apalachicola, December 6, 1898, *Trelease*.

**10. *Nymphaea sagittifolia* Walt.**

*Nymphaea sagittifolia* Walt. Fl. Carol. 155. 1798.

*Nymphaea longifolia* Michx. Fl. Bor. Amer. 1: 312. 1803.

*Nymphaea sagittata* Pers. Syn. Pl. 2: 63. 1807.

*Nuphar sagittaeifolium* Pursh, Fl. Amer. Sept. 2: 370. 1814.

*Nuphar longifolium* Smith; Rees's Cycl. no. 5. 1819.

*Ropalon sagittatum* Raf. New Fl. N. Amer. 2: 17. 1837.

*Nymphaea hastata* Steud. Nom. Bot. ed. 2. 2: 199. 1841.

*Nymphaea sagittaeifolia* Britt. & Brown. Illustr. Fl. 2: 43. 1897; Small, Fl. Southeast. U. S. 456. 1903, in part; Britton, Man. ed. 2. 407, 1905, in part; Robins. & Fern. in A. Gray, Man. ed. 7. 391. 1908, in part.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: Eastern North and South Carolina.

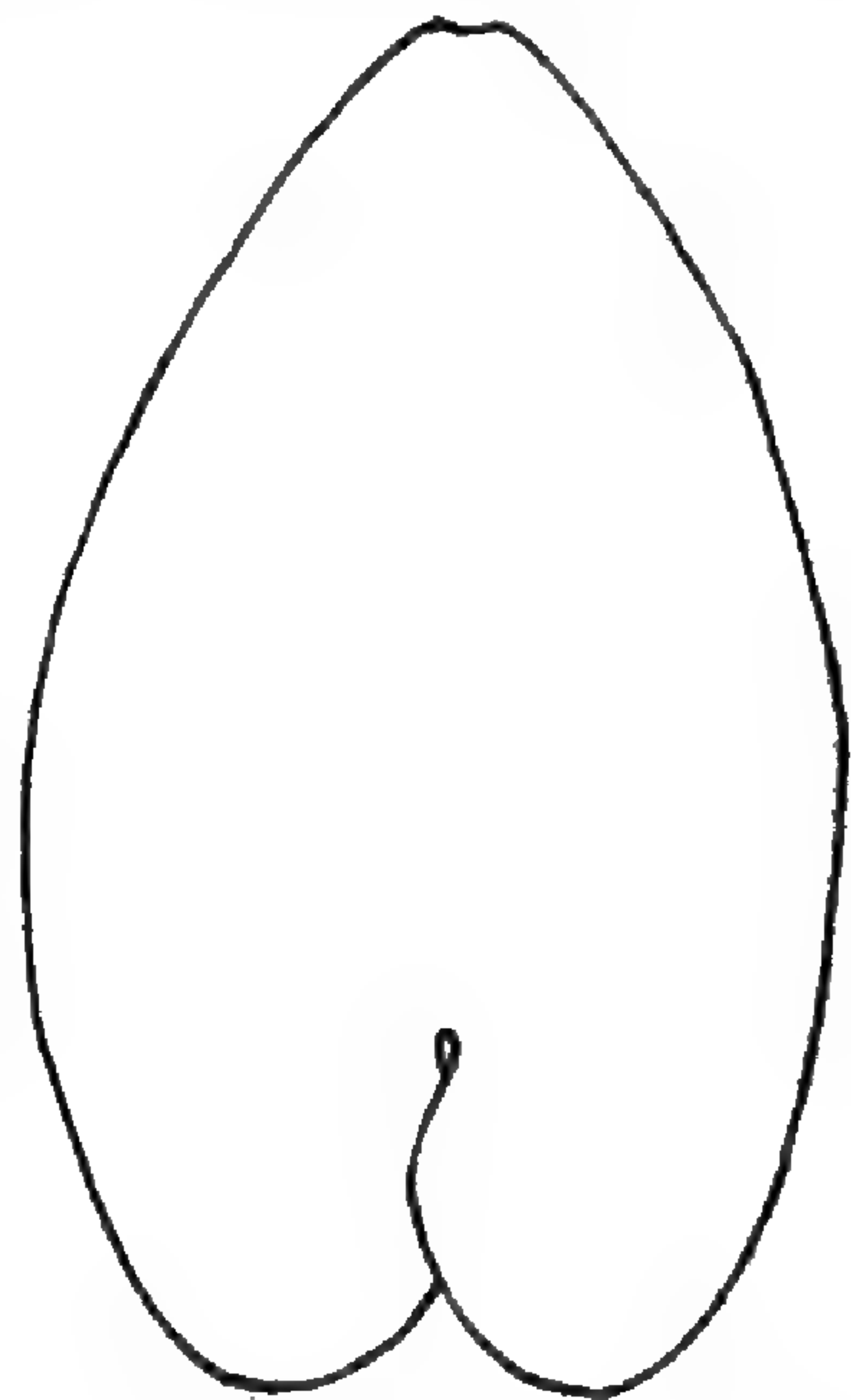


FIG. 23.—Leaf outline of *Nymphaea chartacea*. Scale  $\frac{1}{2}$ .

## DESCRIPTION.

Floating leaves rather thick and leathery, narrowly oblong or usually narrowly oblong-lanceolate, 14 to 28 cm. long and 5 to 10 cm. wide, not conspicuously narrowed at the apex, rounded; sinus 30 to 35 mm. deep, open, V-shaped; submersed leaves well developed, similar in outline to the floating ones but larger, sometimes 36 cm.

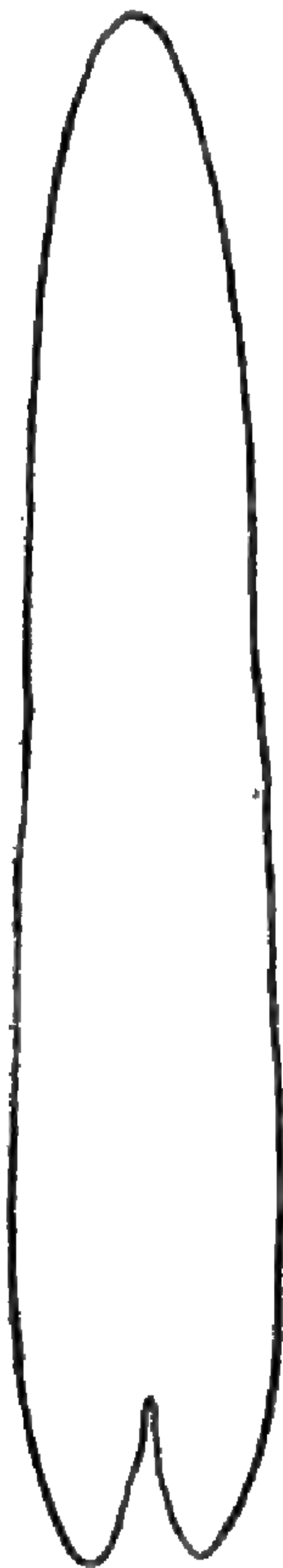


FIG. 24.—Leaf outline of *Nymphaea sagittifolia*. Scale  $\frac{1}{2}$ .

long and only 7 cm. wide, very thin and delicate, crispate, glabrous like the floating ones; petioles slender, glabrous, cylindrical, 8 or 9 mm. in diameter; rootstocks 20 to 25 mm. in diameter, densely leafy; leaf scars narrowly oval to semioval, 6 to 8 mm. long; flowers depressed-globose, 26 to 29 mm. in diameter and 19 to 22 mm. high; sepals 6, glabrous, the outer ones 21 to 26 mm. long and 17 to 20 mm. wide, oblong, slightly narrowed towards the base, thin; the inner sepals of about the same length, orbicular, thin; stamens in 5 or 6 rows, the anthers scarcely if at all longer than the filaments; color of sepals canary yellow, tipped with green; petals and stamens yellow but paler than the sepals; fruit ovoid, 31 to 34 mm. high and 23 to 28 mm. in diameter, considerably constricted above, smooth or almost so below, conspicuously ribbed above; edges of the disk raised 4 or 5 mm., vertical or slightly spreading, orbicular in outline, almost or quite entire, 15 to 17 mm. in diameter, its center depressed about 3 mm., smooth, 3 to 6 mm. in diameter; stigma rays 10 to 14, linear, 4 mm. long, extending to within 2.5 mm. of the edge of the disk, distinct, with no trace of a median groove; color of fruit shining apple green, a little darker towards the top, occasionally darkening to oil green throughout; seeds ovoid, pointed but not sharply so, 4 to 5 mm. long and 3 mm. in diameter, the raphe rather obtuse and not conspicuous. (PLATES 42, A, facing p. 96. 44, A, facing p. 99. FIGURES 7, f, 24, 25.)

EXPLANATION OF PLATE 42.—Seeds of *Nymphaea* spp. (A) *Nymphaea sagittifolia*, (B) *N. ulvacea*, (C) *N. ovata*, (D) *N. puberula*, (E) *N. orbiculata*, (F) *N. bombycina*, (G) *N. polysepala*. All natural size.

*Specimens examined:*

In formalin—

NORTH CAROLINA: Fayetteville, 1902, *Boynton*.

Dried—

NORTH CAROLINA: Fayetteville, 1902, *Boynton*; Wilmington, 1880, *Dr. Thos. F. Wood*; without locality, 1884, *McCarthy*; without locality, 1885, *McCarthy* 9; Northeast River, 1879, *Ilyams* (N. Y.); Cape Fear River, Wilmington, 1855, *Hexamer & Maier* (N. Y.); Fayetteville, 1904, *Biltmore Herbarium* 9657d; Wilmington, *C. S. Williamson* (N. Y.); near Fayetteville in Little River, *Major Le Conte* (Mo.); in the fresh water of Cape Fear River and its bayous under the influence of the tides, 1867, *Canby* (Mo.); Wilmington, *Curtiss* (Mo.).

SOUTH CAROLINA: Georgetown, 1857, *L. R. Gibbes* (N. Y.).

In Mohr's Plant Life of Alabama this species is reported as occurring within that State. The specimens thus referred belong, for the greater part at least, to *Nymphaea chartacea*. In Gray's Manual it is reported as occurring in southern Indiana and Illinois; but the ponds in which the plant grew are now drained, and we have been unable to procure fresh material from the region. It is exceedingly improbable that the species is found outside the States of North and South Carolina.

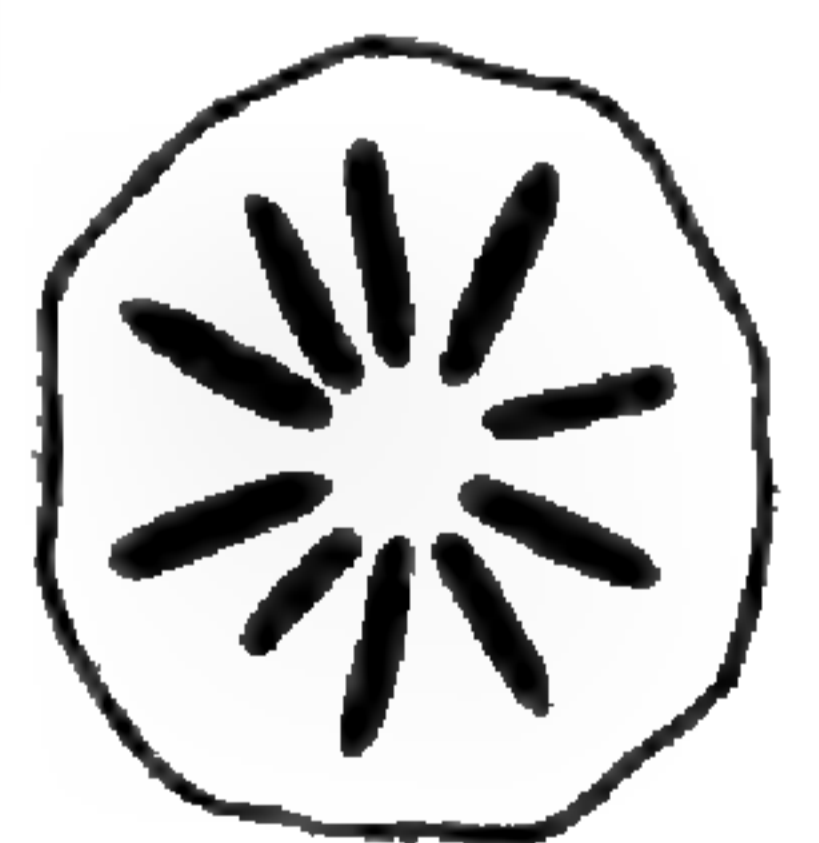
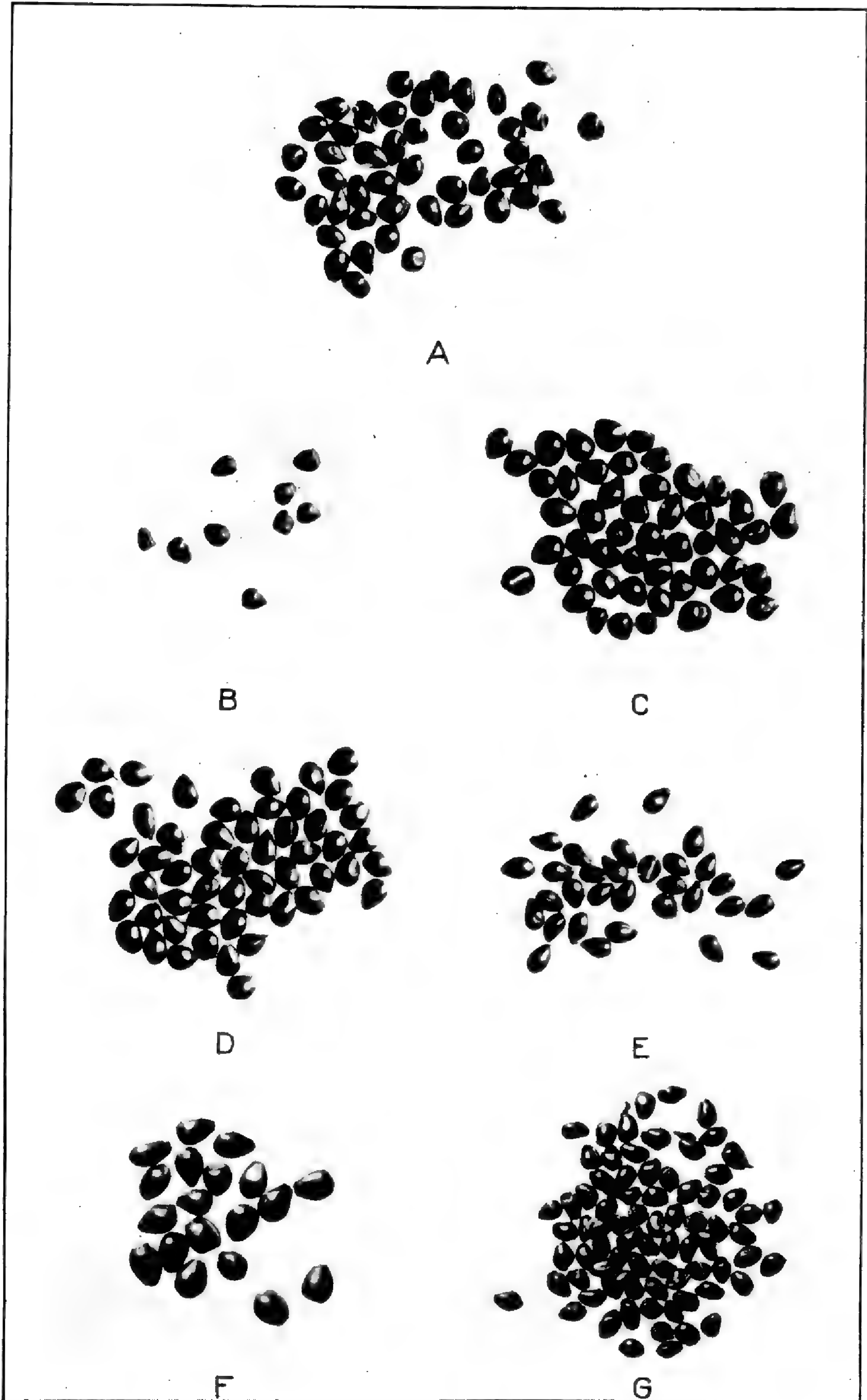


FIG. 25.—Stigmatic pattern of *Nymphaea sagittifolia*. Natural size.

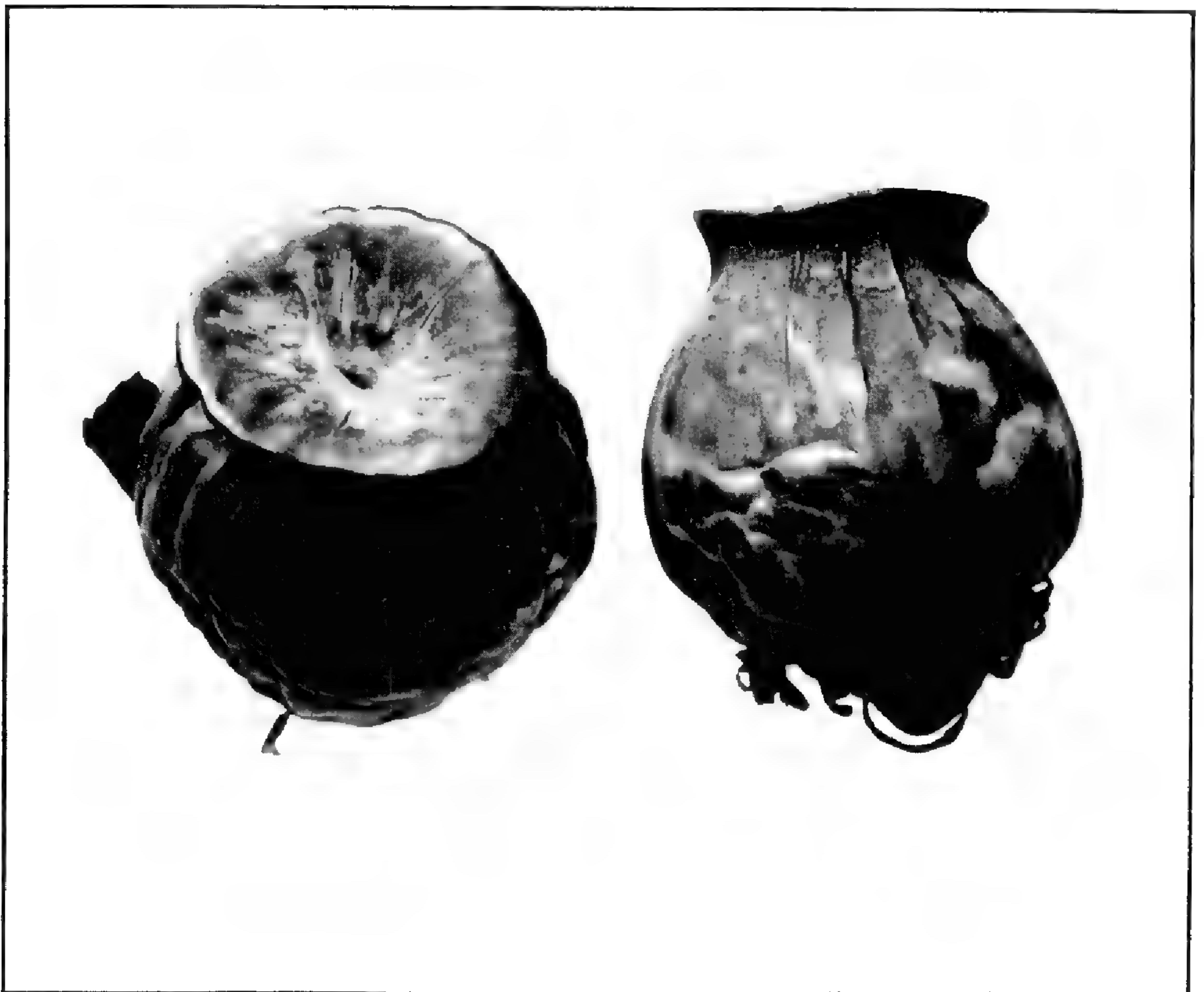


SEEDS OF SEVERAL SPECIES OF NYMPHAEA





A. FRUIT AND UNOPENED FLOWER OF *NYPHAEA ULVACEA* MILLER & STANDLEY.



B. FRUITS OF *NYPHAEA OVATA* MILLER & STANDLEY.

We have seen no specimens from other States nor have we any information that clearly indicates the plant's occurrence elsewhere.

**11. *Nymphaea ulvacea* Miller & Standley, sp. nov.**

Type in the U. S. National Herbarium, no. 357366, collected in the Blackwater River near Milton, Florida, May 14, 1898, by A. H. Curtiss (no. 6409).

DISTRIBUTION: Extreme western Florida.

DESCRIPTION.

Petioles slender, terete, smooth, glabrous, 7 mm. in diameter, 45 to 70 cm. long; rootstocks stout, 2 to 5 cm. in diameter, oval in cross-section, the leaf scars 11 to 13 mm. long and 8 or 9 mm. wide; floating leaves lanceolate or lance-ovate, 115 to 165 mm. long and 54 to 66 mm. wide, very much narrowed at the blunt apex, glabrous; sinus closed, 20 to 28 mm. deep, the lobes overlapping conspicuously; submersed leaves 23 to 28 cm. long and 7 to 10 cm. wide, very thin and delicate, the margins notably plicate; flowers 20 to 23 mm. in diameter, 15 to 18 mm. high, depressed-globose; sepals 6, when spread measuring 45 to 65 mm.; outer sepals 24 to 28 mm. long and 14 to 18 mm. wide, broadly oblong, rounded, slightly narrowed at the base; inner sepals rounded-obovate, thinner, narrowed at the base into a claw 6 mm. long and 7 mm. wide; stamens in 4 or 5 rows, the anthers slightly longer than the filaments; fruit subglobose, abruptly contracted above, prominently ribbed almost to the base, 15 to 21 mm. high and 16 to 24 mm. in diameter; rim of the disk 1.5 or 2 mm. high; disk orbicular, 11 to 18 mm. in diameter, its edges vertical, the center depressed about 3 mm. and smooth; stigma rays 11 to 16, usually 12 to 14, elliptical, 5 mm. long and 1.5 mm. wide, acutish at both ends, distinct, with a very faint median groove or smooth; seeds 3.5 to 4 mm. long, 2.5 mm. in diameter, pointed, with an acute and conspicuous raphe. (PLATES 42, B, facing p. 96; 43, A. FIGURES 7, d, 26, 27.)

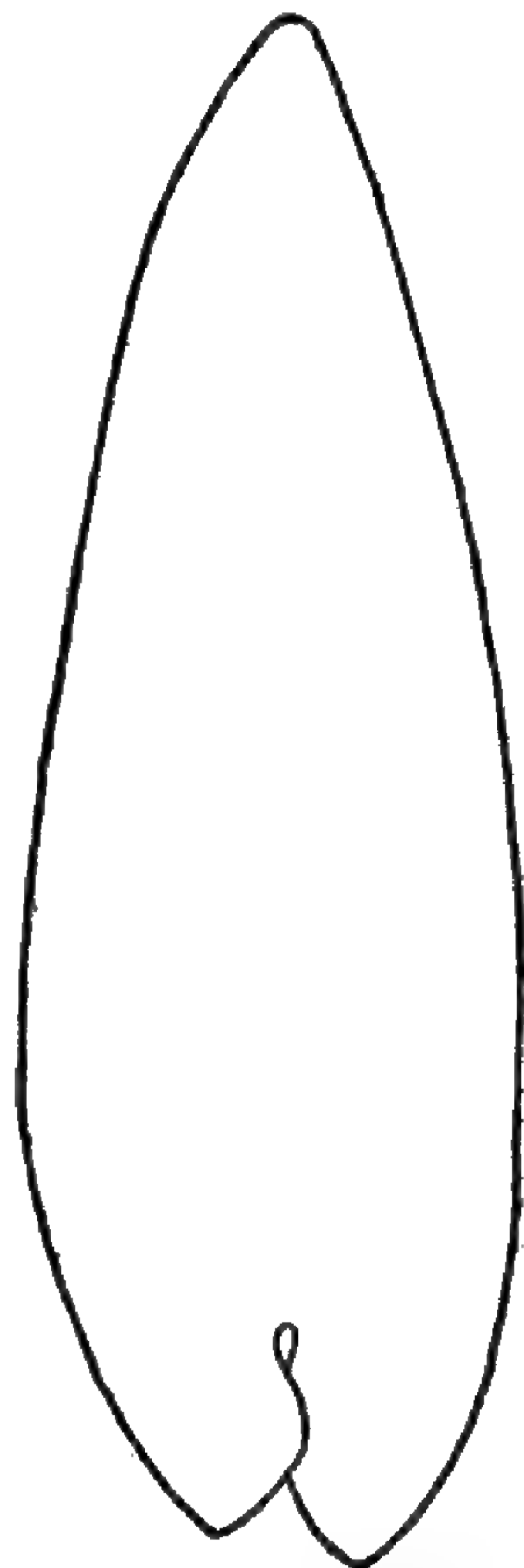


FIG. 26.—Leaf outline of *Nymphaea ulvacea*. Scale  $\frac{1}{2}$ .

EXPLANATION OF PLATE 43.—A. Fruit and unopened flower of *Nymphaea ulvacea*. B. Fruit and flower of *Nymphaea ovata*. Both natural size.

Additional specimens examined:

In formalin—

FLORIDA: Milligan, September 24, 1901, Curtiss.

Dried—

FLORIDA: Milligan, May 14, 1898, Curtiss 6409; Blackwater River, Santa Rosa County, Curtiss 104.

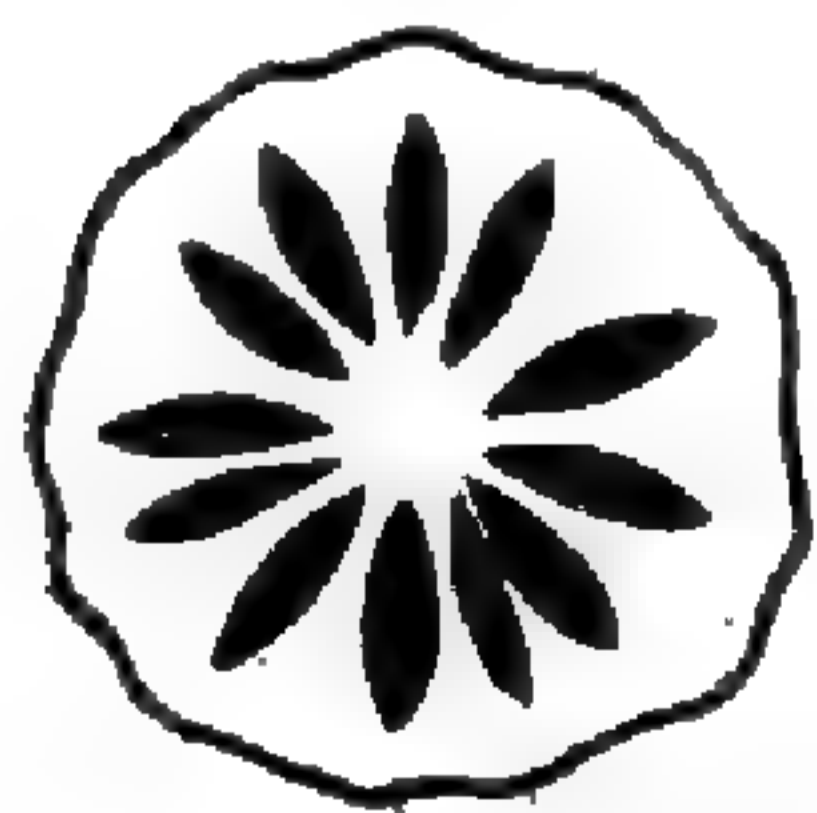


FIG. 27.—Stigmatic pattern of *Nymphaea ulvacea*. Natural size.

Although related to *Nymphaea sagittifolia* the Florida plant may be distinguished by its much wider, more pointed leaves, its smaller fruit, and its elliptical stigma rays. The submersed leaves when dried strongly suggest specimens of certain algæ, especially the genus *Ulva*, hence the specific name.

**12. *Nymphaea ovata* Miller & Standley, sp. nov.**

Type in the U. S. National Herbarium, collected at San Marcos, Texas, August 6, 1901, by Mr. J. L. Leary. Preserved in formalin. The description was based principally upon the fresh material of this collection.

DISTRIBUTION: Central-eastern Texas.

## DESCRIPTION.

Petioles stout, terete, 13 to 15 mm. in diameter, smooth, more or less silky-pubescent; leaf blades ovate, 22 to 35 cm. long and 16 to 28 cm. wide, broadest just above the base, thick, smooth and shining dark green above, densely silky-pubescent beneath, the principal lateral veins about 24 on each side, distinct and parallel for two-thirds the

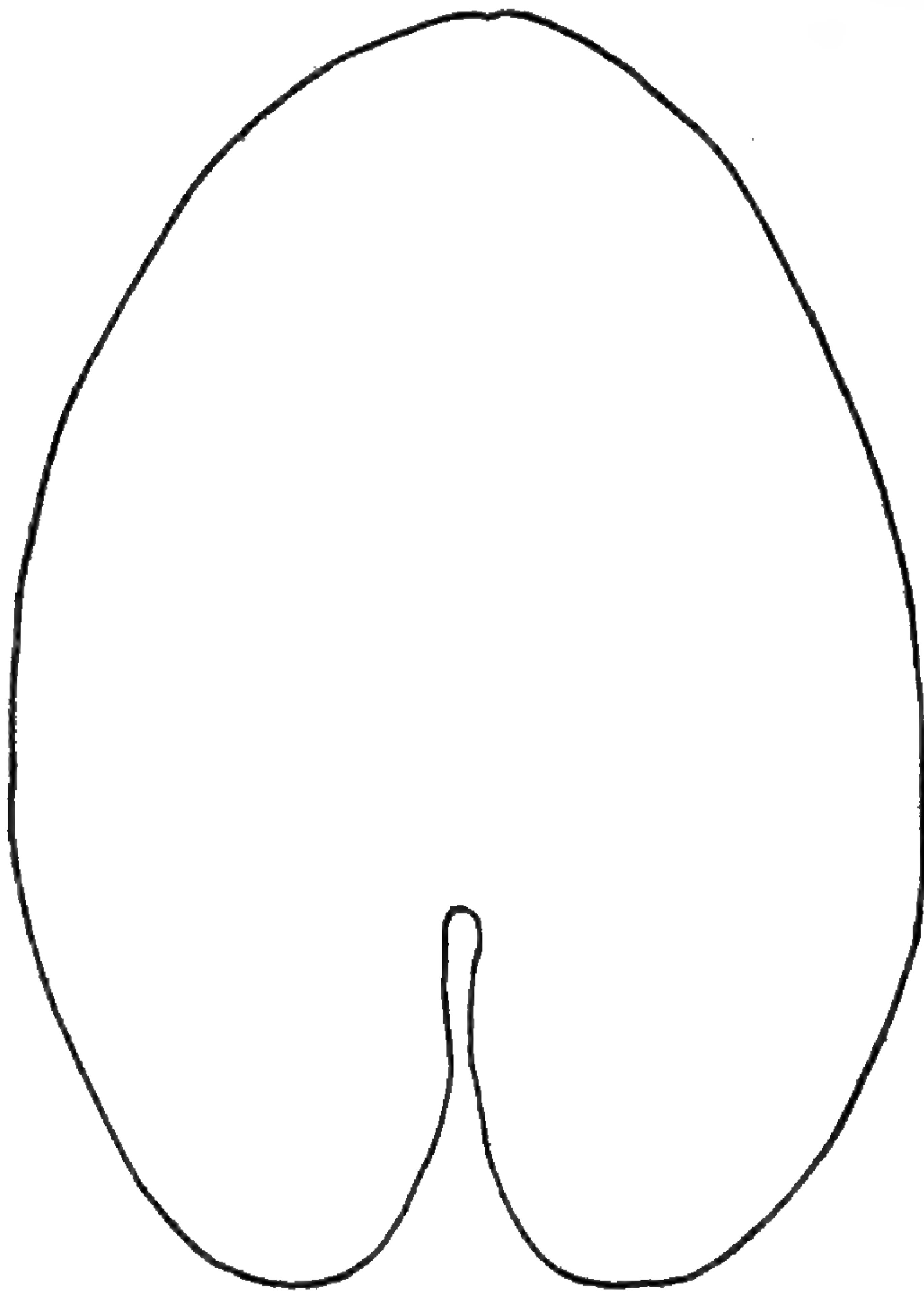


FIG. 28.—Leaf outline of *Nymphaea ovata*. Scale  $\frac{1}{2}$ .

distance to the margin; sinuses open but very narrow, 7 to 9 cm. long; flowers depressed-globose, 30 to 40 mm. in diameter, 18 to 23 cm. high; sepals 6, when spread measuring 65 to 82 mm.; the outer ones 24 to 30 mm. long, 20 to 25 mm. wide, oblong to suborbicular, often asymmetrical, silky-pubescent on the outer surface, strongly convex, green except sometimes at the tips, there yellowish; inner sepals 28 to 32 mm. long and about as broad, broadly deltoid-obovate, truncate or emarginate, glabrous or sparingly pubescent near the middle of the base, narrowed at the base to a short, broad claw, bright chrome yellow throughout or greenish toward the base; stamens in 5 or 6 rows, the anthers twice as long as the filaments; fruit globose-ovoid, slightly constricted above, 30 to 35 mm. high, 30 to 40 mm. in diameter, rather inconspicuously ribbed below, prominently so above, green becoming yellowish above; rim of disk vertical, 5 to 7 mm. high; disk depressed 5 to 8 mm., 22 to 24 mm. in diameter, almost orbicular, smooth in the center, chrome yellow; rays buff, 13 to 20, usually 15 to 17, 5 to 8 mm. long, extending to within 2 to 4 mm. of the edge of the disk, linear-lanceolate, 1.3 mm. wide at the base, narrower and acutish at the apex, usually confluent at the base, with a strong median groove; seeds 3.5 to 4 mm. long, 3 mm. in diameter, ovoid, pointed, with a prominent acute raphe. (PLATES 42, C, facing p. 96; 43, B, facing p. 97. FIGURES 7, a, 28, 29.)

*Additional specimens examined:*

Dry—

TEXAS: New Braunfels, June 17, 1906, *Otto Locke*; same locality, June 15, 1910, *Otto Locke*; San Marcos, November 6, 1897, *Trelease*.

This can not be confounded with any other species. Although its leaves are pubescent beneath they are very different in outline from those of the other species whose leaves are pubescent.

Material collected by Mr. Andrew Allison at Slidell, Louisiana, in July, 1904, resembles this very closely; unfortunately it consists of leaves only. One sheet in the

distance to the margin; sinuses open but very narrow, 7 to 9 cm. long; flowers depressed-globose, 30 to 40 mm. in diameter, 18 to 23 cm. high; sepals 6, when spread measuring 65 to 82 mm.; the outer ones 24 to 30 mm. long, 20 to 25 mm. wide, oblong to suborbicular, often asymmetrical, silky-pubescent on the outer surface, strongly convex, green except sometimes at the tips, there yellowish; inner sepals 28 to 32 mm. long and about as broad, broadly deltoid-obovate, truncate or emarginate, glabrous or sparingly pubescent near the middle of the base, narrowed at the base to a short, broad claw, bright chrome yellow throughout or greenish toward the base; stamens in 5 or 6 rows, the anthers twice as long as the filaments; fruit globose-ovoid, slightly constricted above, 30 to 35 mm. high, 30 to 40 mm. in diameter, rather inconspicuously ribbed below, prominently

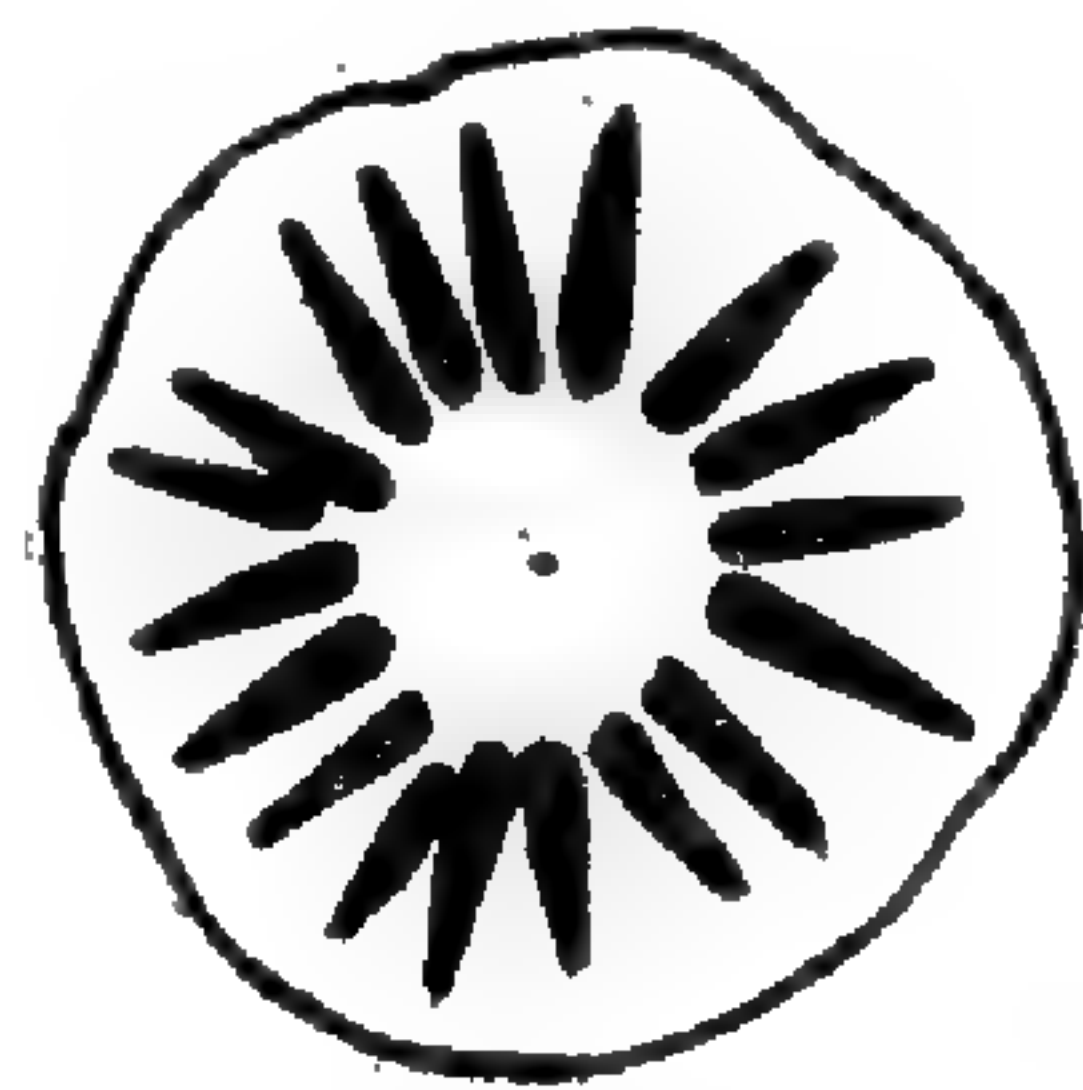
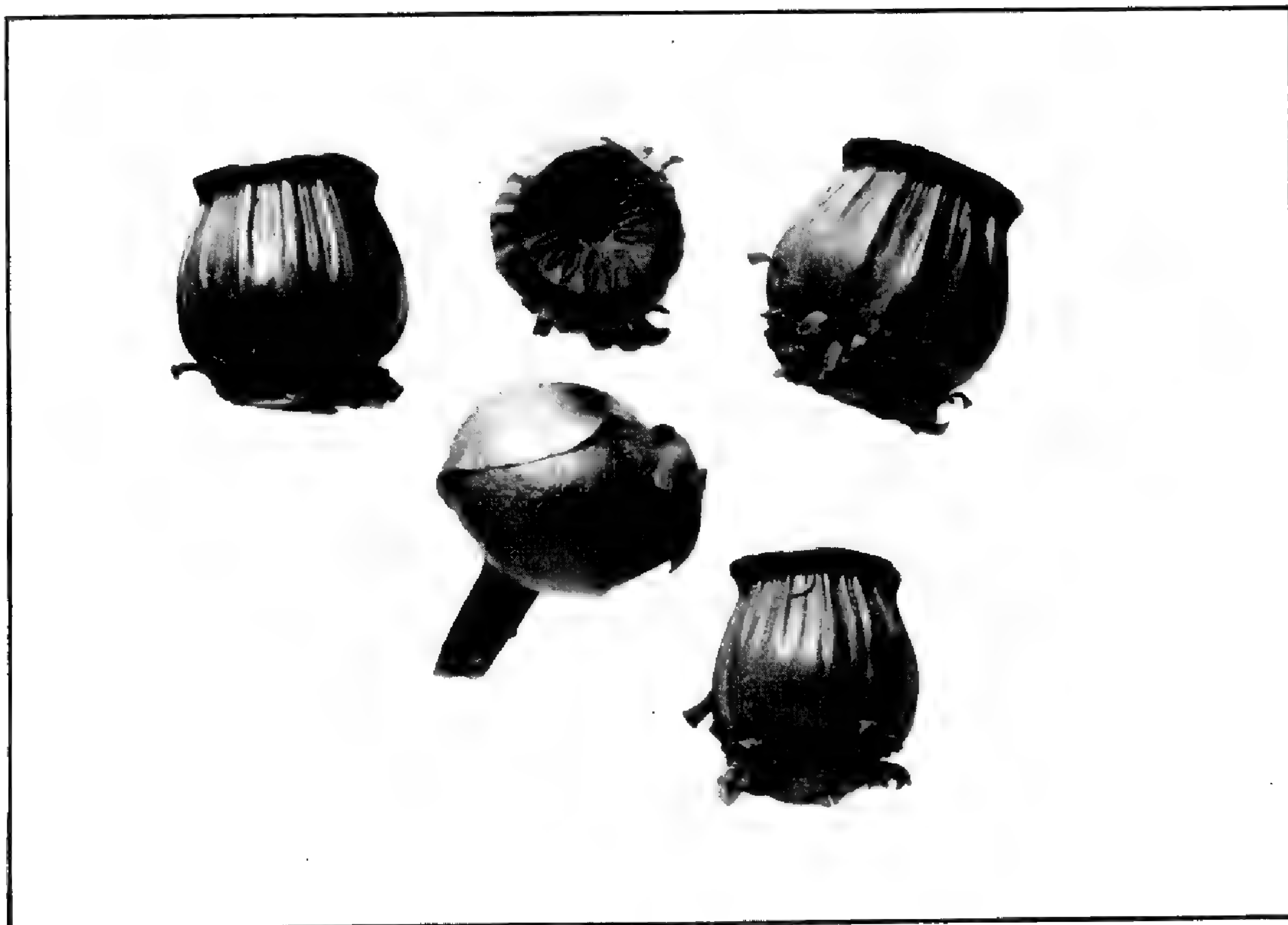
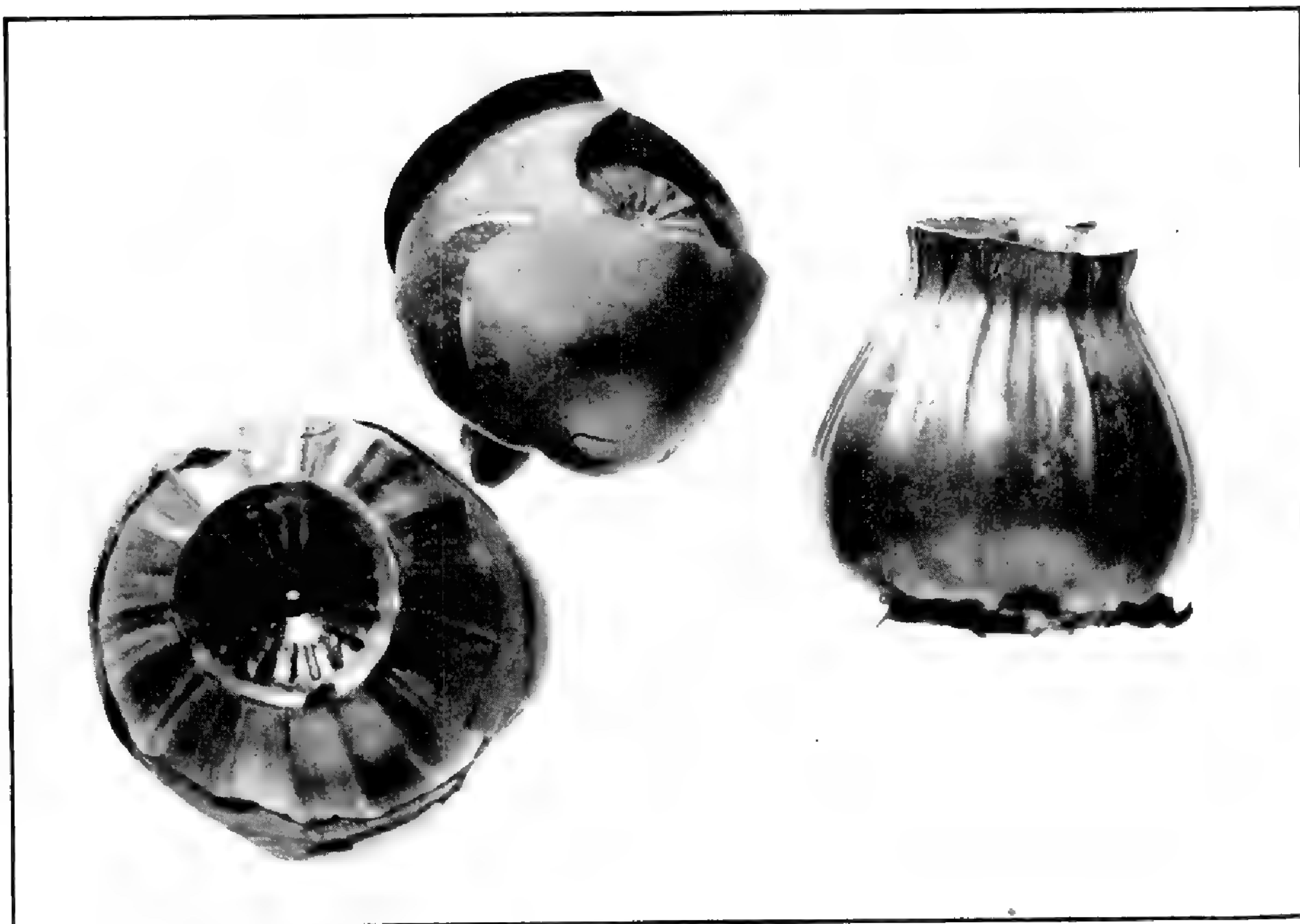


FIG. 29.—Stigmatic pattern of *Nymphaea ovata*. Natural size.



A. FLOWER AND FRUIT OF NYMPHAEA SAGITTIFOLIA WALT.



B. FRUIT OF NYMPHAEA PUBERULA MILLER & STANDLEY.

Mohr Herbarium belongs here so far as one can tell from dried material; it was collected by Doctor Mohr at Mobile, Alabama. The one leaf is 19 cm. long and densely pubescent beneath. A specimen in the herbarium of the Missouri Botanical Garden, collected at San Antonio, Texas, by Gustav Jermy, may also represent this plant.

13. *Nymphaea puberula* Miller & Standley, sp. nov.

Type in the U. S. National Herbarium, collected in Brays Bayou, about 4 miles south of Houston, Texas, September 6, 1901, by H. P. Attwater. Preserved in formalin. Described from the fresh material of this collection.

DISTRIBUTION: Near Houston, Texas.

DESCRIPTION.

Leaves floating, rather thin, orbicular-ovate, rounded at the apex, widest about the middle, 17 to 25 cm. long and 16 to 21 cm. wide, the sinus about 6 cm. deep, open but very narrow; blades smooth above, rather sparsely puberulent beneath; petioles and peduncles terete, almost glabrous; lateral nerves of the blades 14 to 16, parallel and unbranched for one-half or two-thirds their length; flowers depressed-globose, 26 to 33 mm. in diameter, the perianth when spread measuring about 60 mm.; outer sepals oblong, subtruncate at

the apex, slightly narrowed towards the base, 20 to 26 mm. wide; inner sepals broader, broadly deltoid-obovate to almost orbicular, retuse, narrowed abruptly at the base into a claw 5 mm. long and 6 mm. wide; stamens in 5 or 6 rows, linear-cuneate, the anthers one and one-half times as long as the filaments; sepals in color canary yellow, the disk of the ovary slightly and the stamens decidedly paler, no trace of red anywhere present in the flowers; fruit broadly ovoid, only slightly constricted above, 31 to 38 mm. high, 32 to 40 mm. in diameter, the edges of the disk raised as a rim 3 to 5 mm. high; stigmatic crater conspicuously depressed; stigmatic rays 9 to 20, usually 13 to 15, 4 to 5 mm. long, linear, with no trace of a median groove, extending to within 1.5 or 2 mm. of the edge of the orbicular disk; center of disk umbonate; fruit faintly ribbed above, almost smooth below; seeds 4 to 5 mm. long and 2.5 or 3 mm. in diameter, conspicuously pointed, with a sharply acute raphe; color of fruit pepper green, the disk yellowish. (PLATES 42, D, facing p. 96; 44, B. FIGURES 10, a, 30, 31.)

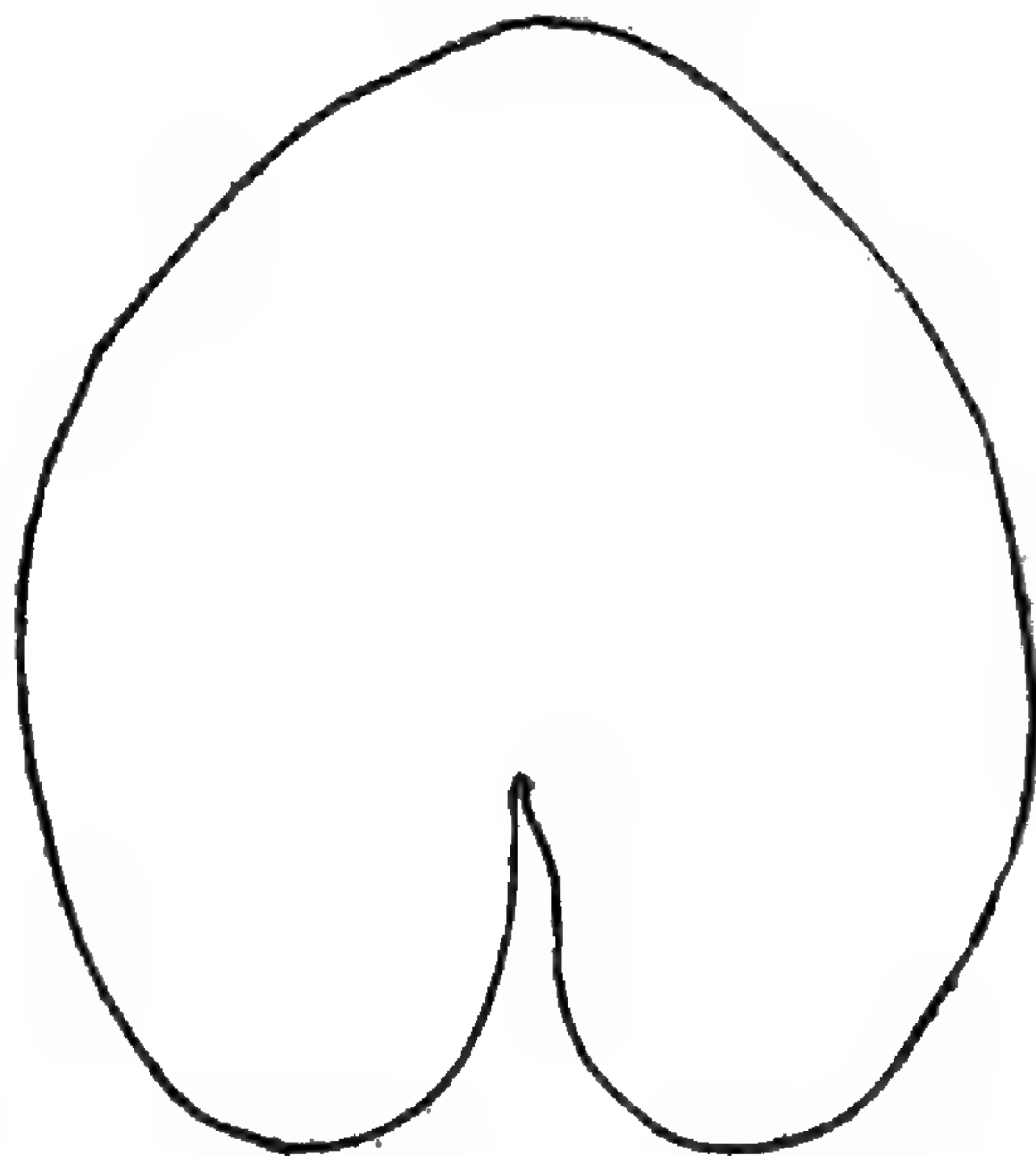


FIG. 30.—Leaf outline of *Nymphaea puberula*, Scale  $\frac{1}{4}$ .

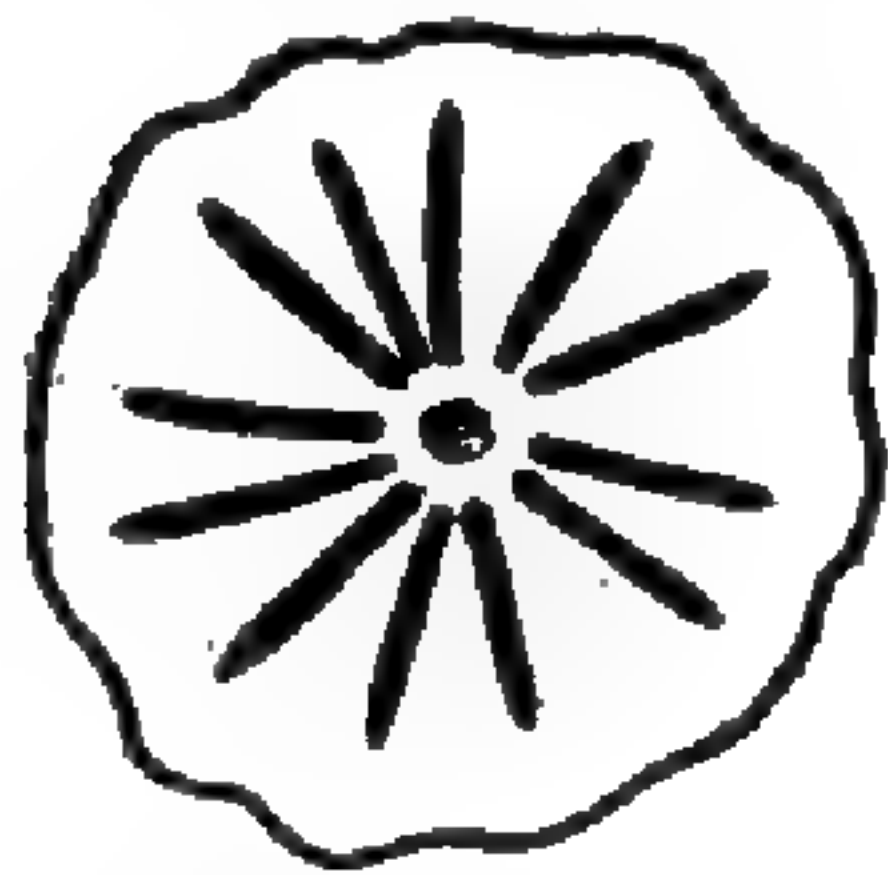


FIG. 31.—Stigmatic pattern of *Nymphaea puberula*. Natural size.

EXPLANATION OF PLATE 44.—A. Flower and fruit of *Nymphaea sagittifolia*. B. Fruit of *Nymphaea puberula*. Both natural size.

Here belongs a sheet in the herbarium of the Missouri Botanical Garden, collected in running water near Houston by Lindheimer.

The plant suggests *Nymphaea fluviatilis* but the pubescent leaves distinguish it at once. Its pubescence throws it into the group with *N. orbiculata*, *N. bombycina*, and *N. ovata*, but the leaves are very different in outline and their pubescence is much more sparse.

Concerning the locality where the specimens were gathered Mr. Attwater, the collector, says: "All of the specimens are from Brays Bayou, about 4 miles south of Houston. This bayou is like many others in the Gulf Region; in dry weather the water stands in pools or holes. Its sides are lined with trees, bushes, and tangled weeds, so that the water is kept shaded all day long. The particular spot where these lilies were taken would get only a few gleams of sunshine during the day, but I presume the plants grow in more open water where they are not shaded all day long. They were growing in water about knee-deep."

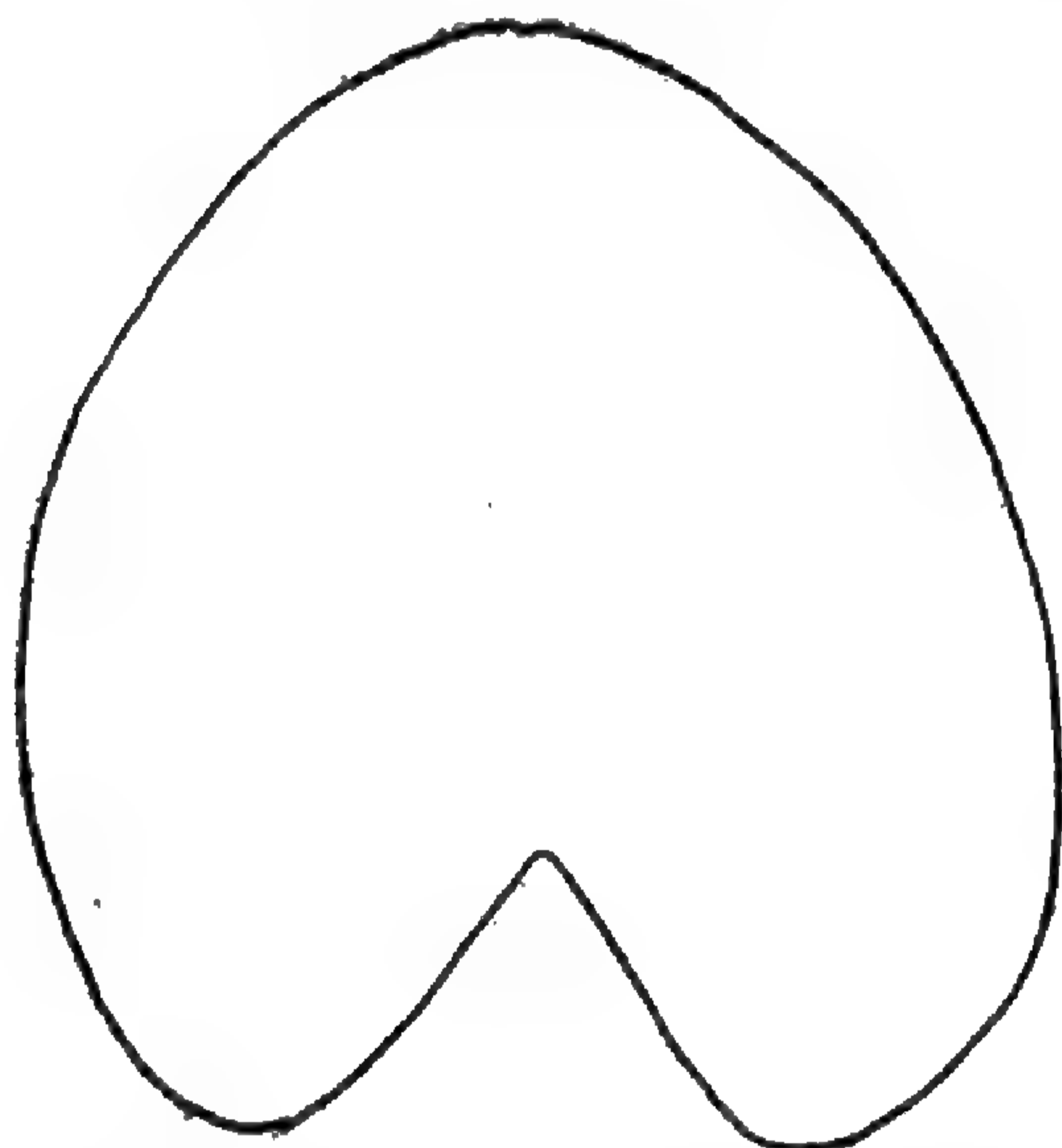


FIG. 32.—Leaf outline of *Nymphaea microcarpa*.  
Scale  $\frac{1}{4}$ .

14. *Nymphaea microcarpa* Miller & Standley, sp. nov.

Type in the U. S. National Herbarium, collected in the San Antonio River near San Antonio, Texas, March 26, 1910, by Mr. Bernard Mackensen. Preserved in formalin. Described from the fresh material of the type collection.

DISTRIBUTION.—Vicinity of San Antonio, Texas.

DESCRIPTION.

Leaves broadly rounded-ovate to orbicular in outline, widest near the base, 12 to 25 cm. long and 16 to 24 cm. wide, rounded at the apex, emarginate, dull green and glabrous above, rather densely silky-pubescent

beneath; sinus broadly V-shaped; lobes rounded; petioles terete, silky-pubescent throughout; sepals thin, the outer orbicular to oblong, the inner obovate, rounded, truncate, or slightly emarginate at the apex, the outer oil green, yellowish at the apex, the inner sulphur yellow, the flowers with no tinge of red; stamens in 5 or 6 rows, the anthers slightly longer than the filaments; fruit subglobose to almost cylindrical, 20 to 26 mm. high and 18 to 24 mm. in diameter, slightly constricted above, deeply ribbed, almost lobed, from base to top; rim of the disk somewhat spreading or erect, 1.5 to 2.5 mm. high; disk orbicular, 13 to 20 mm. in diameter, entire, slightly depressed (1 to 4 mm.), the center umbonate, 3 or 4 mm. in diameter; rays 9 to 15, mostly 12, linear or slightly widened at the base, distinct, with an evident median groove, extending to within 1.5 or 2 mm. of the edge of the disk; body of the fruit clear green, the edge of the disk faintly tinged with red; seeds 3.5 mm. long and 2.5 mm. in diameter, shining dark brown, ovoid, acutish. (PLATE 41, A, facing p. 92. FIGURES 4, a, 32, 33.)

We first became acquainted with this plant through rather incomplete material collected by Mr. H. P. Attwater, October 18, 1902, in the Medina River, about 15 miles southwest of San Antonio, Texas. This consisted of leaves and fruit without flowers. Later we were fortunate enough to secure specimens from Mr. Bernard Mackensen, of San Antonio. This last sending enables us to complete our diagnosis and to be more certain of the distinctness of the species. The same collector has forwarded less complete material than the type collected in the Cibolo River at Sutherland Springs, 30 miles east of San Antonio, March 27, 1910. He states that the leaves are usually floating, rarely erect.

*Nymphaea microcarpa* is most closely related, perhaps, to *N. ovata* of San Marcos, Texas, a locality not far distant. The outline of the leaves, however, is very different,

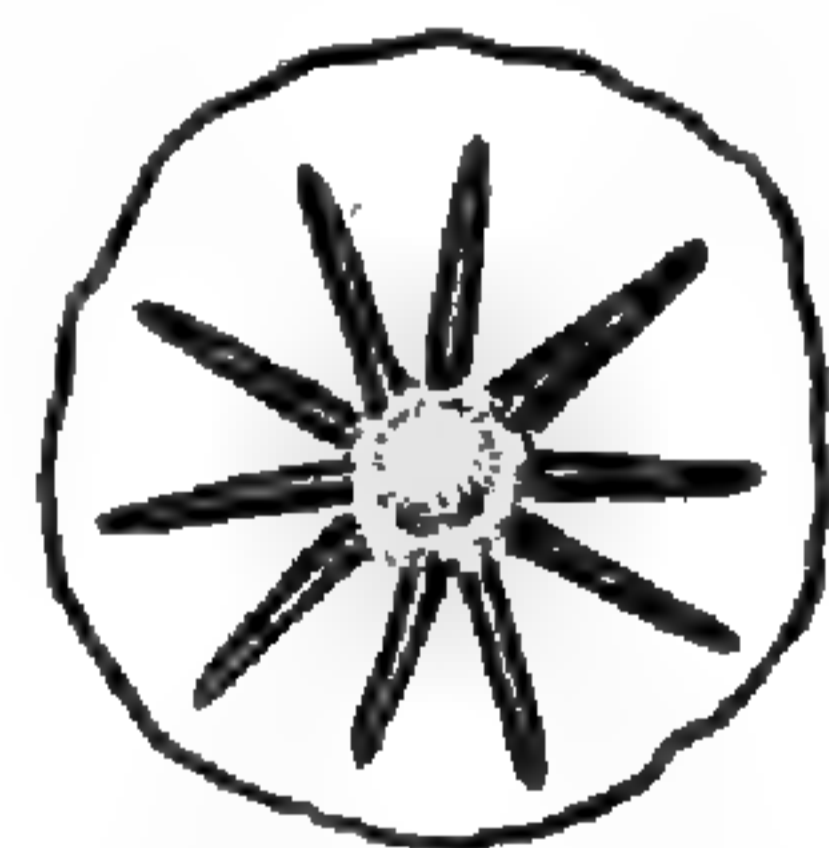
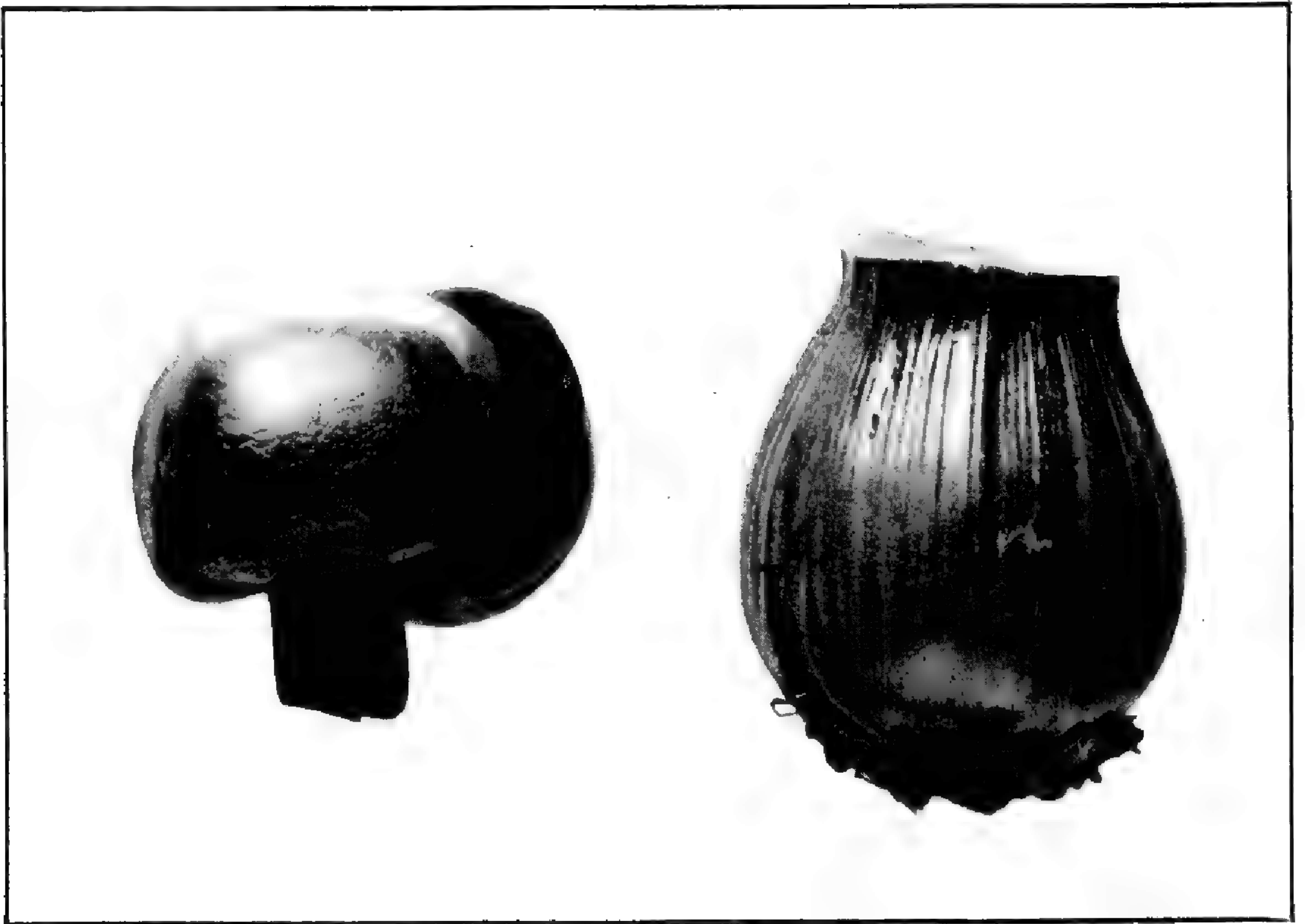


FIG. 33.—Stigmatic pattern of *Nymphaea microcarpa*.  
Natural size.



A. FLOWER AND FRUIT OF *NYMPHAEA ORBICULATA* SMALL.



B. FLOWER AND FRUIT OF *NYMPHAEA BOMBYCINA* MILLER & STANDLEY.

and the plants lack the peculiar yellowish cast exhibited by the San Marcos specimens. The fruit, too, is much smaller, and the number of stigmatic rays decidedly less.

### 15. *Nymphaea orbiculata* Small.

*Nymphaea orbiculata* Small, Bull. Torrey Club 23: 128. 1896.

TYPE LOCALITY: "In a small lake near Thomasville, Thomas County, southern Georgia." Type collected by J. K. Small.

DISTRIBUTION: Known only from Thomas County, Georgia.

#### DESCRIPTION.

Leaves floating, orbicular in outline but broadest near the base, thick and leathery, glabrous above but silky-pubescent beneath, 30 to 50 cm. in diameter, emarginate, the closed sinus 6.5 to 14 cm. deep, the broadly rounded lobes overlapping; veins parallel almost to the margin; petioles and peduncles cylindrical, stout, pubescent throughout; flowers depressed-globose, about 55 mm. in diameter and 30 mm. high, the perianth when spread measuring about 100 mm.; sepals

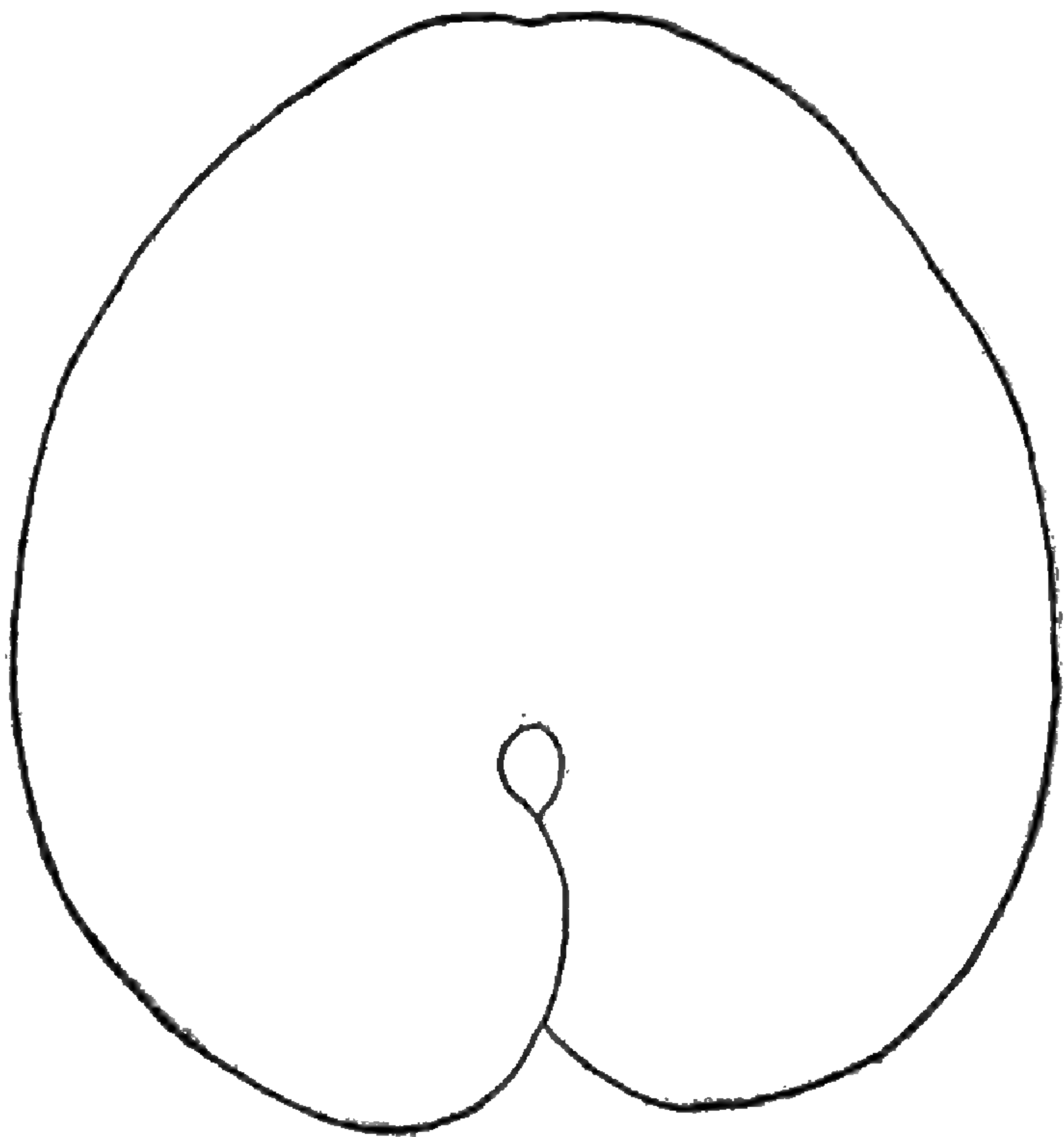


FIG. 34.—Leaf outline of *Nymphaea orbiculata*. Scale  $\frac{1}{4}$ .

normally 6, the 3 outer elliptical-oblong, about 45 mm. long and 30 mm. wide, glabrous throughout, the three inner suborbicular, about 40 mm. in diameter, their bases abruptly narrowed to a claw 10 mm. wide, truncate or retuse at the apex; petals 22 to 24, varying from linear to oblong or oblong-obovate, 9.5 mm. long and 2.5 to 6 mm.

wide, retuse, truncate, or rounded at the apex, with a glandular spot 2 mm. in diameter usually present on the outer side near the tip; stamens usually in 8 rows, about 30 to the row; anthers slightly but distinctly longer than the filaments; color of flowers not accurately known, but specimens after a few weeks' immersion in formalin showing a pattern in no way peculiar and proving the entire absence of red; fruit subglobose, about 45 mm. in diameter, distinctly marked with fine ribs above, smooth about the base; stigmatic crater about 28 mm. wide and 5 mm. deep, its outer wall usually vertical; center of disk smooth; stigma rays distinct, varying in number from 12 to 22, but usually 15, 16, or 17, when fully developed 4 to 6 mm. in length and about 0.5 mm.

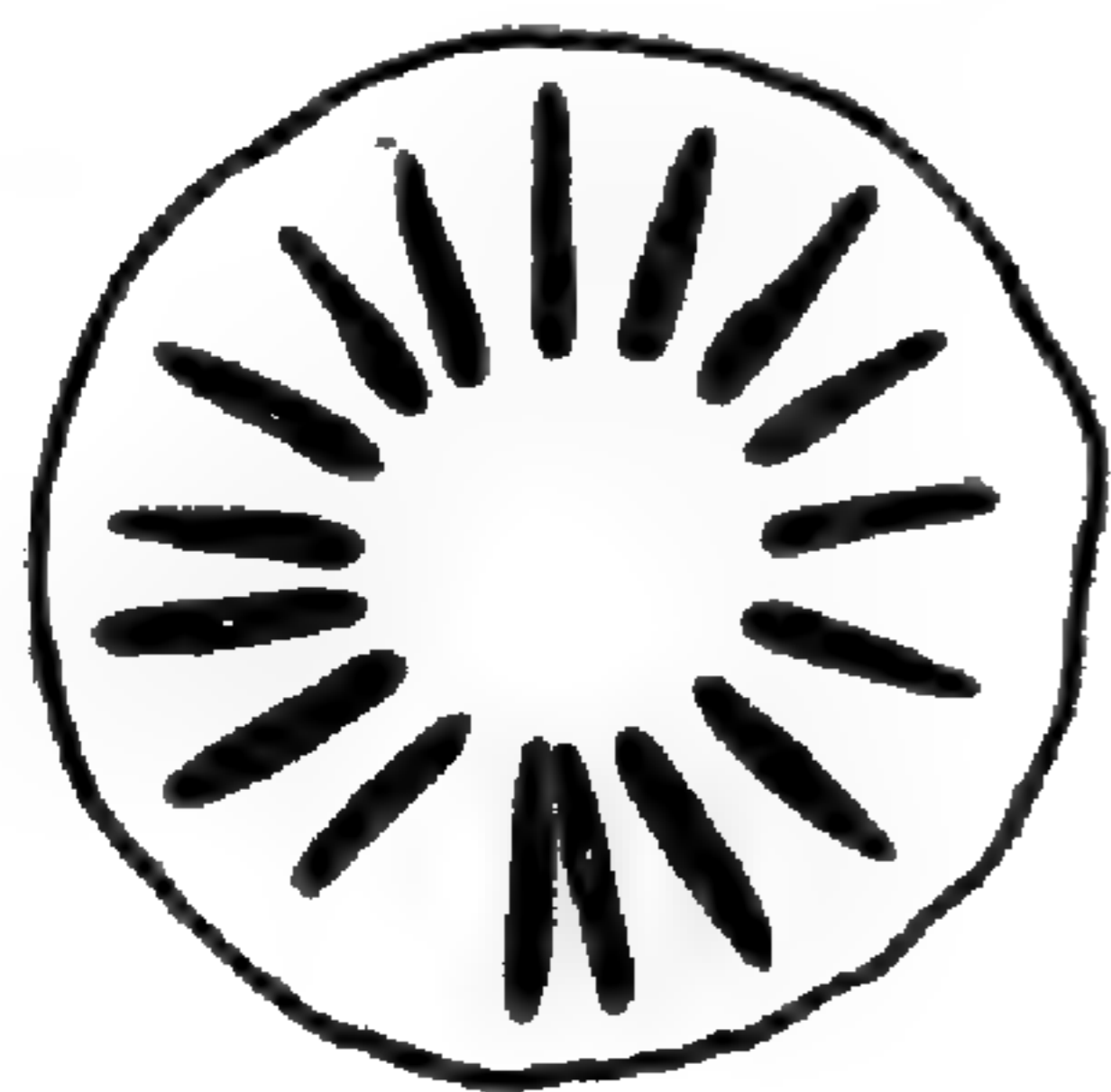


FIG. 35.—Stigmatic pattern of *Nymphaea orbiculata*. Natural size.

wide, extending to within 1.5 mm. of the edge of the disk; surface of rays with barely indicated median line; seeds ovoid, about 4.5 mm. long and 3 mm. in diameter, with a distinct raphe. (PLATE 42, E, facing p. 96; 45, A. FIGURES 4, b, 34, 35.)

EXPLANATION OF PLATE 45.—A. Flower and fruit of *Nymphaea orbiculata*. B. Flower and fruit of *Nymphaea bombycina*. Both natural size.



*Specimens examined:*

In formalin—

GEORGIA: Heard's Pond, 1901, *Harper*.

Dry—

GEORGIA: Along the Ochlockonee River, near Thomasville, 1895, *Small*, type (N. Y.); Heard's Pond, Thomas County, 1901, *Harper* 1178.**16. *Nymphaea bombycina* Miller & Standley, sp. nov.**

Type in the U. S. National Herbarium, no. 394797, collected at Wellborn, Florida, October 11, 1901, by A. H. Curtiss (no. 6900). Besides the type sheet another in the National Herbarium, no. 394798, is of this collection.

DISTRIBUTION: Northern Florida and southern Georgia.

## DESCRIPTION.

Rootstocks stout, very large and fleshy, rough, 7 or 8 cm. in diameter; leaf blades floating, glabrous on the upper surface, densely silky-pubescent beneath, thick and leathery, very broadly ovate to almost orbicular in outline, 20 to 30 cm. long and 20 to 25 cm. wide, broadest near the base, rounded at the apex, and emarginate; sinus open, V-shaped or U-shaped, two-fifths as long as the blade, the lobes broadly rounded; veins

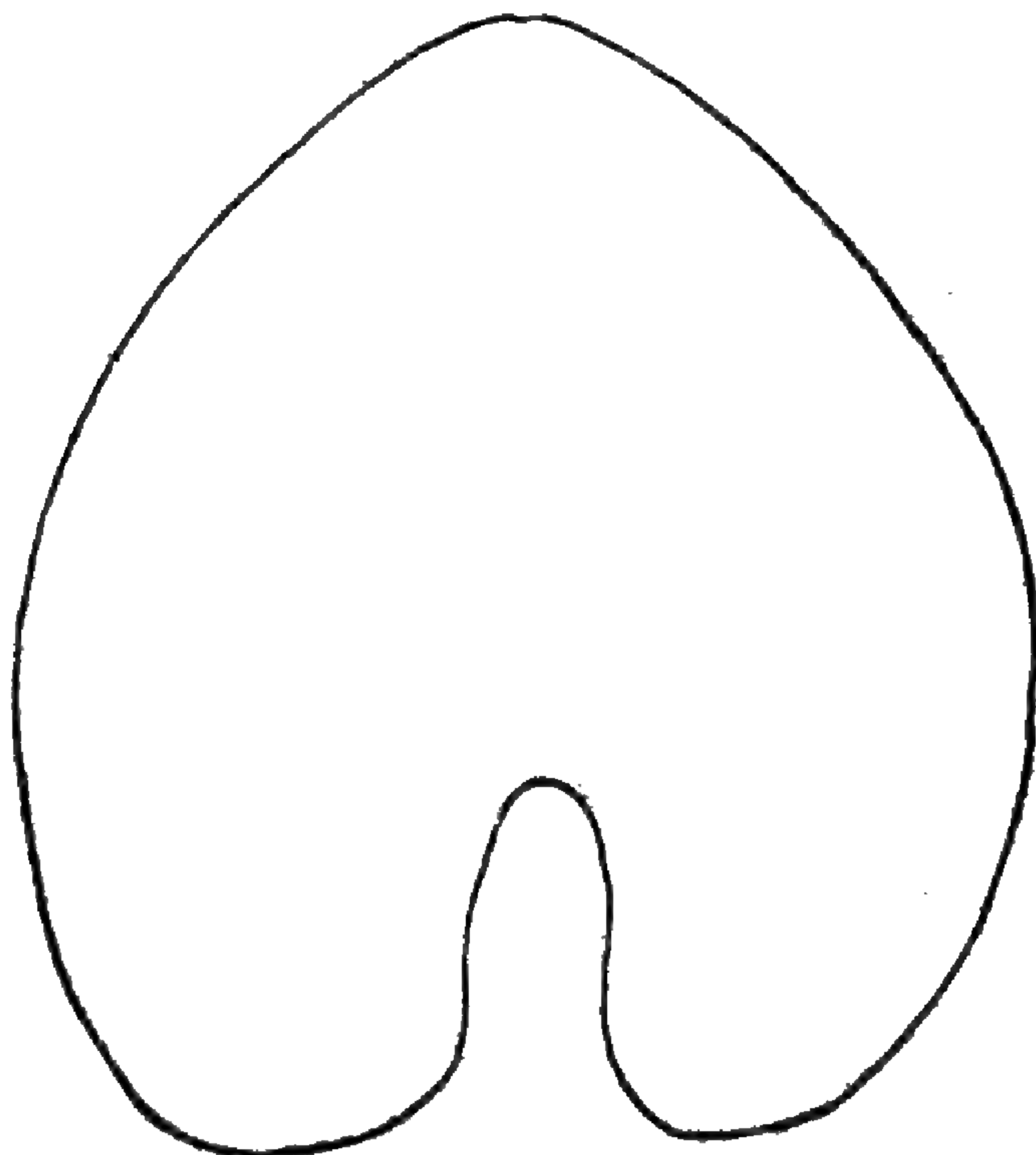


FIG. 36.—Leaf outline of *Nymphaea bombycina*. Scale  $\frac{1}{4}$ .

conspicuous, parallel almost to the margin, the midrib stout and very prominent; petioles stout, terete, about 10 mm. in diameter, silky-pubescent; peduncles stout, densely pubescent, 10 to 15 mm. in diameter; flowers large, depressed-globose, much flattened, 60 to 80 mm. in diameter, 35 to 45 mm. high, when spread measuring 12 to 14 cm.; sepals very thick and fleshy, the outer oblong, obtuse, the inner obovate, broadly rounded; outer sepals oil green, yellowish at the tips, the inner almost entirely sulphur yellow, no red present anywhere in the flower; stamens in 6 or 7 rows, the anthers about twice as long as the filaments; fruit ovoid or almost cylindrical, 50 to 60 mm. in diameter, smooth below, faintly and finely ribbed above, slightly constricted just below the spreading edges of the stigmatic disk, this 30 to 35 mm. in diameter, orbicular, the margin undulate; rays 15 to 18, usually 16, linear, distinct and distant, extending to within 2 mm. of the edge of the disk, with no trace of a median groove; central area about 12 mm. in diameter, smooth, depressed about 5 mm.; seeds ovoid, light chestnut brown, 6 mm. long and 4.5 mm. in diameter. the raphe acutish; color of fruit much as in *N. orbiculata*, the body oil

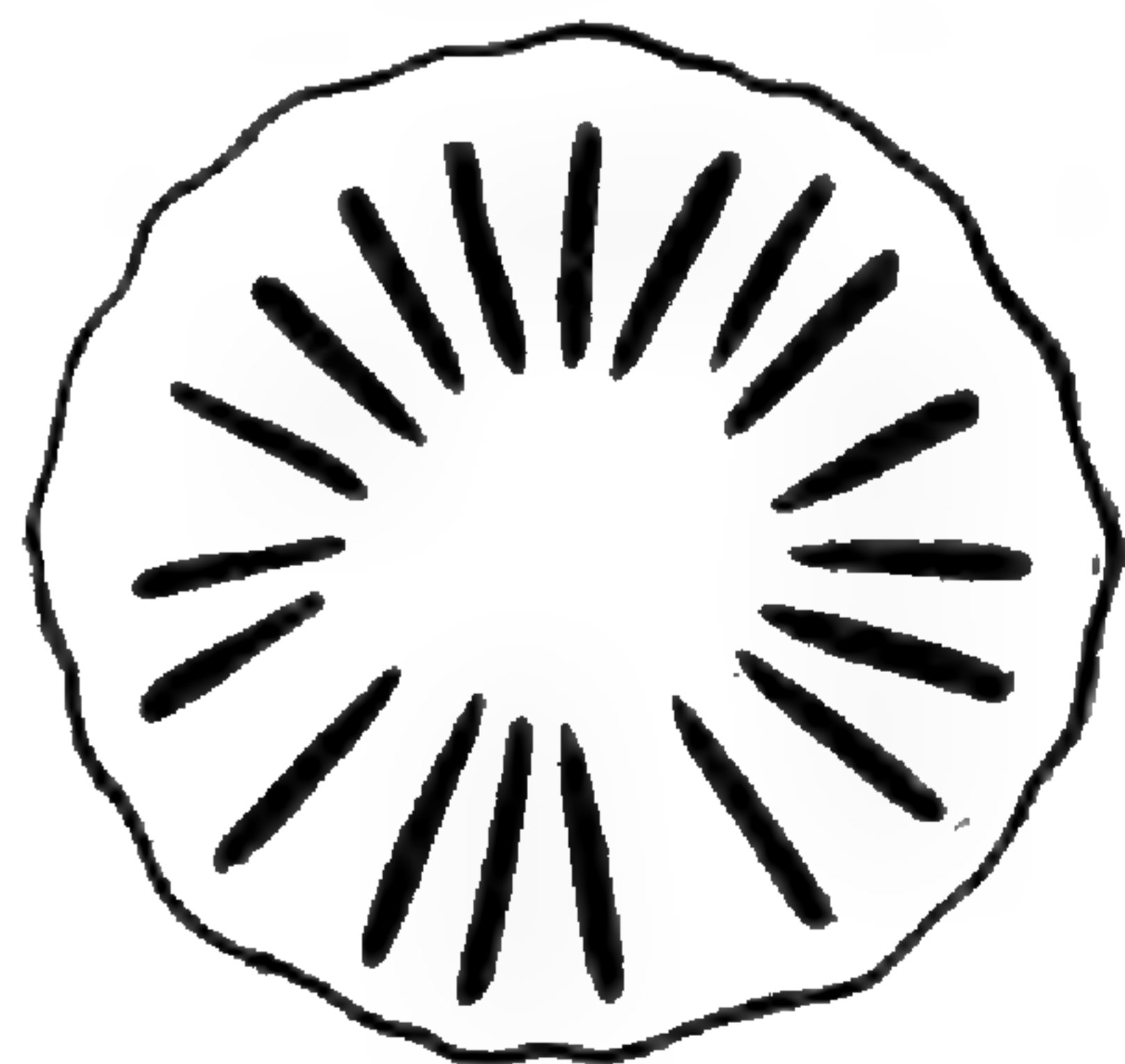


FIG. 37.—Stigmatic pattern of *Nymphaea bombycina*. Natural size.



NYPHAEA POLYSEPALA (ENGELM.) GREENE, AT CRATER BUTTE, COLORADO.

green or lighter, the disk yellowish. (PLATES 42, F, facing p. 96; 45, B, facing p. 101. FIGURES 7, e, 36, 37.)

*Additional specimens examined:*

Dry—

GEORGIA: In shallow water (30 to 60 cm. deep) of Ocean Pond, Lowndes County, September 4, 1902, *R. M. Harper* 1610.

With *Nymphaea orbiculata*, the only closely related species, this forms a group sharply differentiated from all other North American Nymphaeas. The plants are marked by their large, almost orbicular, silky-pubescent, thick and almost leathery leaves, and large flowers and fruit. This species may be separated from its near relative by the open sinus of the leaves, larger flowers and fruit, and larger seeds. In addition the stamens are in decidedly fewer rows.

**17. *Nymphaea polysepala***  
(Engelm.) Greene.

*Nuphar polysepalum* Engelm.  
Trans. Acad. St. Louis. 2:  
283. 1865.

*Nuphar polysepalum pictum*  
Engelm. loc. cit. 285. 1865.

*Nymphaea polysepala* Greene,  
Bull. Torrey Club 15: 84.  
1888.

TYPE LOCALITY: "In Osborn's Lake, in the same region, at an altitude of 8,800 feet." "The same region" is "Gibson's Lake, near Long's Peak," Colorado.

The type was collected by Dr. C. C. Parry.

DISTRIBUTION: Alaska south through northern California and in western Nevada, and southeastward through northern Idaho and western Montana to western South Dakota and Colorado.

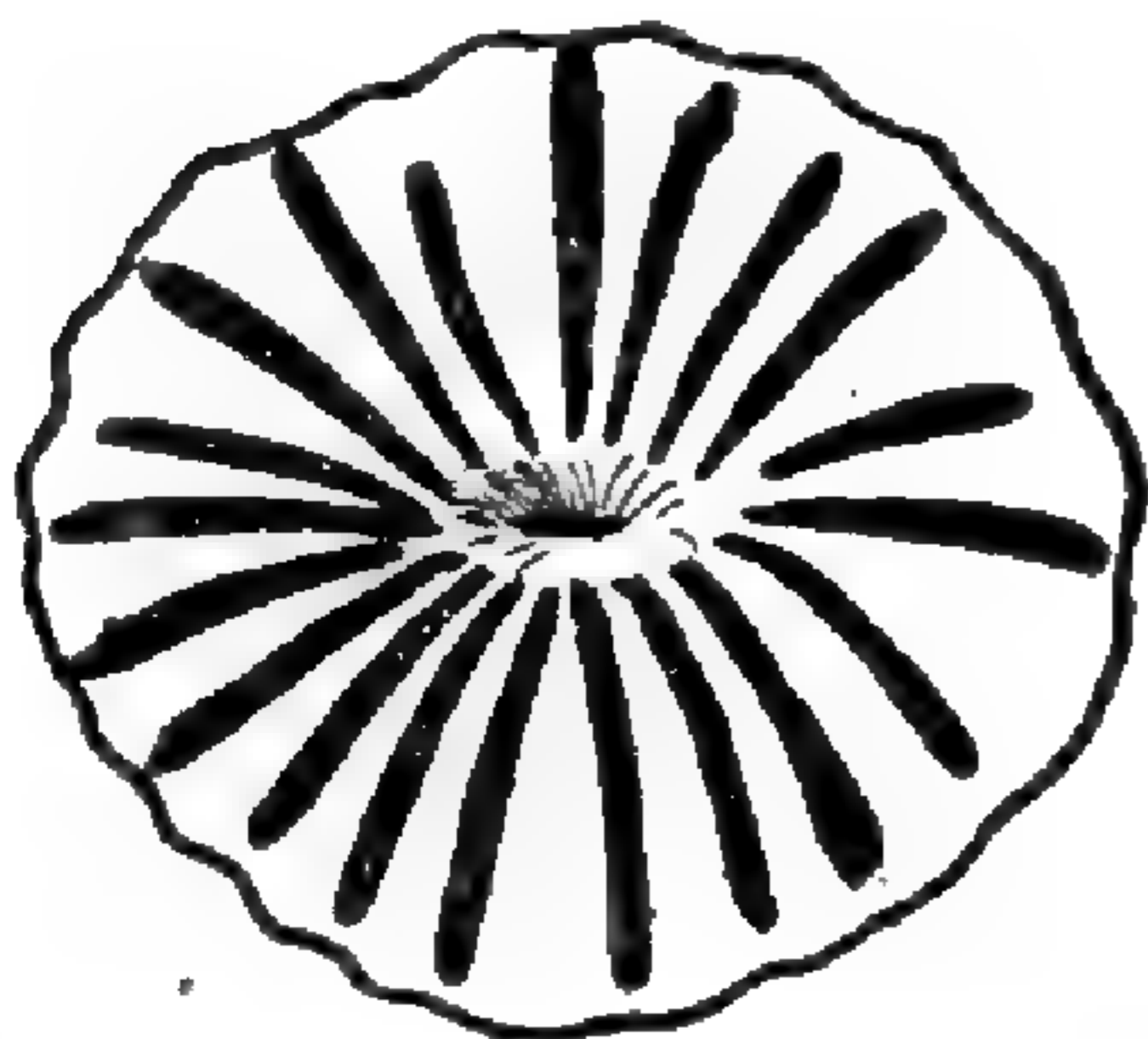


FIG. 39.—Stigmatic pattern of *Nymphaea polysepala*. Natural size.

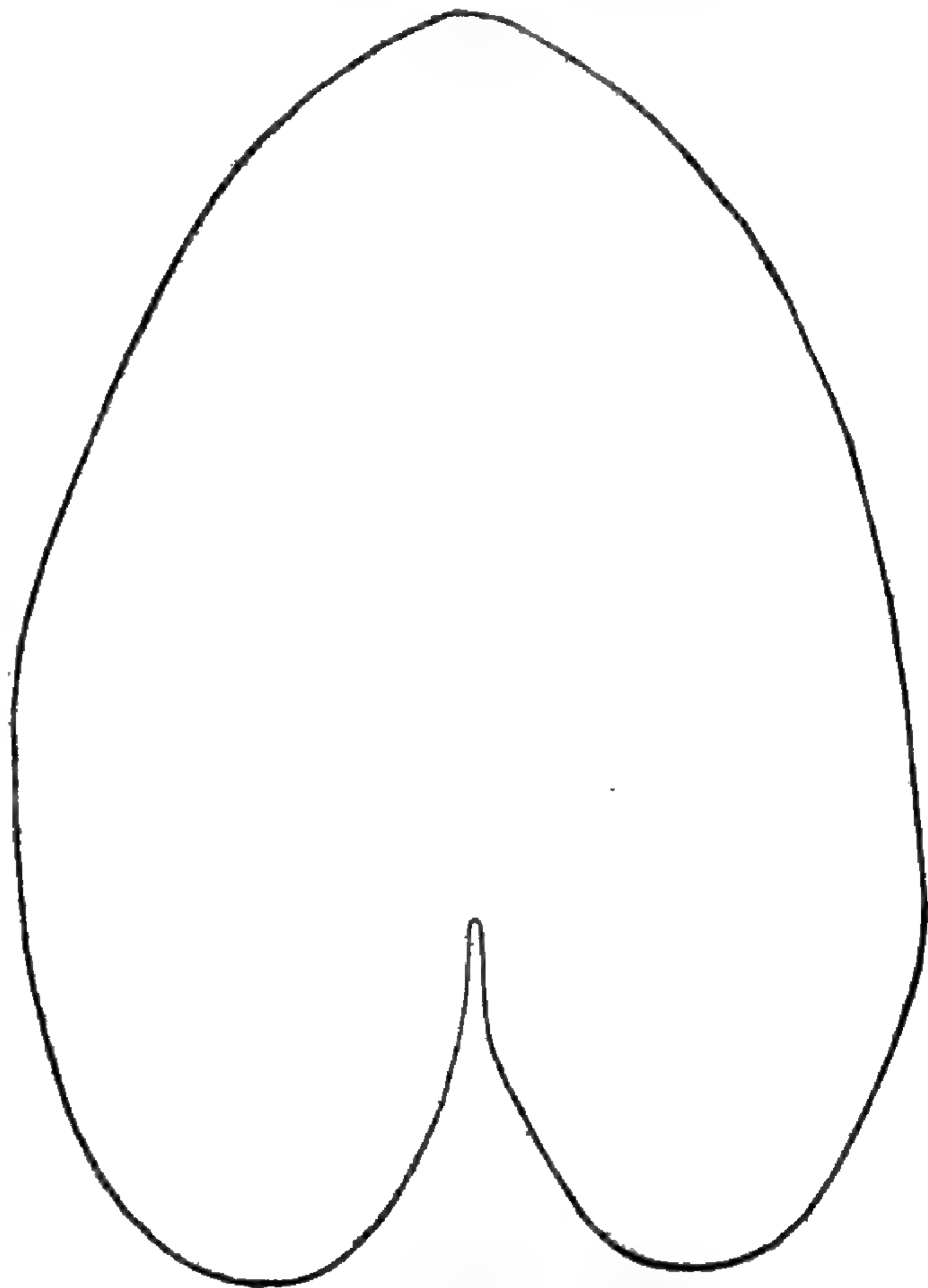


FIG. 38.—Leaf outline of *Nymphaea polysepala*, typical form. Scale  $\frac{1}{4}$ .

DESCRIPTION.

Leaves usually floating, rarely held above the water, the lobes, however, often elevated, oblong or ovate, rather thick, dull green, glabrous, 21 to 40 cm. long and 16 to 26 cm. wide, sometimes slightly narrowed at the apex but usually rather broadly rounded, widest just above the base; sinus usually open and broadly V-shaped, sometimes closed, 7 to 10 cm. deep, the lobes rounded or acutish; petioles and peduncles glabrous, terete, 8 to 16 mm. in diameter; submersed leaves lacking; flowers 55 to 70 mm. in diameter and 40 mm. high, depressed-globose, the perianth when spread measuring 110 to 140 mm.; sepals usually 9, sometimes 7 to 12, the outer ones small, rounded-oblong, 30 to 50 mm. long, the inner orbicular, 40 to 55 mm. long and 35 to

50 mm. wide, truncate or retuse at the apex, gradually narrowed to the base or abruptly narrowed into a short claw; petals very thick, oblong, equaling the stamens; these in 5 to 7 rows, their anthers slightly exceeding the filaments; capsules globose-ovoid to almost cylindrical, 45 to 90 mm. high and 35 to 60 mm. in diameter, abruptly constricted above, rather conspicuously ribbed throughout; stigma rays 14 to 30, usually 20 to 25; crater suborbicular, 30 to 35 mm. in diameter, usually about 20 mm. deep, its margin almost entire, sometimes slightly undulate; rays linear, with no trace of a median groove, distinct, 14 to 18 mm. long, extending to within 1 mm. of the edge of the disk; center of the crater smooth; outer sepals oil green, yellowish at the tips; inner sepals chrome yellow, the tips usually shaded with green; petals greenish yellow, their inner surfaces tinged with purplish brown except at the base and tip; filaments light greenish yellow, the anthers dark prune purple; pollen straw yellow; fruit varying in color from light apple green to citron yellow; seeds 3.5 to 4 mm. long, oblong, dull brown, shining. (PLATES 42, G, facing p. 96; 46, 47. FIGURES 16, c, 38-40.)

EXPLANATION OF PLATES 46, 47.—Pl. 46, *Nymphaea polysepala* at Crater Butte, Colorado; photographed by Mr. E. R. Warren. Pl. 47, fruit of *Nymphaea polysepala* (typical). Natural size.

*Specimens examined:*

In formalin—

ALASKA: Iliamna, 1902, *W. H. Osgood*; Kodiak, 1901, *W. J. Fisher*.

WASHINGTON: Tacoma, 1902, *Flett*; same locality, 1901, *Flett*.

IDAHO: Henrys Lake, Lake P. O., 1901, *J. Sherwood*.

WYOMING: Beaver Lake, Yellowstone National Park, 1902, *Mearns*.

SOUTH DAKOTA: Spearfish, 1901, *D. C. Booth*.

COLORADO: Near Boulder, 1902, *R. T. Young*; near Leadville, 1901, *Tulian*.

CALIFORNIA: Near Albion, Mendocino County, 1901, *James McMurphy*; Stockton, 1902, *L. Belding*.

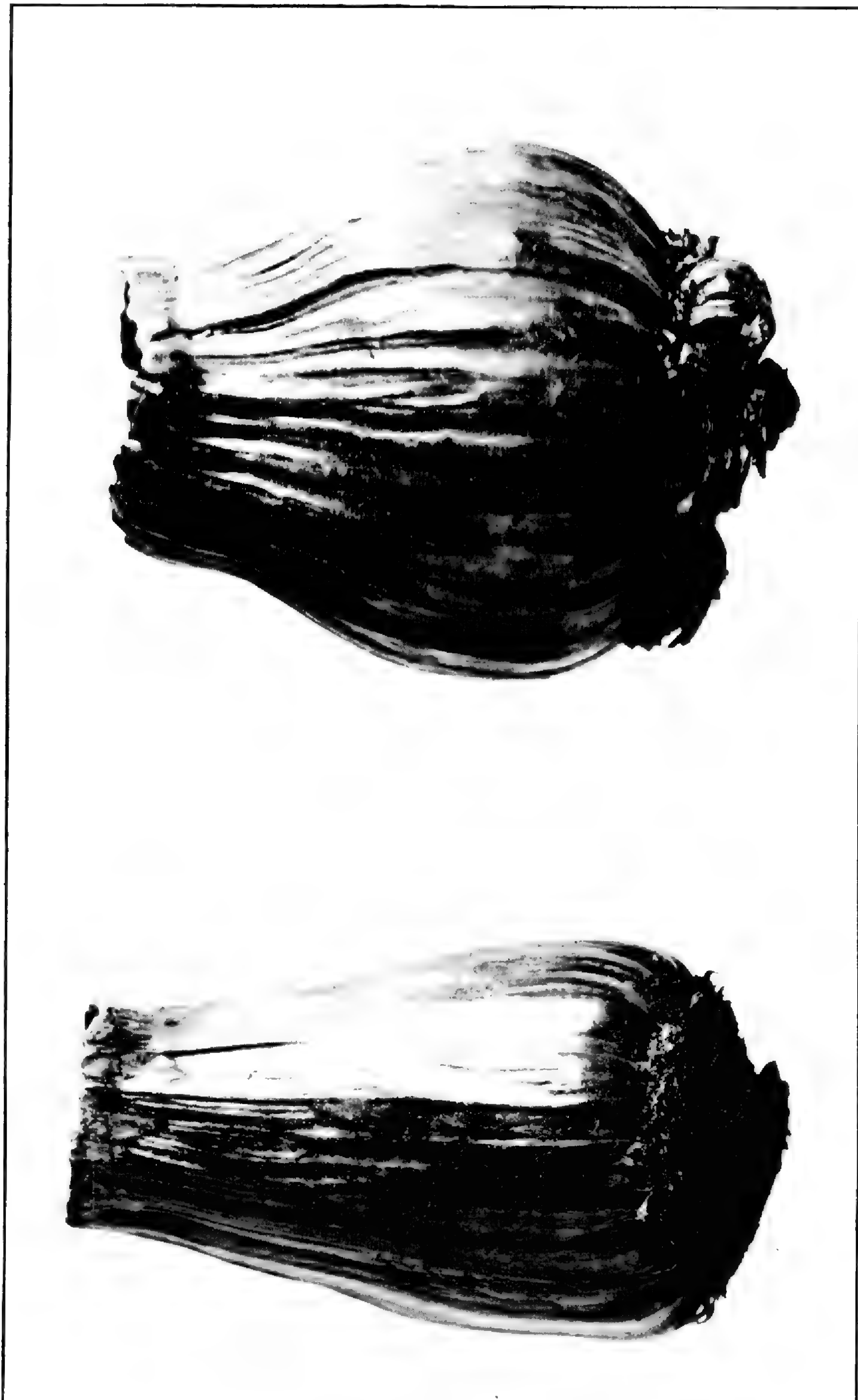
Dry—

ALASKA: Yakutat Bay, 1899, *Trelease & Saunders* 3758, 3758a, 3759, 3760 (Mo.); Yakutat, 1904, *Piper* 4362; Seldovia, 1904, *Piper* 4346; vicinity of Yakutat Bay, Khantaak Island, 1892, *Funston* 43; Copper River Region, 1902, *Wm. L. Poto* 114; Kodiak, 1900, *Walpole* 1173; Sitka, 1900, *Walpole* 1132; Camp Retreat, 1886, *H. G. U. Stoney*; Yakutat Mission, 1899, *Trelease* 3759; near Orca, Prince William Sound, 1899, *Coville & Kearney* 1317; Kodiak, 1899, *Coville & Kearney* 2323; Kodiak, 1897, *Evans* 394; Short Bay, 1895, *Gorman* 107; Kodiak, 1874, *U. S. Coast Survey* (Gray); in small mountain ponds near Yes Bay, 1895, *T. Howell* (Greene).

BRITISH COLUMBIA: Vancouver Island, 1893, *Macoun* (Greene); Chilliwick Valley, 1901, *Macoun* 33763; Revelstoke, 1890, *Macoun*; Victoria, Vancouver Island, *J. R. Anderson*; swamp by Goldstream, Selkirks, 1903, *C. H. Shaw* 986 (Phila.); San Juan Lake and River, Vancouver Island, 1902, *Rosendahl* 893 (N. Y.); Fort Rupert, Vancouver Island, 1904, *Geo. Hunt* (N. Y.); Lower Frazer River, 1859, *Lyall* (Gray); near Victoria, 1885, *Fletcher* (Gray).

WASHINGTON: Falcon Valley, 1882, *Suksdorf*; Union Flat, Whitman County, 1892, *Hull* 421 (N. Y.); Chehalis County 1897, *Lamb* 1260 (N. Y.); Seattle, 1892, *Mosier*; Big Meadows, 8 miles west of Ione, 1902, *Kreager* 426; Spokane River, *Wilkes Exploring Expedition* 546; Lake Union, King County, 1898, *Savage, Cameron & Lencoker* (Mo.).

OREGON: Sauvies Island, 1886, *T. Howell* (C.); Forest Grove, Washington County, 1894, *F. E. Lloyd* (N. Y.); without locality, 1871, *Hall* (Gray); Blue Mountains, 1888, *Cusick* 1525; Buck Lake, Klamath County, 1897, *Coville & Applegate* 48; in a slough near Todds, Forest Grove, 1902, *T. E.*



FRUIT OF NYMPHAEA POLYSEPALA (ENGELM.) GREENE.

*Specimens examined*—Continued.

## Dry—Continued.

*Wilcox* 1; Klamath Agency, 1902, *Walpole* 2221; ponds, Salem, 1871, *Hall*; Mount Hood, 1898, *Applegate* 2844; vicinity of Portland, 1905, *Wm. Palmer* 1474; ponds near Portland, 1900, *Henderson* 44 (Mo.); near Coos Bay, 1880, *George Engelmann* (Mo.).

MONTANA: Spanish Basin, Gallatin County, 1898, *Blankinship*; Big Fork, 1901, *MacDougal* 566 (N. Y.); Forks of the Madison, 1897, *Rydberg & Bessey* 4058; Spanish Basin, 1897, *Rydberg & Bessey* 4059 (N. Y.); Spanish Creek, Gallatin County, 1901, *J. Vogel* (Gray); Lost Horse Pass, Bitter Root Forest Reserve, 1897, *Leiberg* 2982; Madison Valley, *Robert Adams*; no locality, *E. V. Wilcox* 326.

WYOMING: Norris Geyser Basin, Yellowstone National Park, 1899, *Blankinship* (Mo.); Shell Creek, Big Horn Mountains, 1899, *Tweedy* 2284 (N.Y.); shallow water near Leighs Lake, 1901, *Merrill & Wilcox* 1116; Beaver Lake, Yellowstone National Park, 1902, *Mearns* 2626; in a small lake, Norris Geyser Basin, 1899, *A. & E. Nelson* 6152; Yellowstone National Park, 1902, *Mearns* 2526, 2624; head of Green River, 1894, *A. Nelson* 898; pond one mile east of the Falls of the Firehole River, Yellowstone National Park, 1887, *Ward*.

IDAHO: Valley of Lake Tesemini, Kootenai County, 1892, *Sandberg, MacDougal & Heller* 701; Lake Coeur d'Alene, 1892, *Aiton* 71 (N. Y.); Farmington Landing, Lake Coeur d'Alene, 1892, *Sandberg, MacDougal & Heller* 621; in the South Fork of the Coeur d'Alene River, near Old Mission, 1895, *Leiberg* 1412; Clarks Fork, 1889, *Greene* (Greene); North Fork of Columbia River near Lake Pend Oreille, *Leiberg*.

UTAH: Uintas, northern Utah, 1869, *Watson*.

COLORADO: Small lake in Animas Valley, 1875, *T. S. Brandegee* 1166 (Phila.); Osborne Lake, 1864, *Parry* (Gray, Mo.).

NEVADA: Marlette Lake, Washoe County, 1902, *Baker* 1479.

CALIFORNIA: Stockton, 1902, *L. Belding*; 10 to 15 miles west from Amedee, alt. 1,200 meters, 1897, *Jones*; Susie Lake Trail, Lake Tahoe Region, 1909, *McGregor* 179; without locality, *Bridges* 13a (C.); Lagunitas, Marin County, 1877, *Edwards* (N. Y.); Pudding Creek, Mendocino County, 1894, *Eastwood* (Gray); Plumas County, *Mrs. Ames* (Gray); Blue Lakes, Lake County, 1893, *Blankinship* (Gray); Stockton, 1890, *Greene* (Greene); Stockton, 1890, *J. A. Sanford* (Greene); Siskiyou County, 1876, *Greene* (Greene); Eureka, Humboldt County, 1890, *Greene* (Greene); Big Lagoon, Big River, 1903, *McMurphy* 194; without locality, 1875, *G. R. Vasey*; near Lassen Buttes, Plumas County, 1897, *Brown* 656; without locality, *Hartweg* 1637 (Gray); sloughs

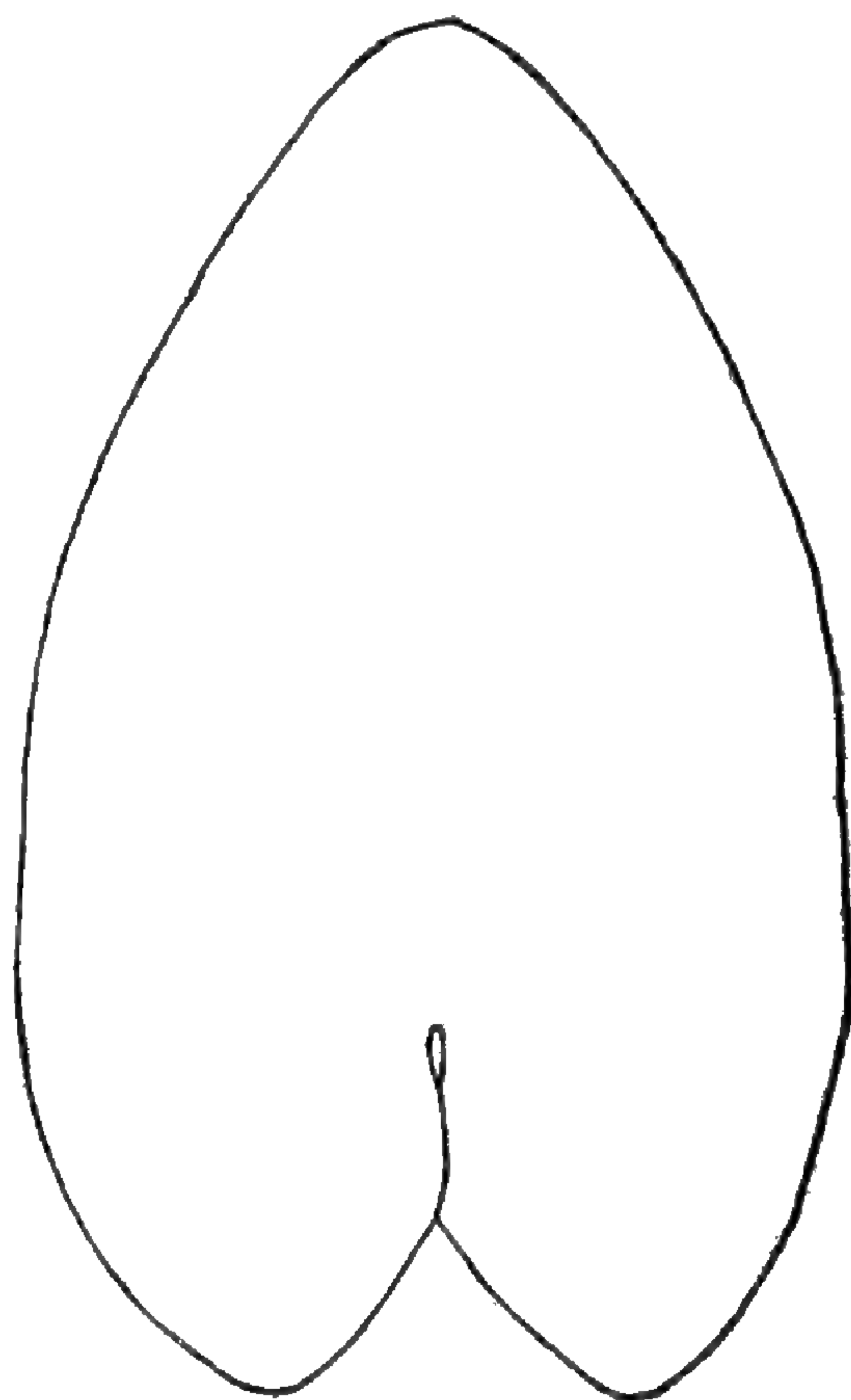


FIG. 40.—Leaf outline of *Nymphaea polysepala*, southern form. Scale  $\frac{1}{4}$ .

*Specimens examined*—Continued.

## Dry—Continued.

near Stockton, 1896, *Jepson* (Gray); Mad River near Vances, Humboldt Bay, 1901, *Chandler* 1236; Olema Lake, Marin County, 1862, *State Survey* 1481; Truckee, 1893, *Miss Michener*; Long Valley, 1866, *Bolander* (Mo.).

The species seems to be fairly constant in all its essential characters. As in other species, the leaves are somewhat variable but within definite limits. Figure 38 represents the typical leaf form exhibited by the greater number of specimens. Figure 39 shows a leaf outline characteristic of the southern representatives of the species. There seem to be no concomitant characters which, combined with the difference in leaf form, might separate the northern and southern plants.

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# DESCRIPTIONS OF NEW PLANTS PRELIMINARY TO A REPORT UPON THE FLORA OF NEW MEXICO.

By E. O. WOOTON and PAUL C. STANDLEY.

## INTRODUCTION.

For several years the writers have had in preparation a flora of New Mexico. The manuscript of the grasses was the first part to be completed, the material of this family in the herbarium of the New Mexico Agricultural College having been carefully worked over in the winter of 1906-7. There has been published recently as a bulletin of the New Mexico Agricultural Experiment Station a list of the grasses and grass-like plants of the State in which are enumerated all the species of the Poaceae, Juncaceae, and Cyperaceae, which we have seen from within our limits, the paper being accompanied by keys to the genera and species. While the material in the Agricultural College Herbarium was the basis of that report, all of that in the National Herbarium has now been gone over carefully, resulting in many additions to our first list.

The Cactaceae of the State have been treated in a similar bulletin published by the same institution. The flora of New Mexico is particularly rich in representatives of this family, no less than 67 being known to occur within the State, while additional ones are doubtless to be discovered.

Other briefer papers dealing with special groups of New Mexican plants have been published from time to time, notably one treating the genus *Androsace*,<sup>1</sup> one upon the genus *Delphinium*,<sup>2</sup> and several describing miscellaneous new species from the State.<sup>3</sup>

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During the winter of 1910-11 both writers gave most of their time to the completion of the report upon the flora of New Mexico, the work being carried on at the National Herbarium. Here are found nearly all the larger collections made in the State from the earliest times, the only important exceptions being those of the James, Wislizenus, and Emory expeditions. The National Herbarium includes the larger sets of Fendler, Wright, Bigelow, Newberry, Heller, Earle, Skehan, and Metcalfe, besides many smaller ones, prominent among the last being one by Dr. E. A. Mearns and another of several hundred numbers gathered by members of the Biological Survey in connection with their field work in the State. More important than these collections, at least for the purposes of determining distribution, are those secured by the writers themselves, embracing several thousands of specimens from almost every part of the State. During the summer of 1911, besides, a careful examination was made of all the New Mexican material in the herbarium of the Agricultural College, resulting in the addition of many other species to our lists. The latter herbarium contains all the more recent sets of New Mexican plants, besides specimens of nearly all collections made by the writers. In addition, there are hundreds of smaller collections to be found nowhere else, not having been made in duplicate. Such are those of Prof. T. D. A. Cockerell, Dr. C. L. Herrick, Mrs. W. T. Bartlett, Miss Charlotte Ellis, Messrs. Maltby and Coghill, and many others who have forwarded their specimens to the Agricultural College for identification.

As a result of our study of this rather ample material we have compiled a list of the plants of the State, which shows that the flora of New Mexico will compare favorably in number of species with that of any of the Western States. It is to be remembered that the plant life of the State is still imperfectly known, except in certain limited localities. Even in those areas which have been fully investigated unknown plants are often turning up; and there are extensive ranges of mountains and hills, as well as stretches of plains, where little or no collecting has been done. For example, the Jemez Range, one of the largest in the State, has never been visited by a botanist. Fewer things of interest are to be expected there, however, than in some of the regions near the boundaries, particularly on the eastern and southern sides. One of the writers in the summer of 1911 collected in the northwestern corner of New Mexico and found more than a hundred species that had not been known previously from the State. Equally productive would be collections made along the southern edge of New Mexico, especially in the Guadalupe and San Luis Mountains and about the south end of the Sacramentos. Along the western border there may be expected many Arizona species which have not yet been collected in New Mexico. When it is realized that the area

of New Mexico is above one hundred and twenty thousand square miles, which is considerably more than the combined areas of New York and the New England States, and that the number of those who have collected extensively in the region is less than a dozen, it is clear that there remains a fertile field for exploration by those interested in taxonomic botany. When new plants are still being found in New England, where for the past century or more hundreds of botanists and botanical collectors have been at work, it is evident that it will be many years before any botanist working in almost any part of New Mexico will fail to find plants that have not before been reported from the State.

There has been published but a single flora covering any considerable part of the great southwestern region, Coulter's *Botany of Western Texas*, although Doctor Gray published several more or less extended papers dealing with various collections from New Mexico. The latter, however, were reports upon the collections of the earliest botanical explorers, who passed through the country hurriedly and were unable to visit the most interesting collecting grounds. Certain groups of southwestern plants have been treated in monographs, but the material from New Mexico examined by students heretofore has been scant and often imperfect. Hence, as might be expected, an attempt to write a complete flora of New Mexico in the light of abundant material has found the taxonomy of our plants in an almost chaotic condition. This is particularly true of those groups which have not been monographed recently. The number of plants here described as new is thus rather large. The diagnoses published in the present paper, however, include practically all undescribed species found by us while working upon the flora of the State.

The manuscript for the proposed New Mexican flora is nearly completed and, it is expected, will be published shortly. It is deemed advisable for several reasons to issue the descriptions of the new species in advance of the complete work. A state flora in its usual form is bulky enough with the material that it must contain without being burdened with pages of descriptions of new plants. Moreover, the amateur in botanical work, for whose use a flora is chiefly intended, is likely, unless all the species are described therein, to have his attention attracted especially to those plants of which he finds descriptions and to strive unduly to associate his specimens with those species. The insertion of occasional diagnoses destroys the uniformity of a work also and seems to us in every way undesirable.

The descriptions published here are arranged by families in their natural order, the genera and species in most cases being in alphabetical sequence. Most of the species discussed are from the southern part of the State, where less botanical work has been done than elsewhere. Not a few, however, are from the northern part. The latter

might have been expected in Doctor Rydberg's Flora of Colorado, and their omission may have resulted from their being overlooked within that State; or they may be plants which do not range so far north. While the flora of those mountains which are the southern extension of the Sangre de Cristo Range, and form the great mass of peaks lying between Santa Fe and Las Vegas, is similar to that of the mountains of southern Colorado, there are found in their canyons and on their slopes more than a few well-known plants which apparently do not occur in Colorado.

The types of the following new species are all in the National Herbarium. With a few exceptions, which are plainly indicated, all are from New Mexico. In nearly every case we have had access to an abundance of material, consisting either of several collections from adjacent or distant localities or of additional individuals of the type collection. In every instance in which the material was scanty the plant was one so strongly marked that its specific distinctness could not be questioned.

Nearly all the new species, as well as new names, are published jointly by the two authors. Exceptions are clearly indicated. We have included descriptions of several plants determined as new species by Dr. E. L. Greene, but never described. These are principally from the collections made by Mr. O. B. Metcalfe. Many other plants of Mr. Metcalfe's collections, distributed under new names, we have associated with published species. The present paper includes also descriptions of several new species detected by Prof. J. J. Thornber, of the University of Arizona, in connection with his work upon the flora of that State.

## DESCRIPTIONS AND NEW NAMES.

### POACEAE.

*Aristida pansa* Wooton & Standley, sp. nov.

Erect, caespitose perennial, 25 to 40 cm. high, forming tufts 10 cm. or more in diameter; culms simple, rigid, though slender, minutely puberulent, glabrous in age, somewhat striate; leaves mostly basal, narrowly linear, involute, striate, puberulent throughout, more or less curled; sheaths of the basal leaves overlapping, 1 to 2 cm. exposed, those of the culms 4 to 5 cm. long, closely investing the culms; ligule a tuft of very fine, white hairs encircling the sheath both inside and out; blades 5 to 15 cm. long, those of the upper culms shortest; panicle at first strict, 10 to 20 cm. long, bearing many more or less crowded spikelets, at last spreading, the branches rigidly ascending, mostly in pairs; rachillæ slender, almost capillary, bearing several crowded small spikelets; glumes slightly unequal, the first shorter, glabrous, narrowly lanceolate, acuminate, 1-nerved, the nerve sometimes slightly produced, purple when young, yellowish in age, the second glume about the length of the lemma; this 8 to 10 mm. long, attenuate upwards, slightly twisted at maturity, scabrous above, callous and bearing a tuft of white hairs; awns short, 10 to 20 mm. long, at

first merely spreading, in age twisted at the base and bent at right angles to the glume.

Type in the U. S. National Herbarium, no. 690259, collected on Tortugas Mountain, Dona Ana County, October 6, 1904, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Tortugas Mountain, October 22, 1892, *Wooton* 1087.

Lloyd's 195, from foothills near Hacienda de Cedros, Mazapil, Zacatecas, Mexico, collected in 1908, is probably the same species.

In the type locality the species is associated with several others of the genus. It somewhat resembles *A. vaseyi*, with which it is found, but may be recognized by the spreading panicle with its numerous spikelets and by the widely divergent awns.

***Aristida vaseyi* Wooton & Standley, sp. nov.**

*Aristida reverchoni angusta* [*angusta*] Vasey, Contr. U. S. Nat. Herb. 3: 46. 1892.

TYPE LOCALITY: "Comanche Peak," Texas.

SPECIMENS EXAMINED: Socorro, 1895, *Plank* 56; mountains west of San Antonio, 1908, *Wooton* 3860; Tortugas Mountain, October 6, 1904, *Wooton*; Pena Blanca, October 21, 1906, *Wooton & Standley*; Mangas Springs, September 2, 1897, *Metcalf*; Alamogordo, 1908, *Hitchcock* 2542.

Our New Mexican material exactly matches the type (Reverchon's plant), and some of it has been referred to *A. reverchoni* by various students of the genus. It is probably a distinct species. There seems to be a typographical error in the original publication, the name being printed *angusta*, not *angusta*, as Doctor Vasey doubtless intended.

In order to avoid the use of a name about which there is some uncertainty, and at the same time to give the plant the specific rank it certainly deserves, we dedicate it to Dr. George Vasey, who was for years a careful student of the grasses of the southwestern region and first recognized this plant as distinct.

This may prove to be *A. fasciculata* Torr., described from material collected by Doctor James in the "forests of the Canadian," a locality somewhere in northeastern New Mexico. We have been unable to compare our material with the type of that species or with authentic specimens.

## CONVALLARIACEAE.

***Salomonias cobrensis* Wooton & Standley, sp. nov.**

Rootstocks slender; stems slender, somewhat flexuous, 20 to 40 cm. high, glabrous; leaf blades elliptic, 50 to 95 mm. long, 10 to 32 mm. wide, acute, narrowed at the base into a broad petiole 3 or 4 mm. long, glabrous, slightly paler beneath, very faintly nerved, none of the nerves prominent except the midrib; peduncles strongly and sharply deflexed, 10 to 15 mm. long, each dividing into 2 or 3 slightly shorter pedicels, these stout and strongly flattened laterally, glabrous; perianth 12 to 19 mm. long, tubular, somewhat expanded toward the mouth, the lobes oblong, obtuse, twice as long as the tube; anthers 6 mm. long, acute, slightly exceeding the almost filiform, slightly roughened filaments; no mature fruit seen, but that present about 6 mm. in diameter.

Type in the U. S. National Herbarium, no. 36170, collected in June at the Copper Mines (Santa Rita) by Dr. J. M. Bigelow (Mexican Boundary Survey no. 1473).

ADDITIONAL SPECIMENS EXAMINED: Copper Mines, 1851, *Wright* 1917; near Kingston, 1904, *Metcalf* 1036.

Our plant is related to *S. biflora* and *S. commutata*. From the former it differs in its narrower and glabrous leaves, strongly deflexed peduncles, and larger flowers; it agrees with it, on the other hand, in the form of the stamens. From *S. commutata* it differs in the form of the stamens, the strongly deflexed peduncles, and the narrower and less prominently nerved leaves.

### ALLIACEAE.

**Allium deserticola** (Jones) Wooton & Standley.

*Allium reticulatum deserticola* Jones, Contr. West. Bot. 10: 30. 1902.

*Allium reticulatum* as applied to plants of southern New Mexico in various reports by Watson, not Fraser.

This is the largest flowered wild onion we have in the State. The flowers are pale pinkish to white with a darker midrib, fading to a dry papery envelope in fruit. The plant is found with us in the foothills of the hotter and drier mountains. It is said to extend into eastern Utah and southern Colorado. We have it from the mountains of the northwestern corner of the State and from the Organ Range.

**Allium rhizomatum** Wooton & Standley, sp. nov.

Plants about 20 cm. high, arising from small, single, scaly-coated, ovate bulbs about 1 cm. in diameter, the outer coats grayish and opaque, the inner white and hyaline, having a few indistinct longitudinal nerves but not reticulate, the bulbs arising from slender, scaly rhizomes 2 or 3 cm. long; leaves 2 or 3, generally longer than the scape, flat, 2 to 3 mm. wide, much broader and clasping at the base, very finely serrulate; scape terete; spathe 2-valved, the valves scarious, broadly ovate, acute, at first pinkish-veined, becoming reflexed and white; umbels erect, few-flowered; pedicels (in young umbels) 1 cm. long or less; flowers small for the genus; perianth segments oblong to oblanceolate, acute, 6 to 8 mm. long, pale with purplish or pinkish midvein, slightly carinate at the base; stamens about equaling the perianth, included, the filaments dilated at the base and coalescent; stigma simple; ovary slightly crested; fruit not seen.

Type in the U. S. National Herbarium, no. 690251, collected at the Gila Hot Springs, August 20, 1900, by E. O. Wooton. Transition Zone.

We hesitate to name another *Allium*, but our material is like nothing else we have been able to discover, being the only species with long and slender rhizomes except *A. glandulosum* Link & Otto, which was named from central Mexico. All material of that species which we have seen comes from the central States of Mexico, not far from Mexico City, a thousand miles or more from the habitat of our plant, and the two are very conspicuously different.

### DRACAENACEAE.

**Yucca baileyi** Wooton & Standley, sp. nov.

Acaulescent; plants solitary; leaves very numerous, rigid, short, 25 to 30 cm. long, 4 or 5 mm. wide or even narrower, smooth, glabrous, yellowish green, thick, convex on both sides near the base, toward the apex flat or shallowly concave on the upper surface, often triangular in cross section, armed with a short, stout tip, the edges of the young leaves with faint white margins, abundantly filiferous, the filaments soft and very slender; inflorescence a simple raceme 50 to 80 cm. long, stout, glabrous; lower bracts subtending the flowers elongated, 10 cm. long, scarious and white or purple at the base, with flat, green tips 4 to 8 cm. long; upper bracts broad, all or nearly all with green herbaceous tips; pedicels stout, 2 to 3 cm. long, erect in flower and in fruit;

perianth segments pure creamy white, not greenish, 60 to 65 mm. long, broadly lanceolate or lance-elliptic, acute; style narrowly oblong, about 1 cm. long, white; filaments slender, papillose; fruit oblong, dehiscent, 5 cm. long, 2.5 cm. thick, rough, costate on the back, erect, short-beaked; seeds dull black, semi-orbicular, somewhat oblique, rounded on the angles, 10 to 12 mm. long, 8 or 9 mm broad, smooth.

Type in the U. S. National Herbarium, no. 686602, collected on a dry slope in pine woods in the Tunitcha Mountains, August 8, 1911, by Paul C. Standley (no. 7638). The description of the fruit is drawn from specimens collected in a canyon of the Carrizo Mountains, July 30, 1911, *Standley* 7448. The plant is named for Mr. Vernon Bailey of the Biological Survey, who first collected it in the Chusca Mountains at an elevation of about 2,700 meters.

This was at first believed to be *Y. angustissima* Engelm., but when complete material was collected in the summer of 1911 it was seen to differ essentially from that species. *Yucca angustissima* has much smaller flowers, strongly constricted capsules, a branched inflorescence, and much smaller seeds of a different shape, and lacks the foliaceous bracts of the inflorescence. *Yucca baileyi* reaches a higher elevation than any other of our species of the genus, being the only one that extends into the Transition Zone. It reaches much farther up into the mountains than *Y. baccata*. So far as we know the species is confined to the chain of mountains including the Chuscas at one end and the Carrizos at the other. It is not improbable, however, that it may be found in some of the not far distant ranges of Arizona and Utah.

***Yucca neomexicana* Wooton & Standley, sp. nov.**

Acaulescent from a thick root, propagating by means of numerous radiating rootstocks, the young plants at the ends of these forming a more or less regular circle about the old plant; leaves short, 25 to 30 cm. long, 8 to 10 mm. wide, constricted near the base and there only about 5 mm. wide, acute and tipped with a slender, straw-colored, very sharp point, glabrous, rather thin, smooth, yellowish, the margins white, cartilaginous, abundantly filiferous below the middle with coarse, white, straight but finally curled filaments; inflorescence a simple raceme, 60 to 90 cm. high, stout, glabrous, bearing at the base 1 or 2 short, reduced leaves, above furnished with numerous narrowly triangular, scarious, white to purple bracts; pedicels stout, 12 to 20 mm. long, recurved in flower; perianth nearly white, 4 cm. long, the segments elliptic-oblong or oblong, obtuse or acutish; style short, greenish, 5 to 7 mm. long, swollen at the base; filaments densely papillose; fruit not seen.

Type in the U. S. National Herbarium, no. 685238, collected on a volcanic hill about half a mile north of Des Moines, Union County, June 20, 1911, by Paul C. Standley (no. 6208). Altitude about 2150 meters. Additional material is mounted on sheets 685239 and 685240. The description is drawn chiefly from material preserved in formalin. Young plants are growing in the greenhouse at Washington.

The plant was very abundant in this one locality, growing all over the top of a low hill, in loose, rocky soil. It was not observed elsewhere. *Yucca glauca* was common on the sides of the hill but the two were readily distinguished at a glance. The principal difference between the two is in the leaves, but this is so striking that the species can scarcely be confused.

## AMARYLLIDACEAE.

***Agave neomexicana* Wooton & Standley, sp. nov.**

PLATE 48.

Leaves numerous, crowded together and forming a compact, almost globose rosette 45 to 60 cm. in diameter when mature; leaves 10 to 30 cm. long, oblong



to ovate-lanceolate, bluish green, glaucous, tipped with a very sharp spine, this brownish black when young, grayish in age, decurrent into a horny, toothed margin bearing 3 or 4 brown or gray, retrorsely hooked teeth on the upper half of the leaf, the lower part armed with fewer and smaller spines, the leaves thick and very rigid; panicle 3 to 5 meters high, with 10 to 15 divergent lateral branches bearing subumbellate clusters of flowers; fresh flowers dull brownish red outside, deep yellow to orange within, 5 to 6 cm. long including the exerted style and stamens; filaments attached by an expanded base to the base of the perianth segments in a saccate depression, 2 cm. long, yellow; anthers versatile, 15 mm. long; style slightly exceeding the stamens; fruit an oblong-elliptic, light brown capsule, 25 to 35 mm. long and about 20 mm. in diameter.

Type in the U. S. National Herbarium, no. 498333, collected in the Organ Mountains, in June, 1906, by Paul C. Standley (no. 541).

ADDITIONAL SPECIMENS EXAMINED: Tortugas Mountain, 1911, *Standley* 6431; San Andreas Mountains, December 10, 1902, *J. H. Gaut*.

This is a part of *Agave applanata* Mulford, but seems to be very distinct from *Agave applanata* Lem.

EXPLANATION OF PLATE 48.—From a field photograph by E. O. Wooton.

## ORCHIDACEAE.

***Achroanthes porphyrea*** (Ridley) Wooton & Standley.

*Microstylis purpurea* S. Wats. Proc. Amer. Acad. 18: 195. 1883, not Lindl.

*Microstylis porphyrea* Ridley, Journ. Linn. Soc. Bot. 24: 320. 1888.

*Achroanthes purpurea* Greene, Pittonia 2: 184. 1891.

## FAGACEAE.

***Quercus confusa*** Wooton & Standley, sp. nov.

A moderately large, spreading tree, 5 to 7 meters high, with short trunk, grayish, checked bark, and dull greenish gray, pubescent, stout twigs; leaves oblong, 6 to 8 cm. long, 2 to 3 cm. wide, bluish green, glabrous above, almost velvety beneath with yellowish stellate hairs, acute, sinuate-dentate with about 4 coarse, mucronate, lobe-like teeth on each side, only slightly crispate; petioles 1 cm. long or less; buds on new growth small, 2 to 3 mm. long, ovoid, with dark brown scales; acorn 20 to 23 mm. long, barrel-shaped, obtuse; cup hemispheric, 15 to 18 mm. in diameter, covering the lower third of the acorn; scales much thickened on the back.

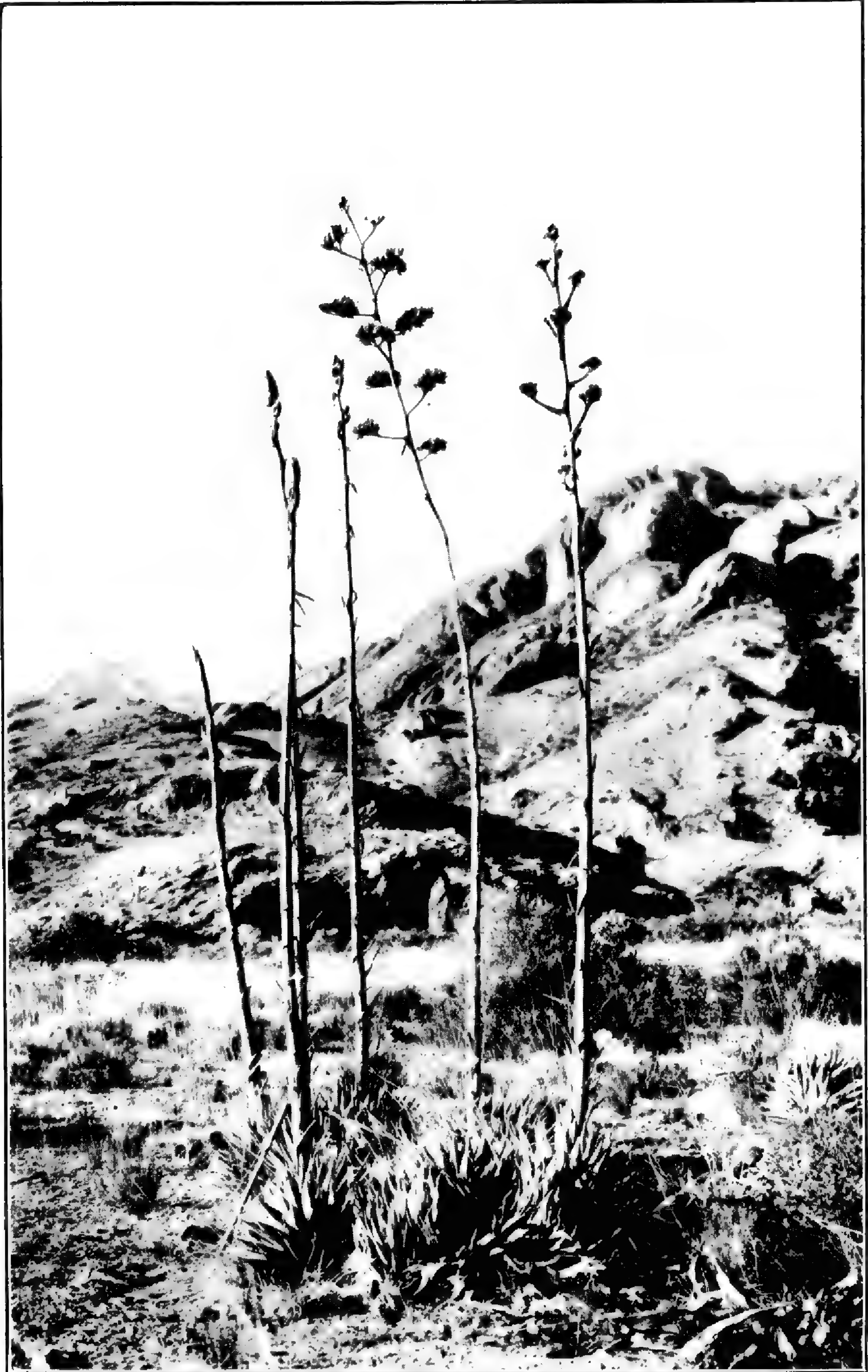
Type in the U. S. National Herbarium, no. 691250, collected on Ruidoso Creek 5 miles east of Ruidoso Post-office, August 5, 1901, by E. O. Wooton. Altitude about 1650 meters.

ADDITIONAL MATERIAL EXAMINED: Gilmores Ranch on Eagle Creek, alt. 2220 meters, July 25, 1901, *Wooton*.

This species is most nearly related to *Q. fendleri*, from which it differs in being a tree and in having still larger leaves (persistent?) and a larger acorn. It occurs at a lower level than is common for *Q. fendleri*, being at home in the Upper Sonoran instead of the Transition Zone, although the latter sometimes comes into the Upper Sonoran.

***Quercus media*** Wooton & Standley, sp. nov.

Low shrub, 1 to 3 meters high, with gray, smooth bark on the older stems, the young branches brown, sparingly pubescent; buds about 3 mm. long, with



AGAVE NEOMEXICANA WOOTON & STANDLEY, IN THE ORGAN MOUNTAINS.

rich reddish brown, glabrous scales; leaves green (not bluish green) and glabrate above, paler beneath and velvety-pubescent with yellowish, stellate hairs, oblong, elliptic, or obovate in outline, acute or obtuse, sinuate-dentate with 2 to 4 coarse, lobe-like teeth on each side, 4 to 7 cm. long, 2 to 3 cm. wide; petioles 1 cm. long or less; teeth mostly mucronate, not spinulose; acorns small, 10 to 13 mm. long, ellipsoidal, acute, the cup hemispheric, 10 to 12 mm. in diameter; the reddish brown scales little or not at all thickened at the base.

Type in the U. S. National Herbarium, no. 690255, collected at Glorieta, August 24, 1910, by E. O. Wooton. Transition Zone.

Another specimen of what seems to be the same is from Oak Canyon near Folsom, collected in 1903 by A. H. Howell (no. 178), in leaf only.

There would seem to be enough species of Rocky Mountain oaks already described, especially of the type of *Q. undulata*, which is at best of doubtful standing. Assuming that *Q. undulata* is a species with bluish green, persistent leaves, the species here described resembles it in nearly all particulars except that its leaves are bright chlorophyll green and probably deciduous. This would make it intermediate between the two groups of the region—the blue green leaved species, which it resembles in habit and shape of leaf, and the green-leaved species, which it resembles in color and texture of leaves and time of dropping its leaves. It might be a hybrid, but the plant was very common about Glorieta, forming numerous clumps of bushes a rod or so in diameter, and Mr. Howell's plant is almost a perfect match from a similar region farther east.

### ARISTOLOCHIACEAE.

*Aristolochia watsoni* Wooton & Standley.

*Aristolochia brevipes acuminata* S. Wats. Proc. Amer. Acad. 18: 148. 1883, not *A. acuminata* Lam.

A not uncommon species of southern Arizona and northern Mexico, which barely reaches the southwestern corner of New Mexico.

### POLYGONACEAE.

*Eriogonum ainsliei* Standley, sp. nov.

Perennial, 15 to 25 cm. high, from a stout, woody root; stems somewhat caespitose, well developed, slender, decumbent at the base and leafy, arachnoid-pubescent; leaves elliptic or linear-oblong, 3 to 4 cm. long, acutish, glabrate above, tomentose beneath, extending about half way up the stem, all on petioles one-third to one-half the length of the blades, attenuate at the base; inflorescence corymbose, the primary branches subtended by linear-subulate bracts 3 to 5 mm. long, the other branches furnished with smaller bracts; involucre short-pedunculate, 3 mm. long, 5-angled, viscid-tomentulose; perianths white tinged with purplish pink, glabrous, the segments obovate; fruit glabrous.

Type in the U. S. National Herbarium, no. 592284, collected at Cimarron, September 20, 1909, by Mr. C. N. Ainslie of the Bureau of Entomology. Additional material of the same collection is mounted on two other sheets.

ADDITIONAL MATERIAL EXAMINED: Cimarron, September 10, 1909, *Ainslie*; Raton Mountains, 1903, *Griffiths* 5097; Colfax, August 13, 1910, *Wooton*.

From the most closely related species, *E. nudicaule* and *E. tristichum*, this plant may be distinguished by its pubescent inflorescence and by the acute lobes of the involucre.

**Eriogonum gypsophilum** Wooton & Standley, sp. nov.

PLATE 49.

Perennial from a thick, woody, cespitose base, the short branches covered with the villous, scale-like bases of old leaves; leaves all basal, thickly clustered, broadly ovate to rotund or reniform, entire, abruptly mucronate, the blades 1 to 2 cm. long, 2 to 3 cm. wide, yellowish green, thick and succulent, glabrous except for a few hairs on the veins beneath and sometimes on the margins; petioles 2 to 3 cm. long, slender, villous, especially at the base; inflorescence a trichotomous cyme 10 to 15 cm. high; bracts small, not leaf-like, the lowest sparingly villous, the upper glabrous; involucre broadly campanulate, 4 or 5-toothed, glabrous, with 6 flowers; pedicels slender, articulated at the base of the perianth, 1 mm. long or less; perianth broadly campanulate, becoming urceolate, the segments ovate, acute or obtuse, the midrib greenish, otherwise bright yellow, sparingly white-pubescent on the middle or glabrous.

Type in the U. S. National Herbarium, no 564576, collected on a hill southwest of Lakewood, growing in pure gypsum, August 6, 1909, by E. O. Wooton. The hill is capped by 50 to 100 feet of limestone, the gypsum appearing in several layers in the lower two-thirds. Our plant did not grow on the limestone soil but was restricted to the outcroppings of the gypsum strata.

The species belongs to the section *Corymbosa* as used by Doctor Rydberg, but is not at all closely related to any of our western species.

EXPLANATION OF PLATE 49.—Part of the type specimen. Natural size.

**Eriogonum leptophyllum** (Torr.) Wooton & Standley.

*Eriogonum effusum leptophyllum* Torr. in Sitgreaves, Rep. Zuni & Colo. 168. 1854.

The plant is similar to *E. effusum*, with which it was at first associated, but differs in its linear and revolute instead of oblong and flat leaves, and in the low, sparingly branched inflorescence not more than 5 cm. high. In *E. effusum* the inflorescence is densely branched and often 15 to 20 cm. long.

**Eriogonum leucophyllum** Wooton & Standley, sp. nov.

Perennial from a thick, woody root, cespitose; leaves all basal, elliptic, 13 to 20 mm. long, about 7 mm. wide, narrowed at the base into a broad petiole 7 to 11 mm. long, densely tomentose beneath, sericeous on the upper surface, white in general appearance; stems scapiform, simple below, about 30 cm. high, slender, tomentose below, tomentulose about the inflorescence, loosely corymbose above, the corymb being 10 to 15 cm. high, its slender branches ascending; involucre in the forks of the branches on slender peduncles 20 to 35 mm. long, the others on peduncles 7 mm. long or more, broadly campanulate, 2 mm. high, with triangular teeth almost equaling the tube, finely sericeous; perianth yellow, densely silvery-pubescent, some of the flowers reflexed in age; ovary densely pubescent.

Type in the U. S. National Herbarium, no. 564577, collected at Lakewood August 6, 1909, by E. O. Wooton.

While related to *E. lachnogynum*, our plant is evidently distinct in its broader, more densely pubescent leaves, taller stems, openly branched inflorescence, and much smaller and more numerous involucre.

**Eriogonum pannosum** Wooton & Standley, sp. nov.

Perennial from a thick, woody caudex covered with the persistent bases of the dead leaves; stems numerous, stout, 20 to 45 cm. high, corymbosely branched above, densely white silky pubescent; leaves mostly basal, those of the stem few, scattered, reduced, the basal ones oblanceolate or spatulate, obtuse, abruptly short-acuminate, narrowed at the base into a long, margined petiole, 40 to 65 mm. long, densely and finely tomentose beneath, sericeous



ERIOGONUM GYPSOPHILUM WOOTON & STANDLEY.

above with a white pubescence, this often denser along the veins so as to produce the appearance of longitudinal silvery lines; involucre 2 or 3 mm. long, campanulate, sericeous, the teeth low, triangular, acute, all on stout pedicels 5 to 10 mm. long; perianth 2 mm. long, yellow, conspicuously sericeous, the segments oblong, on slender, glabrous pedicels reflexed at maturity; achenes glabrous, 3 mm. long, spherical and turgid at the base, narrowly winged above the middle.

Type in the U. S. National Herbarium, no. 45775, collected in the Organ Mountains, August, 1881, by G. R. Vasey.

ADDITIONAL SPECIMENS EXAMINED: Organ Mountains, June 25, 1894, *Wooton*.

Our proposed species is nearest *E. hieracifolium*. That species differs, however, in the loose and longer, coarser pubescence of the leaves and stem, greater size, larger and narrower, more acute leaves, larger involucre 3 to 5 mm. long, and the larger perianths.

### CHENOPODIACEAE.

***Atriplex flagellaris*** Wooton & Standley, sp. nov.

Perennial; stems trailing, slender, 30 to 40 cm. long, weakly ascending at the tips; cortex at first densely white-scurfy, becoming glabrous, shining, shreddy near the base of the stems; leaves numerous, small, 1 to 3 cm. long, scarcely half as broad, oblong to narrowly obovate, tapering into a short petiole, glabrate above, white-scurfy beneath, obtuse or acute, the margins entire or with a few coarse teeth on each side; flowers few, axillary; pistillate flowers 2 to 5 in the axil, usually only one producing fruit; staminate flowers in small, spherical heads 2 mm. in diameter in the same axils; fruiting bracts cuneate-obovate, 5 or 6 mm. long, united to above the middle, prominently 3 to 5-nerved, not appendaged on the back, the upper part of each bract herbaceous with one large central tooth and one or two small lateral ones on each side; seed lenticular.

Type in the U. S. National Herbarium, no. 562291, collected in the Mesilla Valley, June, 1906, by Paul C. Standley (no. 490).

ADDITIONAL SPECIMENS EXAMINED: Mesilla Valley, July 4, 1906, *Wooton*; Mesilla Valley, May 1, 1907, *Wooton & Standley*.

Judging from the description alone and from the character of the fruit, our plant is related to *A. barclayana* D. Dietr., but it differs in having much larger fruit with fewer teeth, while the plant is much smaller and slenderer than that species of the western coast of Mexico.

This is a dooryard and wayside weed commonly found in locations preferred by *A. elegans*, with which it was confused for a long time. Herbarium specimens look somewhat like that species, but the habit of the two is very different, as are their fruits.

***Atriplex collina*** Wooton & Standley, sp. nov.

Low, densely branched shrub, 25 cm. high or less, forming broad, rounded clumps; branches ascending or spreading, ending in sharp, spinose tips, stout, loosely but copiously lepidote; leaves very numerous, small, 2 cm. long or shorter, elliptic-oval to elliptic or nearly lanceolate, thick and fleshy, densely lepidote, obtuse or acutish, acute or cuneate at the base, on very short, broad petioles; plants dioecious, apparently, only the pistillate collected, the fertile flowers axillary, sessile; bracts united only at the base, rather thin, very broadly ovate or quadrilateral, 8 mm. long or smaller, densely lepidote, broadly cuneate at the base, acutish, all or nearly all obtusely dentate on the margins, smooth on the backs.

Type in the U. S. National Herbarium, no. 686447, collected on dry hills near the north end of the Carrizo Mountains, July 31, 1911, by Paul C. Standley (no. 7481).

Related to *A. confertifolia*, but with dentate bracts not rounded at the apex, much smaller leaves, and sessile fertile flowers.

### AMARANTHACEAE.

***Gomphrena viridis* Wooton & Standley, sp. nov.**

Low, caespitose perennial from a long, woody root; basal leaves bright green, obovate to elliptic-oblong, the blades 3 to 7 cm. long, obtuse or acutish, gradually narrowed at the base into a long, slender petiole, sparingly strigose with fine short hairs or nearly glabrous on the upper surface; stems slender, prostrate or spreading, tortuous, 3 to 10 cm. long, cinereous-puberulent to thinly sericeous; cauline leaves a single pair, in outline like the basal ones, or broader, often orbicular, on slender petioles 5 to 10 mm. long; peduncles terminal, slender, 35 to 70 mm. long, loosely sericeous but not densely so; heads subglobose, 8 to 20 mm. high; bracts scarious, white, ovate, acute; calyx lobes linear-oblong or oblanceolate, obtuse, entire, with a broad green midvein and scarious white margins, densely long-hairy.

Type in the U. S. National Herbarium, no. 660403, collected on Hanover Mountain, Grant County, July 31, 1911, by J. M. Holzinger.

ADDITIONAL SPECIMENS EXAMINED: 1851-2, *Wright* 1753; base of San Luis Mountains, up to 1800 meters, September 5, 1893, *Mearns* 2133.

The species also occurs in southeastern Arizona.

Closely related to *Gomphrena caespitosa*, but with green, narrower leaves, sparse pubescence, more conspicuously petioled cauline leaves, and prominently green calyx lobes.

### ALLIONIACEAE.

***Allionia linearifolia filifolia* Standley.**

*Allionia gracillima filifolia* Standley, Contr. U. S. Nat. Herb. 12: 340, 1909.

An examination of the type of *Oxybaphus linearifolius* S. Wats. shows that *Allionia gracillima* Standley is a synonym of that species.

***Allionia subhispida* (Heimerl) Standley.**

*Mirabilis linearis subhispida* Heimerl, Ann. Cons. Jard. Genève 5: 186, 1901.

*Allionia linearis subhispida* Standley, Contr. U. S. Nat. Herb. 12: 342, 1909.

This was well described by Doctor Heimerl. It may be distinguished from *A. linearis* by its abundant hirsute pubescence present on all parts of the branches. It has been collected in New Mexico several times recently.

### PORTULACACEAE.

***Talinum angustissimum* (A. Gray) Wooton & Standley.**

*Talinum aurantiacum angustissimum* A. Gray, Pl. Wright. 1: 14, 1852.

This has long been confused with *T. aurantiacum*, a larger, stouter, more succulent plant with larger, orange-colored flowers. It is difficult to distinguish the two by herbarium specimens, but no one can confuse them in the field. Both species have been confused with *T. lineare* H. B. K., a plant known only from central Mexico.

***Talinum longipes* Wooton & Standley, sp. nov.**

Root slender, very long and tortuous, the crown covered with the persistent bases of dead leaves; leaves numerous and crowded, appearing basal, 12 to

20 mm. long, terete, acutish, slender; scapes very slender, 10 to 12 cm. high, corymbosely branched above; flowers few (3 to 5), all on slender pedicels 3 to 6 mm. long; bracts lanceolate or triangular, scarious; sepals nearly orbicular, 2 mm. long, very thin; petals pinkish, 4 or 5 mm. long; stamens 10; capsule nearly spherical, 3.5 mm. high.

Type in the U. S. National Herbarium, no. 690249, collected on Tortugas Mountain, August 27, 1894, by E. O. Wooton. Apparently the same is part of Wright's 875 in the National Herbarium.

Our plant is unlike the related species, such as *T. parviflorum*, in the form of the sepals and the number of stamens, and in the well-developed pedicels.

**Talinum pulchellum** Wooton & Standley, sp. nov.

Roots stout, dark brown, woody; stems stout and fleshy, 10 cm. high or less, simple below, corymbosely branched above; leaves apparently terete, perhaps slightly flattened, 12 to 20 mm. long, 1.5 to 2 mm. in diameter, not narrowed at the base, blunt, scattered along the stems; flowers axillary, solitary; peduncles stout, 2 or 3 mm. long; pedicels slender, 6 to 20 mm. long; sepals elliptic-lanceolate, about 7 mm. long, acute, smooth, greenish below, scarious-margined; petals about 15 mm. long, purplish red; stamens about 20.

Type in the U. S. National Herbarium, no. 617671, collected near Queen, August 2, 1909, by E. O. Wooton. Altitude about 1,770 meters.

The proposed species is nearest *T. brevifolium*, but differs in habit, size of flowers, form of sepals, and length of pedicels. The two species form a section very unlike the other members of the genus.

### ALSINACEAE.

**Arenaria mearnsii** Wooton & Standley, sp. nov.

A slender, diffusely branched perennial; stems reclining at the base, minutely cinereous-puberulent; leaves linear or linear-elliptic, bright green, numerous, glabrous, somewhat pungently pointed, 8 to 12 mm. long, 2 mm. wide or less; flowers numerous, on slender, ascending, almost glabrous pedicels 10 to 15 mm. long; sepals lanceolate to lance-ovate, attenuate to long, subulate tips, glabrous, bright green with scarious margins, 4 to 5 mm. long; petals 1 or 2 mm. longer than the sepals; capsules 1 to 2 mm. shorter than the sepals.

Type in the U. S. National Herbarium, no. 233375, collected in a canyon of the San Luis Mountains on the New Mexico-Mexico boundary, September 11, 1893, by Dr. E. A. Mearns (no. 2216).

Our specimens seem not to agree with any described species of the United States or Mexico. They are nearest *A. saxosa* and *A. confusa*, but differ from both in the narrow, glabrous, more or less pungently pointed leaves and sparser pubescence. From the former they also differ in the longer pedicels, and from *A. confusa* they are distinguished by the longer sepals and ascending pedicels.

**Drymaria pachyphylla** Wooton & Standley, sp. nov.

Annual; stems slender, prostrate, glabrous, sparingly branched; basal leaves spatulate; cauline leaves ovate, obtuse, glabrous, glaucous, thick, 10 mm. long or less, 6 to 8 mm. wide, narrowed at the base into a slender petiole one-half as long as the blade or more; flowers solitary on the pedicels, clustered in the axils, on rather stout, glabrous pedicels 3 or 4 mm. long; sepals oblong, 3 mm. long, glaucous, with thin, scarious, white margins; capsule slightly exceeding the sepals.

Type in the U. S. National Herbarium, no. 330629, collected on the dry plains south of the White Sands, August 20, 1897, by E. O. Wooton (no. 405). Altitude



tude about 1,230 meters. Also gathered by the same collector at the same place, August 5, 1899.

The type collection was distributed as *D. holosteoides* Benth., a plant of Lower California. Our species is cited from western Texas under this name in the Synoptical Flora. That species, however, has much narrower, acutish leaves, and puberulent pedicels. Another related species is *D. crassifolia* Benth., also of Lower California, but that has much thicker, fleshier leaves, and is a very densely branched perennial.

Besides the New Mexican specimens cited above we have a sheet collected by Havard on the Tarlinga River in western Texas.

### FUMARIACEAE.

*Capnoides euchlamydeum* Wooton & Standley, sp. nov.

Annual or biennial with very slender, ascending or decumbent, glabrous stems; leaves twice pinnate, glabrous, the ultimate segments cuneate or oblong, acute or obtuse, bright green above, glaucous beneath; primary pinnæ mostly divaricate, a pair inserted usually almost at the base of the rachis; flowers in slender, few-flowered racemes; bracts 12 to 25 mm. long, broadly oblanceolate, 4 to 9 mm. wide, acute or acuminate, thin; corolla bright yellow, about 15 mm. long; spur horizontal, thick, half as long as the body; fruit 20 to 30 mm. long, rather slender, not very conspicuously torulose, strongly curved, not angled, on a stout, deflexed pedicel; seeds black and shining, almost smooth, with very obtuse margins.

Type in the U. S. National Herbarium, no. 690256, collected at Cloudfroft in the Sacramento Mountains, August 8, 1890, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: James Canyon, June 26, 1899, *Wooton*; Ruidoso Creek, alt. 1,980 meters, June 29, 1895, *Wooton*; Cloudfroft, 1912, *Stearns* 348.

This *Capnoides* is related to *C. aureum*, but may be distinguished by its very large bracts and by the presence of pinnæ at the base of most of the petioles. It is, besides, a rather more slender plant, with more dissected and delicate leaves.

### RANUNCULACEAE.

*Clematis neomexicana* Wooton & Standley, sp. nov.

A woody climber, one or two meters high; stems striate, finely pubescent; leaves pinnately 5-foliolate, on petioles 4 to 6 cm. long; leaflets ovate in outline, 35 to 60 mm. long, 25 to 45 mm. wide, shallowly 3-lobed, the terminal lobe acute to obtuse, never long-attenuate, the lobes entire or coarsely crenate with obtuse teeth; leaflets bright green, slightly paler beneath, finely and loosely pubescent on both surfaces; flowers in a loose, few-flowered panicle, on a peduncle about 5 cm. long; pedicels about 25 mm. long; sepals oblong-spatulate, obtuse, finely pubescent, 12 mm. long, much exceeding the stamens; carpels densely hairy, tapering gradually into the plumose tail 15 to 35 mm. long.

Type in the U. S. National Herbarium, no. 233000, collected in the San Luis Mountains, September 5, 1893, by Dr. E. A. Mearns (no. 2136). The collector states that it occurs "from the base up to 6000 feet."

ADDITIONAL SPECIMENS EXAMINED: San Luis Mountains, 1893, *Mearns* 2455; Organ Mountains, alt. 2,100 meters, September 23, 1906, *Wooton & Standley*; Organ Mountains, alt. 1,410 meters, 1897, *Wooton* 150; Organ Mountains, alt. 1,950 meters, 1897, *Wooton*; east side Organ Mountains, alt. 1,350 meters, August 17, 1895, *Wooton*.

The plant is near *C. ligusticifolia*, but differs in its pubescent leaflets and stems, the different form of the leaflets, the shorter tails of the carpels, and the shape of the carpels. It may be *Clematis ligusticifolia californica* S. Wats., but the Californian material seems to be of a different species.

**Myosurus egglestonii** Wooton & Standley, sp. nov.

Plant glabrous; leaves linear or linear-oblong, obtuse, thick and somewhat fleshy, 8 to 14 mm. long; scapes solitary or numerous, very short, 2 to 5 mm. long, slender; sepals scarious, linear-oblong, obtuse, 3 mm. long, with a slender spur 1 mm. long; petals not seen, apparently wanting; heads of achenes elongated-oblong, 8 to 13 mm. long, 2.5 mm. in diameter; achenes small, the backs suborbicular, with a low, obtuse border, strongly keeled and with a beak from once to twice as long as the diameter of the back, the beak ascending.

Type in the U. S. National Herbarium, no. 660739, collected on a mesa on the road between Tierra Amarilla and Park View, Rio Arriba County, altitude 2,250 meters, April 18 to May 25, 1911, by W. W. Eggleston (no. 6472).

Evidently related to *M. cupulatus*, but readily distinguished by the very short fruiting spikes, the short scapes, and the elongated beaks of the achenes. In size the plant suggests *M. alopecuroides* Greene, of California, but the achenes of the two are very dissimilar.

**Viorna filifera** (Benth.) Wooton & Standley.

*Clematis filifera* Benth. Pl. Hartw. 285. 1848.

**Viorna palmeri** (Rose) Wooton & Standley.

*Clematis palmeri* Rose, Contr. U. S. Nat. Herb. 1: 118. 1891.

## BRASSICACEAE.

**Arabis angulata** Greene, sp. nov. in herb.

Perennial from a rather thick, woody root; stems simple, clustered, slender, erect, 25 to 40 cm. high, pubescent below with few branched hairs, glabrous above; basal leaves oblanceolate to spatulate, 25 to 35 mm. long, 11 mm. wide or less, obtuse, with a few coarse teeth, rather bright green, pubescent with branched hairs; cauline leaves rather remote, smaller, oblong-lanceolate to almost linear, sessile, auricled, the auricles mostly acute, the lower leaves pubescent, the upper glabrous, obtuse or acute; racemes elongated, slender; pedicels slender, divergent, 12 mm. long or less; sepals purplish, oblong, obtuse, 2.5 mm. long, with scarious margins, usually with a few hairs; petals twice as long, purple; pods slender, 45 to 60 mm. long, 1 mm. wide, curved upward, glabrous; seeds in a single row.

Type in the U. S. National Herbarium, no. 495141, collected at Mangas Springs, April 9, 1903, by O. B. Metcalfe (no. 12). Altitude 1,430 meters.

A species of the group to which belongs *A. fendleri*, distinguished especially by its very long, slender pods conspicuously curved upward.

Doctor Greene recognized this as an undescribed species when Mr. Metcalfe's plants were being named, and the plants were distributed under the name here given to them; a description, however, has not been published until now.

**Arabis porphyrea** Wooton & Standley, sp. nov.

Perennial from a long, slender, woody root; stems slender, erect, pubescent below with branched hairs, glabrous above, purplish; basal leaves 40 mm. long or less, spatulate or oblanceolate, stellate-pubescent, long-petioled; lower cauline leaves petioled, oblanceolate, obtuse, stellate-pubescent, the upper ones linear or linear-oblong, acute, glabrous, sessile and auricled, reduced; pedicels divaricate or reflexed, 10 or 12 mm. long, slender; sepals oblong, obtuse or acutish, 3 mm.

long, with a few branched hairs, purple; petals purple, twice as long as the sepals; pods about 35 mm. long and 1.5 mm. wide, purplish, glabrous, stout, straight or curved downward; seeds in 2 rows, winged.

Type in the U. S. National Herbarium, no. 561991, collected on the dry hills near the Cueva on the west side of the Organ Mountains, April 25, 1907, by E. O. Wooton and Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Modoc, March 19, 1905, *Wooton*; Magdalena Mountains, June, 1880, *Vasey*.

This somewhat resembles *A. angulata*, but has much shorter, broader, purplish pods curved downward instead of upward.

***Dithyrea griffithsii* Wooton & Standley, sp. nov.**

Stems erect, stout, branched, densely stellate-pubescent; cauline leaves entire, narrowly lanceolate, 25 to 40 mm. long, acute, narrowed to the base, sessile, finely stellate-pubescent on both surfaces; pedicels about 15 mm. long, slender, divergent; flowers numerous, at first congested, becoming more distant after anthesis; sepals narrowly oblong, 3 mm. long; petals obovate, clawed, the whole petal 6 or 7 mm. long; fruit 10 mm. wide, the segments 5 mm. high, truncate at the apex, cordate at the base, glabrous, conspicuously reticulate-veined, the border not well developed.

Type in the U. S. National Herbarium, no. 486760, collected by Dr. David Griffiths on the Arroyo Ranch, near Roswell, September 1 to 4, 1903 (no. 5687). A specimen collected by Mrs. Matilda Coxe Stevenson near Zuni in 1902 (no. 74) appears to be the same.

From our other species, *D. wislizeni*, this may be distinguished at once by its glabrous, conspicuously veined fruit. Its cauline leaves, too, are quite entire, while in *D. wislizeni* almost all have a few sinuate teeth, at least near the base.

***Draba gilgiana* Wooton & Standley, sp. nov.**

A densely caespitose perennial from a very thick, woody root covered at the crown with the persistent bases of old leaves; leaves mostly basal, very numerous, densely clustered, linear-oblong, acutish, 35 mm. long and 3 mm. wide or less, tapering gradually into a slender, flat, yellowish petiole; blades bright green, glabrous, or with a very few scattered hairs; stems long and slender, ascending or reclining, 12 cm. long or less, glabrous; cauline leaves few and remote, linear to oblong, 4 to 10 mm. long, acute; flowers few, clustered at the end of the stem, the racemes elongating in fruit; pedicels slender, glabrous, nearly erect, 5 or 6 mm. long; sepals rounded-oblong, glabrous, obtuse, 2.5 mm. long; petals bright yellow, about twice as long; fruit almost 6 mm. long, oblong-lanceolate, acute, glabrous, ending in a slender style slightly more than 1 mm. long.

Type in the U. S. National Herbarium, no. 561295, collected on Organ Peak in the Organ Mountains, September 23, 1906, at an altitude of about 2,550 meters, by E. O. Wooton and Paul C. Standley. The plant was growing high up near the summit of the peak, in the Transition Zone, in rich, deep soil in the shade of oak chaparral.

ADDITIONAL SPECIMENS EXAMINED: Van Pattens, August 29, 1894, *Wooton*; Organ Mountains, alt. 2040 meters, 1897, *Wooton* 675; Tortugas Mountain, September, 1893, *Wooton*.

The specimen from Tortugas Mountain has even narrower leaves than those from the Organs. It seems improbable that a plant of the dry Lower Sonoran Zone can be the same as one found high up in the moist canyons. Our material from Tortugas Mountain, however, is insufficient for satisfactory determination.

Our species is nearest *D. petrophila* Greene, but it is much more slender and nearly glabrous, while the cauline leaves are fewer and more reduced; the basal leaves, too, are different in outline.

The plant was marked as a new species in the National Herbarium by Dr. E. Gilg, but apparently was never published by him, probably because of the scantiness of the material he had examined.

***Draba tonsa* Wooton & Standley, sp. nov.**

A low perennial, 6 cm. high or less, densely caespitose from a long, thickened root; leaves in a dense cluster at the base of the scape, linear-oblongate, obtuse, 6 to 18 mm. long, glabrous except for the long-ciliate margins; stems scapose, with a few scattered leaves very unlike the basal ones, glabrous; cauline leaves oblong to ovate, thick, 5 to 16 mm. long, 2 to 6 mm. wide, obtuse or acutish, glabrous, or with a few long hairs on the margins; flowers congested at the ends of the simple stems, few, on glabrous pedicels 3 mm. long or less; sepals broadly rounded-oblong, obtuse, glabrous, 2.5 mm. long; petals bright yellow, about twice as long as the sepals; ovary glabrous, with a long, slender style; mature fruit not seen.

Type in the U. S. National Herbarium, no. 225083, collected on Hermits Peak, in the Las Vegas Mountains, in August (year not given), by F. H. Snow. Also collected near Beulah, at an altitude of 2,400 meters, by T. D. A. Cockerell.

Although our specimens have no fruit, we feel safe in describing them as new, for they seem amply distinct from *D. streptocarpa*, the most nearly related species, in their glabrous stems and nearly glabrous leaves, the sepals, too, being glabrous, and the cauline leaves broader.

***Cheirinia desertorum* Wooton & Standley, sp. nov.**

Stout, herbaceous biennial or short-lived perennial, 30 to 50 cm. high, with one or several rigid, more or less angled stems rising from a dense cluster of basal leaves, the whole plant cinereous throughout with the appressed, 2-parted hairs common in the genus; basal leaves very numerous, 10 to 20 cm. long, narrowly lanceolate or oblanceolate, tapering into a slender petiole, acute, mostly entire, or some with a few coarse teeth, persisting until the plant is in fruit; cauline leaves linear, 3 to 5 cm. long, strongly ascending or erect; flowers small, 6 to 8 mm. long, pale yellow, the claws of the petals little if at all longer than the sepals; pods almost terete, 3 to 7 cm. long, erect or strongly ascending, on short, thick, ascending pedicels.

Type in the U. S. National Herbarium, no. 563775, collected near Hachita, June 16, 1906, by E. O. Wooton.

From the description this would appear to be most closely related to *C. parviflora*, and upon using Doctor Rydberg's key to the genus in the Flora of Colorado one would run to that species at once. But our plant is affiliated with *C. bakeri* and *C. argillosa* in habit and other characters, and is found in dry rocky soil. It is easily distinguishable from either of these species by its small flowers. It is somewhat anomalous in a genus of plants that lose their basal leaves usually before the flowers appear, and especially so in that it inhabits perhaps the driest and hottest region from which species of the genus have been reported.

***Euklisia valida* (Greene) Wooton & Standley.**

*Disaccanthus validus* Greene, Leaflets 1: 225. 1906.

*Disaccanthus mogollonicus* Greene, loc. cit.

*Disaccanthus luteus* Greene, loc. cit.

All these may be *Streptanthus carinatus* Wright, but that is described as having a purple calyx and petals. In our plants they are always yellow.

In the type of *D. luteus* the flowers are of a deeper yellow than in the plant of the Rio Grande region. Following his description of *D. mogollonicus*, Doctor Greene says: "All white-flowered material from New Mexico, from Las Cruces to the upper Gila, belongs here." As a matter of fact, none of our plants have white flowers, but in all both the calyx and corolla are a pale, clear yellow. This fades on drying, so that the flowers often appear white in old specimens.

***Lesquerella lata* Wooton & Standley, sp. nov.**

A caespitose perennial, 10 cm. high or less, from a stout, woody root; stems slender, ascending or prostrate, rather densely lepidote-stellate, with but few, rather distant leaves; these spatulate or oblanceolate, obtuse, thick, tapering at the base into a slender petiole, lepidote-stellate on both surfaces, 13 to 30 mm. long, 4 to 9 mm. wide, the basal leaves longer and on longer petioles; racemes 3 to 4 cm. long, rather densely many-flowered; pedicels slender, spreading, or reflexed in age, 7 mm. long; sepals oblong, 3.5 mm. long; petals 6 or 7 mm. long, bright yellow; capsules oblong to obovate, thinly lepidote-stellate, 3 mm. high, short-stipitate, much surpassed by the very slender style.

Type in the U. S. National Herbarium, no. 563020, collected somewhere in the Lincoln National Forest in 1903, by Mr. Fred G. Plummer. Here, too, belong young specimens collected by E. O. Wooton on White Mountain Peak, July 6, 1895, at an altitude of about 2,880 meters.

From our other species with pubescent capsules this is easily separated by its broad leaves, small capsules, and very long styles.

***Lesquerella pinetorum* Wooton & Standley, sp. nov.**

Perennial from a rather slender root; stems clustered, slender, ascending, 10 to 20 cm. high, lepidote-stellate but not very densely so, leafy, the leaves not crowded; basal leaves spatulate, obtuse, long-petioled; cauline leaves spatulate or oblanceolate, obtuse or acutish, entire or slightly undulate, tapering gradually at the base into a winged petiole, the whole leaf 20 to 30 mm. long, 3 to 7 mm. wide; racemes long, many-flowered, dense; pedicels about 8 mm. long, erect, stout; petals bright yellow, obovate, clawed, 6 or 7 mm. long; sepals oblong, 4 mm. long, densely lepidote-stellate; capsules nearly spherical, 3.5 mm. long, not compressed, glabrous, not stipitate; style slender, slightly longer than the capsule; seeds about 5 in each capsule.

Type in the U. S. National Herbarium, no. 561347, collected on a dry hillside under pine trees at Gilmores Ranch on Eagle Creek in the White Mountains, August 25, 1907, Wooton & Standley (no. 3460). Transition Zone; altitude about 2220 meters. The plant was also collected at Gilmores Ranch, July 29, 1901, by E. O. Wooton, and apparently the same is a specimen from the top of White Mountain Peak, collected by E. O. Wooton, August 16, 1897.

The species is nearest *L. fendleri*, but is not nearly so densely pubescent—indeed, the plants appear green rather than whitish; the leaves, too, are much broader and thinner, and the capsules are smaller.

***Lesquerella praecox* Wooton & Standley, sp. nov.**

A dense, caespitose, branched perennial, 4 to 6 cm. high, from a thick, woody root; leaves numerous, much crowded upon the short, stout stems; leaves linear-oblanceolate, 25 to 30 mm. long, 2.5 mm. wide or less, acutish, thick, white with a dense, lepidote-stellate pubescence, attenuate to the base; pedicels few, axillary or all arising from the tips of the branches, never racemose, 20 mm. long, erect, usually shorter than the leaves; sepals linear, 5 mm. long, sometimes persistent; petals bright yellow, obovate, 7 or 8 mm. long; capsules spherical or nearly so, not compressed, slightly channeled along the edge of the septum, glabrous, not stipitate, 5 mm. high.

Type in the U. S. National Herbarium, no. 4869, collected in New Mexico in 1853 by J. M. Bigelow.

ADDITIONAL SPECIMENS EXAMINED: Gallinas Mountains, August 27, 1904, *Wooton*; Cabra Springs, 1878, *W. B. Pease*.

From *L. fendleri*, its nearest relative, this plant is at once distinguished by its lower, densely cespitose habit and its few pedicels which are surpassed by the leaves. The general appearance of the two is very different.

***Lesquerella rectipes* Wooton & Standley, sp. nov.**

Perennial or biennial from a rather slender, woody root; stems slender, clustered, ascending or spreading, 12 to 18 cm. long, sparsely leafy, lepidostellate but not densely so; basal leaves narrowly oblanceolate or spatulate, obtuse; cauline leaves linear-oblanceolate, obtuse, 13 to 25 mm. long, lepidostellate on both surfaces; racemes loosely few-flowered, 4 cm. long or less; pedicels ascending, stout, 6 or 7 mm. long; sepals 4.5 mm. long, oblong-lanceolate, only sparingly lepidote; petals pale yellow, 7 mm. long, oblanceolate, obtuse; capsules broadly oblong to almost spherical, not compressed, 4.5 mm. long, not stipitate, very lightly lepidote-stellate; styles much longer than the capsules.

Type in the U. S. National Herbarium, no. 4799, collected in New Mexico June 6, 1883, by C. C. Marsh (no. 81). The exact locality is not given on the label, but it was somewhere in the northwestern part of the State.

ADDITIONAL SPECIMENS EXAMINED: Thirteen miles south of Atarque de Garcia, July 19, 1906, *Wooton*; along the banks of the Rio Grande 19 miles west of Santa Fe, alt. 1630 meters, May 31, 1897, *Heller* 3634.

Our plant has been confused with *L. argentea*, but that species has smaller, very densely pubescent capsules on strongly recurved pedicels.

***Sophia adenophora* Wooton & Standley, sp. nov.**

A coarse, canescent annual, generally with a single erect stem 80 to 120 cm. high, branching rather freely above but not at the base; leaves pinnately or bipinnately divided into rather coarse, obtuse or acute, oblong-lanceolate segments, the upper cauline leaves once pinnate with oblong, abruptly acute segments, the lower leaves once or twice pinnate, at least some of the segments broader; inflorescence an elongated, terminal raceme, 20 cm. long or more in fruit, glandular-pubescent throughout; flowers rather pale yellow; sepals 2 to 3 mm. long, oblong, obtuse, yellow, glandular; petals oblanceolate, spatulate, yellow, slightly longer than the sepals; siliques linear, 12 to 20 mm. long, acute, spreading or ascending; seeds crowded as if in one row; pedicels as long as the pods or longer, slightly ascending or divergent.

Type in the U. S. National Herbarium, no. 562504, collected by E. O. Wooton July 13, 1900, at the Head and Wilson Ranch south of Mule Creek, in northwestern Grant County.

ADDITIONAL SPECIMENS EXAMINED: Rio Frisco, July 25, 1900, *Wooton*; Tularosa Creek, Socorro County, July 14, 1906, *Wooton*; Reserve, July 9, 1906, *Wooton*.

This species is most closely related to *S. obtusa* Greene, from which it differs in having longer, more divergent pedicels, larger petals, and strongly glandular inflorescence. It is found in the Upper Sonoran Zone.

***Sophia glabra* Wooton & Standley, sp. nov.**

A slender, erect, sparingly branched, canescent annual, 30 to 60 cm. high; stems more or less purplish throughout; leaves and stems covered with a thick coat of short, branched hairs, not at all glandular; leaves all bipinnately divided into small, oblong, obtuse or acute segments 1 to 3 mm. long, some of these again lobed; racemes elongated in fruit; flowers small, 1 to 2 mm. long;

sepals purplish, stellate-pubescent; petals yellow, as long as the sepals, narrowly oblanceolate or spatulate; fruiting racemes, rachis, pedicels, and siliques perfectly glabrous; pedicels about 10 mm. long, divergent or slightly ascending; siliques 5 or 6 mm. long, oblong, acute at both ends; seeds in two rows.

Type in the U. S. National Herbarium, no. 564228, collected in the Organ Mountains, March 21, 1907, by E. O. Wooton and Paul C. Standley. The specimens were collected in an arroyo at the foot of the mountains not far from Van Pattens Camp. They grew among the rocks and about the edges of cliffs.

ADDITIONAL SPECIMENS EXAMINED: Van Pattens, April 25, 1895, *Wooton*; Filmore Canyon, April 18, 1903, *Wooton*; Bishops Cap, March 30, 1895, *Wooton*; Bishops Cap, 1908, *Wooton* 3815.

The species is most closely related to *S. halictorum*, but is distinguished by its habit, its strictly glabrous racemes, and the slightly smaller fruit. So far as our material shows, it is restricted to the Organ Mountains, where it is the common and almost the only *Sophia*, though it is not nearly as abundant as the nearly related species of the adjacent Mesilla Valley. It occurs in the Upper Sonoran Zone.

***Thelypodium vernale* Wooton & Standley, sp. nov.**

Probably biennial, glabrous, about 40 cm. high; stems slender, branched throughout, glaucous, purplish near the base, the branches strongly ascending; cauline leaves triangular-lanceolate, attenuate, 35 to 50 mm. long, slightly glaucous, entire, somewhat undulate, auriculate-clasping at the base, the lobes obtuse, 5 to 7 mm. long; pedicels ascending, slender, about 5 mm. long; sepals narrowly oblong, obtuse, 2.5 mm. long, green or tinged with purple; petals white, slightly tinged with purple, narrowly oblong, tapering gradually toward the base, the whole 5 mm. long or less; pods slender, 40 to 60 mm. long, somewhat divergent, arcuate; septum without a midrib; style truncate, not bilobate.

Type in the U. S. National Herbarium, no. 690257, collected in the low mountains west of San Antonio, Socorro County, April 14, 1908, by E. O. Wooton (no. 3847).

This slightly resembles *T. sagittatum*, but the flowers are much smaller, the leaves more acute, and the whole plant much smaller and more slender.

## CAPPARIDACEAE.

***Peritoma breviflorum* Wooton & Standley, sp. nov.**

Slender annual, 40 to 50 cm. high, simple at the base, above with numerous ascending or spreading branches; stems green, glabrous; leaflets 3, elliptic or narrowly elliptic-oblanceolate, green, glabrous, abruptly acute; terminal racemes very short, 4 to 6 cm. long, slender, villous; bracts small, 3 mm. long or less, nearly linear, attenuate; pedicels slender, 4 to 7 mm. long; calyx united at the base, persistent, the lobes narrowly triangular, acute, yellowish green; petals deep yellow, small, 2.5 to 4 mm. long, oblong-obovate, obtuse, entire, abruptly contracted at the base into a very short claw; stamens 6, only slightly exceeding the petals; capsules oblong, 15 to 20 mm. long, acutish, glabrous, torulose, on a slender stipe 4 mm. long; seeds 6 or fewer, ovoid, 3.5 mm. long, brownish, irregularly tuberculate; style very short, about 0.5 mm. long.

Type in the U. S. National Herbarium, no. 686249, collected on the dry, stony hills about Shiprock, July 25, 1911, by Paul C. Standley (no. 7282). Upper Sonoran Zone; altitude about 1425 meters.

The plant is fairly abundant in the region along the low mesas bordering the valley of the San Juan River. It is associated with various species of *Atriplex* and other plants characteristic of alkaline situations. It is similar to *P. luteum*, but the flowers are only half as large, the petals relatively broader and with

shorter claws, as well as of a deeper color, the inflorescence villous instead of glabrous, and the capsules smaller and on much shorter stipes.

### HYDRANGEACEAE.

#### *Fendlera falcata* Thornber, sp. nov.

An erect shrub, 1.5 to 2 meters tall, with grayish, furrowed bark; twigs of one year's growth glabrous or nearly so, somewhat shining, reddish; leaves 15 to 40 mm. long, 5 to 7 mm. wide, nearly sessile, tapering at the base and apex, lanceolate to narrowly lanceolate, more or less falcate, shining above and below, glabrous, or sparsely strigose beneath, the margins revolute; sepals, pedicels, and hypanthium glabrous or slightly pubescent, glabrate at maturity; sepals lanceolate to ovate-lanceolate, 8 to 10 mm. long, about three-fifths the length of the capsule; petals 17 to 22 mm. long, 11 to 13 mm. wide, tapering into a long claw, the margins erose; anthers about 4 mm. long; capsules 11 to 16 mm. long, 7 to 8 mm. in diameter, conical, very gradually tapering upward.

Type in the U. S. National Herbarium, no. 686760, collected in the Tunitcha Mountains on the Navajo Reservation in August, 1911, by Paul C. Standley (no. 7806).

ADDITIONAL SPECIMENS EXAMINED: COLORADO—Dolores, alt. 2,200 meters, June 15, 1902, *Crandall*; Cerro Summit, alt. 2,420 meters, 1901, *Baker* 165; Bayfield, 1907, *Cary* 174; Mancos, 1898, *Baker* 393. ARIZONA—Carrizo Mountains, 1911, *Standley* 7406; Fort Apache, July 28, 1905, *Thornber*. NEW MEXICO—Without locality, 1869, *Palmer*; Cedar Hill, alt. 1,900 meters, 1911, *Standley* 7971.

#### *Fendlera tomentella* Thornber, sp. nov.

Shrub 1 to 1.5 meters high, with dark gray, furrowed branches, and somewhat shining, reddish or straw colored, puberulent twigs, the short flowering ones with 2 to 5 pairs of leaves; leaves lanceolate to narrowly lanceolate, 15 to 30 mm. long, 4 to 7 mm. wide, dull green and hispid or hispidulous above, strongly 3-nerved beneath and strigose and tomentose, appearing hoary; calyx, hypanthium, and pedicels permanently hirsute, the lanceolate sepals extending to beyond the middle of the capsule; flowers not seen; capsules 10 to 12 mm. long, 6 to 6.5 mm. thick, gradually tapering above.

Type in the U. S. National Herbarium, no. 497677, collected in the canyon of the Blue River near Coopers Ranch, Graham County, Arizona, in 1905, by Walter Hough (no. 470).

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Mangas Springs, alt. 1,450 meters, 1903, *Metcalf* 39; Hurrah Creek, September 25, 1853; *Bigelow*; Embudo, alt. 1,760 meters, 1897, *Heller* 3513; Animas Mountains, alt. 2,000 meters, 1908, *Goldman* 1385. COLORADO—Los Pinos, 1899, *Baker* 367. ARIZONA—Santa Catalina Mountains, alt. 900 meters, August 20, 1903, *Jones*.

#### *Fendlerella cymosa* Greene, sp. nov.

A much branched, rather erect, low shrub, 40 to 60 cm. high, with scaly root-stocks; young stems grayish or nearly white; whole plant more or less strigillose with nearly colorless hairs, some of those on the lower surfaces of the leaves with white, papilliform bases; leaves numerous, nearly sessile, narrowly lanceolate to oblanceolate, 10 to 25 mm. long, 1.5 to 5 mm. wide, 3-nerved, acute, with ciliate, slightly revolute margins; cymes several to many-flowered, terminating the leafy branches; hypanthium turbinate, pubescent like the lanceolate or oblong-lanceolate sepals, these 4 mm. long; petals white, oblong-elliptic, 3 to 4 mm. long; filaments of the shorter stamens dilated to near the base, those of the longer ones with a well-defined, constricted neck above; capsules narrowly elongated.



Type in the U. S. National Herbarium, no. 45788, collected in the Huachuca Mountains of southern Arizona, July 7, 1884, by C. G. Pringle.

ADDITIONAL SPECIMENS EXAMINED: TEXAS—Guadalupe Mountains, 1901, *Bailey* 699. NEW MEXICO—Canyon on the east side of San Luis Mountains, 1893, *Mearns* 2253; San Luis Mountains, 1892, *Mearns* 530; Organ Mountains, June 10, 1906, *Standley*; Organ Mountains, alt. 2,000 meters, 1897, *Wooton* 459. ARIZONA—Chiricahua Mountains, alt. 1,666 meters, 1907, *Blumer* 1725; Huachuca Mountains, September, 1882, *Lemmon*.

### SAXIFRAGACEAE.

*Heuchera pulchella* Wooton & Standley, sp. nov.

Acaulescent, with a very thick rootstock; flowering branches scapiform, naked, 7 to 10 cm. high, minutely glandular; leaf blades cordate, 13 mm. wide or less, rather deeply lobed, the teeth broadly ovate, acuminate, bristle-tipped; blades glabrous above, glandular beneath, bright green, ciliate; inflorescence secund, dense, most of the flowers solitary but occasionally two together; hypanthium densely glandular, slightly villous, campanulate, together with the oblong, obtuse sepals 4 mm. long; sepals purplish; petals linear-filiform, not surpassing the sepals; stamens slightly exceeding the sepals.

Type in the U. S. National Herbarium, no. 690250, collected from crevices of rocks on the summit of the Sandia Mountains, August 4, 1910, by E. O. Wooton. Another sheet in the National Herbarium was collected in New Mexico in 1869 by Dr. Edward Palmer.

This is nearest *H. nana*, but has a larger hypanthium and calyx, a more densely glandular hypanthium, a brighter colored calyx, shorter petals, and a denser inflorescence; the ciliæ of the leaf margins, too, are much shorter and fewer.

### ROSACEAE.

*Oreobatus rubicundus* Wooton & Standley, sp. nov.

Shrub about 1 meter high, with spreading branches; stems slender, the bark soon exfoliating in thin layers; young branches reddish, very finely and closely pubescent; leaves 30 to 40 mm. long and about as wide, round-ovate in outline, cordate at the base or truncate, the sinus always broad and open, conspicuously 3-lobed, the lobes obtuse and often again lobed, crenate-dentate, the teeth ovate, usually obtuse and abruptly acuminate, glabrous above or nearly so, sparingly pubescent beneath along the veins, thin, bright green, the veins inconspicuous and scarcely reticulate; petioles slender, as long as the blades or considerably shorter, finely pubescent, reddish; peduncles solitary, short, 5 to 15 mm. long, stout, finely pubescent and glandular; sepals at anthesis about 10 mm. long, lanceolate, acuminate, in age becoming 15 mm. long and ovate, with long, linear tips, finely pubescent on both surfaces, with numerous reddish glands on the outer face; petals white, fugacious, 10 to 15 mm. long, broadly oblong; fruit small, with few, small, nearly dry drupelets.

Type in the U. S. National Herbarium, no. 560937, collected at Van Pattens Camp in the Organ Mountains, June 9, 1906, by Paul C. Standley. The shrubs are found in the Upper Sonoran Zone on the faces of cliffs and in deep rocky canyons.

ADDITIONAL SPECIMENS EXAMINED: Organ Mountains, September 17, 1893, May 15, 1892, *Wooton*; Van Pattens, August 29, 1894, July 27, 1902, *Wooton*.

This plant near *O. neomexicanus*, but has smaller leaves, flowers, and fruit, and nearly glabrous leaves, and the pubescence of the branches and petioles is

fine and appressed instead of loosely spreading. We have seen it only from the Organ Mountains.

***Rosa adenosepala* Wooton & Standley, sp. nov.**

Branches smooth, reddish brown, armed with few, slender, straight spines; stipules broad, acute, densely glandular and soft-pubescent; petioles soft-pubescent, with numerous stalked glands; leaflets on short petiolules, obovate, obtuse, broadly cuneate at the base, sharply and deeply incised-serrate two-thirds of the way to the base or more, dull green, glabrous above or nearly so, beneath densely glandular-puberulent, of about the same color on both surfaces; flowers in clusters of 3 to 5 at the ends of the branches, on glandular peduncles about 1 cm. long; hypanthium glabrous; sepals 15 to 20 mm. long, linear-lanceolate, with very long narrow tips scarcely dilated at the apex, densely glandular-bristly with red glands 1 or 2 mm. long, villous along the margins; petals about 15 mm. long; sepals reflexed after anthesis; fruit not seen.

Type in the U. S. National Herbarium, no. 306499, collected along the Pecos River 8 miles east of Glorieta, San Miguel County, June 9, 1897, by A. A. and E. Gertrude Heller (no. 3674). Altitude 1,950 meters.

Nearest *R. fendleri*, perhaps, but readily distinguished by the densely glandular-bristly calyx lobes.

***Rosa hypoleuca* Wooton & Standley, sp. nov.**

Stems bright reddish brown, more or less glaucous when young, densely armed with very slender, straight, short spines; stipules large, narrow, acute, with glandular margins; petioles with rather few stalked glands, otherwise glabrous; leaflets usually 9, elliptic-oblong or oblong-ovate, obtuse, rounded at the base, coarsely but not deeply incised-serrate, glabrous, strongly glaucous beneath, dull green above, 13 to 20 mm. long; flowers in clusters at the ends of the ascending branches on short, glabrous peduncles; hypanthium glabrous; sepals narrowly lanceolate with long, linear tips, about 15 mm. long, glabrous below, glandular toward the tips, entire or with a few subulate lobes, tomentulose along the margins; petals obovate, deeply notched, bright pink, 15 to 20 mm. long; fruit not seen.

Type in the U. S. National Herbarium, no. 497843, collected near Kingston, Sierra County, June 1, 1904, by O. B. Metcalfe (no. 940). Altitude 1,980 meters.

This is as closely related to *R. fendleri* as to any species. It differs, however, in the perfectly glabrous leaflets, strongly glaucous beneath.

Here we have placed Standley's 4031, collected along Winsor Creek, June 29, 1908, altitude 2,520 meters. This has larger flowers and leaflets than the type but otherwise seems indistinguishable.

## MALACEAE.

***Amelanchier goldmanii* Wooton & Standley, sp. nov.**

A shrub 1.5 meters high or less, with spreading branches; bark on the older stems grayish, on the younger ones dark reddish brown; bud scales reddish, sparingly villous; leaves almost perfectly rotund, on petioles 8 to 15 mm. long, 30 to 40 mm. in diameter, rounded or cordate at the base, with rounded serrate teeth reaching almost to the base; petioles and blades glabrate, probably more or less tomentulose when young; flowers not seen; fruit bluish black, spherical, 7 mm. in diameter, in terminal racemose clusters of several fruits.

Type in the U. S. National Herbarium, no. 562614, collected by E. A. Goldman in Copper Canyon in the Magdalena Mountains, September 3, 1909, at an altitude of 2,550 meters.

ADDITIONAL SPECIMENS EXAMINED: Mogollon-Magdalena Road, in the Mogollon Mountains, about 15 miles east of Mogollon, August 8, 1900, *Wooton*.

### AMYGDALACEAE.

#### PADUS.

Since all but one of our seven species of *Padus* appear to be new it seems desirable to publish a key to them along with the descriptions.

#### KEY TO THE NEW MEXICAN SPECIES.

Calyx persistent in fruit.

Young branches densely tawny-pubescent; young fruit pubescent ----- *P. rufula*.

Young branches and fruit glabrous ----- *P. viréns*.

Calyx deciduous soon after anthesis.

Plants glabrous throughout ----- *P. melanocarpa*.<sup>1</sup>

Plants pubescent on the peduncles, petioles, and lower surface of the leaves.

Leaves not glaucous beneath at maturity, of about the same color on both surfaces ----- *P. punicea*.

Leaves whitish beneath at maturity.

Pedicels longer than the fruit, slender; seeds 8 to 10 mm. in diameter ----- *P. mescaleria*.

Pedicels shorter than the fruit, stout; seeds 7 mm. in diameter or less.

Pedicels glabrous; racemes slender; leaves elliptic, narrowed at the base; buds narrowly lanceolate in outline ----- *P. calophylla*.

Pedicels pubescent; racemes stout; leaves oblong to ovate or obovate, rounded to subcordate at the base; buds ovoid -- *P. valida*.

***Padus rufula* Wooton & Standley, sp. nov.**

Branches slender, grayish brown, with numerous small, gray lenticels; young branches densely soft-pubescent with reddish brown hairs; petioles pubescent, slender, one-fourth as long as the blades or less; leaf blades thin, elliptic, acute, 40 or 50 mm. long, acute at the base, finely and very sharply serrate, dull green and glabrous above, pale beneath, glabrous except for an abundant persistent, tawny tomentum along the midvein; racemes slender, many-flowered, pubescent at the base, glabrous above; pedicels stout, 4 mm. long or less; flowers not seen; hypanthium and sepals persistent; fruit sessile in the hypanthium, globose, 8 to 10 mm. in diameter, pubescent when young, glabrate at maturity.

Type in the U. S. National Herbarium, no. 563898, collected on the West Fork of the Rio Gila, August 6, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Mogollon Mountains, August, 1881, *Rusby* 119. ARIZONA—Santa Rita Mountains, 1881, *C. G. Pringle*.

This is one of the most distinct species of the genus. It is related to *P. salicifolia* of Mexico, but is distinguished at once by the abundant tomentum of the leaves, the densely pubescent branchlets, and the pubescent fruit.

<sup>1</sup> *Padus melanocarpa* (A. Nels.) Shafer in Britt. & Shaf. N. Amer. Trees 504. 1908.

***Padus virens* Wooton & Standley, sp. nov.**

A tree 7 meters high or less, with a smooth, reddish brown trunk and slender, slightly drooping branches; young branchlets and racemes glabrous; leaves ovate, obovate, or oval, 5 or 6 cm. long, acutish or slightly acuminate, truncate or usually rounded at the base, thin, bright green, shining, of about the same color on both surfaces, finely crenulate-serrate with appressed teeth; petioles slender, glabrous, one-third to one-half as long as the blades; leaves glabrate in age, when young with a rather abundant tawny tomentum along the midvein, some of this persistent at maturity; flowers in slender, loose racemes; pedicels slender, 5 or 6 mm. long; hypanthium glabrous, saucer-shaped, 5 mm. broad, the lobes triangular, acute; petals 4 mm. long, obovate; fruit black, glabrous, globose, 7 or 8 mm. in diameter, sessile in the hypanthium.

Type in the U. S. National Herbarium, no. 560917, collected at Van Pattens Camp in the Organ Mountains, June 9, 1906, by Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Organ Mountains, alt. 1,710 meters, 1897, *Wooton* 123; Van Pattens, May 14, 1895, April 29, 1899, *Wooton*; Organ Mountains, 1893, *Wooton* 1108; Rio Frisco, August 9, 1900, *Wooton*; Sycamore Creek, August 13, 1902, *Wooton*; Pine Cienaga, July 17, 1900, *Wooton*; San Francisco Mountains, July 27, 1900, *Wooton*; Alizo near Kellys, July 24, 1900, *Wooton*; Holts Ranch, July 20, 1900, *Wooton*; near Joseph, July 10, 1906, *Wooton*; Tularosa Creek, August 6, 1901, *Wooton*; Cloudcroft, July 18, 1899, *Wooton*; Burro Mountains, 7 miles southeast of Leopold, alt. 2,250 meters, 1908, *Goldman* 1521; Burro Mountains, 5 miles southeast of Leopold, alt. 1,950 meters, 1908, *Goldman* 1510; Florida Mountains, alt. 1,800 meters, 1908, *Goldman* 1500.

This has passed as *P. capuli*, a Mexican species, from which our plant differs in its broader leaves with the midvein tomentose instead of glabrous. In the Organ Mountains this species occurs in abundance in the opening of the canyon in which Van Pattens Camp is located. It is known from only this one locality in the range, where it grows along with *Quercus grisea* and *Q. arizonica*. Attempts have been made to use the trees as stocks for grafting various fruits but they have been unsuccessful.

The material from the western part of the State may represent a different species. It is usually much smaller, only a tall shrub, and its leaves are narrower, thicker, not so bright a green, and on shorter petioles.

***Padus pumicea* Wooton & Standley, sp. nov.**

Branches stout, numerous, ascending, dark reddish brown, the younger ones finely pubescent; petioles mostly one-fifth as long as the blades, sometimes longer, finely pubescent, each bearing two large glands; leaf blades obovate or oblong, averaging about 45 mm. long, rounded or truncate at the base, acute or acuminate, finely serrulate to the base with incurved teeth, bright green and glabrous above, finely pubescent and of the same color beneath, often becoming glabrate; flowers not seen; racemes stout, few-fruited, finely pubescent near the base, glabrous above; pedicels stout, glabrous, much shorter than the fruit; seeds globose, 6 or 7 mm. in diameter.

Type in the U. S. National Herbarium, no. 563903, collected at the "Craters," Valencia County, July 28, 1906, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Mountains south of Canjilon, August 17, 1904, *Wooton* 2706.

From all our pubescent species this differs in having the leaves of about the same color on both surfaces. The fruits, too, are very few and the pedicels remarkably short. The branches are very densely furnished with leaves, so that in general appearance this is unlike any of our other chokecherries.

The type specimen is without fruit, but one of the same collection in the herbarium of E. O. Wooton is well fruited, as is the specimen from Canjilon.

***Padus mescaleria* Wooton & Standley, sp. nov.**

Branches slender, grayish brown, the younger ones finely and sparingly pubescent; buds ovoid, small; petioles about one-third as long as the blades, finely pubescent, with several glands above the middle; blades oblong to narrowly obovoid, acute or slightly acuminate, usually rounded at the base, glabrous and dark green above, strongly glaucous and finely pubescent beneath, rather thick, sharply and evenly serrate to the base; flowers not seen; racemes slender, loosely few-fruited, the rachis glabrous; pedicels slender, noticeably longer than the fruit, glabrous, straight; seeds 7 to 9 mm. in diameter, scarcely at all flattened.

Type in the U. S. National Herbarium, no. 690233, collected on Tularosa Creek near the Mescalero Agency, August 6, 1901, by E. O. Wooton.

The most distinctive features of this are the long pedicels, glabrous racemes, large seeds, and rather narrow, deep green leaves strongly glaucous beneath.

***Padus calophylla* Wooton & Standley, sp. nov.**

Branches stout, dark gray, the younger ones densely and finely pubescent; buds lanceolate to narrowly elliptic in outline; petioles slender, reddish, one-fourth as long as the blades, very finely pubescent, usually with a pair of glands just below the blade; blades elliptic, acute, acutish at the base, 45 to 60 mm. long, about 30 mm. wide, dull pale green above and glabrous, decidedly paler and finely pubescent beneath, especially on the veins, rather thick and coriaceous, very finely and inconspicuously serrulate; veins prominent, the midvein reddish; flowers not seen; racemes slender, the rachis slender, dark reddish purple; pedicels rather slender, shorter than the fruit, often curved, glabrous; fruit about 9 mm. in diameter, abundant and persistent, the seed flattened, 5 mm. in diameter.

Type in the U. S. National Herbarium, no. 562677, collected 5 miles west of Chloride, October 12, 1909, by E. A. Goldman (no. 1768).

The foliage is different from that of any other species, the leaves being especially handsome because of their thick texture and of their pale green coloring, which contrasts with the red of the veins and petioles. The seeds are remarkably small; the fruits are densely clustered and persistent, instead of scattered and soon falling as in most of the related species.

***Padus valida* Wooton & Standley, sp. nov.**

Branches very stout, dark reddish brown, all the younger ones densely but very finely pubescent; buds large, ovoid; petioles less than one-fourth as long as the blades, stout, densely pubescent; blades obovate, oval, or oblong, usually 50 to 70 mm. long, rounded or subcordate at the base, acute or more often abruptly acuminate, thick, dull green and glabrous above, glaucescent and pubescent beneath, inconspicuously serrulate with sharp, nearly subulate, inflexed teeth; racemes very numerous, stout, densely pubescent, often recurved, bearing only a few fruits; pedicels stout, pubescent, much shorter than the fruit; flowers not seen; fruit 10 or 12 mm. in diameter; seeds flattened, about 7 mm. in diameter.

Type in the U. S. National Herbarium, no. 498048, collected in canyons near Kingston, Sierra County, August 24, 1904, by O. B. Metcalfe (no. 1243). Altitude 1980 meters.

ADDITIONAL SPECIMENS EXAMINED: Copper Canyon, alt. 2700 meters, September 3, 1909, *Goldman* 1675; Copper Canyon, alt. 2250 meters, September 3, 1909, *Goldman* 1676; Hop Canyon, May 13, 1895, *Herrick* 535.

A most striking species, characterized by its stout branches and racemes, large fruits, and densely pubescent pedicels and racemes.

## MIMOSACEAE.

**Morongia occidentalis** Wooton & Standley, sp. nov.

Stems prostrate, stout, striate, densely and finely puberulent, armed with very few, distant, recurved prickles; leaves bipinnate, with 5 or 6 pairs of pinnæ; petioles slender, about 4 cm. long, striate, finely puberulent, armed with few stout prickles; leaflets oblong, about 4 mm. long, acute or acutish, thick, smooth, not nerved, glabrous or nearly so; flowers pink, in dense heads; calyx glabrous or nearly so, the thin lobes ovate, acute; peduncles 2 to 6 cm. long, puberulent, with few weak prickles or none; pods slender, 7 to 9 cm. long, 2 or 3 mm. wide, flattened, armed on the sides with long, slender, sparingly puberulent prickles, usually naked on the margins or with prickles of the same kind as on the sides, narrowed at the base, bearing at the apex a stout beak 5 to 7 mm. long.

Type in the U. S. National Herbarium, no. 660612, collected near Nara Visa, July 4, 1911, by Mr. Geo. L. Fisher (no. 190). Also collected near Nara Visa, August 17, 1910, by Mr. Fisher (no. 58).

Most closely allied, perhaps, to *M. angustata*, but distinguished by the flat, puberulent pods armed with but few prickles, and by the few prickles of the abundantly pubescent stems.

## CAESALPINIACEAE.

**Chamaecrista rostrata** Wooton & Standley, sp. nov.

A slender annual, 20 cm. high or less, simple at the base, sparingly branched above; stems herbaceous, reddish, puberulent; leaflets 10 or 12, narrowly oblong, rounded at the apex, very shortly mucronulate, 8 or 10 mm. long, glabrous; petiolar gland oblong, small, short-stipitate; stipules linear-lanceolate, long-attenuate; peduncles few, supra-axillary, arcuate, 1-flowered; petals bright yellow, 12 mm. long; sepals one-half to two-thirds as long as the petals, lanceolate, membranaceous; pods 25 to 35 mm. long, 5 mm. wide, appressed-pubescent, ending in a beak 2 to 3 mm. long.

Type in the U. S. National Herbarium, no. 660032, collected in sandy soil at Logan, October 5, 1910, by Mr. Geo. L. Fisher (no. 93).

While related to *C. fasciculata*, this may be readily distinguished by the long beaks of the pods, the fewer leaflets neither acute nor conspicuously mucronate, the 1-flowered peduncles, and the shorter sepals.

## FABACEAE.

**Anisolotus greenei** Wooton & Standley.

*Hosackia mollis* Greene, Bull. Calif. Acad. 1: 185. 1885, not Nutt.

*Lotus mollis* Greene, Pittonia 2: 143. 1890, not Balf.

**Anisolotus neomexicanus** (Greene) Wooton & Standley.

*Lotus neomexicanus* Greene, Pittonia 2: 141. 1890.

**Anisolotus nummularius** (Jones) Wooton & Standley.

*Hosackia rigida nummularia* Jones, Bull. Calif. Acad. II. 5: 633. 1895.

**Anisolotus puberulus** (Benth.) Wooton & Standley.

*Hosackia puberula* Benth. Pl. Hartw. 305. 1848.

*Lotus puberulus* Greene, Pittonia 2: 142. 1890.

**Anisolotus trispermus** (Greene) Wooton & Standley.

*Lotus trispermus* Greene, Erythea 1: 258. 1893.

**Aragallus veganus** (Cockerell) Wooton & Standley.

*Aragallus pinetorum veganus* Cockerell, *Torreyana* 2: 155. 1902.

Apparently this is a most distinct species, found only on the tops of the highest mountains in the ranges lying between Santa Fe and Las Vegas. The assignment of the plant to rank as a subspecies under *A. pinetorum* was most unfortunate, since the plant is not at all closely related to that species, but finds its affinities among some of the alpine species of Colorado and Wyoming.

**Astragalus albulus** Wooton & Standley, sp. nov.

Plant 40 to 60 cm. high, much branched from a woody root, hirsutulous-canescens throughout; stipules whitish, membranaceous, large, connate opposite the leaves, the free tips broadly triangular; leaves 5 to 8 cm. long, with very short petioles; leaflets 8 to 10 pairs, linear or narrowly oblong, 10 to 15 mm. long, acute or obtuse, glabrous above; flowers in loose, axillary racemes 10 to 15 cm. long; peduncles 3 to 5 cm. long, the pedicels very short, subtended by white, membranous, ovate bracts half the length of the calyx; flowers dull yellow, tinged with purple; calyx cylindric, about 7 mm. long, the subulate teeth one-fourth as long, appressed-pubescent with both black and white hairs; corolla about 12 mm. long, the wings and banner only a little longer than the keel; mature fruit not seen, the very young pods 1-celled, several-seeded, with a very short stipe, slightly flattened dorso-ventrally at the base, acute, appressed-pubescent.

Type in the U. S. National Herbarium, no. 690252, collected in a canyon on the road to Zuni some distance south of Gallup, August 1, 1904, by E. O. Wooton. Upper Sonoran Zone.

Without mature fruit the relationship of this plant can not be stated definitely, but it is unlike any species known to us.

**Astragalus altus** Wooton & Standley, sp. nov.

Perennial, 40 to 60 cm. high, with several slender, erect, sparingly branched stems, these indistinctly striate, sparsely pubescent with very short, appressed hairs; stipules triangular-lanceolate, acuminate, neither connate nor adnate to the expanded bases of the petioles; leaves 8 to 10 cm. long; petioles 1 cm. long or less; leaflets 10 to 14 pairs, elliptic to elliptic-oblong, when mature 8 to 10 mm. long, entire, acute or obtuse, appressed-pubescent beneath; flowers in axillary racemes 6 to 10 cm. long, the peduncles elongating slightly in fruit, the flowers crowded in a short raceme, not capitate; calyx yellowish, sparsely pubescent with appressed, black hairs, 5 mm. long including the small, acute teeth scarcely 1 mm. long; corolla bright yellow, hardly 10 mm. long, the wings and banner considerably surpassing the obtuse keel; pods (about half mature) 15 to 20 mm. long including the stipe (8 to 10 mm. long), oblong, acute, membranous, the lower suture somewhat sulcate, several-seeded, sparsely appressed-pubescent with minute black hairs.

Type in the U. S. National Herbarium, no. 690253, collected at Toboggan in the Sacramento Mountains, Otero County, July 31, 1899, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Upper Tularosa Creek, Sacramento Mountains, August 6, 1901, *Wooton*.

At first glance this might be confused with *A. rusbyi*, which it resembles in a general way. It differs in having shorter and broader leaflets, crowded flowers on much shorter peduncles, and pods with longer stipes and much less inflexed sutures.

**Astragalus neomexicanus** Wooton & Standley, sp. nov.

Herbaceous perennial about 30 cm. high, with somewhat the aspect of *Aragallus deflexus*; stems ascending, branched from the base, pubescent; stipules

narrowly triangular-lanceolate, about 10 mm. long, adnate to the petiole, not connate; leaves 10 to 18 cm. long, with about 20 pairs of leaflets, villous throughout with weak, spreading hairs; leaflets elliptic to ovate-lanceolate, 10 to 12 mm. long, narrowed at the apex, acute, entire, glabrate above; flowers in elongated, several to many-flowered racemes 15 to 25 cm. long (including the peduncles); bracts linear-lanceolate, twice as long as the ascending pedicels (these 2 or 3 mm. long); calyx campanulate, slightly gibbous above, 7 to 9 mm. long, the subulate teeth about one-third as long, pubescent with black and white, loosely appressed hairs, the black ones more noticeable on the buds; corolla purple, about 20 mm. long, the banner and wings considerably surpassing the rounded keel; mature fruit not seen; very young pods 1-celled, several-seeded, thick-walled, terete, neither suture intruded, densely appressed-pubescent.

Type in the U. S. National Herbarium, no. 690254, collected in James Canyon in the Sacramento Mountains near Cloudcroft, Otero County, July 23, 1899, by E. O. Wooton. Altitude about 2,550 meters.

We hesitate to describe this species for which the mature fruit is lacking, but it is so distinct from anything else we have seen that the description is given and a name applied merely as a means of recording the plant.

*Lupinus argillaceus* Wooton & Standley, sp. nov.

Low annual of the *Platycarpus* group; stem about 10 cm. high, with numerous lateral divaricate branches as long or longer; whole plant softly silky villous, the pubescence being somewhat appressed and thus not conspicuous; petioles 3 to 5 cm. long; leaflets 5 to 7, 1 to 2 cm. long, oblanceolate, obtuse or acute, about equally pubescent on both sides; flowers few, in contracted, head-like clusters at the ends of peduncles mostly shorter than the petioles of the adjacent leaves, with broadly ovate-lanceolate bracts 3 or 4 mm. long; calyx similar to that of *L. kingii*, the upper lobe deeply 2-cleft, the divisions lanceolate, acute, the lower lobe minutely 3-toothed at the apex, the toothing more or less obscured by the pubescence in dried material, the upper lobe about two-thirds as long as the lower, with minute bracts at the sinuses between the two lobes; corolla blue or white, the banner narrowly ovate, reflexed, shorter than the wings and the elongated, rather straight keel; stamens monadelphous, the lower five anthers linear, almost as long as their filaments, the upper anthers minute; ovary with 2 ovules; fruit a short, rhombic-ovate, 2-seeded legume; seeds almost rotund, lenticular, whitish, without markings.

Type in the U. S. National Herbarium, no. 498990, collected near Pecos, San Miguel County, at an altitude of 2,010 meters, August 17, 1908, by Paul C. Standley (no. 4974). The plants grew on the low hills about Pecos, especially in the deep gullies, in a heavy red clay soil.

ADDITIONAL SPECIMENS EXAMINED: Near Pecos, alt. 2,010 meters, 1908, *Standley* 4975; El Rito, August 17, 1904, *Wooton*.

Standley's specimens were distributed as *L. kingii* and are listed as that species in his report upon his 1908 collections in *Muhlenbergia*.<sup>1</sup> Of the two numbers collected in the same locality one had white flowers and the other blue.

*Lupinus laetus* Wooton & Standley, sp. nov.

A slender perennial with few spreading or ascending branches; stems finely and sparingly appressed-pubescent; petioles slender, about as long as the leaflets, these elliptic-oblanceolate, 45 to 60 mm. long, obtuse, mucronate, bright green and glabrous above, with a few scattered, appressed hairs beneath; raceme 15 to 20 cm. long, loosely few-flowered, -short-pedunculate; pedicels slender, ascending, 8 mm. long, sparingly pubescent; calyx sericeous, the lobes about equal, broad, rather obtuse; corolla 12 mm. long, bright blue; fruit not seen.

<sup>1</sup> 5: 17-30. 1909.



Type in the U. S. National Herbarium, no. 562219, collected at Winter Folly in the Sacramento Mountains north of Cloudcroft, August 13, 1899, by E. O. Wooton. Altitude about 2,700 meters.

The plant is of the group of *L. plattensis*, but its bright blue flowers at once distinguish it.

**Lupinus aquilinus** Wooton & Standley, sp. nov.

A much branched, suffrutescent perennial, 60 to 150 cm. high; stems slender, spreading, sparingly and finely sericeous; petioles slender, about equaling the leaflets, these elliptic-oblongate, 35 to 45 mm. long, obtuse, mucronate, grayish green, glabrous above, finely sericeous beneath; racemes on short peduncles, dense, 5 cm. long or less, few-flowered; pedicels ascending, stout, sericeous, 4 mm. long; calyx densely sericeous, scarcely gibbous, the two lobes almost equal, rather broad, acute, entire; corolla 12 mm. long, pale bluish and yellowish, the banner with a dark spot; pods 30 mm. long and 8 mm. wide or less, 3 or 4-seeded; seeds 4 mm. long, greenish gray, finely splashed with dark green.

Type in the U. S. National Herbarium, no. 562095, collected at Gilmores Ranch, on Eagle Creek, in the White Mountains, August 25, 1907, by E. O. Wooton and Paul C. Standley (no. 3613). Altitude 2,220 meters.

ADDITIONAL SPECIMENS EXAMINED: Gilmores Ranch, August 15, 1897, *Wooton* 537; Sierra Grande, August, 1903, *Howell* 229.

This is a grayish plant with numerous slender, spreading branches. It is rather abundant about Gilmores Ranch, growing on slopes in the shade of pines. It is of the *L. plattensis* group and is related to *L. sierra-blancae*, which grows not far away. It is a lower plant, however, than *L. sierrae-blancae*, with more branches, fewer flowers, and shorter, obtuse leaflets.

**Lupinus sierrae-blancae** Wooton & Standley, sp. nov.

A tall perennial, 1 meter high or more, much branched; stems stout and somewhat succulent, finely white-pubescent, the pubescence loose; petioles equaling the leaflets, these 7 to 9, 50 to 70 mm. long, linear-elliptic, very acute, attenuate to the base, yellowish green, glabrous above, finely strigillose beneath or almost glabrous; racemes long (25 to 30 cm.), many-flowered, rather loose; pedicels divergent, stout, 10 mm. long, densely pubescent with short, spreading hairs; calyx slightly gibbous, loosely pubescent, the upper lip longer than the lower, both narrow, entire, attenuate; corolla 12 mm. long, dull bluish tinged with yellow, the banner with a large darker spot; pods ascending, stout, 35 mm. long and 35 mm. wide or less, densely hirtellous, 5 to 7-seeded; mature seeds not seen.

Type in the U. S. National Herbarium, no. 562220, collected on the lower part of White Mountain Peak, July 6, 1895, by E. O. Wooton. Altitude 2,340 meters.

ADDITIONAL SPECIMENS EXAMINED: Gilmores Ranch, on Eagle Creek, July 14, 1895, *Wooton*; Gilmores Ranch, July 29, 1901, *Wooton*; Ruidoso Creek, July 5, 1895, *Wooton*.

The plant is known only from the open meadows or parks which are so numerous on the timbered slopes of White Mountain Peak. The largest of our New Mexican lupines, it is a conspicuous feature of the vegetation where it occurs. While related to *L. plattensis*, it may be distinguished by its larger, acute leaves and the much larger size of the plants.

**Petalostemum prostratum** Wooton & Standley, sp. nov.

Stems slender, prostrate, 60 cm. long or less, glabrous, with numerous orbicular, reddish brown glands; leaves long-petioled, the leaflets mostly 7, glabrous, glaucous, glandular-dotted, cuneate-oblongate, nearly sessile, rounded at the

apex; racemes rather densely many-flowered, long-peduncled, about 5 cm. long; flowers sessile; calyx angled, glabrous, straw colored, with a few pellucid, yellowish glands, the lobes lanceolate, green, attenuate, silky-pubescent along the margins; corolla rose purple, about 8 mm. long; stamens 6; fruit glabrous, 3.5 mm. long, semiorbicular in outline.

Type in the U. S. National Herbarium, no. 370697, collected near Albuquerque in 1909 by Winnie Harward (no. 17).

ADDITIONAL SPECIMENS EXAMINED: Near Belen, August 1, 1906, *Wooton*.

This is so unlike all other species of the genus that it can scarcely be confused with any. The habit alone is sufficient to distinguish it. In general appearance it much more closely resembles certain species of *Parosela*, but the structure of the flower and number of stamens makes it impossible to place it with them.

***Phaseolus dilatatus* Wooton & Standley, sp. nov.**

Perennial from a thickened root; stems long, slender, twining, glabrous or sparingly puberulent; stipules small, lanceolate; petioles slender, equaling or longer than the leaflets, these linear-lanceolate to triangular-ovate, entire, or dilated and with 2 small rounded lobes at the base, obtuse, bright green, scaberulous, ciliolate; peduncles slender, somewhat exceeding the leaves, 5 to 12 cm. long; pedicels 4 mm. long or less, sparingly puberulent; calyx puberulent, with rounded lobes; bracts minute, elliptic-oblong; corolla 10 to 12 mm. long; pods about 20 mm. long and 5 mm. broad, stout, slightly curved, nearly glabrous, with a slender style 1.5 mm. long.

Type in the U. S. National Herbarium, no. 138616, collected in the Mogollon Mountains August 30, 1881, by Dr. H. H. Rusby. Another specimen is in the herbarium of Dr. E. L. Greene, collected in the Burro Mountains in June, 1881, by Doctor Rusby.

This suggests *P. grayanus*, but the leaflets are not lobed as in that species, the peduncles are shorter, the pod is nearly glabrous and smaller, and the style is long and slender.

***Phaseolus grayanus* Wooton & Standley, sp. nov.**

*Phaseolus wrightii* A. Gray, Pl. Wright. 2: 33. 1853, not A. Gray, op. cit. 1: 43. 1852.

Perennial with long, slender, climbing stems, these sparingly puberulent; stipules small, triangular-lanceolate; petioles one-half to two-thirds as long as the leaflets; leaflets deeply 3-lobed, at least the terminal one, the lobes narrowly oblong or rhombic, blunt, bright green, thin, nearly glabrous, but puberulent along the veins; peduncles much longer than the leaves, 10 to 25 cm. long, slender, glabrous or puberulent, pubescent about the flowers; flowers few, distant, on pedicels 5 mm. long or less; calyx puberulent, the lobes broadly rounded, ciliate; corolla purplish, 12 to 15 mm. long; pods broad, 25 to 30 mm. long and 8 or 9 mm. wide, curved, densely soft-pubescent, acute, with a very short, stout style.

Type in the U. S. National Herbarium, no. 232982, collected in the San Luis Mountains, September 5, 1893, by Dr. E. A. Mearns (no. 2124).

ADDITIONAL SPECIMENS EXAMINED: San Luis Mountains, alt. 1,720 meters, 1893, *Mearns* 2534; Horsethief Canyon, near Fort Bayard, alt. 2,100 meters, November 9, 1905, *Blumer* 162; Mogollon Creek, alt. 2,400 meters, July 18, 1903, *Metcalf* 259; Mangas Springs, August, 1901, *Metcalf*; 1851, *Wright* 952.

The species also occurs in Arizona.

Our plant has always been referred to *P. wrightii*. Doctor Gray, in *Plantae Wrightianae*, speaks of Wright's specimen, stating that it differs from the Texas plant in certain particulars and that the description of that plant must be modified. The Texan plant, true *P. wrightii*, differs from ours in having

smaller, usually entire, more pubescent leaflets, much shorter peduncles, glabrate pods, and a long, slender style.

**Phaseolus metcalfei** Wooton & Standley, nom. nov.

*Phaseolus retusus* Benth. Pl. Hartw. 11. 1839, not Moench.

We have assigned the specific name in honor of Mr. J. K. Metcalfe, late of Mangas Springs, New Mexico. Mr. Metcalfe was the first to introduce this plant into cultivation, and it has been popularly known as the Metcalfe bean. It has proved of some value as a forage plant in the Southwest and has been treated of in some of the Department of Agriculture publications under this name.

**Phaseolus tenuifolius** (A. Gray) Wooton & Standley.

*Phaseolus acutifolius tenuifolius* A. Gray, Pl. Wright. 2: 33. 1853.

In *P. acutifolius* the leaflets are triangular-lanceolate or ovate, not much longer than the peduncles, while in *P. tenuifolius* they are elongated-linear to linear-oblong, and about twice as long as the peduncles. The latter, too, is usually a much larger, taller plant.

**Psoralea megalantha** Wooton & Standley, sp. nov.

A low perennial, 10 cm. high or less; stems very short; petioles equaling or twice as long as the leaflets, sericeous, also with a few spreading hairs; leaflets usually 6, obovate, 27 mm. long or less, cuneate at the base, rounded at the apex, densely sericeous beneath, sparingly sericeous above, dull green; peduncles stout, 20 mm. long or shorter, sericeous; bracts lanceolate or lance-ovate, 11 mm. long or less, acute or somewhat acuminate, present only at the base of the inflorescence; flowers rather few, nearly capitate, on pedicels 3 mm. long; calyx about 18 mm. long, hirsute, the lobes nearly equal, linear, acute, equaling or shorter than the tube; corolla 20 mm. long.

Type in the U. S. National Herbarium, no. 368979, collected at Aztec, May 18, 1899, by C. F. Baker (no. 440).

The collection was distributed as *P. mephitica* S. Wats., and it is related to that species. The flowers, however, are twice as large in our plant, the inflorescence subcapitate instead of elongated, and the pubescence mostly appressed instead of spreading or retrorse.

**Robinia rusbyi** Wooton & Standley, sp. nov.

Shrub with stout, nearly glabrous, reddish brown branches; spines stout, straight, 15 mm. long or less; rachis of the leaves slender, minutely puberulent or glabrate; leaflets oval or broadly oblong, rounded and mucronate at the apex, rounded or slightly narrowed at the base, grayish green, glabrous above, minutely strigillose beneath; racemes many-flowered, short-peduncled, pubescent; pedicels stout, densely glandular-pubescent; corolla 20 mm. long or more; calyx lobes ovate, acute; pods 45 to 85 mm. long, 18 mm. broad or less, glabrous, purplish.

Type in the U. S. National Herbarium, no. 690238, collected on the Mogollon Road 15 miles east of Mogollon, August 8, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Eagle Peak, August 2, 1900, *Wooton*; Burro Mountains, alt. 2,250 meters, 1903, *Metcalfe* 189; Deep Creek, August 9, 1900, *Wooton*; head of Carrizo Creek, Mescalero Reservation, alt. 2,220 meters, 1903, *Plummer*.

The last specimen cited may not belong here, for the leaflets are narrower, longer, and acute. It certainly is not *Robinia neomexicana*. *R. rusbyi* differs from that species conspicuously in its glabrous fruit and merely glandular-pubescent peduncles and pedicels.

Dr. H. H. Rusby seems to have been the first to observe this shrub and called our attention to it. He collected it somewhere about the Mogollon Mountains in 1880 or 1881.

***Trifolium longicaule* Wooton & Standley, sp. nov.**

Perennial; stems slender, reclining, glabrous, much branched, 60 cm. long or less; petioles slender, several times as long as the leaflets; stipules narrow, attenuate, entire or nearly so; leaflets obovate to elliptic-oblong, rounded or obtuse at the apex, cuneate at the base, bright green, glabrous, prominently veined, the veins slightly prolonged beyond the low teeth; peduncles slender, 40 to 60 mm. long, nearly glabrous but with a few long crinkled hairs, often tomentulose just below the head; involucre short, one-third to one-half as long as the flowers, of linear-lanceolate, subulate bracts distinct almost to their bases; calyx one-half or two-thirds as long as the corolla, the teeth linear-subulate, almost twice as long as the tube; corolla pale purplish, 11 mm. long or less, the banner emarginate.

Type in the U. S. National Herbarium, no. 562146, collected along Eagle Creek at Gilmores Ranch in the White Mountains, August 25, 1907, by E. O. Wooton and Paul C. Standley. Altitude 2,220 meters. The plants grew in gravelly soil at the very edge of the water.

ADDITIONAL SPECIMENS EXAMINED: White Mountains, alt. 1,890 meters, 1897, *Wooton* 235; Cold Spring Canyon, August 17, 1899, *Wooton*.

This is related to *T. lacerum*, the flowers being of the same size, but the involucre is more deeply cleft and the segments much narrower, while the peduncles are more or less pubescent instead of glabrous.

***Vicia melilotoides* Wooton & Standley, sp. nov.**

Perennial from a long, slender root; stems slender, angled, soft-pubescent, 80 cm. long or less, ascending or prostrate; leaflets 10 to 16, linear-oblong or linear-lanceolate, 25 mm. long or less, obtuse and mucronate or acute, bright green, rather thick, finely veined, loosely pubescent on both surfaces, becoming nearly glabrous in age; racemes many-flowered (15 to 20 or more), on peduncles as long as or often much shorter than the rachis; pedicels 1.5 mm. long or less; calyx 1.5 mm. long, at first loosely pubescent, glabrate in age; corolla 7 mm. long, creamy white; pods 25 to 30 mm. long, glabrous, about 8-seeded.

Type in the U. S. National Herbarium, no. 498706, collected at Winsors Ranch in the Pecos River National Forest, July 16, 1908, by Paul C. Standley (no. 4364). Altitude 2,520 meters. The plants were abundant all through this region on open, stony hillsides in the Transition Zone.

ADDITIONAL SPECIMENS EXAMINED: Mountains west of Las Vegas, 1881, *Vasey*; Upper Pecos River, July 27, 1898, *Maltby & Coghill* 108; Coolidge, June 16, 1887, *Tracy* 255; Hillsboro Peak, alt. 3,000 meters, 1904, *Metcalf* 1245; Mogollon Creek, alt. 2,400 meters, 1903, *Metcalf* 266; 1851, *Wright* 943; Middle Fork of the Gila, August 5, 1900, *Wooton*; McClures Ranch, August 2, 1900, *Wooton*; near Cloudcroft, July 31, 1899, *Wooton*; White Mountains, alt. 2,100 meters, 1897, *Wooton* 288.

This has long been confused with *V. pulchella*, which it closely resembles in general appearance. The flowers, however, are white, instead of blue as in that species, and much more numerous, while the peduncles are shorter, and the calyx less pubescent. Both species are found in the same region in the White Mountains, where they are easily distinguished in the field.

## GERANIACEAE.

**Geranium eremophilum** Wooton & Standley, sp. nov.

Perennial from a slender, branched caudex; stems erect or ascending, very slender, 30 cm. long, much branched, minutely retrorse-pubescent, not glandular; leaf blades somewhat pentagonal in outline, 35 to 45 mm. broad, in age glabrate, when young sparingly pubescent, 3 or 5-lobed, the divisions with abruptly acuminate, ovate teeth; pedicels slender, glandular; sepals oblong-lanceolate, about 10 mm. long, ending in an awn 2 mm. long, more or less pubescent, not glandular; petals purplish pink, obovate, retuse, 15 to 20 mm. long; style column canescent or rarely glandular; carpel bodies sparingly hirsute; seeds reticulate.

Type in the U. S. National Herbarium, no. 233003, collected in the San Luis Mountains, September 5, 1893, by Dr. E. A. Mearns (no. 2142).

ADDITIONAL SPECIMENS EXAMINED: San Luis Mountains, September 26, 1893, *Mearns* 2443; San Luis Mountains, September 11, 1893, *Mearns* 2194; Organ Mountains, alt. 1,800 meters, September 23, 1906, *Wooton & Standley*.

It seems undesirable to describe any additional species of *Geranium* in this group where the species are so closely related and so poorly known. These plants, however, could not be placed under any name in Dr. Rydberg's recent revision of the genus without stretching specific limits more than seems reasonable. This species is near *G. fremontii* and *G. caespitosum*, but is more slender, has paler, rather larger flowers, scarcely any glandular pubescence, and nearly glabrous leaves with broader, blunter segments.

**Geranium lentum** Wooton & Standley, sp. nov.

Perennial with a stout caudex; stems weak, slender, ascending or spreading, 30 to 60 cm. long, branched, densely glandular-villous; leaf blades reniform-pentagonal, 35 to 45 mm. wide, dull green, thin, glandular-hirsute on both surfaces, 5-parted, the divisions cuneate and with rounded obtuse teeth; petioles very long and slender, densely glandular; pedicels long and slender, glandular; sepals elliptic-oblong, tipped with an awn less than 1 mm. long, glandular-pilose; petals white, 7 to 10 mm. long; style column densely glandular; seeds finely reticulate.

Type in the U. S. National Herbarium, no. 561079, collected on the West Fork of the Gila, August 7, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Craters, Valencia County, July 28, 1906, *Wooton*; Rio Zuni, July 28, 1892, *Wooton*; West Fork of the Gila, August 6, 1900, *Wooton*; Middle Fork of the Gila, August 5, 1900, *Wooton*.

The specimens cited here have passed as *G. wislizeni*, a Mexican species. Apparently none were examined in the preparation of the Geraniaceae for the North American Flora, for no description in that work agrees with our plant. *Geranium wislizeni* is the plant to which this is most closely related, but that lacks the dense glandular pubescence characteristic of our plant, being glandular only on the style column.

## LINACEAE.

**Cathartolinum vestitum** Wooton & Standley, sp. nov.

Annual, 15 to 25 cm. high; stems slender, striate, densely puberulent, simple below, branched above the middle, the branches strongly ascending; leaves small, linear-lanceolate, glandular-denticulate, acute, thick, glaucous; bracts linear-lanceolate, 3 to 4 mm. long, aristate-tipped; floral branches slender, 6 to 35 mm. long; sepals lanceolate, 5 or 6 mm. long, acute, bristle-tipped, with many glandular teeth on the margins, puberulent on the nerves; petals bright

yellow, 13 to 15 mm. long; capsules oblong-ovoid, 4 to 5 mm. long, shorter than the sepals.

Type in the U. S. National Herbarium, no. 562282, collected at Mangas Springs, August, 1901, by O. B. Metcalfe.

The only species with which this can be confused is *C. puberulum*, but that is a short, stout plant with short, thick pedicels and much shorter petals. Our plant, too, is simple below, while *C. puberulum* is invariably branched.

Evidently related to this and probably the same is Doctor Mearns's no. 47, collected in the Carrizalillo Mountains in 1892.

## ZYGOPHYLLACEAE.

***Kallstroemia laetevirens* Thornber, sp. nov.**

Plants semierect, 30 to 50 cm. tall, branched from the base; stems 30 to 60 cm. long, straight, sparingly pubescent throughout, beset above with scattered stiff hairs; stipules 5 to 6 mm. long, subulate to linear-lanceolate, hispid; leaves 30 to 55 mm. long, the petioles mostly equal to the lowest leaflets; leaflets 4 to 6 pairs, 9 to 20 mm. long, acutish, oblong to elliptical, glabrous above, pubescent with appressed hairs beneath; margins of leaflets prominently ciliate; peduncles in fruit 15 to 40 mm. long, equaling or exceeding the subtending leaves, thickened above, appressed-pubescent and with scattered stiff hairs on the upper half, in age spreading or reflexed; sepals subulate to linear-lanceolate, 6 to 8 mm. long, densely hispid with long, yellowish or tawny hairs; petals bright yellow, 7 to 12 mm. long, rather showy, exceeding the sepals; fruit finely canescent, the beak 5 to 8 mm. long, columnar, grooved, pubescent, often twice the length of the fruit body; nutlets 8 to 10, 3.5 to 4 mm. long, sharply tuberculate on the back, faintly reticulate on the faces.

Type in the U. S. National Herbarium, no. 660420, collected on Hanover Mountain, New Mexico, July 31, 1911, by J. M. Holzinger.

This well marked species differs from *K. parviflora* in its more erect habit, and also in having larger leaflets, leaves, and flowers. It differs from *K. intermedia* in its habit of growth, in its longer peduncles, and in the stems being very pilose.

ADDITIONAL SPECIMENS EXAMINED: ARIZONA—Fort Huachuca, 1894, *Wilcox* 295; without locality, 1869, *Palmer*; Empire Ranch, 1902, *Griffiths & Thornber* 284. NEW MEXICO—Lincoln County, 1898, *Skchan* 52; Organ Mountains, alt. 1,360 meters, 1897, *Wooton* 423; Fort Bayard, 1905, *Blumer* 23; Kingston, alt. 2,000 meters, 1904, *Metcalfe* 1197; San Luis Mountains, 1893, *Mearns* 2202.

## RUTACEAE.

***Rutosma purpureum* Wooton & Standley sp. nov.**

Perennial from a long, thick tap-root; stems very numerous, erect, sparingly branched, 30 cm. high or less, densely punctate with slightly raised glands; leaves linear, 15 mm. long or less, obtuse, thick, abundantly punctate, sessile; pedicels 1.5 mm. long or less; calyx lobes rounded-ovate, obtuse, less than 1 mm. long, purple; petals ovate, obtuse, dull reddish purple except near the base, there yellowish; fruit nearly sessile, 5 mm. high and 6 mm. wide at the top, the carpels strongly diverging, glabrous, conspicuously punctate.

Type in the U. S. National Herbarium, no. 560630, collected on an arid, rocky slope at Bishops Cap at the south end of the Organ Mountains, April 4, 1903, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Bishops Cap, March 30, 1905, *Wooton*; Organ Mountains, September 23, 1906, *Wooton & Standley*; Carrizalillo Mountains, April 20, 1892, *Mearns* 118; 3 miles south of Hillsboro, alt. 1,650 meters, June 6, 1904, *Metcalf* 1293; Mangas Springs, alt. 1,380 meters, 1903, *Metcalf* 784.

Other specimens have been seen from western Texas and southern Arizona.

Doctor Gray, in the second part of *Plantae Wrightianae*, mentions this as "*Rutosma texanum*, var. *corolla purpurea*." His specimens came from "hills near El Paso." *Rutosma texanum*, the other species of the Southwest, occurs in southwestern Texas and adjoining Mexico. It has yellow petals much larger than those of *R. purpureum*, and the carpels are erect instead of spreading.

### POLYGALACEAE.

***Polygala neomexicana* Wooton & Standley, sp. nov.**

Stems slender, erect or ascending, 20 to 35 cm. high, flexuous, simple or branched above, cinereous-puberulent; leaves numerous, thin, bright green, nearly sessile, sparingly puberulent or glabrate, lanceolate or elliptic, 15 to 30 mm. long, acute; inflorescence of few-flowered racemes; flowers soon pendulous, 6 mm. long, on pedicels 2 mm. long; perianth early deciduous; wings obovate, ciliolate, the keel naked; mature fruit oval or broadly oblong, about 10 mm. long, emarginate, the sinus closed, the faces puberulent, the margins ciliate, the seeds narrowly obovoid, hairy, the caruncle lobes forming processes one-third to one-half the length of the seed.

Type in the U. S. National Herbarium, no. 497803, collected on Miller Hill, Grant County, September 8, 1897, by O. B. Metcalfe.

ADDITIONAL SPECIMENS EXAMINED: Guadalupe Canyon, August 16, 1892, *Mearns* 692; San Luis Mountains, September 5, 1893, *Mearns* 2139.

We have also seen specimens from southeastern Arizona.

While closely related to *P. puberula*, our plant differs decidedly in its taller, more slender stems, larger, broader, thinner, nearly glabrous leaves, larger flowers, larger, puberulent fruit, and different seeds. The flowers appear to be yellow or white, but possibly they have faded in the herbarium.

### EUPHORBIACEAE.

***Chamaesyce chaetocalyx* (Boiss.) Wooton & Standley.**

*Euphorbia fendleri chaetocalyx* Boiss. in DC. Prodr. 15<sup>2</sup>: 39. 1862.

In his original description Boissier says: "Ab *E. Fendleri* habitu diversa videtur, sed auctoritate cl. Engelm. qui formas intermedias observasse monuit cum ea junxi." Continued observation in the field compels us to regard this as a distinct species. It differs decidedly from *C. fendleri* in its erect rather than prostrate stems, its narrow, acute leaves, its elongated internodes, and its narrow appendages.

***Chamaesyce micromera* (Boiss.) Wooton & Standley.**

*Euphorbia micromera* Boiss. in DC. Prodr. 15<sup>2</sup>: 44. 1862.

***Chamaesyce serrula* (Engelm.) Wooton & Standley.**

*Euphorbia serrula* Engelm. in Torr. U. S. & Mex. Bound. Bot. 188. 1859.

***Croton eremophilus* Wooton & Standley, sp. nov.**

Perennial, suffrutescent at the base, 35 cm. high or less; stems slender, erect, densely stellate, corymbosely branched above; petioles 25 to 30 mm. long, slender; lower leaf blades oblong or oval, obtuse, 35 to 45 mm. long, grayish beneath with dense, stellate pubescence, green above and with a fine, rather

sparse, or at least not dense, stellate pubescence; upper leaves lanceolate or narrowly oblong, acute; flowers densely clustered, on stout pedicels 5 mm. long; sepals 5 or 6 mm. long, oblong, acute, densely stellate-pubescent; staminate flowers with oblong, ciliate, acute petals; pistillate flowers apetalous; styles 3, bipartite; seeds oblong, brownish gray, 4.5 mm. long, with a stipitate caruncle.

Type in the U. S. National Herbarium, no. 234163, collected by Dr. E. A. Mearns at Dog Spring in the Dog Mountains, September 16, 1893 (no. 2336).

ADDITIONAL SPECIMENS EXAMINED: Parkers Well, July 19, 1901, *Wooton*.

Similar to *C. corymbulosus*, but the two surfaces of the leaves are dissimilar in color, the upper being greener and much less densely pubescent; the upper leaves, too, are acute instead of obtuse, the petals are acute, and the sepals longer.

***Croton luteovirens* Wooton & Standley, sp. nov.**

A slender, branched annual, 80 cm. high or less; stems glabrous, yellowish; petioles slender, glabrous, one-third to one-half as long as the blades, these oblong-lanceolate, glabrous, yellowish green, acute; flowers few, scattered, only a few in each raceme; sepals lanceolate, with a few stellate hairs, acute; petals wanting; capsules sparingly stellate-pubescent when young, soon glabrous; seeds broadly oval, 3 mm. long, light and dark brown striped, with an inconspicuous caruncle.

Type in the U. S. National Herbarium, no. 690232, collected on the Rio Gila, August 15, 1902, by E. O. Wooton.

The plant is very abundant in this region, growing with the related *C. texensis*. Patches of the two are distinguishable at a distance because of their different color. *Croton texensis* is stellate-pubescent throughout, while our plant is glabrous; thus the two may be separated at a glance.

***Tithymalus altus* (Norton) Wooton & Standley.**

*Euphorbia alta* Norton, Rep. Mo. Bot. Gard. 11: 108. 1899.

***Tithymalus chamaesula* (Boiss.) Wooton & Standley.**

*Euphorbia chamaesula* Boiss. Cent. Euphorb. 38. 1860.

***Tithymalus luridus* (Engelm.) Wooton & Standley.**

*Euphorbia lurida* Engelm. Proc. Amer. Acad. 5: 173. 1861.

***Tithymalus mexicanus* (Engelm.) Wooton & Standley.**

*Euphorbia dictyosperma mexicana* Engelm. in Torr. U. S. & Mex. Bound. Bot. 191. 1859.

*Euphorbia mexicana* Norton, Rep. Mo. Bot. Gard. 11: 105. 1899.

***Zygophyllidium delicatulum* Wooton & Standley, sp. nov.**

A slender annual, sparingly branched; stems erect or ascending, green, glabrous, sometimes purplish; leaves mostly alternate, the floral ones opposite or ternate, ovate to oblong, acute or obtuse, 15 to 30 mm. long, thin, bright green, finely serrulate, rounded to cuneate at the base; petioles slender, about as long as the blades; stipules mostly obsolete; flowers solitary, or clustered in the axils; pedicels 2 to 4 mm. long; involucre glabrous, with 5 glands; appendages obovate, greenish or purplish white; capsules glabrous, 4 mm. in diameter; seeds ovoid, terete, papillose, not carunculate.

Type in the U. S. National Herbarium, no. 562959, collected on Mineral Creek, Sierra County, at an altitude of 2,250 meters, September 26, 1904, by O. B. Metcalfe (no. 1414).

ADDITIONAL SPECIMENS EXAMINED: Tularosa Creek, August 18, 1899, *Wooton*; Ruidoso Creek, alt. 2,100 meters, June 30, 1895, *Wooton*.

A very different plant from any of the other species of the genus, differing most noticeably in the width and shape of the leaf blades and the glabrous involucre.



**Zygophyllum exstipulatum** (Engelm.) Wooton & Standley.

*Euphorbia exstipulata* Engelm. in Torr. U. S. & Mex. Bound. Bot. 189. 1859.

### ANACARDIACEAE.

**Rhus choriophylla** Wooton & Standley, sp. nov.

Low shrub, 1 or even 2 meters high, with few branches; stems stout, the younger ones purplish, finely pubescent; leaflets 3 or 5, ovate, abruptly acuminate, 30 to 60 mm. long, thick and coriaceous, glabrous, pale green, rather dull on the upper surface, mostly unequally rounded at the base; rachis finely puberulent; terminal leaflet larger and broader than the others; flowers in dense panicles much shorter than the leaves; bracts ovate, acuminate, densely pubescent; flowers almost sessile; fruit spherical, 5 mm. in diameter, orange, densely hirtellous.

Type in the U. S. National Herbarium, no. 560279, collected in Guadalupe Canyon, on the Mexican boundary, near the southwest corner of New Mexico, August 16, 1892, by Dr. E. A. Mearns (no. 699).

ADDITIONAL SPECIMENS EXAMINED: Guadalupe Canyon, 1893, *Mearns* 2524; Pena Blanca, November 30, 1901, *Mae Gilmore*; San Andreas Mountains, February 9, 1902, *Wooton*.

In addition to the specimens cited, we have seen others from western Texas, southern Arizona, and northern Chihuahua.

Evidently this is closely related to *R. virens* Lindh., but the vegetative characters are noticeably different, the leaflets being uniformly broader, rounded at the base, abruptly acuminate, glabrous, and of about the same shade of pale green on both surfaces. The leaflets, too, are fewer.

### ACERACEAE.

**Acer brachypterum** Wooton & Standley, sp. nov.

Tree of medium size, with spreading, smooth, brownish, slender branches; young twigs finely and densely pubescent; petioles usually shorter than the blades, mostly densely and finely velvety pubescent even in age; leaf blades averaging 5 cm. long and 6 to 8 cm. broad, 5-lobed, all the lobes divergent, the two basal ones much smaller than the others or sometimes wanting; leaves cordate or truncate at the base, dull green and glabrous above, paler and pubescent beneath, thick, the lobes triangular-lanceolate or oblong-lanceolate, entire or with one or two low, rounded, lateral lobes, acutish; flowers not seen; calyx persistent; inflorescence short and few-fruited; pedicels slender, 20 to 35 mm. long, pubescent; body of the fruit turgid, glabrous, strongly reticulate, the wings small, 15 mm. long and 10 mm. wide or smaller, glabrous, strongly veined, reddish.

Type in the U. S. National Herbarium, no. 560270, collected in the San Luis Mountains, July 19, 1892, by Dr. E. A. Mearns (no. 535).

ADDITIONAL SPECIMENS EXAMINED: San Luis Mountains, 1892, *Mearns* 71, 569; San Luis Mountains, alt. 1,800 meters, October 1, 1893, *Mearns* 2481.

A species near *A. grandidentatum*, but the leaves have very different lobes and are more densely pubescent, and the wings of the fruit are much shorter.

A note by Doctor Mearns on one of the sheets says: "This is the hard maple of this region. I also saw it in the Mogollon Mountains of Arizona, where the leaves turned red in October. Usually it is a small tree in ravines or canyons of the mountains. There is a photograph of the tree in the Report<sup>1</sup> which grew

<sup>1</sup> Report of the Boundary Commission upon the Survey and Re-marking of the Boundary between the United States and Mexico west of the Rio Grande, pl. facing p. 15. 1898.

in a moist canyon (Turkey Canyon) on the west side of the San Luis Mountains. It is the largest seen, measuring 225 cm. in circumference one meter above the ground. The trunk is of about the same size for 6 meters, when it divides into 3 branches of nearly equal size. The height was estimated at about 18 meters. There are several trees in the neighborhood which approach this one in height."

The tree also occurs in southeastern Arizona. Possibly the Mogollon Mountain specimens mentioned above are true *Acer grandidentatum*.

## MALVACEAE.

**Malvastrum micranthum** Wooton & Standley, sp. nov.

Stems numerous, stout, erect, 20 cm. high or less, much branched above, the branches ascending, densely and finely stellate-pubescent; leaves mostly about 12 mm. long, rarely as much as 18 mm., 3-cleft, the divisions all of about the same length, most of them deeply 3-lobed, the lobes oblong-ob lanceolate, entire, rounded at the apex, densely stellate-pubescent beneath, sparingly so above; flowers few, only 3 to 5, approximate at the end of each branch; pedicels stout, 3 mm. long; calyx 3 to 4 mm. high, the lobes ovate-lanceolate, acute, longer than the tube; petals orange, 8 mm. long or shorter; fruit depressed; carpels 9 or 10, finely stellate-pubescent, not cuspidate, semioblong, faintly reticulate on the inner surface; seeds solitary, filling the carpel.

Type in the U. S. National Herbarium, no. 561154, collected by E. O. Wooton near Tiznitzin, August 4, 1904 (no. 2673).

ADDITIONAL SPECIMENS EXAMINED: Mountains southeast of Patterson, August 16, 1900, *Wooton*.

A very distinct species because of its small flowers and small, peculiarly divided leaves.

**Sphaeralcea arenaria** Wooton & Standley, sp. nov.

A low perennial, 30 cm. high or less, from a thick, woody root; stems slender, erect or spreading, much branched in age, densely stellate-pubescent with a rather grayish, close pubescence; petioles one-third as long as the blades or less; blades lanceolate, subhastate, rather obtuse, broadly cuneate or rounded at the base, about 25 mm. long, densely and finely grayish stellate pubescent on both surfaces; flowers axillary, solitary; leaves of the inflorescence but little reduced; pedicels slender, 5 to 10 mm. long; calyx 7 or 8 mm. high, the lobes lanceolate, acute, densely stellate-pubescent; petals obovate, emarginate, 12 mm. long, orange red; carpels numerous, 2-ovuled, 1-seeded, 5 or 6 mm. high, with a slender beak more than 0.5 mm. long, smooth above, reticulate below, densely stellate-pubescent on the back.

Type in the U. S. National Herbarium, no. 330390, collected by E. O. Wooton on the White Sands, Otero County, July 17, 1897 (no. 165). Altitude, 1,200 meters.

ADDITIONAL SPECIMENS EXAMINED: Albuquerque, *Herrick*; Providencia Lake, July 3, 1900, *Wooton*; mesa west of Organ Mountains, August 26, 1899, *Wooton*; near Suwanee, August 1, 1906, *Wooton*; White Sands, August 31, 1904, *Wooton* 2662; between Tularosa and Mescalero Agency, June 22, 1895, *Wooton*.

A common plant of the sandy mesas of southern New Mexico, coming into flower usually in late summer. It is low, with many spreading branches. It is similar to *Sphaeralcea subhastata*, but is finely instead of coarsely pubescent, and has thinner, mostly less lobed leaves, and the flowers are on long and slender pedicels rather than short, stout ones.

Doctor Coulter's *Sphaeralcea subhastata* was a composite species, judging from material in the National Herbarium. One specimen of Wright's collecting which he has named "*S. subhastata*, n. sp.," is evidently our *Sphaeralcea arenaria*. Another, however, marked in the same way is what we take to be *S. subhastata*. The original description points rather plainly to the second plant.

***Sphaeralcea tenuipes* Wooton & Standley, sp. nov.**

Perennial from a thick, woody root; stems 30 cm. high or less, very slender, much branched at the base, simple above, erect or ascending, sparingly stellate-pubescent with scattered, yellowish hairs; petioles as long as the blades or shorter; blades pedate, the lobes cuneate-oblongate, obtuse, 10 to 15 mm. long, entire or with 1 or 2 obtuse lateral lobes, rather bright yellowish green, sparingly stellate-pubescent on both surfaces; flowers in terminal racemes, solitary, rather distant, on slender pedicels 7 to 22 mm long; bracts linear-subulate, reddish; calyx 8 mm. high, cleft half or two-thirds the way to the base, the lobes lanceolate, attenuate, densely stellate-pubescent; petals cuneate-oblongate to narrowly obovate, obtuse or retuse, 15 mm. long, 5 to 7 mm. wide, orange red.

Type in the U. S. National Herbarium, no. 564301, collected on Tortugas Mountain southeast of Las Cruces, May 6, 1906, by Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Tortugas Mountain, alt. 1,320 meters, September 1, 1908, *Wooton & Standley*; Tortugas Mountain, April 22, 1894, March 2, 1902, August 27, 1894, August 29, 1902, *Wooton*; between El Paso and Monument 53, September, 1892, *Mearns* 992.

In general appearance this is similar to *S. pedata*, but it is less pubescent and greener, the petals are narrower, and the flowers are solitary on long, slender pedicels instead of fascicled and on short, stout pedicels.

This may be *Sphaeralcea pedata angustiloba* A. Gray.<sup>1</sup> We have seen no material of that subspecies, but the description seems to define a different plant.

*Sphaeralcea tenuipes* is rather common among the rough limestone rocks on Tortugas Mountain. It is a handsome plant, with its almost naked, slender racemes of bright colored flowers. Doubtless it occurs in similar situations about El Paso, Texas, and in northern Chihuahua.

## LOASACEAE.

***Mentzelia asperula* Wooton & Standley, sp. nov.**

Annual with erect, branching stems 30 to 50 cm. high, at first scabrous but becoming smooth below, the upper branches strongly ascending, the lower ones divergent then erect; petioles 1 cm. long or less; leaf blades narrowly ovate to lanceolate, coarsely and irregularly serrate-dentate, sometimes lacinately 2 to 4-lobed near the base, hispid with barbed hairs; flowers solitary, appearing axillary, really terminal, the stem branching below after the flower is well grown, sessile; calyx tube terete, short-clavate, elongating in fruit, densely hispid with barbed hairs, the lobes at first narrowly lanceolate, acuminate, becoming subulate, persisting on the fruit, 3 to 5 mm. long; petals 5, ovate to obovate, 6 to 8 mm. long, short-apiculate, orange, deciduous; filaments shorter than the petals, none of them dilated; fruit cylindrical to long-clavate, 18 to 25 mm. long; seeds about 8, pyriform, obscurely and bluntly angled, gray, with fine, parallel, curved striæ.

<sup>1</sup>Proc. Amer. Acad. 22: 292. 1887.

Type in the U. S. National Herbarium, no. 498146, collected on Trujillo Creek, Sierra County, at an altitude of 2400 meters, September 14, 1904, by O. B. Metcalfe (no. 1364).

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Organ Mountains, September 10, 1899, *Wooton*. ARIZONA—Sonoita Valley, 1874, *Rothrock* 642; near Fort Huachuca, 1894, *Wilcox* 431; Bowie, 1884, *Jones* 4308; pass of the Chiricahua Mountains, 1851, *Wright* 1981. TEXAS—Limpio Canyon, 1889, *Nealley* 659. MEXICO—Near Durango, 1896, *Palmer* 484.

The material from southern New Mexico and Arizona has mostly been referred to *Mentzelia aspera*, a West Indian species with larger flowers, the outer row of filaments petaloid, the leaves acuminate and with more finely toothed margins and longer petioles. The Mexican representatives have been referred to *Mentzelia hispida* Willd., which has much larger flowers and leaves. Some of the Texas specimens have been called *Mentzelia oligosperma*, but that is a tuberous-rooted perennial with different leaves and habit.

***Mentzelia monosperma* Wooton & Standley, sp. nov.**

Tuberous-rooted perennial with divaricately branched stems 30 to 40 cm. high, forming a plant of as great or greater diameter; cortex on young stems yellowish green, hispid, becoming smooth, white, and papery; leaves broadly ovate in outline, obscurely 3-lobed, with a few coarse, sinuate teeth, broadly cuneate at the base, on petioles 2 or 3 mm. long, almost sessile above, acute or obtuse, bright green; flowers solitary, resembling those of *M. oligosperma* but smaller and with broader, shorter petals and calyx lobes; outer row of filaments about twice as wide as the inner ones; fruit clavate, woody when mature, about 1 cm. long, with a single large seed 3 mm. long, this elliptic-oblong more or less triangular in cross section, dull brownish, finely striate with undulating lines.

Type in the U. S. National Herbarium, no. 690230, collected in the Organ Mountains, August 29, 1894, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Thirty-five miles west of Roswell, 1900, *Earle* 521.

In root and seed characters this plant is very similar to *Mentzelia oligosperma*, to which it has been referred. The flowers and habit of the plant are different from those of that species. It has been collected only once in the type locality, therefore is probably very rare.

***Nuttallia gypsea* Wooton & Standley, sp. nov.**

Tufted, herbaceous perennial, 20 to 40 cm. high, branching freely above, leafy to the top; cortex white and smooth below, scabrous above; leaves green, oblong in outline, 2 to 4 cm. long, about 1 cm. wide or less, pinnately divided into linear, mostly obtuse segments barely 1 mm. wide, short-petiolate, never clasping or auriculate at the base, rough with scattered, recurved, stout, white, barbed hairs swollen at the bases; flowers small, on short, terminal pedicels, subtended by 1 or 2 small, linear bracts; hypanthium campanulate, 3 to 4 mm. long; sepals ovate-lanceolate, acuminate in bud, about 5 mm. long, becoming triangular-subulate; petals lanceolate, broader than the 5 inner staminodia, pale yellow, tapering to the base, acute, 12 to 15 mm. long, 2 to 3 mm. wide; stamens numerous, the outer filaments somewhat dilated, about as long as the petals, the inner ones shorter; capsules almost hemispheric, about 7 mm. long; seeds numerous, flat, winged, minutely tuberculate.

Type in the U. S. National Herbarium, no. 564614, collected on pure gypsum near Lakewood, August 6, 1909, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: On gypsum soil on plains 35 miles south of Torrance, August 10, 1909, *Wooton*.

This species seems to be affiliated with *Nuttallia laciniata*, but is much smaller in every way, and the flowers are pale yellow. The time of opening of the flowers is not known. The specimens collected in the morning about 11 o'clock were as wide open as those taken about sundown.

***Nuttallia laciniata*** (Rydb.) Wooton & Standley.

*Touthera laciniata* Rydb. Bull. Torrey Club 31: 565. 1904.

***Nuttallia procera*** Wooton & Standley, sp. nov.

Perennial herb, 60 to 100 cm. high, slender, strict, sometimes branching at the base; cortex white and papery, smooth except on the young stems; leaves small, sessile, oblong, obtuse, 30 to 50 mm. long, about 5 mm. wide, with 5 to 10 coarse, rounded teeth on each side, very rough with short, stout, white barbed hairs; flowers rather small, on slender, terminal peduncles, or the stems somewhat corymbosely branched above; sepals narrowly lanceolate, abruptly acuminate; petals rather bright yellow, about 1 cm. long, oblanceolate, acute, the 5 staminodia narrower and sometimes short-acuminate; outer filaments somewhat dilated; capsules oblong-cylindric, 10 to 12 mm. long, 6 or 7 mm. in diameter; seeds numerous, disk-shaped, surrounded by a broad wing, white, tuberculate.

Type in the U. S. National Herbarium, no. 516161, collected on the White Sands, August 18, 1907, by E. O. Wooton and Paul C. Standley.

The plant has been collected in the vicinity of the White Sands several times. Wooton's 571, distributed as *Mentzelia pumila?*, is the same species collected on the Sands in 1897. It has also been collected above Tularosa in the White Mountains (Wooton 567 in 1897).

The species is most nearly related to *Nuttallia multiflora*, but is of very different habit, much more slender, and has smaller, less pinnatifid leaves and smaller flowers and fruit.

***Nuttallia strictissima*** Wooton & Standley, sp. nov.

Fifty to 70 cm. high or more; stems simple below, with a few erect branches near the top, whitish, scabrous; lower leaves linear or linear-elliptic, acutish, scabrous, very shallowly dentate, sessile; uppermost leaves linear or linear-lanceolate, reduced and bract-like, crowded, mostly entire, attenuate; calyx lobes about 1 cm. long, very thick, scabrous with short, stiff, whitish hairs, narrowly triangular, attenuate; flowers few; petals 18 to 22 mm. long, linear-oblanceolate, very acute, with as many or twice as many petal-like staminodia; stamens numerous, the filaments of the outer ones broad and flattened; capsules 2 cm. long, 8 mm. in diameter, cylindric, scabrous.

Type in the U. S. National Herbarium, no. 496766, collected on the Arroyo Ranch, near Roswell, in September, 1903, by David Griffiths (no. 5701).

ADDITIONAL SPECIMENS EXAMINED: Twenty miles south of Roswell, alt. 1,080 meters, August, 1900, *Earle* 317.

Related to *N. multiflora*, but distinguished by its strict habit, narrow petals, and the peculiar bract-like upper leaves.

## ONAGRACEAE.

***Anogra amplexicaulis*** Wooton & Standley, sp. nov.

Stems stout, reddish, much branched, sparingly hirsute and with a sparse, fine, cinereous pubescence; lower leaves short-petioled, the upper clasping by an auriculate base, oblong-lanceolate, oblong, or triangular-lanceolate, acute, entire or runcinate-toothed near the base, green, puberulent and more or less villous;

calyx tips free; calyx tube slender, 30 to 40 mm. long, villous; sepals 15 to 20 mm. long, sparingly villous; petals white fading pink, about 13 mm. long; pistil slightly exserted; capsules ascending, cylindric, 40 mm. long and 2 or 3 mm. in diameter, villous.

Type in the U. S. National Herbarium, no. 497937, collected by O. B. Metcalfe on a sandbar along the Mimbres River, July 1, 1904 (no. 1054).

Very like *Anogra newcomexicana*, but with much smaller flowers, clasping, more pubescent leaves, longer capsules, and more pubescent stems.

**Anogra ctenophylla** Wooton & Standley, sp. nov.

Biennial, 30 cm. high or less; stems stout, with divergent branches, densely and finely cinereous, often with a few long hairs; leaves 35 to 60 mm. long, short-petiolate or sessile, deeply pinnatifid almost to the midrib, the divisions elliptic-oblong, acute, densely puberulent and more or less hirsute; tips of the calyx lobes free in bud; calyx segments 2 cm. long, densely and minutely cinereous, sparingly hirsute; petals 35 to 40 mm. long, white; pistil shorter than the petals; capsules ascending, cylindric, 35 mm. long, minutely cinereous and hirsute.

Type in the U. S. National Herbarium, no. 564751, collected near Zuni, in 1902, by Mrs. Matilda Coxe Stevenson (no. 99).

ADDITIONAL SPECIMENS EXAMINED: Crawford's Ranch, June 21, 1906, *Wooton*; Reserve, July 9, 1906, *Wooton*; Defiance, June 22, 1883, *Marsh* 121; Burro Mountains, alt. 2,100 meters, August 4, 1906, *Blumer* 1827; Ruidoso Creek, August 20, 1897, *Wooton*.

The last two specimens are somewhat doubtful, but probably belong here. The species is related to *Anogra runcinata*, but it has long hairs among the appressed pubescence and its leaves are deeply pinnatifid.

**Anogra engelmanni** (Small) Wooton & Standley.

*Oenothera albicaulis trichocalyx* Engelm. Amer. Journ. Sci. II. 34: 335. 1862, not *O. trichocalyx* Nutt.

*Anogra pallida engelmanni* Small, Bull. Torrey Club 23: 176. 1896.

The type of this came from Las Vegas, New Mexico, collected by Wislizenus in 1846. We have seen only a single additional collection from the State, one gathered by Mr. Geo. L. Fisher near Nara Visa in 1910 (no. 54).

**Anogra leucotricha** Wooton & Standley, sp. nov.

Low and spreading or prostrate, with many divergent branches; stems stout, densely hirsute, 20 cm. long or less; leaves short-petiolate, 30 to 40 mm. long, deeply pinnatifid, the segments triangular-lanceolate and acute, densely strigillose and somewhat hirsute; calyx tube about 25 mm. long; sepals 15 mm. long, finely appressed-pubescent and hirsute; corolla 20 mm. long, white; capsules divergent, cylindric, 30 to 40 mm. long, hirsute.

Type in the U. S. National Herbarium, no. 690235, collected on the San Augustine Plains, July 22, 1904, by E. O. Wooton (no. 2735).

ADDITIONAL SPECIMENS EXAMINED: Willard, August 26, 1904, *Wooton*; plains 10 miles east of Horse Spring, June 20, 1892, *Wooton*.

Related to *Anogra engelmanni*, but with deeply pinnatifid and short-petiolate leaves and different pubescence.

**Anogra runcinata** (Engelm.) Wooton & Standley.

*Oenothera albicaulis runcinata* Engelm. Amer. Journ. Sci. II. 34: 334. 1862.

*Anogra pallida runcinata* Small, Bull. Torrey Club 23: 175. 1896.

A common species found in almost all parts of New Mexico in the Lower and Upper Sonoran zones.

**Galpinsia camporum** Wooton & Standley, sp. nov.

Low perennial, 15 cm. high, from a thick, woody base; stems very numerous, simple or branched, slender, flexuous, finely and densely villous, glandular; leaves very numerous, green, elliptic-lanceolate, 15 to 20 mm. long, acute, entire or nearly so, glandular-pubescent or glandular-puberulent; calyx tube 4 cm. long, slender, sparingly glandular or villous; sepals 12 mm. long, slightly villous, the free tips 2 mm. long; petals 12 to 18 mm. long, rounded-ovate; capsules cylindrical, erect, 13 mm. long, soft-pubescent and glandular.

Type in the U. S. National Herbarium, no. 564592, collected at Knowles, July 29, 1909, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Highest point of the Llano Estacado, June 17, 1903, *Bailey* 518; near Causey, August 17, 1909, *Wooton*; Buchanan, August 12, 1909, *Wooton*; Hondo Hill, July 28, 1905, *Wooton*; Nara Visa, October 2, 1907, *W. Belknap*.

The type was collected in sandy soil on the broad plains near Knowles. It is similar to *Galpinsia greggii* and *G. lampsana*. From the former it is distinguished by its larger flowers and the different form of the leaves, and from the latter by its much smaller flowers and shorter, less abundant pubescence.

**Galpinsia lampsana** (Buckl.) Wooton & Standley.

*Oenothera lampsana* Buckl. Proc. Acad. Phila. 1861: 454. 1862.

A common species of western Texas and eastern New Mexico.

**Gaura brassicacea** Wooton & Standley, sp. nov.

Stems numerous, slender, ascending, 90 cm. high or less, purplish, densely hispid; basal leaves oblanceolate, 5 to 9 cm. long, sinuate-toothed; cauline leaves oblong to oblanceolate, sessile, acutish or obtuse, deeply sinuate-dentate, abundantly hirsute, especially along the veins; branches of the inflorescence glabrous, slender; bracts broadly obovate, acuminate, short-ciliate; calyx glabrous; fruit glabrous, narrowly ovoid, sharply angled, short-stipitate, 8 to 10 mm. long, acute.

Type in the U. S. National Herbarium, no. 45764, collected at Socorro in May, 1881, by G. R. Vasey. Another specimen of the same collection is mounted on sheet 45763.

**Gaura cinerea** Wooton & Standley, sp. nov.

Probably tall and much branched; stems slender, ascending, covered with a dense, loose, rather stiff pubescence; leaves elliptic or narrowly oblong, 20 to 25 mm. long, abruptly acuminate with subulate tips, sessile, sinuate-serrate below the middle, covered with a dense, coarse, curled pubescence; branches of the inflorescence densely cinereous; bracts ovate-lanceolate, with attenuate, subulate tips, pubescent; calyx and ovary densely cinereous; fruit on a slender cinereous stipe as long as the body.

Type in the U. S. National Herbarium, no. 382592, collected 20 miles south of Roswell, in August, 1900, by F. S. and Esther S. Earle (no. 533). Altitude 1,080 meters.

We have also seen a specimen collected at Big Spring, Texas, in September, 1881, by Dr. V. Havard.

Both sheets are in poor condition, showing neither open flowers nor mature fruit, but the plants are so distinct that one can not hesitate to describe them. The only species with which to compare this is *Gaura villosa*, but in that the branches of the inflorescence are glabrous and the pubescence on the flowers and stems is of an entirely different kind.

**Gaura induta** Wooton & Standley, sp. nov.*Gaura glabra* Rydb. in part, not Lehm.

Low perennial, 30 cm. high or less, with numerous branched, slender, glabrous stems; lower leaves lanceolate-oblong, sparingly toothed, acute, sessile, glabrous, the upper ones linear; bracts linear, much exceeding the ovary; calyx tube 7 or 8 mm. long, it and the lobes densely strigose; petals 6 mm. long, rhombic, long-clawed; fruit 5 or 6 mm. long, with a thick stipe, densely and minutely cinereous.

Type in the U. S. National Herbarium, no. 498956, collected on the dry, clay hills near Pecos, August 15, 1908, by Paul C. Standley (no. 4933). Altitude 2,010 meters.

ADDITIONAL SPECIMENS EXAMINED: Santa Fe, alt. 2,160 meters, 1897, *Heller* 3659; 1847, *Fendler* 231b; Las Vegas, June 24, 1891, *Dewey*; Sandia Mountains, 1898, *Herrick* 276; near Tesuque, August 20, 1904, *Wooton*; Patterson, August 15, 1900, *Wooton*; mouth of Pino Canyon, 1898, *Herrick* 276; Farmington, alt. 1,600 meters, 1911, *Standley* 6919; Cedar Hill, alt. 1,900 meters, 1911, *Standley* 7911; Dulce, alt. 2,150 meters, 1911, *Standley* 8165; Nutritas Creek, alt. 2,250 meters, 1911, *Eggleston* 6638; Raton, alt. 2,100 meters, 1911, *Standley* 6297; north of Ramah, July 25, 1906, *Wooton*; Estancia, September 22, 1907, *M. B. Atkinson*; Hebron, September 21, 1907, *C. de Foresta*; Santa Fe, 1908, *Standley* 4482.

Most, if not all of the material placed by Doctor Rydberg under *Gaura glabra* in the Flora of Colorado belongs here. That species was described as being glabrous, and such a plant is well represented in the National Herbarium by specimens from Montana and adjoining States. Our plant has a wide range outside of New Mexico, extending from Arizona and Utah to Wyoming and South Dakota. It occurs chiefly in the low foothills and on the dry plains of the Upper Sonoran Zone.

**Gaura glandulosa** Wooton & Standley, sp. nov.

Stems usually numerous, slender, much branched, erect, 90 cm. high or less, copiously hirsute; basal leaves oblanceolate, somewhat sinuate-dentate, 7 to 10 cm. long, slender-petioled; cauline leaves linear or linear-oblong, entire or remotely repand-toothed, pubescent especially on the margins and veins, acute to obtuse, bright green, sessile; racemes slender, the branches glabrous except among the flowers and buds, there glandular; bracts ovate, acute, ciliolate, glandular; calyx tube 5 mm. long, glandular; petals oblanceolate, obtuse, 6 mm. long; fruit sessile, broadly ovoid, sharply angled, glabrous, not stipitate.

Type in the U. S. National Herbarium, no. 561072, collected at Reserve, July 9, 1906, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Gila Hot Springs, August 20, 1900, *Wooton*; Middle Fork of the Gila, August 5, 1900, *Wooton*; Sapello Creek, August 22, 1900, *Wooton*; N Bar Ranch, August 2, 1900, *Wooton*.

This has always passed as *Gaura nealleyi* Coulter, but that is a nearly glabrous plant with short-stipitate fruit.

**Gaura gracilis** Wooton & Standley, sp. nov.

Stems very slender, with numerous corymbose, ascending branches, 50 to 80 cm. high, villous; cauline leaves linear, 25 to 35 mm. long, entire, bright green, glabrous or sparingly puberulent, acute, short-petiolate; branches of the inflorescence glabrous; bracts ovate, acuminate, ciliolate, strigillose; calyx tube 4 mm. long, strigillose; petals 5 mm. long; fruit sessile, elliptic-ovoid, sharply angled, glabrous, 7 or 8 mm. long, not stipitate.

Type in the U. S. National Herbarium, no. 499693, collected at the Forest Nursery at Fort Bayard, August 29, 1905, by J. C. Blumer (no. 44).



ADDITIONAL SPECIMENS EXAMINED: Filmore Canyon, September 4, 1897, *Wooton*; Filmore Canyon, alt. 1,800 meters, September 23, 1906, *Wooton & Standley*; Mimbres River, alt. 1,650 meters, 1904, *Metcalf* 1033.

***Gaura linearis* Wooton & Standley, sp. nov.**

Stems slender, erect or ascending, branched, glabrous; leaves linear, bright green, entire, acute, sessile, 10 to 15 mm. long, numerous; branches of the inflorescence cinereous-puberulent among the flowers; bracts lanceolate or ovate, acuminate, usually less than half as long as the ovary; calyx tube 3 mm. long, strigose like the lobes; petals 6 or 7 mm. long, oblanceolate, obtuse, long-clawed; mature fruit not seen, but the ovary densely whitish-strigose.

Type in the U. S. National Herbarium, no. 564593, collected on gypsum soil near Lakewood, August 6, 1909, by E. O. Wooton.

Related to *Gaura induta*, but readily distinguished by the short, broad, acuminate bracts and narrow leaves.

***Gaura podocarpa* Wooton & Standley, sp. nov.**

Stems slender, branched from the base and again above, erect, hirsute, reddish; leaves narrowly oblanceolate or oblong, 4 to 6 cm. long, with a few low, repand teeth, acute, the uppermost leaves entire, linear, hirsute along the veins, ciliate; branches of the inflorescence glabrous; bracts ovate, acute, ciliate; calyx tube glabrous, 5 mm. long; petals oblanceolate, obtuse, 6 or 7 mm long; fruit ovoid, 8 mm. long, acutish, very sharply angled, contracted into a short stipe below.

Type in the U. S. National Herbarium, no. 495277, collected by O. B. Metcalfe on Bear Mountain near Silver City, Grant County, June 17, 1903 (no. 166). Altitude 1,500 meters.

ADDITIONAL SPECIMENS EXAMINED: West Fork of the Gila, alt. 2,040 meters, 1903, *Metcalf* 841; West Fork of the Gila, alt. 2,100 meters, August 6, 1900, *Wooton*; Van Pattens, August 29, 1894, *Wooton*; Filmore Canyon, October 29, 1904, *Wooton*.

The plant also occurs in the Huachuca Mountains of Arizona.

This, with *Gaura strigillosa*, *G. gracilis*, and *G. glandulosa*, described here, has passed as *G. suffulta* Engelm., a plant originally described from Lindheimer's collections. All four of our plants have much narrower leaves, broader and much shorter bracts, smaller flowers, and larger fruit; while each one, in addition, differs from that species in other particulars.

***Gaura strigillosa* Wooton & Standley, sp. nov.**

Stems slender, ascending, much branched, 60 cm. high or less, reddish, hirsute; leaves oblong or linear-oblong, or the uppermost linear, the larger ones sinuate-dentate, sessile, acutish, glabrous except for the short-hirsute mid-vein and ciliate margins; branches of the inflorescence glabrous; bracts ovate or ovate-lanceolate, acute, strigillose, ciliate; calyx strigillose, the tube 6 mm. long; petals 6 mm. long; fruit glabrous, narrowly ovoid, sharply angled, short-stipitate, 8 mm. long.

Type in the U. S. National Herbarium, no. 561073, collected by E. O. Wooton at Wingfields Ranch on Ruidoso Creek in the White Mountains, July 8, 1895.

***Lavauxia hamata* Wooton & Standley, sp. nov.**

Cespitose perennial with a short, thick stem 5 to 6 cm. long; leaves narrowly elliptic-lanceolate, deeply and irregularly pinnatifid, the segments acute, attenuate, long-petioled, bright green, glabrous except along the puberulent margins; calyx tube 5 to 7 cm. long, slender, glabrous or nearly so, the lobes 15 to 20 mm. long, nearly glabrous; petals 2 cm. long; capsules 20 to 25 mm. long, 10 mm.

thick, sharply angled, the angles furnished below the top with stout, divaricate, hooked processes, the beak of the capsule stout, the whole finely puberulent.

Type in the U. S. National Herbarium, no. 45766, collected at Socorro, in May, 1881, by G. R. Vasey.

The stout, hooked beak on the wings distinguish this from all our other species; otherwise it is similar to *Lavauxia flava*.

**Lavauxia taraxacoides** Wooton & Standley, sp. nov.

Caudex short and thick; leaves 20 to 30 cm. long, narrowly oblanceolate, deeply pinnatifid near the base into narrow, acute, distant lobes, the terminal portion merely slightly toothed, long-petioled, glabrous; calyx tube 18 to 20 cm. long, slender, glabrous; sepals 35 mm. long, glabrous; petals 35 to 40 mm. long; capsules oblong, 25 mm. high, acute at the apex, narrowly winged, glabrous or slightly puberulent.

Type in the U. S. National Herbarium, no. 563856, collected in James Canyon of the Sacramento Mountains, July 6, 1899, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Tularosa Creek, August 18, 1899, *Wooton*; White Mountain Peak, August 1, 1901, *Wooton*; James Canyon, June 26, 1899, *Wooton*; White Mountains, alt. 3,000 meters, August 16, 1897, *Wooton* 664.

A species readily distinguished by its large leaves and flowers and by its lack of pubescence.

**Oenothera irrigua** Wooton & Standley, sp. nov.

Probably a biennial, 2 meters high or less, with very numerous stout, spreading branches; stems stout, terete, densely and finely canescent, also with numerous short, spreading hairs; basal leaves not seen, the cauline ones narrowly elliptic-lanceolate, 14 cm. long and 2 cm. wide or less, acute, narrowed to the base, sessile or on short, winged petioles, obscurely repand-denticulate, rather densely appressed-pubescent on both surfaces, grayish green; inflorescence a short, dense raceme; ovary densely strigose; calyx tube rather stout, 35 to 45 mm. long, strigose; sepals about 40 mm. long, separate when reflexed, the tips connivent in bud, 5 to 8 mm. long; petals 35 mm. long, yellow, drying purplish red; pistil slightly exserted; mature capsules not seen, but the immature ones columnar, densely silky-strigose, much exceeded by the floral leaves.

Type in the U. S. National Herbarium, no. 561366, collected in the Mesilla Valley, Dona Ana County, in June, 1906, by E. O. Wooton and Paul C. Standley. Altitude about 1,150 meters. The plant is very abundant along the banks of irrigating ditches and in moist cultivated fields.

ADDITIONAL SPECIMENS EXAMINED: Mesilla Valley, July 25, 1907, *Wooton & Standley*; Farmington, August 8, 1904, *Wooton* 2732; Albuquerque, October 13, 1894, *Herrick*; Aztec, July 1, 1895, *Griffin*; Mesilla Valley, *Ivah Mead*.

A plant similar to *O. hookeri*, but much larger and more abundantly branched, and with very different pubescence.

**Oenothera macrosiphon** Wooton & Standley, sp. nov.

Perennial, 50 cm. high or less, with slender, weak, decumbent branches; stems several from each root, branched, hirsute, the hairs rising from papillæ, also minutely cinereous, but sparingly so; cauline leaves lanceolate or elliptic-lanceolate, 7 to 9 cm. long, 25 mm. wide or less, undulate, acute, cuneate at the base or rounded to a short, winged petiole, sparingly repand-denticulate, finely appressed-pubescent, hirsute along the veins, the leaves of the inflorescence slightly reduced; flowers few; calyx tube 15 to 19 cm. long, 2 mm. thick, sparingly pilose; sepals 50 to 60 mm. long, the subulate tips 5 mm. long or more; pistil and stamens included; petals 50 to 55 mm. long, deep

yellow turning purplish; capsules 30 to 40 mm. long, columnar, obtusely angled, sparingly hirsute.

Type in the U. S. National Herbarium, no. 241243, collected in the Organ Mountains, August 29, 1894, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Organ Mountains, alt. 1,860 meters, July 8, 1897, *Wooton* 114; Organ Mountains, 1881, *Vasey*; Van Pattens, June 11, 1906, *Standley*; Van Pattens, September 10, 1899, *Wooton*; Dripping Springs, August, 1898, *Cockerell*.

A beautiful plant with larger flowers than any other species of the genus. It occurs in the Organs in deep, rocky canyons, principally about the edges of pools. It has been called *O. jamesii*, but that species has much smaller flowers and abundant, appressed pubescence.

***Oenothera procera* Wooton & Standley, sp. nov.**

A slender biennial or perennial, 40 to 100 cm. high; stems simple, sparingly and loosely hirsute, also with a few inconspicuous, appressed, curled hairs; basal leaves not seen, the cauline ones elliptic-lanceolate or mostly oblanceolate, 8 to 10 cm. long, 15 mm. wide or less, acute, narrowed at the base to a slender petiole, bright green, thin, entire or faintly repand-denticulate, sparingly appressed-pubescent on both surfaces; leaves of the inflorescence considerably reduced; racemes short, few-flowered; calyx tube slender, about 25 mm. long, loosely pubescent or nearly glabrous; sepals distinct in anthesis, 15 mm. long; petals 12 to 14 mm. long, golden yellow fading purplish; pistil not exerted; capsule 20 to 25 mm. long, obtusely angled, 3 to 4 mm. thick, sparingly hirsute.

Type in the U. S. National Herbarium, no. 498579, collected along Winsor Creek in the Pecos River National Forest, July 5, 1908, by Paul C. Standley (no. 4212). Altitude 2,550 meters.

ADDITIONAL SPECIMENS EXAMINED: Mouth of Mora River, alt. 2,460 meters, July 7, 1908, *Standley* 4246; *Fendler* 218; West Fork of the Gila, alt. 2,250 meters, August 4, 1903, *Metcalf* 379; Ruidoso Creek, August 20, 1897, *Wooton*; James Canyon, August 11, 1899, *Wooton*; Beulah, August, 1899, *Cockerell*; Gilmores Ranch, alt. 2,220 meters, August 25, 1907, *Wooton & Standley*; Pajarito Park, August, 1908, *Bartlett*; Upper Pecos River, 1898, *Maltby & Coghill* 75; Gilmores Ranch, July 14, 1895, *Wooton*; White Mountain Peak, July 6, 1895, *Wooton*; Harveys Upper Ranch, alt. 2,880 meters, 1908, *Standley* 4672; Santa Fe, 1908, *Standley* 4523.

A common plant in the mountains in the Transition Zone. It grows usually on moist open slopes, but sometimes along streams. Seldom or never does it exceed a meter in height, and the stems are invariably simple. The type collection was distributed as *O. strigosa* Rydb., but that is a plant with much larger flowers and different pubescence. Part of the specimens referred to *Onagra strigosa* by Doctor Rydberg in the Flora of Colorado belong here.

***Pachylophus australis* Wooton & Standley, sp. nov.**

Acaulescent, cespitose; leaves on short, rather slender petioles, the blades 10 to 14 cm. long, narrowly oblanceolate, abruptly acute, remotely denticulate near the apex, toward the base pinnatifid into distant, triangular segments, finely cinereous on both surfaces, green; hypanthium tube 14 cm. long, about 12 mm. wide in the throat, minutely cinereous; sepals nearly linear, cinereous; petals white, obovate, 5 cm. long; mature capsules not seen, the ovaries densely appressed-pubescent.

Type in the U. S. National Herbarium, no. 690245, collected on the South Fork of Tularosa Creek, July 31, 1897, by E. O. Wooton.

Related to *P. montanus* (Nutt.) A. Nels., but with much larger flowers and a long hypanthium tube.

**Pachylophus eximius** (A. Gray) Wooton & Standley.

*Oenothera eximia* A. Gray, Mem. Amer. Acad. II. 4: 45. 1849.

*Pachylophus exiguus* Rydb. Colo. Agr. Exp. Sta. Bull. 100: 246. 1906.

### CORNACEAE.

**Garrya goldmanii** Wooton & Standley, sp. nov.

A low shrub, 1 meter high or less; young branches densely covered with fine curled hair, the pubescence persisting often for several years; leaves small, 40 mm. long and 20 mm. wide or smaller, usually about 25 mm. long and 12 mm. wide, elliptic, narrowed toward the base and the mucronate apex, very thick, yellowish green, somewhat crispate, not at all conspicuously veined, pubescent on both surfaces, densely so beneath, the hairs long and only slightly curled or crinkled; margins of the leaves thickened, yellowish, muriculate; the stout petioles 5 to 7 mm. long; fruit in racemes 2 cm. long or less, sessile, subtended by lanceolate, abruptly acuminate bracts about 7 mm. long; fruit glabrous, ovoid to spherical, 6 mm. in diameter or less.

Type in the U. S. National Herbarium, no. 562308, collected on limestone ledges near Queen, New Mexico, July 31, 1909, by E. O. Wooton. Altitude about 1,770 meters.

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Big Hatchet Mountains, alt. 2,010 meters, 1908, *Goldman* 1319, 1318; Sheep Mountain, San Andreas Range, 1902, *Gaut* 36. TEXAS—Guadalupe Mountains, 1901, *Bailey* 452; Chisos Mountains, 1901, *Bailey*, 371.

In Coulter's Botany of Western Texas this is referred to as a narrow-leaved variety of *G. ovata* Benth. It is undoubtedly closely related to that species of central Mexico, but it differs in its lower growth, and small, narrow, more pubescent, crispate leaves. The leaves are much less conspicuously veined than in *G. ovata* and the fruit is much smaller.

### ARALIACEAE.

**Aralia bicrenata** Wooton & Standley, sp. nov.

Somewhat branched herb about 1 meter high; stems stout, sparingly pubescent on the older parts, abundantly pubescent on the younger branches; petioles long and slender; leaflets ovate, 6 to 8 cm. long, the lower ones 3-parted, abruptly acuminate, oblique to cordate at the base, very thin, bright green, doubly crenate almost to the base, nearly glabrous above, puberulent beneath, especially along the veins; inflorescence much branched; peduncles short, 10 to 25 mm. long, puberulent; pedicels 7 to 8 mm. long, numerous; bracts linear, 1 to 2 mm. long; petals ovate, obtuse; ovary glabrous; mature fruit not seen.

Type in the U. S. National Herbarium, no. 563963, collected near Holts Ranch in the Mogollon Mountains, July 20, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Mogollon Creek, alt. 2,250 meters, July 23, 1903, *Metcalf* 303; Las Vegas Hot Springs, August, 1901, *H. S. Barber* 151; South Bonito Creek, 2 miles above the forks, 1899, *Turner* 216; Gallinas Planting Station, 1908, *Bartlett* 301; Sierra Grande, alt. 2,600 meters, 1911, *Standley* 6136.

The plant is related to *A. pubescens* DC. and *A. humilis* Cav. (if they are separable species) of Mexico, but it has much larger and thinner leaves, doubly instead of simply crenate, the pubescence is much more sparse, and the stems are not at all woody. Our plant is also an ally of *A. racemosa*, but the form of the inflorescence is different, the leaves are not deeply cordate at the base, and they are not so conspicuously acuminate.

## APIACEAE.

**Phellopterus utahensis** (Jones) Wooton & Standley.

*Cymopterus montanus purpurascens* A. Gray in Ives, Rep. Colo. Riv. 15. 1860.

*Cymopterus utahensis* Jones, Proc. Calif. Acad. II. 5: 684. 1895.

*Cymopterus utahensis monocephalus* Jones, op. cit. 685.

*Phellopterus purpurascens* Coult. & Rose, Contr. U. S. Nat. Herb. 7: 168. 1900.

**Pseudocymopterus filicinus** Wooton & Standley, sp. nov.

Roots elongated, 15 mm. thick or more; stems very densely clustered, low, 20 to 25 cm. high, sparingly branched or nearly simple, slender, glabrous; basal leaves very numerous, 20 to 25 cm. long; petioles slender, 6 to 8 cm. long; blades broadly triangular or rhombic in outline, 8 to 14 cm. long and usually almost as broad, the length of the lower divisions causing the blades to appear ternate; most of the blades thrice parted; ultimate segments linear or linear-elliptic, bright green, thin, glabrous, very numerous, crowded, short, 15 mm. long or less; principal divisions of the leaves appearing sessile because of the presence of lobes at their bases; peduncles scarcely exceeding the leaves; umbels 15 mm. wide or less, dense, the short branches often puberulent; involucls linear; flowers bright yellow.

Type in the U. S. National Herbarium, no. 564352, collected on Bear Mountain near Silver City, Grant County, June 17, 1903, by O. B. Metcalfe (no. 165). Another specimen of the same collection is mounted on sheet 560402.

ADDITIONAL SPECIMENS EXAMINED: Mangas Springs, September 1, 1897, *Metcalfe*; Holts Ranch, July 20, 1900, *Wooton*; Pinos Altos, 1891, *Nealley* 46.

A very handsome plant for the family, its leaves strongly suggesting some of the ferns. It is distinguished from our other species by the very numerous leaves of peculiar form, and by the small umbels usually but slightly exceeding the leaves.

## PRIMULACEAE.

**Steironema validulum** Greene, sp. nov.

Stem 30 to 60 cm. high, robust, whitish and somewhat polished, densely leafy and floriferous from below the middle; leaves lanceolate or lance-oblong, acute, entire, glabrous, only the short, broad petiole fringed, and that loosely and coarsely; flowers copious, rather crowded at the ends of the branches; sepals ovate-lanceolate, not indistinctly feather-veined above the middle; segments of the corolla nearly orbicular, quite as broad as long, shortly cuspidate-acute; capsule globose, much shorter than the calyx.

Type in the U. S. National Herbarium, no. 45865, collected along Oak Creek, near Flagstaff, Arizona, in July, 1884, by J. G. Lemmon and wife. The best specimens are from northern Arizona collected by MacDougal, Lemmon, and others. One sheet of not very good specimens from McKinneys Park in the Mogollon Mountains, collected by O. B. Metcalfe, seems to represent the species in New Mexico.

## OLEACEAE.

**Menodora laevis** Wooton & Standley, sp. nov.

A low perennial about 25 cm. high, from a thick, woody root; stems slender, woody below, very numerous, simple below, corymbosely branched above, bright green and shining, glabrous, angled; leaves obovate to lanceolate, 15 mm. long or less, obtuse or acute, contracted at the base into a short petiole, glabrous; pedicels about 5 mm. long, glabrous; tube of the calyx 1.5 mm. high, the 7 to

10 lobes linear, acute, glabrous, 5 to 6 mm. long; tube of the corolla very short, the lobes obovate, 8 or 9 mm. long, acute; capsules glabrous, 7 or 8 mm. high.

Type in the U. S. National Herbarium, no. 45767, collected in the Organ Mountains in August, 1881, by G. R. Vasey.

ADDITIONAL SPECIMENS EXAMINED: La Luz Canyon, August 27, 1901, *Wooton*; Duck Creek Flats, 1903, *Metcalf* 770.

The type was distributed as *M. scoparia* Engelm., but that has fewer, shorter calyx lobes. The species is more closely related to *M. scabra*, but differs in being glabrous throughout instead of scabrous.

## GENTIANACEAE.

*Dasystephana rusbyi* (Greene) Wooton & Standley.

*Gentiana rusbyi* Greene; A. Gray, Syn. Fl. 2<sup>1</sup>: 406. 1878.

## APOCYNACEAE.

*Apocynum angustifolium* Wooton, sp. nov.

Stems slender, tall, much branched, the branches strongly ascending, glabrous; leaves narrowly oblong-lanceolate, 7 to 10 cm. long, 1 to 2 cm. wide, glabrous, bright green on both surfaces, acute or rather abruptly acute, mucronate, acute at the base or the lowest rounded, all at least short-petioled, the upper with petioles 5 mm. long; cymes few, densely flowered, on slender peduncles 3 to 5 cm. long; bracts small, linear-lanceolate, attenuate, somewhat scarious; calyx 1.5 mm. long or less, glabrous, the lobes lanceolate, acute; corolla greenish white, 3 to 3.5 mm. long, narrow, with short, erect lobes; follicles slender, 9 to 12 cm. long, 3 to 4 mm. in diameter, glabrous.

Type in the U. S. National Herbarium, no. 564322, collected in the Gila River bottom near Cliff, Grant County, June 13, 1903, by O. B. Metcalfe (no. 132). Altitude 1,350 meters.

ADDITIONAL SPECIMENS EXAMINED: Mimbres, alt. 1,650 meters, July 1, 1904, *Metcalf* 1070; Lower Plaza, July 25, 1900, *Wooton*; Eagle Creek, 1899, *Turner* 129.

A very distinct species of the *cannabinum* group, distinguished by its narrow, bright green leaves, nearly all of them acute at the base.

*Apocynum viride* Wooton & Standley, sp. nov.

Plant 1 meter high or more, with numerous erect, slender, glabrous branches; leaves narrowly elliptic-oblong, bright green, glabrous, 6 to 10 cm. long, 15 to 30 mm. wide, acute or abruptly short-acuminate, rounded or acutish at the base, on slender petioles 3 mm. long or less; cymes few, compact, 30 to 35 mm. wide, many-flowered, on slender peduncles 15 to 30 mm. long; bracts linear, thin; calyx 1 to 1.5 mm. wide, glabrous, with lanceolate, acute lobes; corolla 2 to 3 mm. long, pinkish, glabrous, with short, erect lobes.

Type in the U. S. National Herbarium, no. 499829, collected at Gilmores Ranch on Eagle Creek in the White Mountains, Lincoln County, August 25, 1907, by E. O. Wooton and Paul C. Standley (no. 3451). Altitude 2,220 meters.

ADDITIONAL SPECIMENS EXAMINED: Farmington, alt. 1,550 meters, 1911, *Standley* 6970; Cedar Hill, alt. 1,900 meters, 1911, *Standley* 8003; Las Vegas, July, 1881, *Vasey*; near Pecos, alt. 2,010 meters, 1908, *Standley* 5044; Reserve, July 9, 1906, *Wooton*; Fresno, July 21, 1899, *Wooton*; Sapello Creek, August 22, 1900, *Wooton*; Gilmores Ranch, July 27, 1901, *Wooton*.

Similar to *A. cannabinum* L., but differing in its narrow, bright green, glabrous leaves, as well as in other minor characters.

## DICHONDRAEAE.

**Dichondra brachypoda** Wooton & Standley, sp. nov.

Perennial from a slender root; stems slender, creeping, 50 cm. long or less, seldom rooting at the nodes, villous; petioles slender, erect, 12 to 30 mm. long, villous; blades reniform, with broadly rounded lobes and a narrow sinus, emarginate, 2 to 3 cm. wide, bright green, pubescent on both surfaces, more densely so beneath; pedicels stout, 4 or 5 mm. long; sepals oblong-obovate, rounded at the apex, 3 to 4 mm. long, villous; capsules pubescent, 4.5 mm. high, much exceeding the calyx at maturity.

Type in the U. S. National Herbarium, no. 564085, collected in Filmore Canyon in the Organ Mountains, high up in deep ravines, September 23, 1906, by E. O. Wooton and Paul C. Standley. Altitude about 1,800 meters.

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Kingston, alt. 2,010 meters, 1904, *Metcalf* 1377; Organ Mountains, 1890, *Wooton*; Queen, alt. 1,770 meters, July 31, 1909, *Wooton*; Mexican Boundary Survey 1005; 1851-2, *Wright* 1620. TEXAS—1849, *Wright* 515, 516.

A most distinct species, evidently related to *D. caroliniana* Michx. That, however, has smaller leaves, much longer petioles and pedicels, and its capsules are shorter than the calyx.

## POLEMONIACEAE.

**Eriastrum** Wooton & Standley, nom. nov.

*Hugelia* Benth. Edwards's Bot. Reg. 19: pl. 1622. 1833, not DC. 1830.

*Gilia* section *Hugelia* A. Gray, Proc. Amer. Acad. 8: 271. 1870.

**Eriastrum filifolium** (Nutt.) Wooton & Standley.

*Gilia filifolia* Nutt. Journ. Acad. Phila. n. ser. 1: 156. 1848.

*Navarretia filifolia* Brand in Engl. Pflanzenreich 27: 167. 1907.

**Gilia brachysiphon** Wooton & Standley, sp. nov.

Perennial from a usually slender root; stems stout, 15 to 50 cm. high, cinereous-tomentulose, simple or branched; leaves petiolate, pinnately parted into linear, spinulose-tipped segments, cinereous to glabrate; inflorescence thyriform, often short and somewhat congested, in age elongated, the flowers collected in small, pedunculate, close clusters; calyx 3 to 4 mm. long, villous, sparingly viscid, with lanceolate-subulate, spinescent lobes nearly as long as the tube; corolla bluish, 8 to 10 mm. long, the tube usually not at all exerted, about equaled by the oblong, apiculate lobes; stamens exerted; capsules obtuse, 4 mm. long.

Type in the U. S. National Herbarium, no. 561092, collected at Van Pattens Camp in the Organ Mountains, August 29, 1894, by E. O. Wooton. The plant is not uncommon in this range, growing on slopes near the summit, in the thin shade of yellow pines.

ADDITIONAL SPECIMENS EXAMINED: Kingston, alt. 1,980 meters, 1904, *Metcalf* 1269; near Carlisle, August 13, 1902, *Wooton*; mountains southeast of Patterson, August 16, 1900, *Wooton*; Filmore Canyon, September 20, 1908, *Wooton & Standley*; Organ Mountains, September 4, 1898, *Cockerell*, September 23, 1906, *Wooton & Standley*, in 1897, *Wooton* 440.

This is related to *G. multiflora*, but the corolla is very different, the tube in that species equaling the lobes, while in *G. brachysiphon* it is often shorter.

**Gilia campylantha** Wooton & Standley, sp. nov.

Perennial with numerous clustered stems from running rootstocks; stems tall, 30 cm. high, very slender, densely tomentulose; leaves numerous, pecti-

nately parted into linear, abruptly acuminate, aristate-tipped lobes, tomentose or tomentulose, petiolate; flowers numerous, in few-flowered pedunculate or sessile clusters arranged in a secund, raceme-like thyrses; pedicels short; calyx 3 mm. long, green, only slightly scarious, puberulent, cleft to the middle or lower into triangular-subulate, pungently pointed lobes; corolla white, the tube about 8 mm. long, thick, sharply bent downward just above the calyx, the lobes elliptic-oblong, obtuse, narrowed at the base into a short claw, about 4 mm. long.

Type in the U. S. National Herbarium, no. 233429, collected in the San Luis Mountains, September 11, 1893, by Dr. E. A. Mearns (no. 2242).

A remarkable species, distinguished from all the related ones by its small, white flowers and the peculiarly formed corolla tube. Otherwise it suggests *G. glomeriflora* Benth., but that has a very different calyx besides.

***Gilia formosissima*** (Greene) Wooton & Standley.

*Callisteris formosissima* Greene, Leaflets 1: 160. 1905.

*Batanthes formosissima* Greene, op. cit. 224. 1906.

***Gilia greeneana*** Wooton & Standley, nom. nov.

*Callisteris collina* Greene, Leaflets 1: 159. 1905, not *Gilia collina* Eastwood.

*Batanthes collina* Greene, op. cit. 224. 1906.

*Gilia attenuata collina* Cockerell, Univ. Mo. Stud. Sci. 2<sup>2</sup>: 197. 1911.

***Gilia texana*** (Greene) Wooton & Standley.

*Callisteris texana* Greene, Leaflets 1: 160. 1905.

*Batanthes texana* Greene, op. cit. 224. 1906.

***Gilia viscida*** Wooton & Standley, nom. nov.

*Gilia pinnatifida* Nutt.; A. Gray, Proc. Amer. Acad. 8: 276. 1870, not Moc. & Sessé, 1837.

***Phlox grayi*** Wooton & Standley.

*Phlox longifolia stansburyi* forma *brevifolia* A. Gray, Proc. Amer. Acad. 8: 255. 1870.

*Phlox longifolia brevifolia* A. Gray, Syn. Fl. 2<sup>1</sup>: 133. 1878, not *P. brevifolia* Baum.

This plant is distinct enough from both *P. longifolia* and *P. stansburyi* to receive specific rank; in fact, it is much more distinct from those species than are most of the members of the genus from each other. It is marked chiefly by its lower habit, more branched stems, and especially by the short, broad, rather crowded leaves. The corollas of our New Mexican specimens have a very small limb, only about 13 mm. wide and each lobe of the limb is retuse rather than rounded, as in most of our species.

***Phlox tenuis*** Wooton & Standley, sp. nov.

Slender perennial 15 to 20 cm. high; stems numerous, erect, tortuous, finely villous, slightly glandular; internodes long; leaves linear, 35 to 65 mm. long, divaricate, acute, villous; pedicels slender, 12 to 30 mm. long, glandular-villous; calyx 12 to 14 mm. high, densely glandular-villous, the linear-subulate lobes about as long as the tube; corolla tube only slightly exceeding the calyx; corolla lobes cuneate-oblongate, 13 to 14 mm. long, 5 mm. wide, broadly rounded at the apex; fruit not seen.

Type in the U. S. National Herbarium, no. 306405, collected at Barranca, Taos County, May 26, 1897, by A. A. and E. Gertrude Heller (no. 3589). Altitude 2,070 meters.

On the same sheet with the type, and distributed under the same number, are plants of what appear to be *P. stansburyi*. The collection was distributed



under that name. Our plant, however, is very unlike *P. stansburyi*, having the corolla tube only slightly longer than the calyx instead of twice as long, while the leaves are larger and more slender, and the corolla lobes longer and narrower.

Baker's no. 60 from Cerro Summit, Colorado, is apparently the same species.

### HYDROPHYLLACEAE.

***Marilaunidium foliosum* Wooton & Standley, sp. nov.**

Annual, 12 to 30 cm. high; stems with very numerous, dense, spreading branches, these rather stout, hirsute and puberulent; leaves obovate to oblanceolate or broadly oblong, very numerous especially about the inflorescence, obtuse, acute at the base, sessile, flat, glandular throughout, hispid on the upper surface; flowers very numerous, in terminal or axillary clusters, sessile or nearly so; calyx 5 or 6 mm. long, the linear lobes coarsely hirsute; corolla about 7 mm. long, purple, the very short tube much exceeded by the calyx, the lobes broad and rounded; seeds very numerous, minute, ovoid, with a thin, rugulose coat.

Type in the U. S. National Herbarium, no. 480933, collected by F. S. Earle on saltgrass flats near Roswell, August 30, 1900 (no. 531).

ADDITIONAL SPECIMENS EXAMINED: Roswell, alt. 1,140 meters, 1900, *Earle* 558; near Lake Arthur, August 1, 1905, *Wooton*; Fort Stanton, July 26, 1905, *Wooton*.

This was distributed as *Nama stenocarpum* A. Gray, but that is a prostrate plant with decurrent leaves and different pubescence. It is more closely related, perhaps, to *Marilaunidium hispidum*, but that, too, has more abundant pubescence, narrower leaves, and different corollas.

***Marilaunidium tenue* Wooton & Standley, sp. nov.**

Annual; stems slender, with few erect branches, 9 cm. high or less, puberulent and hirsutulous; leaves few, linear-spatulate, obtuse, 16 mm. long or less, narrowed at the base into a short petiole, hirtellous, glandular, the margins revolute; flowers few, axillary or cymulose, on slender pedicels 1 to 4 mm. long; calyx 3 mm. long in anthesis, increasing in size in age, the lobes linear, green, hirsute; corolla 4 to 5 mm. long, light blue, with a thick tube and narrow limb; capsules glabrous, two-thirds as long as the calyx; seeds few, brown, pitted.

Type in the U. S. National Herbarium, no. 498090, collected on limestone hills 3 miles south of Hillsboro, Sierra County, by O. B. Metcalfe, September 6, 1904 (no. 1291). Altitude 1,500 meters.

This was originally determined as *Conanthus demissus* (A. Gray) Heller, with which it has nothing to do. It is more closely related to *Marilaunidium angustifolium*, but is a lower, more slender plant, scarcely at all viscid, with longer corolla and much shorter calyx, and shorter floral leaves.

***Marilaunidium xylopodum* Wooton & Standley, sp. nov.**

Perennial from a very thick, woody root; stems numerous, slender, sparingly branched, ascending, 8 cm. long or less, hispid; leaves numerous, oblanceolate or oblong, acute, mostly flat, attenuate to the base, glandular, hispid; flowers few, cymulose, short-pedicellate; calyx 2.5 to 4 mm. long, with linear-subulate, hispid lobes; corolla purple, 6 or 7 mm. long, with a very thick tube not exceeding the calyx, the lobes somewhat spreading, rounded; capsule about half as long as the calyx.

Type in the U. S. National Herbarium, no. 564567, collected in crevices of limestone rocks near Queen, July 31, 1909, by E. O. Wooton. Altitude about 1,770 meters.

We have another specimen of the species collected in the same range of mountains (the Guadalupe) but across the line in Texas, in October, 1881, by Dr. V. Havard.

This differs from all our other New Mexican species in being perennial. It does not seem to be closely related to any of the perennial species found elsewhere.

***Phacelia bombycina* Wooton & Standley, sp. nov.**

Annual, 12 to 20 cm. high; stems few, stout, nearly scapose, hirsute and glandular-puberulent; basal leaves on stout petioles 4 to 5 cm. long, obtuse, pinnatifid into oblong-ovate, rounded, crenate lobes, sericeous and glandular on both surfaces; cauline leaves few or absent, petiolate, lobed; inflorescence narrow, with few branches; flowers numerous, crowded, on very short, stout pedicels; sepals oblong, obtuse, 2.5 mm. long or less, glandular-hirsute; corolla 5 to 6 mm. long, the lobes rounded, entire; stamens much exserted; styles hairy below; capsules subglobose, 2 to 2.5 mm. in diameter, hirtellous and glandular; seeds 1.5 mm. long, dark brown, finely pitted on the back.

Type in the U. S. National Herbarium, no. 45771, collected on "gravelly banks" at Mangas Springs in March or April, 1880, by H. H. Rusby (no. 276).

ADDITIONAL SPECIMENS EXAMINED: Bear Mountains, alt. 1500 meters, 1903, *Metcalf* 75.

- Similar in general appearance to *P. intermedia*, but with hirsute pubescence, silky leaves, and narrower calyx lobes.

***Phacelia depauperata* Wooton & Standley, sp. nov.**

Annual, 6 cm. high or less; stems erect, slender or stout, simple or branched at the base, densely glandular-puberulent and hirsute; leaves linear-oblong in outline, 35 mm. long or less, once pinnatifid, the oblong-oval segments crenate or lobed, obtuse, scaberulous and glandular on both surfaces; inflorescence short and dense; pedicels stout, less than 1 mm. long; calyx 2 mm. long, the segments rounded-obovate, hirsute and glandular-puberulent; corolla 5 mm. long, the lobes broadly rounded, undulate-margined; stamens much exserted.

Type in the U. S. National Herbarium, no. 496292, collected on the Arroyo Ranch, near Roswell, in 1903 by David Griffiths (no. 4249).

This was determined as *P. arizonica*, but it differs from that species in its much longer flowers, the form of the calyx lobes, and the character of the pubescence.

***Phacelia tenuipes* Wooton & Standley, sp. nov.**

Annual, 15 to 20 cm. high; stems slender, with a few ascending branches above the base, hirsute and sparingly glandular; lower leaves broadly oblong, with a few small lobes near the base, the terminal part lobed and crenate, sparingly sericeous or with spreading pubescence on both surfaces and glandular, all the leaves petioled; upper leaves rather numerous, ovate, obtuse, crenate or lobed; inflorescence open, slender, few-flowered, the flowers not crowded, at least in age; pedicels slender, 2 or even 3 mm. long; calyx lobes oblong, obtuse, 2.5 mm. long, hirsute, glandular; corolla about 4 mm. long, the lobes rounded, entire; stamens well exserted; style hirsute near the base; capsules globose, shorter than the sepals, hirtellous, glandular.

Type in the U. S. National Herbarium, no. 45770, collected at Carrizalillo Spring, April 17, 1892, by Dr. E. A. Mearns (no. 91).

Related to *P. bombycina*, but a more slender plant with much longer pedicels, fewer flowers and very different leaves.

## EHRETIACEAE.

**Eddya gossypina** Wooton & Standley, sp. nov.

Perennial from a somewhat woody base; stems stout, prostrate, 20 cm. long, densely canescent; leaves spatulate, thick and fleshy, 8 mm. long or less, on slender petioles, obtuse, the blades hispid and short-pubescent, the petioles densely canescent; floral leaves crowded, densely white-villous; flowers few, axillary, sessile or nearly so; calyx lobes linear-lanceolate, white-villous, 3 mm. long; corolla purplish, 10 mm. long, with a spreading limb, the rounded lobes with nearly entire margins; stamens unequally inserted, unequal, the bases of the filaments much enlarged and filling the tube of the corolla; style 2-parted at the top, glabrous; mature fruit not seen.

Type in the U. S. National Herbarium, no. 690234, collected on Tortugas Mountain, September 2, 1894, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Tortugas Mountain, 1911, *Standley* 6439.

In general this resembles *E. hispidissima*, but has a white, cottony appearance very different from that species, while the corolla is much larger and the stamens are somewhat different.

## BORAGINACEAE.

**Lappula grisea** Wooton & Standley, sp. nov.

Biennial from a short, thick taproot; stems stout, 80 cm. high or less, simple below, canescent; basal leaves numerous, narrowly oblanceolate, obtuse, 3 to 5 cm. long; cauline leaves narrowly oblanceolate to linear-oblong, obtuse or acute, 25 to 40 mm. long, the upper sessile, the lower attenuate to a broad, winged petiole; all densely canescent on both surfaces, the hairs with large, white, bulbous bases; inflorescence sparse, with slender, loosely few-flowered, erect branches; bracts very small, lanceolate; pedicels 3 to 4 mm. long; sepals ovate, obtuse; corolla blue, small, 2.5 mm. long; nutlets small, 2.5 mm. long, the prickles as long as the body, free to the base, the back of the nutlets papillose.

Type in the U. S. National Herbarium, no. 562188, collected in James Canyon of the Sacramento Mountains, August 6, 1905, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Tularosa Creek, alt. 2040 meters, July 30, 1897, *Wooton* 252.

Apparently a recognizable species, distinguished from the related *L. floribunda* by its grayish appearance, caused chiefly by the enlarged white bases of the hairs. The pubescence, too, is more abundant, longer, stiffer, and harsher than in any of the related species.

**Lappula hirsuta** Wooton & Standley, sp. nov.

Biennial from a short tap-root; stems stout, erect, a meter high or less, coarsely appressed-pubescent, more or less hirsute above, simple up to the inflorescence; basal leaves narrowly spatulate, obtuse, long-petiolate, 10 cm. long or less; cauline leaves narrowly oblanceolate to oblong, 5 to 8 cm. long, acute, sessile by a rounded base, or the lower ones attenuate to a winged petiole, canescent or appressed-pubescent on both surfaces, glandular, long-ciliate; inflorescence with numerous slender, ascending branches, the racemes long and distantly flowered; bracts elliptic or lanceolate, small; pedicels 4 to 8 mm. long; sepals narrowly oblong, obtuse; corolla deep blue, 8 mm. broad, the lobes orbicular, the appendages finely papillose; marginal bristles of the nutlets separate to the base, about equaling the body, this nearly smooth on the back but minutely hirtellous.

Type in the U. S. National Herbarium, no. 306419, collected by A. A. and E. Gertrude Heller in Santa Fe Canyon, 9 miles east of Santa Fe, July 2, 1897 (no. 3793). Altitude about 2,400 meters; Transition Zone.

ADDITIONAL SPECIMENS EXAMINED: Gallinas Planting Station, 1908, *Bartlett* 302; mountains near Las Vegas, July, 1881, *Vasey*; Winsors Ranch, alt. 2,520 meters, 1908, *Standley* 4106; 1847, *Fendler* 633; Beulah, 1899, *Porter*; Water Canyon, 1897, *Herrick* 750; Upper Pecos River, September, 1904, *Bartlett*, in 1898, *Maltby & Coghill* 66; Beulah, 1899, *Helen Blake*; Mogollon Creek, alt. 2,400 meters, 1903, *Metcalf* 249.

Related to *L. floribunda*, but differing in its hirsute pubescence and larger flowers. Mr. C. V. Piper was the first to suggest<sup>1</sup> that this might be a distinct species. Fendler's specimens were referred by Doctor Gray<sup>2</sup> to *L. ursina*, but this has nothing to do with that species.

***Mertensia amplifolia* Wooton & Standley, sp. nov.**

Perennial from a thick rootstock; stems several, erect, stout, 25 to 35 cm. high, retrorsely appressed-pubescent, simple, or branched above the base, with loosely ascending branches above; basal leaves lance-oblong, 11 cm. long and 5 cm. wide or smaller, acutish, unequal at the base and somewhat decurrent upon the slender petiole, 9 cm. long or less; cauline leaves very numerous, the upper ones little reduced, lanceolate, sessile, or the lowest petiolate, 5 to 9 cm. long, acute, rounded at the base, all the leaves finely appressed-pubescent on both surfaces; inflorescence ample, very leafy, the branches slender, few-flowered, strigose; pedicels slender, about 10 mm. long; calyx in anthesis 5 mm. high, in age about twice as long, cleft to about the middle, the lobes triangular-lanceolate, acute, strigose; corolla 10 mm. long, the limb about 4 mm. and the tube 1.5 mm. wide, the limb and tube about equal in length, the throat with a ring of short hairs; nutlets 2 to 3 mm. long, dark brown, minutely papillose.

Type in the U. S. National Herbarium, no. 45768, collected at Glorieta, June, 1881, by G. R. Vasey. Additional material of the same collection is mounted on sheet 45769.

Our plant is related to *M. bakeri* Greene, but is larger, has larger leaves of different shape, is less pubescent, and has much smaller flowers.

***Mertensia grandis* Wooton & Standley, sp. nov.**

Perennial from a slender rootstock; stem stout, fleshy, erect or ascending, glabrous, 40 to 100 cm. high; leaves ovate to lanceolate, rather fleshy, acute, rounded at the base, 8 to 18 cm. long, the basal long-petioled, the cauline sessile, the uppermost reduced, glabrous beneath and glaucescent, scaberulous on the upper surface; inflorescence rather ample, the slender branches white-strigose; pedicels stout, 8 to 12 mm. long, strigose; calyx 4 to 5 mm. high, cleft to near the base, the lobes oblong, obtuse, glabrous or strigose, ciliate, the tube strongly strigose, the whole enlarging in age; corolla bright blue, 12 to 17 mm. long, the limb 5 to 9 mm. wide, much shorter than the tube, the latter 2.5 to 5 mm. thick, the throat with a ring of short hairs.

Type in the U. S. National Herbarium, no. 498109, collected on a shaded slope of Hillsboro Peak, in the Black Range, September 11, 1904, by O. B. Metcalfe (no. 1319). Altitude 2,550 meters.

ADDITIONAL SPECIMENS EXAMINED: Holts Ranch, July 20, 1900, *Wooton*; Mogollon Mountains, August, 1881, *Rusby* 291; Eagle Peak, August 2, 1900, *Wooton*; Mogollon Creek, alt. 2,250 meters, July 23, 1903, *Metcalf* 302.

<sup>1</sup> Bull. Torrey Club 29:545. 1902.

<sup>2</sup> Syn. Fl. 2<sup>1</sup>:422. 1878.

Related to *M. ciliata* (Torr.) Don, but with a larger, differently formed and abundantly pubescent calyx. It is a larger plant, too, than most of our western *Mertensias*. It is related also to *M. franciscana* Heller, but the corolla and calyx are very different.

**Oreocarya urticacea** Wooton & Standley, sp. nov.

Perennial from a woody caudex covered by the bases of the dead leaves; stems very stout, about 30 cm. high, hispid and densely canescent, simple up to the inflorescence; basal leaves spatulate, rounded at the apex, 7 to 9 cm. long, petiolate, green but hirsute and finely canescent; cauline leaves narrowly oblanceolate, obtuse, attenuate to a winged petiole, very numerous; inflorescence a dense, narrow thyse with numerous linear-lanceolate or linear-oblong, strongly hispid leaves, its branches densely setose-hispid with yellowish hairs; lateral glomerules of the inflorescence on peduncles 10 to 35 mm. long, the flowers in very dense clusters; calyx lobes nearly linear, 6 mm. long, densely hispid; corolla white, 5 or 6 mm. long, the tube shorter than the calyx; mature fruit not seen.

Type in the U. S. National Herbarium, no. 306425, collected at Canyoncito, Sante Fe County, June 18, 1897, by A. A. and E. Gertrude Heller (no. 3731). Altitude 2,160 meters.

ADDITIONAL SPECIMENS EXAMINED: Glorieta, June, 1881, *Vasey*; Sierra Grande, alt. 2,200 meters, 1911, *Standley* 6056.

The type collection was distributed as *O. glomerata* (Pursh) Greene, but that is a lower, rather less hispid plant with a dense, spike-like inflorescence and broader leaves. Our plant is also related to *O. perennis* (A. Nels.) Rydb., but differs from that species in about the same manner as from *O. glomerata*.

## VERBENACEAE.

**Verbena imbricata** Wooton & Standley, sp. nov.

Erect plant, 35 cm. high, with numerous strict, herbaceous stems from the crown of a stout, woody root, sparingly hispid throughout; leaves cuneate-obovate in outline, 3 cm. long or less, pinnately 3-lobed, the middle lobe largest and pinnately toothed or lobed, decurrent below into a short petiole; flowers in crowded, bracted spikes resembling those of *V. bracteosa* but more crowded and the bracts shorter; bracts lanceolate, 5 to 10 mm. long; fruiting calyx barely 3 mm. long; corolla deep blue, about 4 mm. long, shorter than the bracts; nutlets as in *V. bracteosa*.

Type in the U. S. National Herbarium, no. 562249, collected at Farmington, August 8, 1904, by E. O. Wooton (no. 2831).

This may possibly be a hybrid between *V. bracteosa* and some erect species, but this seems improbable, since no species is found in that general region that would be likely to hybridize with *V. bracteosa* to produce such a plant as this.

## MENTHACEAE.

**Agastache cana** (Hook.) Wooton & Standley.

*Cedronella cana* Hook. Curtis's Bot. Mag. pl. 4618. 1851.

*Cedronella cana lanceolata* A. Gray, Syn. Fl. 2<sup>1</sup>: 462. 1878, in part.

*Brittonastrum lanceolatum* Heller, Muhlenbergia 1: 4. 1900.

SPECIMENS EXAMINED: Headwaters of the Pecos, August, 1905, *Bartlett*; hills near Santa Rita, October 9, 1904, *Metcalf*; Hillsboro, alt. 1,650 meters, 1904, *Metcalf* 1015; Organ Mountains, August, 1881, *Vasey*; Dona Ana Mountains, October 28, 1906, *Wooton & Standley*; Organ Mountains, alt. 1,660 meters,

1897, *Wooton* 437; San Augustine Ranch, alt. 1,740 meters, August 16, 1895 *Wooton*; Soledad Canyon, September 24, 1905, *Wooton*.

This is without doubt the plant which Hooker described and figured as *Cedronella cana*. The locality cited in Wright's field notes indicates that the type was collected in the low mountains, probably the Huecos, about 30 miles east of El Paso, possibly near the Hueco Tanks, which were then a watering place on the route leading across the plains from El Paso, the one probably followed by Wright's party. The Organ Mountains, where we first found this plant, are the next chain to the northwest, and only a little farther away than El Paso. The plant collected by G. R. Vasey and referred to by Doctor Gray in his description of *Cedronella cana lanceolata* is *C. cana* from the Organ Mountains, in all probability. This is the only Agastache in the National Herbarium collected by Vasey, and this herbarium should contain specimens of all his collections. We have not seen the Wright specimen referred to by Gray in his description of *lanceolata*, which was probably his no. 1533, collected at Santa Rita. The Rusby plant from Mangas Springs that deserves the name of *lanceolata* is *Cedronella rupestris*, an excellent species which has been collected several times since in the immediate region. The Burro Mountain plant collected by Bigelow is also that species.

**Agastache greenei** (Briq.) Wooton & Standley.

*Brittonastrum greenei* Briq. Ann. Cons. Jard. Genève 6: 157. 1902.

We do not agree with Doctor Rydberg in considering this a synonym of *A. pallidiflora* (Heller) Rydb. A rather extended series of the Arizona plant from various localities and also from western New Mexico in the Mogollon Mountains, shows that it has a green calyx and pale whitish flowers, while *A. greenei* has the calyx teeth and upper part of the tube decidedly pink or purplish tinged and the corolla also brighter colored. Besides these more conspicuous calyx differences, the corollas in *A. greenei* are noticeably longer, more arched, and wider at the throat. These differences in color and size of corolla and calyx and noticeable ones in the calyx teeth seem to be the most important diagnostic characters in a group of closely related but distinct species which have until recently been considered as belonging to two or three very variable ones.

**Agastache mearnsii** Wooton & Standley, sp. nov.

Herbaceous, branched perennial, about 70 cm. high, with several erect stems from the base, finely puberulent throughout; stems distinctly quadrangular, sulcate above, below almost terete; petioles mostly 10 to 12 mm. long; blades 25 to 50 mm. long, about two-thirds as broad, triangular to hastate, sometimes ovate, mostly truncate at the base, acute to abruptly short-acuminate, coarsely crenate-dentate, finely and closely puberulent beneath and pale; flowers numerous, in crowded, terminal, spike-like clusters 10 cm. long and 3 to 4 cm. wide when in full flower; peduncles and pedicels 2 or 3 mm. long, the linear-subulate bracts about 5 mm. long; calyx tubular, reddish purple, 10 to 12 mm. long, the triangular-subulate, almost equal teeth fully 2 mm. long, erect; corolla about 20 mm. long, reddish purple, somewhat arched, puberulent outside, the upper lip retuse, the lower 3-lobed; stamens 4, the longer pair exceeding the corolla; nutlets brown, scabrous at the apex.

Type in the U. S. National Herbarium, no. 233421, collected in a canyon on the east side of the San Luis Mountains in extreme southwestern New Mexico, nearly on the Mexican boundary line, September 11, 1893, by Dr. E. A. Mearns (no. 2251).

ADDITIONAL SPECIMENS EXAMINED: Animas Valley, 1893, *Mearns* 2502; Burro Mountains, alt. 2190 meters, 1908, *Goldman* 1517; Pinos Altos Mountains, September 10, 1880, *Greene*.

This is one of the species of southern New Mexico and northern Mexico which has been passing as *Cedronella mexicana*, a much larger plant with larger flowers from some hundreds of miles farther south. It is nearest to *Brittonastrum barberi* and *B. ionocalyx* Robinson, both of which have larger corollas, the former a longer calyx and the latter a shorter one, and both much broader and relatively shorter calyx teeth. The species is named for Dr. E. A. Mearns, whose extensive collections along the Mexican boundary have added records of many little known species to the flora of New Mexico.

**Agastache micrantha** (A. Gray) Wooton & Standley.

*Cedronella micrantha* A. Gray, Proc. Amer. Acad. 8: 369. 1872.

**Agastache verticillata** Wooton & Standley, sp. nov.

Perennial herb, 40 to 80 cm. high, branched, puberulent throughout, green, the younger stems sulcate-quadrangular, slightly scabrous; leaves ovate-lanceolate, the blades 2 to 4 cm. long, on petioles 10 to 15 mm. long, rather thin, slightly paler beneath, the margins distantly and coarsely crenate-dentate, broadly cuneate or truncate at the base, the apex acute and somewhat attenuate in the upper leaves; flowers small for the genus, in an interrupted, verticillate spike 10 to 12 cm. long, the verticels crowded, the internodes slightly longer than the fruiting calyces; peduncles and pedicels very short, 1 to 2 mm., the linear bracts but little longer; calyx tubular, 5 to 6 mm. long, the subulate lobes about one-fourth as long, unequal, two of them shorter than the others, the tube green below, the lobes purple; corolla slender, 10 to 12 mm. long, pale, slightly, if at all, curved; nutlets smooth.

Type in the U. S. National Herbarium, no. 561455, collected in the Organ Mountains, altitude about 2,250 meters, September 23, 1906, by E. O. Wooton and Paul C. Standley.

ADDITIONAL MATERIAL EXAMINED: Organ Mountains, August, 1881, *Vasey*; Organ Mountains, August 16, 1895, *Wooton*; Filmore Canyon, October 23, 1904, *Wooton*; West Fork of the Gila, altitude 2,250 meters, 1903, *Metcalf* 348; West Fork of the Gila, August 6, 1900, *Wooton*; Old Tiptop, Organ Mountains, October 18, 1903, *Metcalf*.

This species is nearest *A. wrightii*, but is easily separated. The flowers are about twice as large, the calyx lobes are purple instead of white, and the leaves are larger and have fewer teeth. The dried calyces of the different species of the genus have different odors when pulverized. This species gives a pronounced odor of camphor.

**Agastache wrightii** (Greenman) Wooton & Standley.

*Cedronella wrightii* Greenman, Proc. Amer. Acad. 41: 244. 1905.

*Brittonastrum wrightii* Robinson, Proc. Amer. Acad. 43: 26. 1907.

**Hedeoma pulcherrima** Wooton & Standley, sp. nov.

Perennial herb, much branched, from a woody root, the stems slender, diffusely ascending, finely and sparingly puberulent throughout, about 30 cm. high; leaves opposite, elliptic-oblong, 2 cm. long or less, the largest 7 mm. wide, tapering below into a short petiole, rather thin, green, obtuse, entire; flowers large for the genus, in 1 to 5-flowered cymose clusters in the axils of the leaves, the upper internodes and leaves somewhat reduced; floral bracts linear-lanceolate, hardly longer than the short (1 to 2 mm. long) pedicels; calyx 6 to 7 mm. long, 15-ribbed, slightly constricted above the middle, sparingly hispidulous, the three upper lobes triangular-lanceolate, about 1 mm. long, the two lower ones sub-

late, about twice as long, slightly curved upward, all of them sparingly bearded in the throat; corolla bluish purple, 12 to 14 mm. long, narrowly funnelform, gaping, finely pubescent outside, the upper lip erect, retuse, the lower lip 3-lobed, the central lobe largest; stamens 2, surpassing the upper corolla lobe; nutlets oval, dark brown, smooth, acute.

Type in the U. S. National Herbarium, no. 330465, collected in the White Mountains, Lincoln County, altitude about 1,950 meters, July 30, 1897, by E. O. Wooton (no. 241).

ADDITIONAL SPECIMENS EXAMINED: Cloudfcroft, June 30, 1899, *Wooton*; Tularosa Creek, August 19, 1899, August 6, 1901, *Wooton*; Toboggan, July 31, 1899, *Wooton*; Dark Canyon, 1907, *Wooton & Standley* 3480; Mescalero Reservation, July 21, 1905, *Wooton*.

The plant is most nearly related to *H. jucunda* Greene, from Durango, Mexico, and was distributed under that name, having been determined from the description alone. Ours, however, is a stouter plant, with flowers about half again as large, and very different calyx. The species seems to be on the dividing line between the two principal groups of our species: its upper calyx lobes are not foliaceous-expanded as in one group, nor narrowly subulate as in the other, but are triangular-lanceolate, and they are hispid-ciliate like those of the second group. In habit and general appearance our plant resembles *H. jucunda*, but it is a little more leafy and has larger and fewer flowers.

*Salvia earlei* Wooton & Standley, sp. nov.

Tall, slender, herbaceous perennial, 30 to 100 cm. high, branched above, the stems erect, sometimes 3 or 4 from a single root, finely puberulent throughout; leaves linear to narrowly oblong-lanceolate, 4 to 8 cm. long (mostly about 5 cm.) including the petiole, acute, cuneate and decurrent at the base into a petiole about 1 cm. long, entire or undulate with occasionally a few obscure teeth, glabrate but finely glandular above; flowers in terminal, interrupted, glomerate clusters, about 12 flowers in each verticel; calyx 6 to 8 mm. long, campanulate-tubular, obscurely 8 to 10-ribbed, becoming somewhat urceolate in fruit, densely white or blue tomentose with very fine short hairs, the limb short-truncate, obscurely 2-lipped, the upper lip entire, the lower with 2 minute teeth; corolla bright blue to almost violet, about twice as long as the calyx, the upper lip notched, erect, tomentose on the back, the lower lip 3-lobed, the middle lobe much the largest; style densely bearded with bluish hairs; nutlets smooth, brown.

Type in the U. S. National Herbarium, no. 382519, collected 35 miles west of Roswell, in August, 1900, by F. S. and Esther S. Earle (no. 375).

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Twenty miles west of Roswell, July 28, 1905, *Wooton*; South Berendo River near Roswell, June, 1899, *Tinsley*; Sixteen Spring Canyon, August 23, 1901, *Wooton*. TEXAS—Toyah Creek, 1902, *Tracy & Earle* 138; southwestern Texas, 1880, *Palmer* 1066; Frio Water Hole, Edwards County, 1895, *R. T. Hill* 36; Tom Green County, 1880, *Tweedy* 255; Baird, 1882, *Letterman* 72; Ballinger, 1889, *Nealley* 391a.

The plant has long been confused with *S. farinosa* Benth., which it resembles very closely as to its flowers, although these are smaller, but the leaves are of an entirely different character, much more like those of *S. pitcheri* Torr. The distribution area is farther west than that of the one and farther south than that of the other, in a climate much more arid than either of the others endures.

*Salvia pinguifolia* (Fernald) Wooton & Standley.

*Salvia ballotaeiflora pinguifolia* Fernald, Proc. Amer. Acad. 35: 523. 1900.

The type was collected by Wright in 1851 or 1852 (no. 1524), probably in New Mexico somewhere near the Copper mines of Santa Rita.



This is distinguished from *S. ballotaeflora* by the very large, scarcely rugose, broad leaves, pale beneath because of the presence of abundant whitish pubescence, and by the denser and more ample inflorescence. The species has been collected at various times in southern New Mexico and southeastern Arizona.

*Salvia vinacea* Wooton & Standley, sp. nov.

A low, suffrutescent plant, about 30 cm. high; stems slender, sparingly tomentulose above; leaves broadly ovate, about 30 mm. long and 25 mm. wide, rather obtuse, coarsely crenate, mostly truncate at the base or slightly decurrent, glabrous above and almost so beneath but slightly puberulent, of about the same color on both surfaces; petioles slender, half as long as the blades or more; flowers in short, congested spikes, numerous; calyx ampliate in age, its lobes very broad and obtuse, the whole calyx 12 or 13 mm. long, of a deep wine color, greenish at the base, on a short, deflexed pedicel; corolla dark blue, 20 to 22 mm. long, its tube much exceeding the calyx, the upper lip oblanceolate.

Type in the U. S. National Herbarium, no. 499430, collected in the Florida Mountains at an altitude of about 1,950 meters, September 8, 1908, by E. A. Goldman (no. 1501).

ADDITIONAL SPECIMENS EXAMINED: Florida Mountains, September 7, 1903, M. E. Jones; Martins Spring, Florida Mountains, 1895, Mulford 1067.

Nearest *S. pinguifolia*, but differing in its much larger corolla with a narrower upper lip, wine colored calyx, and more congested inflorescence, and in not having its leaves conspicuously whitened beneath.

*Tetradlea angustifolia* Wooton & Standley, sp. nov.

Herbaceous perennial with several branching, obscurely 4-angled, ascending or spreading stems 40 to 50 cm. high from a woody root, the whole plant scabrous with short, stout, recurved, whitish hairs, these most abundant on the stems; leaves narrowly oblong, tapering into a short petiole, serrate-dentate with a few coarse teeth on each side, acute, the hairs mostly on the petioles, veins, and margins of the leaves; flowers in few-flowered axillary clusters with narrowly linear bracts; calyx campanulate, the lobes narrowly lanceolate, acuminate in flower, accrescent and persistent in fruit; corolla and stamens as in *T. coulteri* but smaller and the tube narrower; nutlets slightly more reticulate and of the same size.

Type in the U. S. National Herbarium, no. 330627, collected on the plains south of the White Sands, August 23, 1897, by E. O. Wooton (no. 403). We have one other specimen collected from the same locality, August 26, 1899, by E. O. Wooton.

This plant is more slender, taller, less pubescent and with shorter hairs, and has narrower calyx lobes, smaller corolla, and more reticulate nutlets than the only other species of the genus, *T. coulteri*. The leaves, too, are narrower and toothed.

## SOLANACEAE.

*Androcera novomexicana* (Bartlett) Wooton & Standley.

*Solanum heterodoxum novomexicanum* Bartlett, Proc. Amer. Acad. 44: 628. 1909.

Type collected by Fendler in New Mexico, doubtless near Santa Fe, in 1847 (no. 673). Although *Solanum heterodoxum* has been reported from New Mexico at various times, it is to this species that all such specimens belong. The plant, while seldom abundant in any one locality, has a rather wide range in New Mexico, having been collected in the region about Santa Fe and as far south as Santa Rita.

## SCROPHULARIACEAE.

*Castilleja eremophila* Wooton & Standley, sp. nov.

Perennial from a slender root, the stout, solitary stems 10 to 15 cm. high, cinereous-puberulent; a few of the lowest leaves linear-oblongate, the others pinnatifid, each with 1 or 2 pairs of oblong-linear, divergent or ascending, obtuse lobes, all dull green, thin, cinereous-puberulent, sessile, not conspicuously veined; flowers rather few, crowded; bracts narrow, acute, usually with several linear lateral lobes, glandular-puberulent or slightly villous; calyx 16 to 20 mm. long, about equally cleft before and behind, the lateral divisions each cleft at the summit into 2 oblong-lanceolate, acute segments, glandular and villous, scarlet at the tips; corolla about 25 mm. long, the short tube about 10 mm. and the galea 15 mm. long, the tube glabrous, greenish, the galea puberulent, yellowish green faced with scarlet, the lower lip of 2 glabrous, green, oblong-lanceolate, acute teeth about 1 mm. long.

Type in the U. S. National Herbarium, no. 687232, collected on arid, sandy mesas about the north end of the Carrizo Mountains, July 31, 1911, by Paul C. Standley (no. 7464). Additional material is mounted on sheet 686431.

The plant is somewhat like *C. chromosa* A. Nels., but is much lower and has always solitary stems; the pubescence is very different besides. It grows in the most arid situations in the Upper Sonoran Zone. No other *Castilleja* was found growing at so low an altitude, *C. integra* having a habitat most nearly approaching that of this species.

*Dasystema wrightii* (A. Gray) Wooton & Standley.

*Gerardia wrightii* A. Gray, U. S. & Mex. Bound. Bot. 118. 1859.

*Mimulus parvulus* Wooton & Standley, sp. nov.

Slender annual with almost filiform, prostrate or ascending branches not more than 4 or 5 cm. long, often rooting at the nodes; stems mostly glabrous; leaves thin, 4 to 8 mm. long and fully as wide or wider, broadly rounded-ovate, obtuse, subcordate at the base, short-villous with white hairs, entire or obscurely denticulate, on slender petioles half as long as the blades or longer; pedicels axillary, very slender, exceeding the leaves, glabrous or sparingly villous; calyx turbinate or narrowly campanulate, sharply angled, 5 mm. long in fruit, in flower not much shorter, purplish, oblique at the mouth, sparingly villous with coarse, white hairs; corolla bright yellow, 8 or 9 mm. long, the slender tube more than twice as long as the calyx; capsules 2 mm. long, narrowly oblong, abruptly acute.

Type in the U. S. National Herbarium, no. 660448, collected in Rocky Canyon, Grant County, August 9, 1911, by J. M. Holzinger.

A most distinct species, very unlike any of our other southwestern ones and apparently very different from any of those from farther west or south.

*Pentstemon cardinalis* Wooton & Standley, sp. nov.

Perennial, forming dense clumps 40 cm. in diameter or more; stems rather slender, erect, simple, glabrous, green; basal leaves elliptic-spatulate, obtuse, long-petiolate; cauline leaves various, the lower oblong-lanceolate, obtuse, 13 cm. long or less, narrowed at the base, the upper ones oblong to triangular-ovate, acutish or acuminate, sessile by a truncate or clasping base, thin, glabrous; bracts triangular-subulate, very small; inflorescence thyrsiform, secund, loosely many-flowered, glabrous; pedicels slender, erect, conspicuous; sepals 4 mm. long, lance-ovate, acute, scarious-margined; corolla 22 to 28 mm. long, cardinal red, considerably dilated in the throat, contracted at the mouth, the upper

lobes erect, the lower deflexed, nearly orbicular, 2 or 2.5 mm. long, strongly bearded in the throat with yellow hairs; anthers echinate along the commissure.

Type in the U. S. National Herbarium, no. 563916, collected on White Mountain Peak just above the forks of Ruidoso Creek, July 6, 1895, by E. O. Wooton. Altitude about 2,400 meters.

This is somewhat, but not very closely, related to the group of *P. puniceus* and *P. wrightii*. The plants are not at all glaucous, however, and the form of the corolla is altogether different, especially in the contracted mouth.

***Pentstemon crassulus* Wooton & Standley, sp. nov.**

Perennial from slender, fleshy roots and a stout caudex; stems stout, 45 cm. high or less, simple, erect, glabrous, purplish above; basal leaves narrowly oblanceolate, short-petiolate, acute or obtuse, 10 cm. long or less; cauline leaves all sessile, narrowly oblong to triangular-lanceolate, acute or abruptly acuminate, glabrous, thick and rather fleshy; inflorescence secund, loosely few-flowered, glabrous; pedicels slender, erect; sepals 3 mm. long, broadly ovate, obtuse or abruptly short-acuminate, scarious-margined; corolla about 25 mm. long, red, much dilated in the throat and sparingly bearded, contracted at the mouth, the upper lobes erect, the lower deflexed, nearly orbicular, short, about 2 mm. long.

Type in the U. S. National Herbarium, no. 563032, collected in the Lincoln National Forest in 1903 by Fred G. Plummer.

Similar in general appearance to *P. cardinalis*, but the calyx lobes are shorter and broader and obtuse, and the leaves thick and fleshy and of different outline.

***Pentstemon neomexicanus* Wooton & Standley, sp. nov.**

Perennial from a slender, creeping rootstock; stems stout, erect, simple, 50 to 70 cm. high, glabrous; basal leaves linear-oblanceolate, acute, petiolate, 8 cm. long or less; cauline leaves oblong to linear, acutish or obtuse, 6 to 10 cm. long, thick and fleshy, glabrous, rather numerous, scarcely reduced above; leaves of the inflorescence reduced, the lowest sometimes longer than the flowers; inflorescence much elongated, thyrsiform, secund, many-flowered, glabrous; pedicels stout, short; calyx lobes obovate to oblong, 4 to 5 mm. long, truncate or obtuse, abruptly short-mucronate, erose-denticulate at the apex, scarious-margined; corolla 22 to 25 mm. long, deep bright blue, with a dilated throat and spreading limb, the lobes rounded, strongly hairy in the throat; capsules ovoid-conic, 5 or 6 mm. high.

Type in the U. S. National Herbarium, no. 561371, collected in pine woods near Gilmores Ranch on Eagle Creek in the White Mountains, altitude 2,220 meters, August 15, 1907, by E. O. Wooton and Paul C. Standley (no. 3507).

ADDITIONAL SPECIMENS EXAMINED: Capitan Mountains, 1900, *Earle* 200; James Canyon, August 5, 1899, *Wooton*; Cloudcroft, alt. 2,550 meters, 1909, *Fisher* 23; Capitan Mountains, 1903, *Plummer*; White Mountains, alt. 1,890 meters, 1897, *Wooton* 238; White Mountain Peak, August 1, 1901, *Wooton*; Gilmores Ranch, July 27, 1901, *Wooton*; Wingfields Ranch, July, 1895, *Wooton*; Mescalero Reservation, July 21, 1905, *Wooton*; Ruidoso Creek, alt. 1,980 meters, July 3, 1895, *Wooton*; Cloudcroft, June 30, 1899, *Wooton*.

A very common and handsome plant in the higher parts of the Sacramento, White, and Capitan Mountains. It is most nearly related to *P. unilateralis* Rydb., but has very different calyx lobes and a hairy instead of glabrous throat. That species is found in New Mexico only in the higher mountains near the Colorado border.

***Pentstemon oliganthus* Wooton & Standley, sp. nov.**

Stems slender, erect, simple, 20 to 30 cm. high, glabrous below, glandular above; basal leaves oblong or oval, petiolate, obtuse, 2 cm. long or less; cauline

leaves few and remote, lanceolate to narrowly oblong, acute, erect, thick, glabrous beneath, minutely puberulent above; inflorescence loosely few-flowered, its branches glandular and slightly villous; pedicels mostly slender, sometimes 1 cm. long; calyx 4 mm. high, the lobes elliptic-oblong, acute, glandular-villous; corolla 20 to 25 mm. long, the tube slightly widened upward, the spreading lobes oblong, obtuse, bearded in the throat; sterile stamen strongly bearded with yellow hairs; capsules conic-ovoid, 6 or 7 mm. high, acute.

Type in the U. S. National Herbarium, no. 259061, collected in the mountains west of Grants Station, August 1, 1892, by E. O. Wooton.

This belongs to the group of *P. confertus* and *P. procerus*, but differs decidedly from those species in its larger flowers and loose, few-flowered inflorescence.

***Pentstemon spinulosus* Wooton & Standley, sp. nov.**

Stems slender, ascending, 20 to 35 cm. high, purplish, minutely puberulent; leaves linear-oblong to linear-lanceolate, numerous, obtuse or acute, slightly reduced upward, glabrous, narrowed at the base or sessile, 5 cm. long or less; bracts linear-lanceolate, 1 to 2 cm. long; inflorescence few-flowered; pedicels short, stout; sepals 7 mm. high, the lobes lanceolate, rather abruptly acuminate, not scarious, glabrous, the tips spreading; corolla 3 cm. long, dilated in the throat, not bearded, the spreading limb 2 cm. wide; stamens included; anthers sagittate, dehiscent for half their length, finely spinulose along the sutures.

Type in the U. S. National Herbarium, no. 156865, collected in the Magdalena Mountains in June, 1881, by G. R. Vasey.

This is more closely related to *P. bridgesii* than to any of the southwestern species, but may be separated by the glabrous instead of glandular inflorescence and the much dilated corolla tube. Whether the corollas are red as in that species can not be told from the faded dried specimens.

***Scrophularia laevis* Wooton & Standley, sp. nov.**

Tall perennial, 1 meter high or more; stems slender, bright green, glabrous, erect, simple or with a few weak, spreading branches; petioles long, slender, usually half as long as the blades, these ovate or broadly lanceolate, 4 to 7 cm. long, acute, neither attenuate nor acuminate, bright green, thin, glabrous, scarcely if at all paler beneath, few, truncate or rounded and usually somewhat decurrent at the base, coarsely lacinate-dentate, the teeth triangular, acute or attenuate; inflorescence rather sparse and short, consisting of 5 or fewer pairs of few-flowered corymbs on spreading peduncles; pedicels stout, ascending, 1 to 2 cm. long, glabrous or nearly so; flowers not seen; calyx lobes triangular-lanceolate, very acute, 3 to 4 mm. high; capsules narrowly ovoid, attenuate, about 8 mm. high, terminated by the persistent filiform style 4 mm. long.

Type in the U. S. National Herbarium, no. 561409, collected on a moist, shaded slope high up on Organ Peak above Filmore Canyon, altitude about 2,400 meters, September 23, 1906, by E. O. Wooton and Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Old Tiptop, Organ Mountains, October 18, 1903, *Metcalf*.

On account of its slender habit, green stems, and pale leaves, and of its long petioles, this plant appears very different from the other western species. It is also distinguished from our others by its broad, short leaves and very acute calyx lobes, as well as by its almost complete lack of indument.

***Scrophularia parviflora* Wooton & Standley, sp. nov.**

Perennial, about a meter high; stems rather slender, dull green or purplish, finely and densely puberulent throughout, simple or sparingly branched; petioles short, less than one-third as long as the blades, these mostly triangular-lance-

olate, 5 to 10 cm. long, truncate to cuneate at the base and unequal, often decurrent, attenuate, coarsely laciniate-dentate, the teeth mostly triangular and not very acute, dull green, conspicuously veined, puberulent on both surfaces; inflorescence short, of about 6 pairs of corymbs or fewer, these on stout, spreading peduncles, finely glandular-puberulent; pedicels slender, 15 mm. long or less; calyx lobes short, triangular-ovate, acute or acutish; corolla 6 mm. long, dull purplish; mature capsules not seen.

Type in the U. S. National Herbarium, no. 495413, collected in the Mogollon Mountains on the West Fork of the Rio Gila, Socorro County, altitude about 2,250 meters, August 2, 1903, by O. B. Metcalfe (no. 345).

ADDITIONAL SPECIMENS EXAMINED: Graham, July 21, 1900, *Wooton*.

Related to *S. californica* Cham. & Schlecht., but with sparser inflorescence, smaller flowers, thicker and more strongly veined leaves not cordate at the base, and different pubescence. We have seen two specimens of *S. parviflora* from Arizona, the one collected by G. C. Nealley in 1891 (no. 90), no locality given, and the other from the canyon of the Blue River near Coopers Ranch, Graham County, collected by Walter Hough, July 5, 1905.

***Veronica micromera* Wooton & Standley, sp. nov.**

Slender, stoloniferous perennial; stems slender, 10 to 20 cm. long, ascending, freely rooting at the lower nodes, succulent, glabrous; leaves small, 1 to 2 cm. long, oval or obovate, the upper scarcely reduced, mostly shorter than the internodes, obtuse, thin, entire or obscurely and remotely serrulate, all the upper sessile, some of the lower contracted into petioles 1 mm. long, or all sessile; racemes axillary, slender, 3 to 7 cm. long, glabrous; pedicels very slender, ascending, or divergent and curved upward at the tip, subtended by very small, linear bracts; sepals 3 mm. long, narrowly lanceolate or elliptic-lanceolate, glabrous, very acute, in fruit evidently exceeding the capsule; corolla nearly white, bluish, scarcely exceeding the sepals; capsules small, 3 mm. long, glabrous, broadly oval, nearly orbicular, scarcely as broad as long, rounded at the apex but not broadly so.

Type in the U. S. National Herbarium, no. 686250, collected along ditches about Shiprock, on the Navajo Reservation, July 25, 1911, by Paul C. Standley (no. 7283). Altitude 1,425 meters.

The plant is similar to *V. americana*, but is much smaller and more slender in all its parts. The leaves are almost all sessile instead of petiolate, and the sepals are longer and narrower.

## BIGNONIACEAE.

***Stenolobium incisum* Rose & Standley, sp. nov.**

A low shrub 1 meter high or less, the stems simple or very sparingly branched; leaves 17 cm. long or less, with 5 to 11 leaflets, usually with 9; leaflets linear-lanceolate, mostly about 6 cm. long and a little less than 1 cm. wide, acuminate, attenuate to the base, the uppermost sessile, the lower conspicuously petiolulate, all sharply incised-serrate with deep, salient teeth, glabrous, or sometimes sparingly puberulent beneath; flowers about 4 cm. long, on peduncles about 5 mm. long, in simple racemes, each peduncle subtended by a linear bract; calyx with 5 acute, cuspidate teeth; fruit 12 to 15 cm. long, smooth, or with numerous light colored lenticels.

Type in the U. S. National Herbarium, no 46776, collected on hills near Chihuahua, Mexico, November 15, 1886, by C. G. Pringle (no. 960). Also collected in the same locality by the same collector, October 2, 1885 (no. 360).

ADDITIONAL SPECIMENS EXAMINED: Santa Eulalia Mountains, Chihuahua, 1885, *Wilkinson*; near Concepcion del Oro, Zacatecas, 1902, *Palmer* 389; Durango,

1896, *Palmer* 131, 507; Saltillo, 1898, *Palmer* 193; near San Juan Capistrano, Zacatecas, 1897, *Rose* 2495.

The plant occurs as far north as western Texas and southern Arizona. In New Mexico it is known only from the Dona Ana Mountains, where it was collected October 28, 1896, by Wooton & Standley.

This has always passed as *S. stans* (*Tecoma stans* L.), but is distinguished by its low stature, narrow leaflets with sharp and salient teeth, and the narrower and longer bractlets. The leaflets, too, are usually more numerous than in *S. stans*. The latter is a shrub often 3 meters high or more, or even a low tree with well-defined trunk. The proposed species is never more than a very small shrub, often not more than 60 cm. high. It grows in the driest places in the southwestern mountains, on exposed slopes among rocks.

### RUBIACEAE.

*Houstonia rigidiuscula* (A. Gray) Wooton & Standley.

*Houstonia angustifolia rigidiuscula* A. Gray, Syn. Fl. 1<sup>2</sup>: 27. 1884.

Readily distinguished from *H. angustifolia* by the lower, stouter, less erect stems, the thick, rigid leaves, and the few, more closely glomerate flowers. A common plant of western Texas and eastern New Mexico, growing on the plains and low hills of the Upper Sonoran Zone.

### CAPRIFOLIACEAE.

*Sambucus vestita* Wooton & Standley, sp. nov.

Shrub 3 meters high or less, with numerous stout stems from a single root; young branches minutely and densely velvety-pubescent; leaflets lanceolate or narrowly so, 8 to 15 cm. long, long-attenuate, very unequal at the base and usually rounded, puberulent beneath, puberulent above along the veins, thin, rather pale green, coarsely serrate, the teeth not incurved, acute, or acutish; petioles and petiolules densely and finely pubescent; cyme broad (10 to 20 cm.), flat-topped, with numerous open, slender, pubescent branches; flowers small, 3 to 4 mm. in diameter; fruit abundant, 5 mm. in diameter, black, glaucous.

Type in the U. S. National Herbarium, no. 560944, collected by Paul C. Standley in Ice Canyon above Van Pattens Camp in the Organ Mountains, June 11, 1906.

ADDITIONAL SPECIMENS EXAMINED: West Fork of the Gila, alt. 2,250 meters, 1903, *Metcalf* 344; 4 miles west of Kingston, 1909, *Goldman* 1822; Eagle Peak, August 2, 1900, *Wooton*; San Mateo Peak, alt. 3,000 meters, 1909, *Goldman* 1740; Black Range, alt. 2,550 meters, 1904, *Metcalf* 1184; Organ Mountains, 1908, *Bailey* 1469, May 15, 1892, *Wooton*.

The plant is common in the canyons of the southwestern mountains. It is related to *S. neomexicana*, but has smaller flowers and pubescent instead of glabrous branches. In habit the two are dissimilar, for *S. neomexicana* has usually a well-developed trunk with branches, while *S. vestita* consists of a clump of mostly simple shoots.

### CICHORIACEAE.

*Crepis chamaephylla* Wooton & Standley, sp. nov.

Perennial from a thick, fleshy root; stems glabrous, glaucous, 30 cm. high, erect or ascending, very slender, the branches ascending, nearly naked, bearing only a few small, linear, bract-like leaves; basal leaves oblanceolate, entire, acute, 9 cm. long or less, glabrous, glaucous especially beneath, thick and succu-

lent, all lying flat upon the ground, sessile, or on short, broadly winged petioles; heads few; involucre 8 mm. high, glabrous, the bracts linear-lanceolate, pale yellowish green, the few outermost much reduced; corollas deep yellow; achenes dark brown, glabrous, scarcely discoid at the summit, with copious pappus of bright white bristles 4 mm. long.

Type in the U. S. National Herbarium, no. 686386, collected at the north end of the Carrizo Mountains, July 30, 1911, by Paul C. Standley (no. 7419). The plants were common in the wet ground about a small hillside spring flowing out from among juniper and pinyon trees. Upper Sonoran Zone.

The proposed species is a very distinct one by its entire, glaucous leaves which are reflexed upon the ground instead of erect as in most of our species. The heads are comparatively small and the bracts are a clear, pale yellowish green rather than black or brownish as we find them in most species. The aspect of the plant is strikingly like that of two of the species of *Cynthia*.

***Crepis mogollonica* Greene, sp. nov. in herb.**

Basal leaves numerous, some of them linear and entire, others narrowly linear-oblong or linear-oblongate and runcinate-pinnatifid into linear lobes, glabrous, bright green, thin, 18 to 24 cm. long; stems slender, 40 to 60 cm. high, glabrous, with few, ascending branches, bearing linear, bract-like leaves at the nodes; heads few, long-pedunculate; involucre 10 to 12 mm. high, of linear-oblong, glabrous bracts; flowers bright yellow; achenes slender, brown, 5 mm. long, shorter than the slightly sordid pappus.

Type in the U. S. National Herbarium, no. 495570, collected in the Mogollon Mountains, Socorro County, on the West Fork of the Gila, altitude 2,400 meters, August 23, 1903, by O. B. Metcalfe (no. 576).

This is related to *C. glauca*, or is of that group at least. It is distinguished from the related species by its large heads and the very long, extremely narrow leaves.

***Crepis neomexicana* Wooton & Standley, sp. nov.**

Basal leaves in a dense cluster, about 9 cm. long, nearly sessile by winged bases, oblanceolate or oblong, deeply runcinate-pinnatifid with broadly triangular lobes, rather obtuse at the apex, thick and firm, bright green, glabrous; stems about 30 cm. high, stout, glabrous, sparingly branched, with reduced, linear, bract-like leaves at the nodes; peduncles sparingly tomentose; involucre 8 mm. high, the bracts linear, slightly attenuate upwards, glandular; flowers bright yellow; mature achenes not seen, the young ones very short, brown.

Type in the U. S. National Herbarium, no. 563743, collected on Tularosa Creek, Socorro County, July 14, 1906, by E. O. Wooton.

Similar to *C. perplexans* Rydb., but with smaller heads and very thick, broad, deeply lobed leaves.

***Ptiloria bigelovii* (A. Gray) Wooton & Standley.**

*Hemiptilium bigelovii* A. Gray, U. S. & Mex. Bound. Bot. 105. 1859.

## CARDUACEAE.

***Coelestina sclerophylla* Wooton & Standley, sp. nov.**

Slender, rigid perennial, about 35 cm. high, with numerous puberulent, nearly simple stems from a suffrutescent base; leaves opposite, numerous, lanceolate to ovate or somewhat deltoid, 25 to 40 mm. long, thick and rigid, acute or attenuate, attenuate or acute at the base, coarsely crenate, puberulent on both

surfaces, glandular-dotted beneath, all on slender petioles 7 mm. long or less; inflorescence of few, clustered heads terminating long, naked branches; heads campanulate, 7 mm. high, on short, glandular or puberulent peduncles; bracts linear, appressed, attenuate, puberulent, striate; flowers but little exceeding the bracts; achenes 3 mm. long, 5-angled, glabrous; pappus a short, obtusely toothed, glabrous crown.

Type in the U. S. National Herbarium, no. 232780, collected in Guadalupe Canyon, Sonora, August 27, 1893, by E. C. Merton (no. 2031). Also on Cajon Creek in Chihuahua along the New Mexico line, August 16, 1892, *Mearns* 700. Guadalupe Canyon extends into New Mexico, and doubtless the plant occurs on the north as well as on the south side of the boundary.

Doctor Gray reported this plant from this same region as *Ageratum corymbosum* Zucc., but the northern plant is very unlike true *corymbosa*, which occurs much farther south. It differs especially in the form of the leaves and in the pubescence and inflorescence.

***Kuhnia chlorolepis* Wooton & Standley, sp. nov.**

Perennial with numerous stems from a thick, woody root; stems slender, erect, 30 to 50 cm. high, simple up to the inflorescence, there abundantly branched, densely puberulent; upper leaves linear, the lower lanceolate or lance-linear, all obtuse, densely puberulent, sessile, 3-nerved, glandular-dotted on the lower surface; heads numerous, on long, slender peduncles, large, 15 mm. high; bracts firm, green tinged with purple, linear-oblong, broad, the outer short and acute, the inner obtuse or acuminate, finely pubescent, conspicuously striate, in several series, the outer ones gradually and successively shorter; corolla lobes oblong-lanceolate, rather long; achenes pubescent, 6 mm. long, finely striate; pappus 6 mm. long, whitish, copper colored at the base.

Type in the U. S. National Herbarium, no. 560399, collected at Mangas Springs, June 2, 1903, by O. B. Metcalfe (no. 104).

ADDITIONAL SPECIMENS EXAMINED: Gila River bottom near Cliff, alt. 1,350 meters, 1903, *Metcalfe* 152; 1851-2, *Wright* 1394 and 1132 (in part); Alamo Viejo, 1892, *Mearns* 138; *Mexican Boundary Survey* 458 (in part).

This is most nearly related, perhaps, to *K. gooddingii* A. Nels., but that has smaller heads and densely glandular bracts. In that species, too, the bracts are much thinner and not green.

***Coleosanthus chenopodinus* Greene, sp. nov. in herb.**

Small, much-branched shrub; stems stout, with exfoliating bark, puberulent below, glandular above, densely branched; leaves small, ovate or lanceolate, 35 mm. long or less, rather thick and succulent, glabrous or nearly so, acute, rounded or cuneate at the base, somewhat serrate; heads paniculate, large, about 12 mm. long, on slender, leafy, densely viscid peduncles 2 to 4 cm. long; outer bracts often foliaceous, lanceolate, the others lanceolate to oblong-linear, conspicuously nerved, glandular-viscid, acute, or the inner obtuse; achenes faintly strigose.

Type in the U. S. National Herbarium, no. 495728, collected in the Gila River bottom near Cliff, Grant County, September 22, 1903, by O. B. Metcalfe (no. 776). Altitude 1,350 meters.

A peculiar species, somewhat related to *C. floribundus*, but with very long peduncles, larger heads, and peculiarly succulent leaves.

***Coleosanthus venosus* Wooton & Standley, sp. nov.**

Low perennial, 50 cm. high or less, with several stems from a woody root; stems slender, simple below, sparingly branched above, cinereous-puberulent; leaves narrowly oblong to linear, obtuse, sessile, entire or obscurely serrate,



thick, conspicuously veined, canescent, 55 mm. long or less; heads few, racemose or narrowly paniculate, 10 to 12-flowered, 10 to 12 mm. high; peduncles slender, bearing 1 to 3 heads, 10 to 35 mm. long; bracts much imbricated in several series, the outer orbicular to broadly oblong or ovate, obtuse or emarginate and mucronate, cinereous, the inner lanceolate, acute, ciliolate, all prominently striate; achenes equally striate, strigose, brown, with firm, white, scaberulous pappus.

Type in the U. S. National Herbarium, no. 495629, collected at Mangas Springs, September 5, 1903, by O. B. Metcalfe (no. 653). Altitude 1450 meters.

ADDITIONAL SPECIMENS EXAMINED: 1851, *Wright* 1135; Burro Mountains, September, 1880, *Rusby*; San Luis Mountains, 1893, *Mearns* 2211 and 2234.

The plant also occurs in southern Arizona and northern Chihuahua. In the Synoptical Flora it was listed as *Brickellia oliganthes* (Less.) A. Gray, but that name was applied originally to a plant from much farther south in Mexico. *C. venosus* differs in having much narrower, sessile, more pubescent leaves, as well as different inflorescence, bracts, and pubescence. Doctor Gray at various times remarked that the plant from New Mexico and Arizona was different from that of Mexico, but probably he had not sufficient Mexican material to warrant separation of the two.

***Grindelia neomexicana* Wooton & Standley, sp. nov.**

Erect biennial or perennial, 50 cm. high or less; stems slender, sparingly branched from the base but abundantly branched above, the branches erect, leafy throughout, glabrous; cauline leaves narrowly oblong, or oblong-lanceolate, 45 mm. long and 10 mm. wide or less, sessile, obtuse or acute, glabrous, sharply and evenly serrate, rarely entire; heads few, large, 15 mm. wide and 12 mm. high or smaller; rays numerous, showy, stiff, 15 mm. long, narrowly spatulate, obtuse; bracts many, elongated-linear, the outermost thick and green throughout, with lax, slightly spreading tips, the innermost wide, scarcely if at all viscid; heads subtended by 1 or 2 linear or linear-lanceolate, bract-like leaves; achenes light brown, faintly striate, the pappus smooth or sparingly and very faintly barbellate.

Type in the U. S. National Herbarium, no. 561099, collected in the mountains north of Santa Rita, August 23, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Mountains southeast of Patterson, August 16, 1900, *Wooton*; G O S Ranch, 1911, *Holzinger*.

We have seen no other New Mexican plant with involucre bracts like those of this species. They are unusually numerous, narrow, green, and only slightly spreading, none of them being recurved.

***Grindelia pinnatifida* Wooton & Standley, sp. nov.**

Perennial or biennial, 30 to 45 cm. high, with numerous stout stems from each root, these simple below but with numerous erect, slender, corymbose branches above; stems glabrous, striate, reddish above; lower leaves long-petiole, lacinate-pinnatifid, the segments irregularly dentate, oblong, acutish; upper leaves linear-oblong, lacinate-serrate, sessile by clasping bases, all glabrous or nearly so, conspicuously glandular-punctate; heads solitary at the ends of the branches, depressed-hemispheric, 15 to 17 mm. in diameter; bracts linear, with flat, green, slightly reflexed tips, densely viscid; immature achenes glabrous; pappus bristles smooth.

Type in the U. S. National Herbarium, no. 685628, collected on open slopes about Chama, altitude about 2,400 meters, July 9, 1911, by Paul C. Standley (no. 6806).

The plant was very abundant about Chama, in the Transition Zone. It differs from all our other species in its evidently pinnatifid lower leaves. The

truly basal ones were not secured, but doubtless they are even more deeply divided than the lower cauline ones.

*Grindelia setulifera* Wooton & Standley, sp. nov.

Stems slender, with numerous erect branches, leafy throughout, glabrous, reddish; cauline leaves oblanceolate, 25 mm. long or less, obtuse, sessile, with numerous setose teeth, the teeth toward the apex usually broader; heads numerous, mostly 10 to 12 mm. broad, subtended by 1 or 2 oblanceolate, bract-like leaves; outer bracts lanceolate, acute, thick and green at the tips, the inner mostly oblong, acute or abruptly acuminate, thin, straw colored, scarcely at all viscid; all the bracts erect and appressed; rays numerous, narrowly spatulate, obtuse, about 10 mm. long; achenes brown, glabrous, about 3 mm. long.

Type in the U. S. National Herbarium, no. 45772, collected on high summits of the Mogollon Mountains, September, 1881, by Dr. H. H. Rusby (no. 206).

This was originally determined as *G. arizonica*, but it differs from that species in its much smaller heads and very different leaves. The bracts, too, are not alike in the two species.

*Chrysopsis cryptocephala* Wooton & Standley, sp. nov.

Perennial with several stems from a slender, woody root; stems very slender, 30 to 40 cm. high, erect, glandular-puberulent, sometimes sparingly hirtellous above, simple, with rather few leaves; leaves sessile, oblong to lanceolate or ovate, obtuse, often abruptly acuminate and mucronate, 25 mm. long or less, green, thin, minutely glandular, scaberulous, especially on the upper surface; heads mostly solitary at the ends of the simple stems, sometimes corymbose, about 1 cm. broad, almost hidden by the numerous, thin, broad, often ciliate, ovate, acute, bract-like leaves; rays numerous, pale yellow, 8 or 9 mm. long.

Type in the U. S. National Herbarium, no. 563739, collected by E. O. Wooton in section 23 of the V Pasture in the White Mountains, July 23, 1905.

ADDITIONAL SPECIMENS EXAMINED: Gavilan Creek, August 19, 1897, *Wooton* 512.

This formed a part of Doctor Greene's *C. fulcrata*, as originally described, but it is very different from the type of that species. It is most like *C. rest-nolens* A. Nels., but has broader, fewer heads, different leaves, and very different bracts.

*Chrysopsis nitidula* Wooton & Standley, sp. nov.

Perennial with several stems from a slender root; stems slender, erect, 20 to 35 cm. high, finely and rather sparingly sericeous, leafy; leaves oblanceolate, or the uppermost lanceolate, obtuse or acutish, sessile, the lower tapering to the base, finely sericeous, the leaf as a whole appearing green and remarkably soft and smooth; heads 1 to several, on slender, erect peduncles, subtended by a few elliptic to oblanceolate, thin, bract-like leaves; disk about 1 cm. broad, the bracts linear-lanceolate, acute, sericeous; rays numerous, bright yellow, 10 to 12 mm. long; achenes compressed, sericeous.

Type in the U. S. National Herbarium, no. 495550, collected by O. B. Metcalfe in the Mogollon Mountains on the West Fork of the Gila, at an altitude of about 2,250 meters, August 20, 1903 (no. 552).

ADDITIONAL SPECIMENS EXAMINED: North of Ramah, July 25, 1906, *Wooton*; Middle Fork of the Gila, August 5, 1900, *Wooton*.

This is very unlike any of our other species, being strongly marked by its peculiar pubescence and long rays.

*Chrysopsis senilis* Wooton & Standley, sp. nov.

Stout perennial with several stems from each root; stems simple below, corymbosely branched above, the branches ascending, densely villous throughout, very leafy, the leaves mostly longer than the internodes; leaves sessile, oblong or

oblong-lanceolate, obtuse, often abruptly short-acuminate, thick, canescent; heads crowded, 3 to 8 at the end of each branch, about 1 cm. broad, subtended by numerous ovate to elliptic, thin, bract-like leaves, these long-ciliate; involueral bracts thin and membranous, linear or linear-lanceolate, in several series, acute, canescent; the very short peduncles densely white-villous; rays numerous, dull yellow, about 9 mm. long; achenes compressed, densely villous.

Type in the U. S. National Herbarium, no. 330713, collected in the Organ Mountains at an altitude of 1,440 meters, September 1, 1897, by E. O. Wooton (no. 509).

ADDITIONAL SPECIMENS EXAMINED: Pena Blanca, October 21, 1906, *Wooton & Standley*; San Augustine Ranch, September 1, 1897, *Wooton*; 1851, *Wright*; Organ Mountains, September 4, 1898, *Cockerell*; Van Pattens, September 10, 1899, *Wooton*.

This is related to *C. fulcrata* Greene, which grows in the same range of mountains, but it has abundant, long, white pubescence, while in that species the pubescence is short and not conspicuously white. *C. senilis*, too, has mostly grayish, narrower leaves and there are several heads clustered at the ends of each branch, while in *C. fulcrata* the heads are usually solitary.

***Sideranthus laevis* Wooton & Standley, sp. nov.**

Perennial from a thick, woody root; stems slender, much branched, erect, the branches ascending, bright green, glabrous; leaves linear or linear-oblong, bright green, glabrous, entire or sparingly serrate, the teeth low and inconspicuous; heads few, solitary, 8 or 9 mm. broad, on slender peduncles; bracts linear or linear-lanceolate, acute, glabrous or sparingly puberulent; rays pale yellow, 4 mm. long; achenes small, densely sericeous, the pappus evidently barbellate.

Type in the U. S. National Herbarium, no. 564582, collected on gypsum hills near Lakewood, August 6, 1909, by E. O. Wooton.

From its lack of pubescence this might be confused with *S. glaberrimus* Rydb., but in appearance the two are really very unlike. Our plant is much more slender, is much branched, and has fewer heads and narrow, shallowly toothed leaves, and the whole plant is of a bright green, while the stems and foliage of *S. glaberrimus* are dull and somewhat glaucous.

***Sideranthus viscidus* Wooton & Standley, sp. nov.**

Stems stout, branched, ascending or spreading, densely glandular-puberulent, 50 cm. high or less; cauline leaves thick, numerous, oblong, obtuse, sessile, coarsely serrate, the teeth not spinulose, densely viscid; heads few, on slender peduncles, campanulate, about 12 mm. broad; bracts linear, with evident green tips, glandular-puberulent; rays few, short, not more than 5 mm. long; achenes nearly 3 mm. long, densely sericeous, with tawny pappus 5 or 6 mm. long.

Type in the U. S. National Herbarium, no. 690240, collected near Hope, August 3, 1905, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Dayton, October 3, 1907, *E. S. Wigsdale*.

Very different from our other species in the form of its leaves and in its densely viscid pubescence.

***Isocoma oxylepis* Wooton & Standley, sp. nov.**

Perennial, about 30 cm. high, with numerous stems from a thick, woody root; stems slender, glabrous, densely leafy, erect, ending in a corymbose inflorescence; leaves linear, acute, glabrous or scaberulous, 4 cm. long or less, weak and spreading or reflexed; heads very numerous, all on slender peduncles 1 cm. long or shorter; involucre narrowly campanulate, about 4 mm. high; bracts glabrous or nearly so, lanceolate or oblong-lanceolate, acute; throat of

the corolla but slightly inflated, the lobes lanceolate, acute; achenes densely sericeous.

Type in the U. S. National Herbarium, no. 233968, collected near White Water, Chihuahua, September 11, 1893, by Dr. E. A. Mearns (no. 2288).

ADDITIONAL SPECIMENS EXAMINED: Dog Spring, New Mexico, September 22, 1893, *Mearns* 2407.

This is a very striking species, distinguished by its numerous, very narrow, long, and weak leaves, the many pedunculate heads, and the acute bracts.

*Isocoma wrightii* (A. Gray) Wooton & Standley.

*Linosyris wrightii* A. Gray, *Pl. Wright.* 1: 95. 1852.

*Bigelovia wrightii* A. Gray, *Proc. Amer. Acad.* 8: 639. 1873.

This has been confused with *I. heterophylla*, but is amply distinct in its narrow leaves and slenderly pedunculate heads. Both species occur in New Mexico.

*Chrysothamnus baileyi* Wooton & Standley, sp. nov.

Low, densely branched shrub; older branches covered with rough, dark gray bark, the younger ones straw colored, slender, puberulent, angled, densely leafy; leaves erect or appressed, linear or linear-oblong, 15 mm. long or less, abruptly acuminate, sharp-pointed, thick, dull pale green, minutely ciliolate with short, stout hairs, otherwise glabrous, sessile; heads numerous, clustered at the ends of the branches, turbinate to cylindrical, not strongly angled; involucre 10 mm. high or less, the numerous bracts ovate to oblong or lanceolate, thin, glabrous, abruptly acuminate, mostly bristle-pointed; achenes glabrous, striate; pappus yellowish, 8 to 10 mm. long.

Type in the U. S. National Herbarium, no. 443565, collected at the north end of the Guadalupe Mountains, September 4, 1902, by Vernon Bailey (no. 498).

ADDITIONAL SPECIMENS EXAMINED: White Mountains, alt. 1,620 meters, 1897, *Wooton* 508; Buchanan, August 12, 1909, *Wooton*.

This is similar in general appearance to *C. pulchellus*. That species does not have ciliolate leaves and has much larger heads and longer pappus.

*Solidago arizonica* (A. Gray) Wooton & Standley.

*Solidago canadensis arizonica* A. Gray, *Proc. Amer. Acad.* 17: 197. 1882.

Stems stout, usually simple, 1 meter high or often more, striate, finely and densely cinereous-puberulent; leaves very numerous, often crowded, elliptic to elliptic-lanceolate or oblanceolate, 7 to 18 cm. long, acute, attenuate at the base to a broad, margined petiole or sessile, sharply serrate or often only obscurely and remotely serrate, bright green, evidently triple-veined, copiously scaberulous on both surfaces; inflorescence a broad, pyramidal panicle, 25 cm. long and as broad or smaller, all the branches recurved-ascending, slender, densely puberulent, sparsely viscid; pedicels slender, erect or ascending, 5 to 7 mm. long; heads campanulate, about 5 mm. high, with very numerous flowers and short, narrow, inconspicuous rays; achenes short, loosely pubescent, less than half as long as the white, scabrous pappus.

Although first described from Arizona, this plant is a common and showy species of southern New Mexico. It has always been associated with *S. canadensis*, but seems remarkably distinct from that species, especially by its very large heads.

*Solidago howellii* Wooton & Standley, sp. nov.

Stems low and stout, 40 cm. high or less, purplish below, densely canescent; basal leaves not seen; cauline leaves narrowly elliptic to oblanceolate or linear-ob lanceolate, 25 to 75 mm. long, acute, or the lower obtuse, very thick and stiff, tapering at the base, mostly entire, prominently 3-nerved, densely scabrous-

canescent on both surfaces; inflorescence pyramidal or narrow, 10 to 15 cm. long, all the branches recurved, densely canescent; leaves of the inflorescence elliptic to ovate-lanceolate or linear-lanceolate, acute; pedicels 3 to 5 mm. long; heads 5 to 7 mm. high; involucrel bracts oblong, obtuse, straw colored, glabrous or nearly so; rays 2 to 2.5 mm. long, pale yellow; achenes conspicuously strigose.

Type in the U. S. National Herbarium, no. 495104, collected on the Sierra Grande, August 15, 1903, by A. H. Howell (no. 219).

ADDITIONAL SPECIMENS EXAMINED: Clayton, 1891, *Carleton* 393; Sierra Grande, 1903, *Howell* 236, 237; Trinchera Pass, September 7, 1903, *Howell* 190; Folsom, 1903, *Howell* 162; Capitan Mountains, 1903, *Gaut* 91; Sierra Grande, altitude 2,300 meters, 1911, *Standley* 6097; Nara Visa, 1911, *Fisher* 204.

This is related to *S. radula*, but has larger heads and 3-nerved cauline leaves. The plant, too, is not bright green, but dull yellowish or grayish, because of the more abundant pubescence of the various parts. It is also related to *S. mollis* Bartl., but has very different leaves.

The plant is abundant upon the lower slopes of the Sierra Grande, growing among the volcanic rocks.

***Solidago neomexicana* (A. Gray) Wooton & Standley.**

*Solidago multiradiata neomexicana* A. Gray, Proc. Amer. Acad. 17: 191. 1882.

Stems stout, erect, 50 to 60 cm. high, purplish, striate, nearly glabrous below, above viscid-puberulent; basal leaves not seen, the cauline ones oblanceolate, 5 to 10 cm. long, acute, pale green, narrowed at the base into broadly winged petioles, glabrous, finely and inconspicuously reticulate-veined, never triple-veined; inflorescence rather loosely thyrsoid, often with loose axillary clusters, viscid-puberulent; peduncles short, stout, 2 to 4 mm. long; heads large, 7 mm. high, campanulate, with numerous disk and ray flowers; bracts unequally imbricated, narrowly oblong, obscurely puberulent, acute; achenes about 2 mm. long, terete or nearly so, stout, densely appressed-pubescent, about half as long as the copious pappus.

The type was collected by Rusby, in September, 1881, on high, rocky summits of the Mogollon Mountains of New Mexico. The plant seems not to have been found by any other collector.

***Solidago tenuissima* Wooton & Standley, sp. nov.**

Stems slender, glabrous, pale, about 1 meter high or a little less, simple; basal leaves linear-oblanceolate, acute, entire or with a few remote, low teeth, 10 to 20 cm. long; cauline leaves linear-oblanceolate, the uppermost nearly linear, glabrous, bright green, conspicuously veined but never triple-nerved, acute, long-attenuate to the base, 5 to 15 cm. long, usually entire or the lower remotely serrate, the leaves rather numerous on the stems, spreading or inclined to be ascending; inflorescence a narrow panicle with few ascending branches, often a few pedunculate racemes in the axils of the leaves, the whole very narrow and slender, 10 cm. long or less and less than 5 cm. wide; branches of the inflorescence and pedicels puberulent, the latter 3 to 5 mm. long; bracts linear, 5 mm. long or less; heads rather numerous, 3.5 or 4 mm. high; involucrel bracts oblong-lanceolate, obtuse, ciliolate at the apex, glabrous or sparingly puberulent; rays small, 1.5 mm. long.

Type in the U. S. National Herbarium, no. 591665, collected in Guadalupe Canyon near Cloverdale, July 15, 1892, by Dr. E. A. Mearns (no. 466).

ADDITIONAL SPECIMENS EXAMINED: Head of Guadalupe Canyon near Cloverdale, July 15, 1892, *Mearns* 473; along streams, Mogollon Mountains, July, 1881, *Rusby* 227.

Doctor Rusby's specimens were distributed as *S. missouriensis*, and our species belongs to the group of which that species is a member. It is related

to *S. glaberrima*, but is a taller, much more slender plant, with very narrow leaves and a different, narrow inflorescence.

***Petradoria graminea* Wooton & Standley, sp. nov.**

Tufted perennial from a thick, woody caudex, low, 10 to 15 cm. high; old leaves persistent at the base in a dense mass, grayish; leaves linear, rigid, sharp-pointed, 1-nerved, 3 to 5 cm. long, glabrous, dilated at the base, very numerous; corymbs with few cylindric heads 6 to 7 mm. high; bracts acute to abruptly acuminate or obtuse, smooth, stramineous; flowers usually 5; achenes brown, glabrous.

Type in the U. S. National Herbarium, no. 45773, collected in northwestern New Mexico, July 14, 1883, by C. C. Marsh (no. 209).

ADDITIONAL SPECIMENS EXAMINED: South of Gallup, 1904, *Wooton* 2560; Gallup, 1897, *Herrick* 816; Tunitcha Mountains, 1911, *Standley* 7777.

A species of different aspect from *P. pumila* because of the very numerous, short, grass-like leaves and smaller stature. In general appearance the plants suggest some of the narrow-leaved species of *Arenaria*.

***Leptilon integrifolium* Wooton & Standley, sp. nov.**

Annual or possibly biennial, 20 to 40 cm. high; stems stout, much branched at the base or above, glandular-villous and arachnoid; leaves numerous, oblong, obtuse, entire or rarely with a few teeth, sessile by a clasping base, villous; heads rather few, racemose, subtended by small lanceolate leaves, on slender peduncles 1 to 3 cm. long, 6 to 8 mm. broad; bracts green, lanceolate, acute, villous and arachnoid; rays very short, nearly obsolete, white; achenes small, glabrous, the fine, nearly white pappus 3 mm. long.

Type in the U. S. National Herbarium, no. 495594, collected on the West Fork of the Gila in the Mogollon Mountains, altitude about 2,100 meters, August 28, 1903, by O. B. Metcalfe (no. 610).

ADDITIONAL SPECIMENS EXAMINED: Mineral Creek, alt. 2,250 meters, 1904, *Metcalfe* 1419; White Mountains, alt. 2,100 meters, 1897, *Wooton* 356; East Las Vegas, September 24, 1907, *S. Y. Parnay*; Gilmores Ranch, alt. 2,220 meters, 1907, *Wooton & Standley* 3698.

Similar to *L. subdecurrens*, but that has all its leaves prominently toothed, its heads short-pedunculate, its stem less branched, and its pubescence rather different.

***Erigeron deminutus* Wooton & Standley, sp. nov.**

Perennial with creeping rootstocks; stems stout, 30 cm. high or less, simple, canescent; basal leaves spatulate, oblanceolate, obtuse or acutish, 6 cm. long or less; cauline leaves oblanceolate to oblong-lanceolate, acutish, sessile, thick, canescent, the upper much reduced; peduncles 1 to 5, long, stout, canescent and sparingly glandular; disk 10 to 12 mm. wide; bracts in about 2 series, linear, acute, appressed, densely canescent; rays pale purplish, narrow, about 100, 7 to 8 mm. long; achenes strigose, brown, the pappus in 2 series.

Type in the U. S. National Herbarium, no. 690244, collected north of Ramah, July 25, 1906, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Mountains west of Grants Station, alt. 1,800 meters, August 2, 1892, *Wooton*.

A species of the *glabellus* group, readily distinguished by its thick, canescent leaves.

***Erigeron eastwoodiae* Wooton & Standley, sp. nov.**

Low annual, 10 to 14 cm. high, with very numerous spreading, slender branches arising from or near the base; stems much branched, smooth, sparingly cinereous, the tips of the hairs all directed upward; leaves linear or

linear-oblongate, obtuse, 20 cm. long or less, the uppermost shorter and narrower, cinereous but not densely so; heads small, about 7 mm. wide; peduncles very slender, terminating the branches, mostly naked; involucre bracts in about 2 series, green, thin, nearly linear, slightly glandular, sparingly hirsute, abruptly acute; rays 25 to 30, pale purple, 3 mm. long; achenes slender, conspicuously compressed, nearly glabrous; pappus deciduous, uniseriate, of few weak, white bristles.

Type in the U. S. National Herbarium, no. 687233, collected on dry hills at the north end of the Carrizo Mountains, July 30, 1911, by Paul C. Standley (no. 7433).

ADDITIONAL SPECIMENS EXAMINED: Shiprock, alt. 1,425 meters, 1911, *Standley* 7275.

The plant was first collected by Miss Alice Eastwood along the San Juan River in southeastern Utah, July 12, 1895. Probably it is what is reported as *E. bellidiastrum* in Rydberg's Flora of Colorado, said to come from McElmo Canyon. It is nearly related to that species, but is a very low, diffusely branched plant, very unlike *E. bellidiastrum* in habit. The rays are brighter colored and the leaves shorter and narrower.

***Erigeron gilensis* Wooton & Standley, sp. nov.**

Biennial or possibly only annual, 35 cm. high, branched from the base; stems several, slender, erect, with numerous leaves, copiously strigose, the pubescence near the base mostly spreading; leaves oblanceolate to narrowly oblong or linear-lanceolate, the lower obtuse, the upper acute, sessile or attenuate to the base, sparingly strigose on both surfaces; heads few, on slender, erect peduncles, the disk 8 or 9 mm. wide; bracts linear, acute or attenuate, villous, slightly viscid; rays numerous, about 100, lavender, linear, 5 mm. long.

Type in the U. S. National Herbarium, no. 690243, collected on the North Fork of the Rio Gila, August 4, 1900, by E. O. Wooton.

This is related to *Erigeron divergens*, but the pubescence is mostly appressed instead of spreading, and the plant is greener, more slender, lower, and less branched.

***Erigeron rudis* Wooton & Standley, sp. nov.**

Perennial from a stout, creeping, branched rootstock, 4 or 5 stems or more in each clump; stems erect, a meter high or less, stout, striate, hirsute throughout, usually simple below; radical leaves oblanceolate to spatulate, acute or obtuse, entire, 12 cm. long and 14 mm. wide or smaller, 3-nerved, bright green, scabrate or glabrate, long-petiolate; cauline leaves lanceolate or oblong-lanceolate, 6 cm. long and 2 cm. wide or smaller, very numerous, the plants appearing densely leafy, the leaves little reduced above, acute, sessile by broad, somewhat clasping bases, scabrous on both surfaces, ciliate; peduncles stout, short, villous, glandular, ascending; heads 3 to 8, the disk about 15 mm. wide and 7 mm. high; rays numerous, very narrow, light purple, about 12 mm. long; bracts linear, appressed, glandular-puberulent, in about 2 series; achenes strigose, the pappus in 2 series.

Type in the U. S. National Herbarium, no. 330495, collected in the White Mountains, Lincoln County, August 1, 1897, by E. O. Wooton (no. 270). Altitude 2,100 meters.

ADDITIONAL SPECIMENS EXAMINED: Burro Mountains, alt. 2,100 meters, 1906, *Blumer* 1831; Luna, July 28, 1900, *Wooton*; West Fork of the Gila, August 6, 1900, *Wooton*; Middle Fork of the Gila, August 5, 1900, *Wooton*; 1851, *Wright* 1165; Wheelers Ranch, July 11, 1906, *Wooton*; Graham, July 21, 1900, *Wooton*; Gilmores Ranch, July 14, 1895, *Wooton*; Capitan Mountains, 1900, *Earle* 397; Capitan Mountains, alt. 2,100 meters, 1900, *Earle* 196.

One of the most abundant species in the mountains of southern New Mexico; a tall, coarse plant, usually growing along streams. It has passed as *Erigeron macranthus*, but has different pubescence and is a stouter, more leafy plant.

*Erigeron semirasus* Wooton & Standley, sp. nov.

Perennial from a slender rootstock; stems usually slender, erect, densely leafy, 60 cm. high or less, mostly glabrous below, above puberulent and somewhat glandular, reddish; basal leaves oblanceolate-spatulate; lower cauline leaves oblanceolate, the upper lanceolate or lance-ovate and but little reduced, acute, the uppermost sessile by clasping bases, scabrous, not ciliate, bright green, thick, entire; peduncles few, short, stout, ascending, nearly concealed by the leaves; disk about 12 mm. broad; bracts in 2 series, linear, acute, glandular-puberulent; rays purple, narrow, numerous, 10 mm. long; achenes strigose, the pappus in 2 series.

Type in the U. S. National Herbarium, no. 495395, collected in the Mogollon Mountains on Mogollon Creek, July 23, 1903, by O. B. Metcalfe (no. 320). Altitude 2,400 meters.

ADDITIONAL SPECIMENS EXAMINED: Mountains near Las Vegas, July, 1881, *Vasey*; 1847, *Fendler* 376; Harveys Upper Ranch, alt. 2,880 meters, 1908, *Standley* 4606; Beulah, August, 1899, *Cockerell*; Beulah, 1899, *Porter*; Upper Pecos, 1904, *Bartlett* 123.

*Erigeron senilis* Wooton & Standley, sp. nov.

Biennial or a short lived perennial from a slender root; stems branched from near the base, usually simple for about 2 cm. then branched, the branches very slender, 30 cm. long or less, prostrate or ascending, densely hirsute at the base, above strigose; basal leaves spatulate-obovate, obtuse, long-petiolate; cauline leaves rather distant, spatulate-obovate to oblanceolate, thin, bright green, considerably reduced toward the extremities of the branches, abruptly acuminate or acutish, strigose; heads 10 to 12 mm. in diameter, on long, slender, sparingly strigose peduncles; bracts nearly equal, linear, acute, hirsute; rays numerous, pale purplish, very narrow, 4 to 5 mm. long; achenes glabrous, stramineous, the pappus in a single series.

Type in the U. S. National Herbarium, no. 560777, collected in a canyon above Van Pattens Camp in the Organ Mountains, June 9, 1906, by Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Organ Mountains, alt. 1,650 meters, August 29, 1894, *Wooton*.

In habit this is much like *E. flagellaris*, but the stems have different pubescence and the leaves are much broader, less reduced toward the extremities, and more obtuse. The method of branching, too, is different from that of *E. flagellaris*.

*Erigeron bakeri* Wooton & Standley, sp. nov.

Perennial from a slender rootstock; stems stout, erect, 45 cm. high or less, simple up to the inflorescence, glabrous near the base, elsewhere finely and densely soft-pubescent; basal leaves oblanceolate, acute, 20 cm. long or less, long-petiolate; cauline leaves oblanceolate below to lanceolate or elliptic-oblong above, acute or acuminate, numerous, thin, sparingly appressed-pubescent, bright green; peduncles stout, 10 cm. long or less, soft-pubescent with fine, dark hairs, bearing a few small leaves; disk 12 to 14 mm. wide; bracts in about 2 series, linear, acute, appressed, canescent; rays purplish, narrow, numerous, 7 or 8 mm. long; achenes strigose, the pappus in 2 series.

Type in the U. S. National Herbarium, no. 369203, collected near Chama, September 9, 1899, by C. F. Baker (no. 678).



ADDITIONAL SPECIMENS EXAMINED: Chama, 1899, *Baker*; Chama, alt. 2,400 meters, 1911, *Standley* 6744; Dulce, alt. 2,400 meters, 1911, *Standley* 8088 and 8179.

This is another species of the *macranthus* group, apparently, with pubescence very different from that of the related species. The plant is common about Chama and Dulce, growing in the moist meadows along the small streams.

*Erigeron tonsus* Wooton & Standley, sp. nov.

Biennial or a short-lived perennial, from a slender, short root; stems very slender, flagelliform, spreading and forming dense mats, 20 cm. long or less, glabrous or with a few scattered, appressed hairs, bright green; basal leaves narrowly oblanceolate-spatulate, 6 cm. long or less, abruptly acuminate or acutish, attenuate to a slender petiole, entire; cauline leaves linear-oblanceolate to nearly linear, much reduced upward, numerous, acutish or acuminate, sessile, bright green, glabrous or thinly strigose; heads small, about 5 mm. broad, on long, naked, nearly glabrous, slender peduncles; bracts nearly equal, linear, acute, purplish, strigose; rays very narrow, about 50, 2.5 mm. long.

Type in the U. S. National Herbarium, no. 690241, collected near the N Bar Ranch, August 2, 1900, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Luna Valley, July 27, 1900, *Wooton*; north of Ramah, July 25, 1906, *Wooton*.

This is clearly related to *Erigeron flagellaris*, resembling that species in habit, but it is nearly glabrous and has smaller heads and more brightly colored rays.

*Eschenbachia tenuisecta* (A. Gray) Wooton & Standley.

*Conyza coulteri tenuisecta* A. Gray, Syn. Fl. 1<sup>2</sup>: 221. 1884.

Very distinct from *E. coulteri* in its smaller and more numerous heads, and in its bipinnately parted leaves with very narrow segments. In *E. coulteri* the leaves are mostly entire, but sometimes toothed or shallowly pinnatifid.

*Herrickia* Wooton & Standley, gen. nov.

Perennial herb with alternate, thick, rigid, toothed, sessile leaves; stems branched; heads solitary at the ends of the slender, leafy branches; rays purple; disk flowers perfect, tubular, yellow drying purplish, with short, narrowly ovate lobes; ray flowers pistillate; bracts of the involucre in several series, about equal, conspicuously keeled, with green, foliaceous tips and spinescent points, the outer bracts foliaceous and changing gradually into the proper leaves; receptacle convex, naked; style appendages lanceolate, acute; achenes compressed, striate, glabrous; pappus simple, of numerous stout, simple, nearly equal, strongly barbellate bristles.

The genus is named for the late Dr. C. L. Herrick, an enthusiastic and distinguished scientist, for several years president of the University of New Mexico. Although chiefly interested in geology, he made large collections of plants in many parts of the State.

Our plant seems not to agree with any of the published asteraceous genera. Doctor Gray, doubtless, would have placed it in the genus *Aster*, but to-day none would hold it congeneric with the typical representatives of that group. It is related to *Xylorrhiza*. The plants composing that genus, however, are mostly scapiform and have large heads with very different involucre and pubescent achenes. The rigid, spinulose teeth of the leaves of *Herrickia* are very characteristic. They give the plant a strange, xerophytic aspect strikingly like that of *Perezia nana*.

*Herrickia horrida* Wooton & Standley, sp. nov.

PLATE 50.

Perennial with numerous slender, branched stems from a somewhat woody root; stems 30 cm. high or less, wiry, hirsute, glandular; leaves thick and



HERRICKIA HORRIDA WOOTON & STANDLEY.

rigid, sessile, oblong or oblong-ovate, 20 to 45 mm. long, obtuse or acutish, subcordate or clasping, conspicuously veined, coarsely spinulose-serrate, puberulent; involucre about 1 cm. high, the bracts linear-lanceolate to oblanceolate, glandular, spinulose-tipped; rays rather broad, 8 mm. long; achenes 3 to 4 mm. long; pappus tawny, 6 mm. long.

Type in the U. S. National Herbarium, no. 690258, collected at Baldy, August 14, 1910, by E. O. Wooton. The plant was first collected at Raton, August 22, 1897, by Dr. C. L. Herrick (no. 762). Specimens not yet in flower were gathered on the sides of Goat Mountain at Raton, June 22, 1911, by Paul C. Standley (no. 6330). The plants are very abundant about Raton, growing in the canyons on the sides of the mountains in oak chaparral.

EXPLANATION OF PLATE 50.—Part of type specimen. Slightly less than natural size.

**Aster hydrophilus** Greene, sp. nov. in herb.

Perennial or biennial; stems simple, bright green, 30 to 40 cm. high, stout, glabrous up to the inflorescence; cauline leaves linear or very narrowly linear-lanceolate, 6 cm. long or less, 3 to 4 mm. wide, attenuate, acute, sessile by a broad base, bright green, rather succulent, glabrous, with only the single midvein; heads few, 4 to 8, large, about 12 mm. wide; peduncles stout, ascending, 4 to 6 mm. long, densely glandular-puberulent, each bearing several small, reduced, bract-like, lanceolate, acute, glandular leaves about 3 mm. long; involucre bracts irregularly imbricated, the outer successively shorter, green, oblong-linear, acute, densely glandular-puberulent; rays numerous, 10 to 12 mm. long, nearly 2 mm. wide, spreading; achenes strigose, the pappus of numerous slender, tawny, obscurely scaberulous bristles.

Type in the U. S. National Herbarium, no. 498171, collected along the edge of Berendo Creek at the south end of the Black Range, Sierra County, September 22, 1904, by O. B. Metcalfe (no. 1393). Altitude 1,500 meters.

Similar to *A. pauciflorus*, but with much larger heads and greener herbage.

**Aster neomexicanus** Wooton & Standley, sp. nov.

Stems tall, up to 1 meter high, glabrous, smooth, green, sparingly branched below or simple; leaves thick and rather fleshy, green, glabrous, few and inconspicuous, linear or linear-lanceolate, 8 cm. long or less, acute; inflorescence corymbosely much branched, the slender branches ascending, glabrous; heads solitary at the ends of the branches, 6 to 8 mm. high; peduncles with numerous linear-lanceolate, bract-like leaves; involucre bracts glabrous, in several series, green but with scarious margins; rays purple, narrow, 4 mm. long or less; achenes olive gray, striate, nearly glabrous.

Type in the U. S. National Herbarium, no. 382479, collected at Roswell in August, 1900, by F. S. and Esther S. Earle (no. 327). Altitude about 1,140 meters.

ADDITIONAL SPECIMENS EXAMINED: Near Lake Arthur, August 1, 1905, *Wooton*; Roswell, August 28, 1902, *Cockerell*.

In general appearance the plants resemble *A. pauciflorus*, but that is usually a smaller plant and has strongly glandular peduncles and involucre.

**Machaeranthera amplifolia** Wooton & Standley, sp. nov.

Biennial or perhaps perennial, 70 cm. high or lower; stems slender, sparingly paniculate-branched above, the branches ascending, almost glabrous below, puberulent above, the hairs very fine and short, occasionally one of them gland-tipped, but the stems scarcely viscid; leaves bright green, the basal ones broadly spatulate, 40 mm. long and 25 mm. wide or less, broadly obtuse, narrowed at the base to a long, slender, winged petiole, the petiole as well as the base of

the leaf ciliate; leaves with coarse, shallow, rather obtuse teeth; upper leaves oblong-obovate or narrowly oval, sessile, often by clasping bases, serrate, obtuse, obscurely puberulent or glabrous; heads solitary at the ends of the branches, 15 mm. broad and 12 mm. high, with numerous narrow, violet rays 2 cm. long; bracts linear, acute or acuminate, some of them with subulate tips, green for two-thirds their length, puberulent, only slightly glandular, the tips spreading, the lowest bracts reflexed; achenes straw-colored, glabrous.

Type in the U. S. National Herbarium, no. 562446, collected high up in Filmore Canyon of the Organ Mountains, September 23, 1906, by E. O. Wooton and Paul C. Standley.

ADDITIONAL SPECIMENS EXAMINED: Filmore Canyon, October 23, 1904, October 29, 1904, *Wooton*; Old Tiptop, Organ Mountains, October 18, 1903, *Metcalf*.

A very handsome plant with large heads and showy, bright-colored rays. It is related to *M. asteroides*, but the leaves are very different, likewise the pubescence.

***Machaeranthera angustifolia* Wooton & Standley, sp. nov.**

Stems reddish, slender, erect, 80 cm. high or less, simple below, corymbosely branched above, cinereous; leaves linear-oblong to linear-oblongate, entire, densely scabrous, especially beneath, 1-nerved, acute, sessile by slightly narrowed bases, the uppermost leaves reduced; heads few, hemispheric, 15 mm. wide and 10 mm. high or smaller, with numerous bluish-purple rays; bracts unequal, thick, green above for half their length or more, linear-subulate, their tips squarrose, rather densely glandular near the tips; achenes almost or quite glabrous.

Type in the U. S. National Herbarium, no. 45774, collected in New Mexico, probably in the Sandia Mountains, in 1853, by J. M. Bigelow. Another sheet of the same collection, which we have examined, is in the Gray Herbarium.

ADDITIONAL SPECIMENS EXAMINED: Bear Canyon, Sandia Mountains, September 24, 1897, *Herrick*; Dulce, alt. 2,200 meters, 1911, *Standley* 8124; Pecos, 1904, *Bartlett* 105; north of Glorieta, alt. 2,220 meters, 1908, *Standley* 5217, 5265; Tunitcha Mountains, 1911, *Standley* 7765, 7620.

***Machaeranthera aquifolia* Greene, sp. nov. in herb.**

Stems very slender, erect, 80 cm. high or less, sparingly branched near the base, the branches simple up to the loosely paniculate inflorescence, sparingly scabrous, abundantly glandular; leaves linear-oblong, acute or nearly obtuse, thin, sparingly spinulose-dentate, sessile by scarcely narrowed bases, somewhat scabrous, bright green, the uppermost reduced; heads few, hemispheric, 14 mm. broad and 10 mm. high or smaller; bracts very unequal, green for half their length, with spreading tips, linear-subulate, the outermost reflexed, finely glandular-puberulent; achenes scaberulous.

Type in the U. S. National Herbarium, no. 495763, collected at the Gila Hot Springs in the Mogollon Mountains, Socorro County, August 26, 1903, by O. B. Metcalfe (no. 856). Altitude 1,950 meters.

ADDITIONAL SPECIMENS EXAMINED: Hop Canyon, 1895, *Herrick* 628; Magdalena Mountains, 1895, *Herrick* 616; Grand Canyon of the Gila, August 19, 1900, *Wooton*; Mangas Springs, alt. 1,430 meters, 1903, *Metcalf* 715; East Canyon, 1911, *Holzinger*; Gilmores Ranch, July 25, 1901, *Wooton*.

The plant occurs in Arizona as well. The specimens from the Magdalena Mountains are stouter and have more heads than the typical form.

***Machaeranthera centaureoides* Greene, sp. nov. in herb.**

Stems 70 cm. high or less, stout, green, simple below, corymbosely branched above, the branches ascending, glabrous below, rather densely scabrous and

glandular above, the pubescence especially abundant on the branches of the inflorescence; lower leaves firm and thick, oblong-linear, 11 cm. long or less, 15 mm. wide or narrower, acute, bright green, mostly glabrous, closely and sharply spinulose-dentate, sessile by narrow bases, the uppermost leaves sessile by broad, clasping bases, some of the leaves almost entire, obtuse; heads few, 14 mm. wide and 12 mm. high or smaller, hemispheric, with numerous narrow, violet rays; bracts linear-subulate, green for two-thirds their length, the tips all spreading and some of the lowest bracts reflexed, unequal, densely and coarsely viscid-pubescent; achenes almost or quite glabrous.

Type in the U. S. National Herbarium, no. 495484, collected in the Mogollon Mountains on the Middle Fork of the Rio Gila, Socorro County, August 9, 1903, by O. B. Metcalfe (no. 440). Altitude about 2,250 meters.

ADDITIONAL SPECIMENS EXAMINED: West Fork of the Gila, August 25, 1903, *Metcalfe*; Luna, July 28, 1900, *Wooton*.

Similar to *M. asteroides*, but distinguished by its stouter stems and narrow, thick leaves, and especially by the coarse, glandular pubescence

***Machaeranthera pygmaea* (A. Gray) Wooton & Standley.**

*Machaeranthera tanacetifolia pygmaea* A. Gray, Pl. Wright. 2: 74. 1853.

*Aster tanacetifolius pygmaeus* A. Gray, Syn. Fl. 1<sup>2</sup>: 206. 1884.

***Machaeranthera simplex* Wooton & Standley, sp. nov.**

Perennial or biennial from a thick, somewhat woody root; stems several, clustered, very slender and wiry, erect, 40 cm. high or less, simple or bearing 2 or 3 heads on short peduncles, reddish, glabrous below, sparingly cinereous above; leaves thin, green, oblanceolate to oblong-lanceolate, acute, tapering to the base, coarsely salient-serrate, nearly glabrous except on the ciliate margins and villous veins; heads about 12 mm. broad; bracts linear, with long, linear, spreading, green tips, cinereous, nowhere glandular; rays narrow, 8 to 10 mm. long.

Type in the U. S. National Herbarium, no. 382533, collected in the Capitan Mountains at an altitude of 2,100 to 2,250 meters, August 31, 1900, by F. S. and Esther S. Earle (no. 390).

This is near *M. asteroides*, but differs in having thin, oblanceolate, nearly glabrous leaves, few heads, and very slender, simple stems.

***Aphanostephus perennis* Wooton & Standley, sp. nov.**

Slender perennial; stems wiry, erect, 30 cm. high or less, much branched, the branches ascending, rough-puberulent or hispidulous; leaves all linear, entire, bright green, 15 mm. long or less, cinereo-scaberulous; heads few, 8 or 9 mm. broad, on slender peduncles; bracts numerous, much imbricated, elliptic-lanceolate, acute, puberulent; rays rather few, pinkish; achenes dark brown, nearly terete, almost glabrous.

Type in the U. S. National Herbarium, no. 564549, collected at Knowles, July 29, 1909, by E. O. Wooton.

This may be readily distinguished from our other species by its perennial root, wiry stems, narrow leaves, and harsh pubescence.

***Dicranocarpus dicranocarpus* (A. Gray) Wooton & Standley.**

*Heterospermum dicranocarpum* A. Gray, Pl. Wright. 1: 109. 1852.

*Dicranocarpus parviflorus* A. Gray, Mem. Amer. Acad. n. ser. 5: 322. 1854.

*Wootonia parviflora* Greene, Bull. Torrey Club 25: 122. 1898.

There is no doubt that the genera *Dicranocarpus* and *Wootonia* are the same, as suggested long since by Mrs. Brandege and Mr. M. E. Jones. The types of the two genera came from the same general region, from localities probably not more than 100 miles apart. It is interesting to find that both are

included in Dalla Torre and Harms's Genera Siphonogamarum, but with an interval of just one hundred genera between the two!

**Gymnolomia brevifolia** Greene, sp. nov. in herb.

Perennial; stems 50 to 60 cm. high, slender, brownish, with sparse, short, appressed, grayish pubescence; leaves ovate, rhombic-ovate, or elliptic, or the lowest oblanceolate, 20 to 40 mm. long, 10 to 20 mm. wide, acute, entire or obscurely serrate, the upper on short, winged petioles, the lowest on more slender petioles 10 mm. long, appressed-pubescent, scaberulous above, bright yellowish green; heads 10 mm. in diameter; bracts lanceolate, acuminate, canescent; rays showy, bright yellow; achenes obovate, glabrous, dark brown, without pappus.

Type in the U. S. National Herbarium, no. 495518, collected in the Mogollon Mountains on the West Fork of the Rio Gila, altitude 3,300 meters, August 15, 1903, by O. B. Metcalfe (no. 511).

Evidently this is closely related to *G. multiflora*, but not more so than is *G. longifolia*. It is distinguished especially by its broad and remarkably short leaves. It seems to grow at a far higher altitude than most of our species of the genus.

**Helianthus canus** (Britton) Wooton & Standley.

*Helianthus petiolaris canescens* A. Gray, Pl. Wright. 1: 108. 1852, not *H. canescens* Michx.

*Helianthus petiolaris canus* Britton, Mem. Torrey Club 5: 334. 1894.

This seems to be worthy of specific rank. It is nearest *H. petiolaris*, but in general appearance is very different, chiefly because of the abundant white pubescence on leaves and stems. The pubescence of the peduncles is of long, spreading hairs, while in *H. petiolaris* it consists of short, appressed ones.

**Helianthus neomexicanus** Wooton & Standley, sp. nov.

Tall, branched perennial; stems comparatively slender, reddish, hispid or hispidulous up to the inflorescence; leaves all except the uppermost opposite, on slender petioles one-fourth to one-third as long as the blades, these ovate-lanceolate, thick, 8 to 15 cm. long, 6 cm. wide or less, rounded or narrowed and acute at the base, attenuate or long-acuminate at the apex, sparingly serrate with low teeth, scabrous on the upper surface, beneath soft-villous; heads rather few, the disk 15 mm. broad, on long, slender, densely canescent peduncles; bracts lanceolate, with long, abruptly acuminate, spreading tips, ciliate below the middle, scaberulous on the back, 13 mm. long or less; achenes not seen.

Type in the U. S. National Herbarium, no. 563826, collected at Mangas Springs, August 19, 1902, by E. O. Wooton.

It is not certain that this is a perennial plant, but in its various characteristics it agrees better with the perennial than the annual species. We have only the upper branches.

The pubescence of the lower surface of the leaves is very different from that found in any of our other New Mexican species, exactly matching that of the southeastern *Helianthus tomentosus* Michx.

**Verbesina oreophila** Wooton & Standley, sp. nov.

Tall plant, probably perennial, 1 meter high or more; stems erect, stout, not winged, minutely puberulent; leaf blades triangular-lanceolate to deltoid-ovate, 8 to 11 cm. long, 7 cm. broad or less, acute, narrowed at the base to a short, slender petiole, coarsely serrate, scaberulous on the upper surface, beneath soft-pubescent; heads numerous, about 12 mm. in diameter, loosely cymose, on slender, naked peduncles; bracts oblanceolate, linear-oblong or lanceolate,

acute, 5 mm. long or less, appressed-pubescent; rays bright yellow, conspicuous, obovate-spatulate; achenes 5 mm. long, cuneate-obovate, brown, glabrous, closely invested by the paleæ.

Type in the U. S. National Herbarium, no. 563951, collected at Cloudfcroft, in the Sacramento Mountains, August 24, 1899, by E. O. Wooton.

A species of the section *Verbesinaria*, but very unlike anything listed for the section by Robinson and Greenman in their revision of the genus.<sup>1</sup> It has larger heads than most members of the section.

**Thymophylla hartwegi** (A. Gray) Wooton & Standley.

*Hymenatherum berlandieri* Benth. Pl. Hartw. 18. 1839, not DC.

*Hymenatherum hartwegi* A. Gray, Pl. Wright. 1: 117. 1852.

**Thymophylla neomexicana** (A. Gray) Wooton & Standley.

*Adenophyllum wrightii* A. Gray, Pl. Wright. 2: 92. 1853, not *Hymenatherum wrightii* A. Gray, 1849.

*Hymenatherum neomexicanum* A. Gray, Proc. Amer. Acad. 19: 40. 1883.

**Thymophylla thurberi** (A. Gray) Wooton & Standley.

*Hymenatherum thurberi* A. Gray, Proc. Amer. Acad. 19: 41. 1883.

**Hymenopappus fisheri** Wooton & Standley, sp. nov.

Probably biennial, from a long, slender root; stems several, erect, stout, 30 to 40 cm. high or more, leafy, the leaves gradually reduced toward the top; basal leaves not seen; cauline ones large, once pinnatifid into narrowly oblong to broadly linear, obtuse segments, densely arachnoid beneath, above sparingly woolly when young, but soon glabrate and bright green; heads numerous, corymbose, about 8 mm. in diameter, on slender peduncles; bracts sparingly tomentose, obovate, 5 mm. long, with thin, yellow, scarious tips; corolla bright yellow, glandular, the lanceolate lobes about equaling the campanulate throat; achenes dark brown, nearly naked on the faces, densely villous-ciliate on the angles; pappus conspicuous, about equaling the diameter of the achene at the summit.

Type in the U. S. National Herbarium, no. 564948, collected near Nara Visa, in clay and sandy soil, September 8, 1910, by Mr. Geo. L. Fisher (no. 16). Also collected at Nara Visa, June 12, 1911, *Fisher* 177.

The plant is suggestive of *H. artemisiaefolius* DC., but the bracts lack the very broad, white margins of that species, the leaf segments are narrower, and the corollas are bright yellow instead of nearly white.

**Hymenopappus nudatus** Wooton & Standley, sp. nov.

Perennial, 30 to 50 cm. high, with several stems clustered at the top of a thick, black root; leaves practically all basal, 10 cm. long, twice pinnate into linear divisions, densely arachnoid, the petioles very densely so, their bases covered with long, white wool; stems scapose, densely arachnoid, bearing but 1 or 2 much reduced leaves; heads few, 1 to 5, large, 12 to 15 mm. broad, on long, stout peduncles; bracts 8 mm. long or less, unequal, obovate or oblong, with scarious stramineous tips, densely arachnoid; corolla pale yellow, the oblong-ovate, obtuse lobes not more than one-third as long as the tube; achenes densely silky-villous with tawny hairs; pappus of prominent scales nearly 2 mm. long.

Type in the U. S. National Herbarium, no. 495226, collected in the Burro Mountains, Grant County, altitude 1,650 meters, June 6, 1903, by O. B. Metcalfe (no. 107).

ADDITIONAL SPECIMENS EXAMINED: West of Patterson, June 21, 1892, *Wooton*; Cactus Flat, July 5, 1906, *Wooton*; near Santa Rita, 1877, *Greene*; Silver City, June 2, 1880, *Greene*.

The type collection was originally determined as *H. luteus* Nutt., but that is a smaller plant with smaller heads and more leafy stems. Our plant suggests *H. arenosus*, but that, too, has smaller heads and lower, more leafy stems.

**Picradeniopsis dealbata** (A. Gray) Wooton & Standley.

*Bahia dealbata* A. Gray, Mem. Amer. Acad. n. ser. 4: 99. 1849.

*Bahia absinthifolia dealbata* A. Gray, Pl. Wright. 1: 121. 1852.

**Hymenoxys brachyactis** Wooton & Standley, sp. nov.

Perennial or possibly biennial, from a thick tap-root; stems solitary, very stout, simple at the base, with a few erect, corymbose branches above; basal leaves long-petiolate, once or twice pinnatifid into numerous narrowly linear segments; cauline leaves very numerous, all once or twice pinnatifid into linear or filiform divisions, the lower leaves with very numerous divisions, the upper with but few; heads numerous, 6 mm. in diameter, on short, slender, glabrous peduncles; involucre glabrous, 5 mm. high, the outer bracts lanceolate, acute, strongly keeled, united for nearly half their length, the inner ones very obtuse, short-acuminate, tomentose on the margins; rays pale yellow, cuneate-obovate, much shorter than the involucre bracts, usually not more than half as long; disk flowers bright yellow, sparingly glandular; achenes villous with pale tawny hairs; paleæ of the pappus long-attenuate, two-thirds as long as the disk corollas.

Type in the U. S. National Herbarium, no. 690242, collected near East View, August 4, 1906, by E. O. Wooton.

The plant has the size and habit of *H. rusbyi*, but it has very different leaves and heads. Its most striking characteristics are its tall, stout, simple stems, its finely divided Artemisia-like foliage, and the numerous small, angled heads.

**Hymenoxys cockerellii** Wooton & Standley, nom. nov.

*Hymenoxys chrysanthemoides juxta* Cockerell, Bull. Torrey Club 31: 503. 1904.

This seems to be a distinct species, differing conspicuously enough from *H. chrysanthemoides*, as originally pointed out by Professor Cockerell. Ordinarily, in raising a subspecies to specific rank we should not think of changing the subspecific name unless it were preoccupied. There is, however, so far as we know, no precedent for the use of a preposition as a specific name, nor do we think it desirable or even permissible that one be established.

**Hymenoxys mearnsii** (Cockerell) Wooton & Standley.

*Hymenoxys chrysanthemoides mearnsii* Cockerell, Bull. Torrey Club 31: 506. 1904.

A common species of southern New Mexico, ranging from the southwest corner as far east as the Pecos Valley. It is the smallest of our annual forms.

**Tetraneuris formosa** Greene, sp. nov. in herb.

Perennial from a thick root; caudices cespitose, thickened; basal leaves oblanceolate-spatulate, 60 cm. long and 9 mm. broad or smaller, obtuse, green, sparingly silky-pubescent on both surfaces, glandular-punctate; peduncles about 20 cm. long, slender, bearing 2 or 3 small leaves near the base, rarely branching, pubescent with few loosely appressed hairs; heads large, the involucre 12 mm. broad and 7 or 8 mm. high; bracts oblong, obtuse, densely silky-villous; rays large, extending 15 mm. beyond the involucre, 7 or 8 mm. broad, with 3 rounded teeth at the apex, conspicuously veined; achenes villous; paleæ of the pappus ovate, with long, abruptly acuminate tips.

Type in the U. S. National Herbarium, no. 498042, collected on dry hills near Kingston, Sierra County, at an altitude of 1,980 meters, August 22, 1904, by O. B. Metcalfe (no. 1235).



A specimen collected in the Magdalena Mountains in June, 1881, by G. R. Vasey appears to be the same, although it has more densely pubescent leaves and stems.

The species is related to *T. leptoclada*, but has very much longer rays and larger heads and is a taller plant. The pappus scales are broader and not so acute.

**Tetraneuris pygmaea** (Torr. & Gray) Wooton & Standley.

*Actinella depressa pygmaea* Torr. & Gray, Mem. Amer. Acad. n. ser. 4: 100. 1849.

The type came from the Raton Mountains of New Mexico. We have specimens from the Sandia Mountains that we take to be the same plant. It is similar to *T. depressa*, but the leaves are densely sericeous instead of villous, the heads are not nearly so large as in that species, and the rays are shorter than the involucre instead of equaling it.

**Artemisia albula** Wooton, nom. nov.

*Artemisia microcephala* Wooton, Bull. Torrey Club 25: 455. 1898, not Hillebr. 1888.

**Artemisia petrophila** Wooton & Standley, sp. nov.

Low shrub, 30 to 40 cm. high, the lower branches spreading, bearing numerous very slender, mostly simple, erect ones; stems densely tomentose; the lower leaves, i. e., those of the older thicker branches, cuneate, 2 to 3 cm. long, densely white-sericeous, tridentate at the apex, the teeth oblong or oblong-lanceolate, obtuse; leaves of the upper slender branches oblanceolate to linear-oblong, entire, obtuse or acutish, white-sericeous, rather distant, never crowded; inflorescence of very narrow panicles, the lateral branches not more than 2 cm. long, slender; heads homogamous, few-flowered, solitary or in small clusters, sessile or pedunculate, the peduncles soon recurved; involucre campanulate, 2.5 mm. broad, the bracts few, in about two series, oblong, obtuse, densely tomentose.

Type in the U. S. National Herbarium, no. 686323, collected on a dry sandstone mesa at the north end of the Carrizo Mountains, July 28, 1911, by Paul C. Standley (no. 7355).

ADDITIONAL SPECIMENS EXAMINED: NEW MEXICO—Dry hills near Farmington, alt. 1,650 meters, July 17, 1911, *Standley* 7084. ARIZONA—Moki Reservation, 1896, *Hough* 58.

This low shrub is similar to *Artemisia tridentata*, especially in herbarium specimens. Even here, however, it may be distinguished by its broader inflorescence, recurved peduncles, campanulate heads, and rather distant, mostly entire leaves. In the field the two are very unlike. *A. tridentata* is a densely branched shrub usually a meter high, growing on the plains, while this is a low plant with slender, open, never dense branches, growing on the hills, usually among rocks.

**Senecio metcalfei** Greene, sp. nov. in herb.

Perennial, multicipitous, from a rather stout, ascending, somewhat woody rootstock; stems scapiform, 20 cm. high or mostly less, stout, glabrous or with very scanty tomentum; leaves numerous, erect or somewhat spreading, less than half as long as the stem, rather thick and firm, dull green, oblanceolate or narrowly spatulate, obtuse, mostly entire or some with 2 or 3 low, inconspicuous teeth, glabrous except the very youngest, these with a scanty tomentum, narrowed at the base into a petiole as long as the blade or shorter; leaf blades 45 mm. long and 15 mm. wide or smaller; stems almost naked but with a few much reduced leaves; heads few, on short peduncles, campanulate, mostly about 9 mm. long or smaller; peduncles mostly naked; bracts linear or linear-

lanceolate, acute, 6 mm. long or less, light green; rays oblong, rather bright yellow, 6 mm. long and 3 mm. wide or smaller; achenes striate, glabrous.

Type in the U. S. National Herbarium, no. 497842, collected on open slopes on Hillsboro Peak, at the south end of the Black Range, May 27, 1904, by O. B. Metcalfe (no. 938). Altitude 3,060 meters.

Most closely related, perhaps, to *S. pentodontus*, but with very different leaves and pubescence.

***Senecio remifolius* Wooton & Standley, sp. nov.**

Perennial, multicapitose, from a rather stout, creeping or ascending rootstock; stems scapiform, 25 cm. high or lower, glabrous, slender; basal leaves linear-oblong, glabrous, or with an obscure and very sparse tomentum visible only under a lens, about 60 mm. long and 8 mm. wide, obtuse, entire or with 3 or sometimes a few more shallow teeth, thick and fleshy, deep green, gradually tapering at the base into a slender petiole as long as the blade or longer; lower cauline leaves like the basal ones but smaller; upper ones linear, sessile by a somewhat widened base; stems sometimes with an obscure tomentum in places; branches of the inflorescence several, ascending, each bearing 1 to 3 rather long-pedunculate heads, these campanulate, about 12 mm. high; peduncles naked or with a few bractlets; involucrel bracts 10 to 12, linear-lanceolate, acute, with membranous margins, about 7 mm. long; rays oblong, pale yellow, 10 mm. long and 2.5 mm. wide or smaller; achenes striate, ciliolate along the angles.

Type in the U. S. National Herbarium, no. 690231, collected along Willow Creek, August 8, 1900, by E. O. Wooton.

Similar to the preceding but with different leaves, heads, and achenes.

***Senecio sacramentanus* Wooton & Standley, sp. nov.**

Erect from a cluster of rather fleshy roots, 70 cm. high or less; stems mostly simple below but paniculately branched above, sparingly tomentose below, densely so above, the pubescence densest about the nodes; leaves lanceolate to triangular-lanceolate, 14 cm. long or less and 5 cm. wide or narrower, abruptly acuminate, coarsely salient-dentate, tapering, truncate, or cordate at the base, sparingly puberulent beneath, glabrous above, bright green, thin; petioles of the lowest leaves 7 cm. long, slender, dilated and clasping at the base, those of the upper leaves shorter and winged, the uppermost leaves sessile and often clasping by a broad base; stems leafy throughout, the upper leaves considerably smaller than the others; inflorescence much branched, of paniculate racemes; heads very numerous, small, 10 mm. long and 9 mm. wide or less, rather narrowly campanulate, nodding; bracts about 8, rather broadly oblanceolate, acute, with membranous, light-colored margins; heads subtended by 2 or 3 short, filiform bracts; rays none; achenes light chestnut colored, striate, with abundant soft, barbellate pappus.

Type in the U. S. National Herbarium, no. 690237, collected in the vicinity of Cloudercroft, near the summit of the Sacramento Mountains, altitude about 2620 meters, August 15, 1901, by E. O. Wooton.

ADDITIONAL SPECIMENS EXAMINED: Cloudercroft, August 24, 1901, *Wooton*; James Canyon, August 11, 1899, *Wooton*.

This is as nearly related to *S. pudicus* as to any species, but its foliage is very different. In that species the leaves are linear to oblanceolate, tapering to the base, and nearly entire. In *S. sacramentanus* the leaves vary from cordate-ovate to oblong-lanceolate, are coarsely serrate, and are mostly truncate to abruptly contracted at the base. The general appearance of the two is so unlike that at first glance one would not suspect the relationship between them.

**Carduus gilensis** Wooton & Standley, sp. nov.

Tall, sparingly branched biennial with slender, striate, villous stems; basal leaves oblanceolate, about 40 cm. long, acute, conspicuously lobed, the lobes dentate, the few teeth tipped with slender spines, glabrous on the lower surfaces, puberulent above; upper cauline leaves oblong or triangular-lanceolate, acute, clasping at the base, shallowly lobed, the lobes and their principal teeth with numerous long, slender, salient spines; heads usually solitary at the ends of the branches, campanulate, about 3 cm. broad or more and of the same height, subtended by many narrowly linear-lanceolate, spiny, bract-like leaves; outer bracts foliaceous, linear-lanceolate, with elongated tips, often arachnoid on the margins, pectinate with very numerous spiny teeth; inner bracts broader, scaberulous, little or not at all dilated at the tips and laciniate; corollas greenish yellow.

Type in the U. S. National Herbarium, no. 495440, collected in the Mogollon Mountains on the West Fork of the Rio Gila, Socorro County, altitude 2250 meters, August 4, 1903, by O. B. Metcalfe (no. 377).

This, like *C. inornatus*, was determined as *C. parryi*. It is of that group, but is distinguished by its large, mostly solitary heads, as well as by its unusually large and thin leaves, and the very numerous foliaceous bracts.

**Carduus inornatus** Wooton & Standley, sp. nov.

Tall biennial about 1 meter high with a stout stem, this simple below, above with a few ascending branches; stems striate, sparingly arachnoid, densely so on the younger parts, nearly glabrous in age; basal leaves not seen; lower cauline leaves linear-lanceolate, 10 to 18 cm. long, 17 mm. wide or less, with few remote, triangular, spine-tipped teeth, the margins beset with fine spines, glabrous beneath except on the midvein, sparingly villous there as well as on the upper surface with long, weak, white hairs; upper cauline leaves lanceolate or oblong, acute or attenuate, sessile and clasping at the base, the auricles rounded, the margins irregular and bearing numerous slender, yellow spines; heads few, occasionally solitary at the ends of the branches but usually in clusters of about 3, pedunculate, campanulate, 25 mm. long and 20 mm. broad or smaller, subtended by numerous spiny, reduced, bract-like leaves; bracts of the involucre in several series, successively shorter outward, the outer linear-lanceolate with long-attenuate tips, mostly glabrous on the back, rarely slightly arachnoid, spine-tipped, the margins bearing many weak, yellow spines; inner bracts broader, scaberulous, most of them abruptly dilated at the tips into a lanceolate or oval, often laciniate, spine-tipped portion; corollas yellow; achenes obovate, compressed, brownish, 4 to 5 mm. long, the pappus about 10 mm. long.

Type in the U. S. National Herbarium, no 561013, collected in the Sacramento Mountains near Cloudcroft, August 24, 1901, by E. O. Wooton.

Originally this collection was determined as *C. parryi*, and it is nearer to that than to any other species. It differs in having fewer heads and slightly if at all arachnoid bracts with pectinately spiny margins and less dilated tips. The leaves, too, are not nearly as spiny as in that species, and only the innermost bracts have dilated tips, while in *C. parryi* almost all have them.

**Carduus pallidus** Wooton & Standley, sp. nov.

Tall biennial, 1 to 2 meters high, with simple, very leafy stems sparingly branched about the inflorescence; stems stout, arachnoid above, becoming glabrate below, striate; lower cauline leaves lanceolate, acute, attenuate to the base, irregularly serrate-dentate, the teeth tipped with short, weak spines; upper cauline leaves narrowly oblong to triangular-lanceolate, clasping at the base, with rounded auricles, acute irregularly dentate or shallowly lobed, the

margins spine-tipped, the blades glabrous beneath, above sparingly white-villous, lanate along the midrib; inflorescence of rather few heads, these racemose in age, crowded when young, on short, stout peduncles or sometimes sessile, subtended by reduced, very spiny leaves; heads campanulate, 3 cm. high and as broad or smaller; bracts linear, none of them with dilated tips, the outer arachnoid on the backs and margins, tipped with a long, slender spine and usually bearing 2 or more slender lateral spines just below the tip; inner bracts lanceolate, thick and firm, scaberulous, with slender, flat, weak tips; corollas greenish yellow; achenes oblong-obovate, dark brown, glabrous and shining.

Type in the U. S. National Herbarium, no. 498699, collected in the Pecos River National Forest near Winsors Ranch, altitude 2520 meters, July 16, 1908, by Paul C. Standley (no. 4357).

ADDITIONAL SPECIMENS EXAMINED: Tunitcha Mountains, 1911, *Standley* 7533; Chama, alt. 2400 meters, 1911, *Standley* 6763; mountains west of Las Vegas, 1881, *Vasey*; Baldy, August 14, 1910, *Wooton*; Gilmores Ranch, alt. 2220 meters, 1907, *Wooton & Standley* 3491; Gilmores Ranch, July 14, 1895, *Wooton*; James Canyon, August 3, 1899, *Wooton*.

A common species in the higher mountains of New Mexico, occurring chiefly in the Transition Zone, although frequently extending farther up. It grows usually in swamps or marshes along the edges of mountain streams, sometimes in shaded thickets, frequently in open meadows. It is a tall, coarse plant, with pale yellowish stems and foliage. Commonly this has passed as *Carduus parryi*. Apparently no one has ever questioned this determination, yet examination of herbarium material reveals the fact that true *parryi* does not occur in New Mexico. That species differs from ours in its small heads, more spiny leaves, and the conspicuously dilated bracts.

***Carduus vinaceus* Wooton & Standley, sp. nov.**

Tall biennial, 1 to 2 meters high, with very numerous ascending branches; stems brownish purple, striate, slender, glabrous; basal leaves glabrous, green, 30 to 50 cm. long, 20 cm. wide or less, elliptic-oblong in outline, pinnatifid nearly to the midrib, the segments overlapping, laciniately lobed, the lobes oblong-lanceolate, acute, the teeth tipped with short, slender, yellowish spines; heads very numerous, naked, campanulate; bracts in numerous series, narrowly lanceolate, with long, flat, weak, spreading tips, deep reddish purple throughout, glabrous on the back, scarcely keeled, ciliate or puberulent on the margins, tipped with short, slender, yellowish spines; inner bracts with long, slender, twisted tips; whole head 5 cm. in diameter and 4 cm. high or smaller; corolla lobes long and narrow, purplish; achenes obovate, brown, glabrous, with tawny, plumose pappus 15 to 20 mm. long.

Type in the U. S. National Herbarium, no. 690246, collected in the Sacramento Mountains near Fresno, July 12, 1899, by E. O. Wooton.

No other North American species of which we have seen either specimens or description is at all like this in the form of the involucre. Some of the Mexican species suggest our plant but not very closely. When growing it is a handsome large plant with very numerous, purplish heads and dark stems, these contrasting with its glabrous, bright green foliage.

# SUPPLEMENTARY NOTES ON AMERICAN SPECIES OF FESTUCA.

By CHARLES V. PIPEB.

Since the publication of his monograph of the North American species of *Festuca*,<sup>1</sup> the author has availed himself of opportunities to study the type specimens of several species, which has resulted in clearing up various matters of synonymy. In the course of these studies, it also became apparent that the North American grass referred to *Festuca fratercula* Rupr. is not that plant at all, but an unnamed species.

***Festuca sororia* sp. nov.**

*Festuca fratercula* Contr. U. S. Nat. Herb. 10: 39. 1906, as to description and specimens cited.

An examination of the type of *Festuca fratercula* Rupr. preserved in the herbarium of the Jardin Botanique de l'État at Brussels shows it to be a very different species, and one not represented in the National Herbarium. *Festuca sororia* is a rare plant occurring in Colorado, Arizona, and New Mexico in mountain ravines.

Type in the U. S. National Herbarium, no. 45866, collected in the Rincon Mountains, Arizona, altitude 225 meters, September, 1891, by G. C. Nealley (no. 177).

The species has been further collected, as follows:

COLORADO: Pagosa Peak, Baker 36, 75, 94, 177, 178; Durango, Tweedy 393a.

NEW MEXICO: Hillsboro Peak, Grant County, O. B. Metcalfe 1236.

***Festuca fratercula* Rupr.; Fourn. Mex. Pl. 2: 124. 1881.**

"Culmo fere tripedali scabro; foliis 3'' latis, retrorsum scabris, longis, planis, apice longe convolutis; ligula brevissima; panícula libera effusa fere pedali folium summum longe superante, radiis geminis divaricatis inaequalibus parce divisis; spiculis 3-floris cum terminali quarto abortivo; glumis inaequalibus acutis, floribus teretibus remotis, palea inferiore acuta potissimum in floribus summis breviter mucronata, glabra; squamulis lanceolatis ovarium aequantibus.

"In humidis inter Pinos montis Orizabensis, 11-12000' (Gal. n. 5778); Cumbre de Estepa, agosto (Liebm.)."

To the above description the following notes may be added: Culm stout, smooth, bearing two leaves; lower leaf blade 20 cm. long, strongly nerved above, firm, scabrous on nerves and margins, attenuate-acute; ligule a fringe of short bristles; lower sheath 30 cm. long, smooth outside, scabrous within near the

<sup>1</sup> Contr. U. S. Nat. Herb. 10: 1-48. 1906.

top; panicle 25 cm. long; rays slender, in twos, the longest 12 cm. long, very scabrous, naked for half its length; spikelets 10 to 12 mm. long, 5-flowered; glumes firm, lanceolate, acute, minutely scabrid near the tip, obscurely veined, the lower 5 mm., the upper 6 mm. long; lemmas firm, thickish, very obscurely veined, acute, purplish near the tip, 7 mm. long; palea slightly exceeding the lemma.

There are no specimens in the National Herbarium that can be referred to this species.

**Festuca tolucensis** H. B. K. Nov. Gen. & Sp. 1: 153. 1816.

In Contributions from the U. S. National Herbarium, volume 10<sup>1</sup>, the treatment of this species and its supposedly near allies *F. multiculmis* Steud.<sup>2</sup> and *F. aequipaleata* Fourn.<sup>3</sup>, was admittedly unsatisfactory. The types of all three are in the herbarium of the Muséum d'Histoire Naturelle at Paris. *Festuca tolucensis*, as shown by more abundant recently collected material, is rather variable, especially in the size of the spikelets and the development of the awns. *Festuca multiculmis* Steud. must be regarded as a synonym, as the type (Heller 306, Mount Toluca) is identical with the type of *F. tolucensis* from the same mountain. *Festuca aequipaleata* Fourn. differs only in the tendency of the spikelets to be smaller and in the unawned or very short-awned lemmas. On some specimens both awned and awnless lemmas occur, and other specimens show complete intergradation to *F. tolucensis*. It is therefore best considered a subspecies.<sup>4</sup>

**Festuca texana** Steud. Syn. Pl. Glum. 1: 310. 1854.

The type is preserved in Steudel's herbarium in the Muséum d'Histoire Naturelle, Paris. It was collected by Drummond (no. 387) in Texas, at San Felipe, as indicated by the specimen at Kew. The plant is *Leptochloa fascicularis* (Lam.) A. Gray.

**Festuca pseudoduriuscula** Steud. Syn. Pl. Glum. 1: 312. 1854.

The type of this, Drummond's no. 389 from Texas, is also in Paris. It is *Festuca obtusa* Spreng., as is also Drummond's no. 398, indicated by Steudel as a variety but not named in publication. According to the specimens at Kew, nos. 389 and 398 are both from San Felipe, Texas.

**Festuca glabra** Spreng. Syst. Veg. 1: 353. 1824.

The original specimen of this is in the Königliches Botanisches Museum, Dahlem, Berlin, and is labeled "Seacoast, Long Island, Nuttall." It is the ordinary Atlantic coast form of *Festuca rubra* L.

<sup>1</sup> Page 44.

<sup>2</sup> Syn. Pl. Glum. 1: 310. 1854.

<sup>3</sup> Mex. Pl. 2: 125. 1881.

<sup>4</sup> **FESTUCA TOLUCENSIS AEQUIPALEATA** (Fourn.)

*Festuca aequipaleata* Fourn. Mex. Pl. 2: 125. 1881.

The following specimens of *Festuca tolucensis* have been examined:

MEXICO (STATE): Mount Toluca, Bonpland in 1833 (type); Heller 306 (type of *F. multiculmis*); Rose & Painter 7983; E. W. Nelson 14.

MORELOS: Mount Popocatepetl, Hitchcock 6001; Rose & Hay 5735, 6297, 5978a.

JALISCO: Mount Nevada, Hitchcock 7167, 7158, 7165½.

PUEBLA: Mount Orizaba, Seaton 193, 228; Liebmann 510, 511 in part.

Specimens of *Festuca tolucensis aequipaleata* have been examined as follows:

PUEBLA: Mount Orizaba, Liebmann 510, 511 in part.

MORELOS: Mount Popocatepetl, Rose & Hay 5697.

SAN LUIS POTOSI: Specific locality not stated, Parry & Palmer 924.

**Festuca delawarica** Kunth, Rév. Gram. 1: 129. 1829.

*Poa delawarica* Link, Hort. Berol. 1: 174. 1827.

The type is in Berlin, labeled "Delaware (Bernhardi)". The specimen was apparently grown in the Botanic Garden at Berlin. It is the species American botanists call *Puccinellia distans*.

**Festuca villiflora** Steud. Syn. Pl. Glum. 1: 313. 1854.

The type is in Steudel's Herbarium at Paris labeled "Labrador, Missionary Albrecht" and consists of one small plant. It is *Festuca rubra kitaibeliana* (Schultes) Piper, as previously surmised from Steudel's description.

**Festuca megalura** Nutt. Journ. Acad. Phila. n. ser., 1: 188. 1847.

This has as synonyms *F. commutata* Steud.<sup>1</sup> and *F. chaetantha* Kunze, cited as a synonym under *F. sciuroides* by Desvaux.<sup>2</sup> Both types are in Paris.

**Festuca eriolepis** Desv. in Gay, Fl. Chil. 6: 428. 1853.

The type is in the herbarium of the Muséum d'Histoire Naturelle, Paris. It is not the plant described and figured in Contributions from the U. S. National Herbarium volume 10,<sup>3</sup> but is the same as *Festuca octoflora hirtella* Piper.<sup>4</sup> The Chilean specimens have usually but 5 florets to each spikelet, a condition that also occurs in dwarfed specimens from California and Oregon.

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<sup>1</sup> Syn. Pl. Glum. 1: 304. 1854.

<sup>2</sup> In Gay, Fl. Chil. 6: 427. 1853.

<sup>3</sup> Contr. U. S. Nat. Herb. 10: 13. 1906.

<sup>4</sup> Op. cit. 12.

## DELPHINIUM SIMPLEX AND ITS IMMEDIATE ALLIES.

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By CHARLES V. PIPER.

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*Delphinium simplex* Dougl. and a few related species are distinguished among American larkspurs by the following combination of characters: Roots grumose or tuberiform; flowers short-pediceled and the inflorescence therefore narrow and strict; sepals erect or but little spreading; seeds smooth and produced into thin margins on the angles. Four species have been described as belonging to this group, namely *D. simplex* Dougl., *D. distichum* Geyer, *D. strictum* A. Nels., and *D. burkei* Greene, the last-named to me unknown.

In the original description of *Delphinium simplex* Dougl., Hooker<sup>1</sup> gives the locality as follows: "On the subalpine range west of the Rocky Mountains near the Columbia, plentiful." In the Herbarium at Kew are two sheets collected by Douglas labeled *Delphinium simplex*. One of these bears the legend "On the subalpine range of the Rocky Mountains near springs, plentiful." Some one has written "type" on this sheet, a conclusion which seemingly admits of no doubt. The other Douglas sheet is from "Grassy points of land on the banks of the Wallawallah." On this sheet is written in Doctor Gray's handwriting "The type of *D. simplex*. A. G." In the British Museum is a sheet of the "Wallawallah" collection, but none of the first mentioned. As the two collections represent the same species no error could have originated by choosing either as the type, but nevertheless the plant described by Doctor Gray in the Synoptical Flora is a different species from Douglas's original. Apparently Doctor Gray understood the species aright when he examined the material at Kew, but later was misled by a Douglasian specimen in the Gray Herbarium which he supposed was true *Delphinium simplex*. Based on a knowledge of three species in the field and the material in the U. S. National Herbarium the following revision of the group is offered.

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<sup>1</sup> Fl. Bor. Amer. 1: 25. 1829.



## KEY TO SPECIES.

- Flowers usually 10 to 20; leaves rather few; puberulence, at least of the inflorescence, villous in character and somewhat viscid ----- 1. *D. cyanoreios*.
- Flowers more numerous; leaves rather many; puberulence not villous, more or less appressed.
- Leaves puberulent, usually densely so, all with narrow divisions; puberulence of inflorescence usually viscid --- 2. *D. simplex*.
- Leaves glabrous or mostly so, the lower with broad divisions; puberulence of inflorescence usually not viscid -- 3. *D. distichum*.

1. *Delphinium cyanoreios* sp. nov.

Stems strict, erect, usually simple, 40 to 99 cm. high from a thick tuberiform root, at least the inflorescence densely velutinous and somewhat viscid, the lower portion of the plant puberulent or glabrate; leaves few, the basal usually glabrous, parted into 3 cuneate divisions, these again cleft into linear, obtuse lobes; upper leaves reduced and more deeply cleft into narrower segments; raceme 10 to 30-flowered, 10 to 30 cm. long, the pedicels decidedly shorter than the spurs; bracts linear-lanceolate; calyx dark blue, sparsely villous without, the straight spur 12 to 14 mm. long, much longer than the sepals; upper petals whitish, veined, tinged with blue at the tips; carpels 3, 12 to 20 mm. long without the beak, villous, straight or slightly spreading at maturity; seeds dark, smooth, the angles produced into narrow white margins.

This is the plant Dr. Gray described as *D. simplex* Dougl.,<sup>1</sup> but it is not the plant of Douglas. It occurs mainly in the Blue Mountains of Oregon.

Type in the U. S. National Herbarium, no. 529341, collected near Sled Creek Ranger Station, Wallowa County, Oregon, June 25, 1907, by Frederick V. Coville (no. 2444).

Among the specimens in the U. S. National Herbarium are, in addition, the following:

OREGON: Blue Mountains, *Sheldon* 8399; Billy Meadows, Blue Mountains, 1,500 meters alt., *J. T. Jardine* 312; head of Anthony Creek, Blue Mountains, 2,100 meters alt., *Cusick* 2339; Silver Creek, Harney County, *Cusick* 2609; eastern Oregon, *Cusick* 2181, 2204; Steens Mountain, *Cusick* 1982; Two Color Creek, Blue Mountains, *Cusick* 3305a; Cliff Creek, Blue Mountains, *Cusick* 3325; source of Rock Creek, Blue Mountains, *Cusick* 3175.

IDAHO: Craig Mountains, June 23, 1894, *Henderson*; South Clearwater, June 26, 1894, *Henderson*; near Sawtooth, *Everman* 603; Long Valley, *Henderson* 3140.

*Delphinium depauperatum* Nutt. is distinguished from the present species almost wholly by the more elongated lower pedicels, but some specimens like *Cusick's* nos. 3325 and 3175 are ambiguous in this respect. The pubescence of the two species is identical.

2. *Delphinium simplex* Dougl.; Hook. Fl. Bor. Amer. 1: 25. 1829.

In its original locality this species grows in stream bottoms and moist meadows and has uniformly pale, dull blue flowers. Douglas's types represent this form. Elsewhere in eastern Washington the flowers are a deeper, brighter blue, but the other characters remain the same. This brighter flowered plant matches the type of *Delphinium strictum* A. Nels., but it is scarcely worthy of nomenclatorial recognition.

<sup>1</sup> Syn. Fl. 1<sup>1</sup>: 49. 1895.

Representative examples of this species in the U. S. National Herbarium are the following:

WASHINGTON: Pullman, July 21, 1894, *Piper*; *Elmer* 3; July 30, 1895, *Hardwick*; without definite locality, *Vasey* 160, 161; Wenache, *Whited* 1277; Tieton Basin *Cotton* 449; Ellensburg, *Whited* 523; Spokane County, *Suksdorf* 720; Falcon Valley, July 17, August, 1881, *Suksdorf*.

OREGON: Pine Valley, *Cusick* 2440; John Day River, *H. E. Brown* 72; Camas Prairie, *Griffiths & Hunter* 86.

BRITISH COLUMBIA: Mouth of Kootenai River, July, 1890, *Macoun*.

3. *Delphinium distichum* Geyer; A. Gray, Syn. Fl. 1<sup>1</sup>: 49. 1895.

This is very closely allied to *D. simplex* Dougl. and seems to intergrade fully. Typically it is distinguished by the broader lobed, nearly glabrous basal leaves. The true *D. simplex* Dougl. and *D. distichum* Geyer make up together the *Delphinium distichum* of the Synoptical Flora. On the whole Hooker's original treatment of the plant as a variety of *Delphinium simplex* (*D. simplex distichiflorum* Hook.)<sup>1</sup> is perhaps the wisest disposition.

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<sup>1</sup> Hook. Lond. Journ. Bot. 6: 67. 1847.

## THE IDENTITY OF HEUCHERA CYLINDRICA.

By CHARLES V. PIPER.

In the original description of *Heuchera cylindrica* Douglas,<sup>1</sup> the species is stated to occur "On the declivity of low hills, and on the steep banks of streams on the west side of the Rocky Mountains." This has always been puzzling from the fact that the plant accepted by all American botanists as *Heuchera cylindrica* occurs only in and west of the Cascade Mountains, and grows mainly in copses about low moist meadows. An examination of the Douglasian specimens at Kew and in the British Museum clears up the discrepancy. At Kew there are two sheets, one of which is labeled exactly as quoted by Hooker. The other sheet is of the same species, and with scarcely a doubt of the same collection, but is labeled merely *Heuchera cylindracea* [sic] Dougl. The plant is not at all the one taken by American botanists for *Heuchera cylindrica*, but is the one recently named *Heuchera columbiana* by Rydberg.<sup>2</sup> Another Douglasian sheet in the British Museum has two different species mounted upon it, but each is numbered and the label reads:

"In dry mountain woods near Kettle Falls. 1. *H. cylindracea*. 2. *Heuchera*."

This writing is in ink and is identified by Dr. A. B. Rendle as that of Sir W. J. Hooker. In the lower left-hand corner of the sheet written in pencil is the following: "*Heuchera cylindrica* Dougl. Flor. Bor. Am." Such pencil inscriptions in the same hand occur on many of the Douglas sheets in the British Museum, but the handwriting is not identified. Plant no. 2, unnamed, is a young specimen of the species that all American botanists have been calling *Heuchera cylindrica*, namely, Torrey and Gray,<sup>3</sup> Brewer and Watson,<sup>4</sup> Wheelock,<sup>5</sup> Howell,<sup>6</sup> Rydberg,<sup>7</sup> Rosendahl,<sup>8</sup> and Piper.<sup>9</sup>

As the plant called *Heuchera cylindrica* by American botanists is unnamed, it is here described as a new species.

<sup>1</sup> Hook. Fl. Bor. Amer. 1:236.

<sup>2</sup> N. Amer. Fl. 22:116. 1905.

<sup>3</sup> Fl. N. Amer. 1:580. 1840.

<sup>4</sup> Bot. Calif. 1:201. 1876.

<sup>5</sup> Bull. Torrey Club 17:202. 1890.

<sup>6</sup> Fl. Northw. Amer. 203. 1898.

<sup>7</sup> N. Amer. Fl. 22<sup>2</sup>:115. 1905.

<sup>8</sup> Bot. Jahrb. Engler 37<sup>2</sup>:80. 1905.

<sup>9</sup> Contr. U. S. Nat. Herb. 11:322. 1906.

***Heuchera chlorantha* sp. nov.**

Tufted from a stout branching caudex; leaves all basal, the blades 5 to 8 cm. broad, orbicular to reniform, deeply cordate, 7 to 9-lobed, the lobes broadly rounded or faintly lobed and dentate with broad cuspidate teeth, glabrous except on the veins beneath; petioles 5 to 15 cm. long, with spreading or somewhat retrorse, usually brownish hairs; flowering stems scapiform, 50 to 100 cm. high, villous, with spreading or somewhat retrorse brownish hairs, and usually bearing one or two fimbriate leaf rudiments; inflorescence a narrow dense panicle 5 to 10 cm. long, the short branches 3 to 7-flowered the axis hirsute and glandular; bracts ovate to lanceolate, the lower 3-cleft, fimbriate; calyx greenish, turbinate-campanulate, the lobes oblong, obtusish, the whole pruinose-puberulent, 7 to 8 mm., or in fruit 10 to 12 mm. long; petals minute or lacking.

Type in the U. S. National Herbarium, no. 690786, collected in Falcon Valley, Klickitat County, Washington, June 28, 1892, by W. N. Suksdorf (no. 1739).

This species differs from all others in the group by its leaves being membranaceous instead of subcoriaceous and from all except *H. tenuifolia* in its greenish flowers, the remainder having cream-colored flowers.

The following additional specimens have been examined:

WASHINGTON: Sumas Prairie, 1858, *Lyall*; Kitsap County, July, 1895, *Piper*; Seattle, *Piper* 2515; Tacoma, *Flett* 123; Montesano, *Heller* 4067; Falcon Valley, *Suksdorf* 1739 (type); Vancouver, *Piper* 4944; Upper Columbia, *Wilkes Exped.* 461 (this locality probably wrong, as many of the labels on Wilkes Expedition plants are undoubtedly misplaced).

OREGON: Cascade Mountains, *Cusick* 2675; Cascade Mountains, latitude 44°, *Newberry*; Farewell Bend, Crook County, *Leiberg* 481; Elk Creek, Jackson County, *Applegate* 2573; Lake of Woods, Klamath County, *Coville & Applegate*; Western Oregon, June, 1880, *Howell* 137; Silver Creek, *Hall* 161.

BRITISH COLUMBIA: Skidegate. Graham Island, Queen Charlotte Island, *Osgood* in 1890.

*Heuchera cylindrica* Dougl. (*H. columbiana* Rydb.) belongs to an exceedingly puzzling group of the genus. Rydberg, in the North American Flora, recognizes six species, mainly on the basis of leaf contour and pubescence. The characters assigned to the various species do not separate herbarium material into homogeneous units, and additional forms would require names if the scheme used were carried out fully. It would seem preferable to consider *Heuchera cylindrica* a polymorphous species with several intergrading subspecies. Typical examples of *Heuchera cylindrica* Dougl. are the following:

WASHINGTON: Loon Lake, July 20, 1897, *Winston*; Clark Springs, *Kreager* 71; Wenache Mountains, *Whited* 1134; Clark Springs, *Beattie & Chapman* 2019.

IDAHO: Near Lewiston, *Sandberg, Heller & McDougal* 161.

Just how the confusion as regards the identity of *Heuchera cylindrica* arose is difficult to say. In the Gray Herbarium is a specimen marked "Ex Hooker," which is not the true *H. cylindrica*, but the plant to which all American botanists have applied the name. Lindley<sup>1</sup> published a colored plate of *Heuchera cylindrica* from specimens grown in the garden of the London Horticultural Society, also stating that Douglas collected it "in dry mountain woods near the Kettle Falls." This plate evidently represents true *Heuchera cylindrica*, but modified by the conditions under which it was grown, so that it might easily be mistaken for the species here named *Heuchera chlorantha*.

<sup>1</sup> Edwards's Bot. Reg. 23: pl. 1924. 1837.

# NEW OR NOTEWORTHY SPECIES OF PACIFIC COAST PLANTS.

BY CHARLES V. PIPER.

The identity of many of the older described species of northwestern plants can only be settled by an examination of the original specimens. The conclusions reached from an examination of some of these are presented herewith, together with descriptions of several new species sent to me from time to time by various correspondents.

*Luzula arcuata major* Hook. Fl. Bor. Amer. 2: 189. 1840.

The type specimens of this collected by Tolmie on Mount Rainier is at Kew. It is identical with *Juncooides piperi* Coville.

*Alsine viridula* sp. nov.

Perennial, forming dense, prostrate, circular mats, 10 to 20 cm. broad; herbage entirely glabrous except for a few ciliate hairs at the bases of the leaves; stems 5 to 10 cm. long, green, scarcely shining, branched; leaves ovate, plane, short-acuminate, dull, rather thin, but the veins obscure, 5 to 15 mm. long, nearly as long as the internodes, each abruptly narrowed into a short petiole, this bearing a few long hairs; flowers solitary in the axils, the pedicels mostly shorter than the leaves; sepals oblong-ovate, acutish, green, with a narrow, white, scarious margin, thin, 3-nerved, 2 to 2.5 mm. long; petals none; pods green, ovoid, not longer than the calyx; seeds dark brown, 0.5 mm. long.

Type in the U. S. National Herbarium, no. 249940, collected on ridges south from Wiessners Peak, Idaho, July 28, 1895, by J. B. Leiberg (no. 1396). Growing in springy places in canyons, altitude 1,700 meters. Also collected along rivulets in woods, altitude 1,400 meters, in the Blue Mountains, Columbia County, Washington, July, 1896, by C. V. Piper (no. 2328).

This species is a close ally of *Alsine crispa* (Cham. & Schlecht.) Holzinger,<sup>1</sup> but that has a much looser habit, with internodes much exceeding the leaves, shining stems, less distinctly petioled leaves lacking the basal hairs, pedicels mostly exceeding the leaves, and thick, lanceolate sepals which are shorter than the capsule and when mature 3-ribbed. The seeds, too, are larger and paler.

*Alsine crispa* also occurs in Idaho and in the Blue Mountains, but it remains perfectly true in its characters.

*Oreobroma longipetala* sp. nov.

Root stout, simple or branched, about 6 cm. long; leaves linear, 2 to 3 cm. long, about 2 mm. wide; flowering stems simple or bearing 1 to 3 erect branches,

<sup>1</sup>*Alsine crispa* (Cham. & Schlecht.) Holzinger, Contr. U. S. Nat. Herb. 3: 216. 1895.

*Stellaria crispa* Cham. & Schlecht. Linnaea 1: 51. 1826.

much exceeding the leaves; bracts opposite or the upper alternate, sessile, ovate, mostly glandular-denticulate; flowers rose colored (?), long-pediceled; sepals truncate or slightly rounded, 4 to 5 mm. long, with very short, blunt, glandular teeth; petals 12 to 18 mm. long,

Type in the U. S. National Herbarium, no. 10881, collected in the Sierra Nevada, California, in 1875, by J. G. Lemmon.

Intermediate between *O. pygmaea* and *O. oppositifolia*.

***Arabis olympica* sp. nov.**

Perennial from a stout, slightly branched caudex; stems erect, simple, 6 to 10 cm. high, sparsely pubescent with branched hairs; basal leaves obovate to oblanceolate, obscurely crenate, obtuse, thickish, sparsely pubescent on the midrib and margins with simple hairs, the blade 5 mm. long on a shorter margined petiole; cauline leaves 3 to 8 mm. long, sessile, oblong to lanceolate, obtuse, entire or nearly so, the margins and midribs pubescent with mostly simple hairs; flowers corymbose, somewhat nodding, short-pediceled; sepals oblong, acutish, purple-tinged, 2 mm. long; petals white, as long as the sepals; pods erect, narrowly linear, obtuse, glabrous, 18 to 23 mm. long on stout, glabrous pedicels one-fourth as long; style stout, about 0.5 mm. long.

Type in the U. S. National Herbarium, no. 690787, collected near Humes Glacier, Mount Olympus, Washington, August 12, 1907, by J. B. Flett.

A near ally of *A. furcata* S. Wats., but distinguished by its much smaller flowers and the branched pubescence of the stem.

***Cheiranthus capitatus* Hook. Fl. Bor. Amer. 1: 38. 1829.**

The type of this, collected by Douglas "on rocky places of the Columbia near the sea," is in the Kew Herbarium, and a duplicate is in the British Museum. The plant is identical with *Erysimum elatum* Nutt. and has nothing to do with *Erysimum grandiflorum* Nutt., to which it has commonly been referred.

***Astragalus glareosus* Dougl.; Hook. Fl. Bor. Amer. 1: 52. 1830.**

Wholly on the basis of the description the writer identified this species somewhat hesitatingly with *Astragalus allanaris* Sheldon. In Hooker's description it was said to be "plentiful on dry gravelly banks of rivers, from the confluence of Lewis and Clarkes Rivers with the Columbia to the mountains." At Kew there are two sheets of Douglas's collecting, one labeled "On barren sandy grounds, common, a fine plant," and the other "Abundantly on sandy dry grounds in the interior of the Columbia, 1826." A duplicate of the second sheet is in the British Museum. All are flowering specimens of the plant later called *Astragalus allanaris* Sheldon. The plant of Colorado and Wyoming, heretofore referred to *Astragalus glareosus*, is quite different and is properly named *Astragalus argophyllus* Nutt.

***Lysimachia terrestris* (L.) B. S. P. Prel. Cat. N. Y. 34. 1888.**

*Viscum terrestre* L. Sp. Pl. 1023. 1753.

This species, not before recorded from west of the Rocky Mountains, has been collected at Shoalwater Bay, Washington, in ditches along a cranberry bog by Dr. Cora B. Eaton, July 1, 1910.

***Ligusticum scoticum* L. Sp. Pl. 250. 1753.**

According to Hooker<sup>1</sup> this plant was collected by Douglas at the mouth of the Columbia, and Gray<sup>2</sup> later identified one of Cooper's plants as this species—"not rare along the coast at Shoalwater Bay." What the Cooper

<sup>1</sup> Fl. Bor. Amer. 1: 265. 1834.

<sup>2</sup> U. S. Rep. Expl. Miss. Pacif. 12<sup>2</sup>: 62. 1860.

plant may be is uncertain, as the specimens have not been found either at Washington or in the Gray Herbarium. No Douglas specimens could be found either at Kew or in the British Museum, but in both herbaria are undoubted specimens of *Ligusticum scoticum* labeled "Fort Vancouver, ex Herb. Greville." While it would not be strange to find this plant on the Washington coast, inasmuch as it is common on the shores of Alaska, it has been collected by no recent botanist. It is quite certain that the plant does not grow at Fort Vancouver, and that the label is erroneous, as many other plants have been recorded from this place which do not occur there.

**Pentstemon cinereus** sp. nov.

Cespitose, with several to many slender erect stems from a much-branched woody base, the whole herbage densely and minutely canescent-puberulent and the inflorescence glandular; leaves all entire, subcoriaceous, the basal ones numerous, spatulate-lanceolate, acute, the blades 10 to 20 mm. long, usually a little shorter than the petioles; cauline leaves about 6 pairs, lanceolate, broadest at the sessile base, 2 to 3 mm. long, gradually reduced upwards, the margins somewhat involute; inflorescence narrow and strict, 10 to 20 cm. long, the puberulence becoming glandular especially on the peduncles and flowers; peduncles erect, 3 to 7-flowered; pedicels very short; calyx 2 mm. long, the broadly ovate sepals abruptly acute, not margined; corolla dark blue, tubular, 10 to 12 mm. long, slightly bilabiate, puberulent on the outside, slightly hairy within; sterile filament bearded at the top; anthers splitting their whole length.

Type in the U. S. National Herbarium, no. 690798, collected in dry rocky ground at Bend, Crook County, Oregon, July 4, 1907, by Kirk Whited (no. 3055a).

The species is perhaps most closely allied to *P. collinus* A. Nels.

**Plectritis congesta minor** Hook. Fl. Bor. Amer. 1: 291. 1834.

The original specimens of Douglas were said to be from "near the mouth of the Columbia." The specimens at Kew, apparently the originals, are labeled "near the ocean." They are merely small plants of *Plectritis congesta*, and have nothing to do with *Plectritis macrocera* Torr. & Gray, under which *P. congesta minor* Hook. was cited as a synonym in the Synoptical Flora. *Plectritis macrocera* is not known to occur west of the Cascade Mountains.

**Erigeron filifolius** (Hook.) Nutt. Trans. Amer. Phil. Soc. n. ser. 7: 308. 1841.

*Diplopappus filifolius* Hook Fl. Bor. Amer. 2: 21. 1834.

In the original description this plant, collected by Douglas, was said to be "Common on the Great Falls of the Columbia, and barren grounds of the interior." There has been doubt as to whether this name properly applies to the plant with yellow flowers named *Erigeron peucephyllus* by Gray,<sup>1</sup> or to a closely related species with violet or purple flowers. The doubt is probably traceable to Hooker's original description, where the rays are described as "flavescentibus." In the British Museum there are three sheets of Douglas's specimens labeled *Diplopappus filifolius*. One of these is inscribed "Sandy ground near the Great Falls of the Columbia, 1825." This plant is the species described as *Erigeron filifolius* in the Synoptical Flora of North America, and the sheet is doubtless the type or a duplicate type. The other two sheets are labeled "Dry grassy plains of the Columbia, 1826." Both are *Erigeron peucephyllus* Gray. In the Kew Herbarium are also three Douglasian sheets of *Diplopappus filifolius* Hook., but all represent the same species as the "Great Falls" plant in the British Museum. Thus it appears that Doctor Gray's treatment in the Synoptical Flora is correct and that Hooker was misled as

<sup>1</sup> Proc. Amer. Acad. 16: 89. 1810.

to the color of the rays either by their being faded, or, more likely, by the two sheets of *Erigeron peucephyllus* that he associated with the "Great Falls" plant. The question still remains open as to the identity of *Diplopappus linearis* Hook.<sup>1</sup> Search for the original specimens of this, both at Kew and at the British Museum, was unsuccessful. Doctor Gray cited the name with doubt as a synonym of *Erigeron ochroleucus* Nutt.

**Aster columbianus** sp. nov.

Stems slender, erect, 40 to 70 cm. high, somewhat puberulent, much branched above and bearing numerous crowded small heads; leaves linear, entire, acute, sessile by a broad base, 3 to 8 cm. long, glabrous, or nearly so, except the scabrous-ciliate margin; reduced leaves of the branches very numerous and more strongly ciliate; involucre turbinate, 5 mm. high; bracts linear, in about 3 series, somewhat squarrose, the outer cuspidate and ciliate, the inner acute and not ciliate, all green at the tips; rays violet, 4 to 5 mm. long; pappus sordid; achenes canescent.

Type in the U. S. National Herbarium, collected at Waitsburg Washington, by R. M. Horner.

In Contributions from the U. S. National Herbarium, volume 11,<sup>2</sup> this was referred to *A. amethystinus* Nutt., but that species has the leaves scabrous on both surfaces. The whole aspect is that of *Aster campestris* Nutt., but that has the inflorescence glandular.

The species has been collected as follows:

WASHINGTON: Wawawai, Piper 1602; Waitsburg, Horner 559 (type), 627; Okanogan River, Sereno Watson 191.

OREGON: Wallowa Mountains, Piper 2513.

**Aster delectus** sp. nov.

Stems puberulent, 10 to 30 cm. high; leaves entire, lanceolate or oblanceolate, acute, puberulent especially beneath, sessile by a narrowed base or the lower with margined petioles; inflorescence corymbiform, of 3 to 15 rather crowded small heads; involucre rather hemispheric, 5 mm. high; bracts pubescent but not ciliate, mostly obtuse, in about 3 series; rays violet, 5 mm. long; pappus sordid.

Type in U. S. National Herbarium, no. 411493, collected in a moist meadow near the Sycan River, Klamath County, Oregon, August 15, 1901, by W. C. Cusick (no. 2761).

A close ally of *A. occidentalis* Nutt.

**Aster paludicola** sp. nov.

Glabrous throughout, the rather slender stems 60 to 80 cm. high; leaves linear-lanceolate, sessile by a slightly narrowed base, entire, acute, 8 to 12 cm. long, 5 to 7 mm. wide, only the midnerve evident; inflorescence loosely cymose, the medium-sized heads few; involucre 6 to 8 mm. high, of 20 to 25 loose bracts in about three indistinct series; bracts glabrous, acute, green at tip, chartaceous below the middle; rays violet, 8 mm. long; pappus sordid achenes canescent.

Type in the U. S. National Herbarium, no. 620391, collected in Darlingtonia swamps, at Eight Dollar Mountain, Josephine County, Oregon, August 15, 1907, by C. V. Piper.

The species is remarkable for the few bracts to the involucre. Its alliance is apparently with *Aster occidentalis* Nutt.

<sup>1</sup> Fl. Bor. Amer. 2: 21. 1834.

<sup>2</sup> Page 572.



## THE AMERICAN SPECIES OF MEIBOMIA OF THE SECTION NEPHROMERIA.

By J. N. ROSE AND PAUL C. STANDLEY.

Of the several sections of the genus *Meibomia*, that designated as *Nephromeria* by Bentham<sup>1</sup> is one of the smallest. Besides the American species, a single one is known from Sumatra. Hitherto six American species have been recognized, one of which is but imperfectly known. Three additional ones are described in the present paper, making a total of nine.

The section *Nephromeria* is distinguished from the others of the genus by the few reniform or subreniform joints of the loment. In some species this reniform outline is not very pronounced, but there is always a more or less evident sinus along the dorsal suture of each joint.

The species fall readily into two groups. In the first, composed of but two species, *Meibomia mollis* and *M. scopulorum*, the loment are sessile, the 3 lowest joints usually do not develop, but are small and abortive, and the tips of the calyx lobes are subulate. Most important of all, the plants are low and erect. In the second group, which includes the seven other species, the loment are commonly stipitate, only the lowest joint (if any) is abortive, and the calyx lobes are flat and broad, far from subulate. Most, if not all, of the species of this group are coarse, high-climbing vines. The joints of their loment are generally much larger and broader than those of the smaller group.

But few specimens of these plants, excepting only *Meibomia mollis*, are found in herbaria. Explorations in Central America and southern Mexico during the last few years have supplied the U. S. National Herbarium with ampler material, among which we have detected several apparently undescribed species, besides representatives of all but one of those previously known.

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<sup>1</sup> In Benth. & Hook. Gen. Pl. 1: 520. 1865, as a subsection of the section *Heteroloma*.

## KEY TO THE SPECIES.

- Three lowest joints of the loment usually not developing, twisted; loment sessile; tips of the calyx lobes subulate.
- Leaflets linear-lanceolate; terminal joint of the loment semiorbicular ----- 1. *M. scopulorum*.
- Leaflets lance-ovate; terminal joint of the loment elliptic-oblong, abruptly narrowed at both ends ----- 2. *M. mollis*.
- Only the lowest joint, or sometimes none, abortive, the joints not twisted; loment usually stipitate; tips of calyx lobes not subulate.
- Flowers and fruit in a dense panicle; often more than two joints of the loment developing ----- 3. *M. skinneri*.
- Flowers and fruit not in a dense panicle, the inflorescence open; never more than two joints of the loment developing.
- Leaflets orbicular, rounded at the apex ----- 4. *M. painteri*.
- Leaflets ovate or lanceolate, acute or acutish.
- Leaflets thick, glabrous, and shining above ----- 5. *M. metallica*.
- Leaflets thin, pubescent, and dull above.
- Loment sessile; leaflets with a broad, silvery stripe along the midrib ----- 6. *M. albonitens*.
- Loment conspicuously stipitate; leaflets not striped.
- Leaflets apiculate; joints very large, 25 to 30 mm. long ----- 7. *M. lunata*.
- Leaflets not apiculate; joints smaller, less than 20 mm. long.
- Joints narrowed at the base; leaflets lance-ovate ----- 8. *M. angustata*.
- Joints not narrowed at the base; leaflets ovate ----- 9. *M. barclayi*.

1. *Meibomia scopulorum* (S. Wats.) Rose & Standley. PLATE 51, b.

*Desmodium scopulorum* S. Wats. Proc. Amer. Acad. 24: 47. 1889.

Stems erect, slender, much branched, pale, minutely uncinately puberulent; leaves trifoliolate; petioles slender, 30 to 35 mm. long, striate, puberulent; leaflets linear-lanceolate, 55 to 80 mm. long, acute, rounded at the base, glabrous except along the minutely uncinately veins; stipules lanceolate, long-acuminate, persistent; petiolules 2 mm. long; inflorescence of terminal or axillary, slender panicles or racemes, the branches minutely puberulent; flowers solitary or in twos, on slender pedicels 10 mm. long; calyx teeth ovate, with subulate tips; corolla not seen; bracts filiform, short; loment sessile, of usually 4 joints, all except the terminal one abortive, the lowest three twisted, densely puberulent; terminal joint semiorbicular, 10 mm. long, with scarcely any suture on the upper edge, the walls thin, finely puberulent.

Type locality, "Guaymas," Sonora, Mexico. Type collected by Dr. Edward Palmer in 1887 (no. 258).

*Specimens examined:*

SONORA: On rocky ledges in the mountains about Guaymas, 1887, Palmer 258, type collection.

**2. Meibomia mollis** (Vahl) Kuntze, Rev. Gen. Pl. 198. 1891. PLATE 51, *d*.*Hedysarum molle* Vahl, Symb. Bot. 2: 83. 1791.*Desmodium molle* DC. Prodr. 2: 332. 1825.

Stems erect, stout, herbaceous, much branched, minutely uncinat-puberulent; petioles 35 mm. long or less, those of the uppermost leaves very short, uncinat-puberulent; leaflets 3, ovate to lanceolate, 24 to 70 mm. long, rounded or sometimes subcordate at the base, acutish, of about the same color on both surfaces, sparingly puberulent above, finely soft-pubescent beneath; petiolules 2 or 3 mm. long; stipules 4 mm. long, triangular-subulate; inflorescence mostly of axillary and terminal simple racemes disposed so as to form a panicle, the racemes 25 cm. long or less; flowers usually in clusters of 3 or 4, on slender pedicels 6 mm. long; bracts short, filiform, villous, deciduous; calyx cleft almost to the base, the lobes about equal, lanceolate, puberulent, their tips subulate; corolla greenish yellow, 3 or 4 mm. long; loment sessile, of usually 4 joints, all except the terminal one abortive, twisted, densely puberulent; terminal joint elliptic-oblong, somewhat narrowed at both ends, 9 mm. long, with a shallow sinus on the upper edge, minutely pubescent, with thin, membranous walls.

Type locality, Island of St. Croix, West Indies.

*Specimens examined:*

PORTO RICO: Sandy soil, Culebra, March, 1906, *Britton & Wheeler* 238; Juana-Diaz, "ad vias circa Escalabrado," November 30, 1885, *Sintenis* 2900.

ST. CROIX: Jerusalem, January 8, 1896, *Ricksecker* 198.

CUBA: Limestone hillside, Guantanamo Bay, March, 1909, *Britton* 1940.

COSTA RICA: Forêts de Nicoya, January, 1900, *Tonduz*, Inst. Fís. Geogr. Costa Rica 13590.

MEXICO: Limestone ledges near Iguala, Guerrero, October 25, 1900, *Pringle* 9264; Tomellin Canyon, Oaxaca, September 7, 1906, *J. N. & J. S. Rose* 11327.

The Mexican specimens differ in having the terminal joint glabrous except along the margin, where it is minutely puberulent; otherwise there seems to be no essential difference from West Indian specimens.

**3. Meibomia skinneri** (Benth.) Kuntze, Rev. Gen. Pl. 198. 1891. PLATE 51, *h*.*Desmodium skinneri* Benth.; Hemsl. Diag. Pl. Mex. 3: 47. 1880.

Stems stout, suffrutescent, usually erect, glabrous in age, the younger branches with dense, retrorse, soft pubescence, the hairs usually tawny; leaves numerous, large, trifoliolate; petioles stout, 5 cm. long or less, soft-pubescent, striate; stipules lanceolate, 7 or 8 mm. long, deciduous, membranaceous, strigillose; leaflets ovate to oblong or rhombic-lanceolate, often unequal at the base, the terminal one largest and broadest, 12 cm. long or less, acutish to obtuse at the apex, rounded at the base, sparingly strigillose above, paler and densely velvety-pubescent beneath, the pubescence tawny along the veins, elsewhere white; petiolules very short and stout; inflorescence a dense, much branched, leafy or naked, terminal panicle, axillary racemes or panicles often present, the branches often sparingly uncinat; flowers on filiform pedicels 3 mm. long; bracts subulate, very short, hirtellous, deciduous; calyx appressed-pubescent, scarcely bilabiate, the teeth ovate and acute; corolla deep purple, 6 or 7 mm. long; loment of usually 3 joints, raised on a slender stipe 2 or 3 mm. long; constrictions very narrow; joints semiorbicular, with thin, mem-

branous walls, 11 to 13 mm. long, 7 mm. wide, with a very shallow sinus on the upper side, puberulent when young, becoming glabrous.

Type locality, "Guatemala." Type in the Kew Herbarium, collected by Skinner (no. 37).

*Specimens examined:*

GUATEMALA: 1891, *J. D. Smith*; Garrucha, Depart. Chimaltenango, alt. 1350 meters, March, 1892, *Heyde & Lux* 3287; 1892, *Heyde* 519; Lake Amatitlan, February 11, 1905, *W. A. Kellerman* 4355.

MEXICO: Roadside between Mascota and San Sebastian, Jalisco, March 14, 1897, *E. W. Nelson* 4049; roadside between San Sebastian and the summit of the mountain known as the "Bufa de Mascota," Jalisco, alt. 1800 meters, March 20, 1897, *Nelson* 4109.

4. *Meibomia painteri* Rose & Standley, sp. nov.

PLATE 51, a.

Stems herbaceous, climbing, stout, angled, rather sparingly uncinat-hirsute; leaves large, trifoliolate; petioles 3 to 7 cm. long, stout, uncinat-hirtellous; leaflets orbicular or broadly oblong, all of about the same size, 3 to 8 cm. long, sparingly strigillose above and more densely so beneath, slightly paler beneath, the veins large and conspicuous; petiolules stout, 5 to 7 mm. long, hirtellous; stipules persistent, ovate; inflorescence of simple, axillary racemes, or these sometimes sparingly branched, 2 or 3 from each axil, the branches uncinat-puberulent; flowers not seen; pedicels 6 mm. long; bracts deciduous; loment of 1 or 2 joints, on a stipe 3 mm. long, the lower joint often abortive, the terminal one sometimes smaller than the basal; constrictions very narrow; joints orbicular-reniform, 10 to 12 mm. long and almost as wide, with a shallow suture upon the upper edge, the center hard and turgid, surrounded by a rather thin wing, the whole strongly reticulate-veined, sparingly and very finely puberulent.

Type in the U. S. National Herbarium, no. 690911, collected in Iguala Canyon, near Iguala, Guerrero, Mexico, September 21, 1905, by C. G. Pringle (no. 13688).

From all other species of the group this may at once be distinguished by its orbicular leaflets and the peculiar inflorescence. The joints of the loment, too, are not like those of any other species.

The species is named for Mr. J. H. Painter, formerly Assistant Curator in the Division of Plants of the U. S. National Museum, who, at the time of his death, was preparing to monograph the genus *Meibomia*. He had indicated this plant as a new species in the herbarium, but failed to give it a name.

5. *Meibomia metallica* Rose & Standley, sp. nov.

PLATE 51, c.

Stems stout, climbing, suffrutescent below, smooth, conspicuously uncinat-hirtellous; leaves ample, numerous, trifoliolate; petioles 25 to 60 mm. long, rather slender, uncinat-hirtellous; stipules lanceolate, attenuate, deciduous; leaflets ovate to ovate-lanceolate, rounded at the base, acute, mucronate, 7 to 11 cm. long, glabrous and shining above with an almost metallic sheen, thick and coriaceous, sometimes sparingly pubescent in the youngest leaves, densely soft-pubescent or sericeous beneath, most of the hairs whitish but those along the conspicuous veins bright yellow and longer; petiolules stout, 2 or 3 mm. long, densely pubescent with tawny hairs; inflorescence of terminal, sparingly branched panicles, or of simple, axillary racemes, the branches stout, densely uncinat-hirtellous; flowers on slender pedicels 6 mm. long; bracts soon deciduous, lanceolate, long-acuminate, 4 mm. long, hirsute; calyx finely puberulent, large, about 4 mm. long, almost equally 5-toothed, the teeth ovate, abruptly short-acuminate; corolla purple; loment raised on a slender stipe 3 mm. long, of usually 2 joints, the lower one often abortive; joints quadrate-orbicular, almost straight on the upper edge but with an obtuse suture 2.5 mm. deep, about

20 mm. long, thin, conspicuously reticulate, finely hispidulous; constrictions very narrow.

Type in the U. S. National Herbarium, no. 408084, collected by O. F. Cook and R. F. Griggs at Cajabon, Alta Verapaz, Guatemala, March 30, 1902 (no. 354). The specimen on this sheet is in fruit, but a flowering branch of the same collection is mounted on sheet no. 408083. The thick leaflets, glabrous and shining on the upper surface, distinguish the plant from all the related species, but good additional characters are found in the fruit.

*Other specimens examined:*

GUATEMALA: Sehachicha, Alta Verapaz, March, 1902, *H. von Tuerckheim* 8367.

**6. *Meibomia albonitens* (Lem.) Rose & Standley.**

*Rhynchosia?* *albonitens* Lem. Ill. Hort. Lem. 1861: pl. 290. 1861.

*Desmodium skinneri albolineatum* Hook. Curtis's Bot. Mag. pl. 5452. 1864.

*Desmodium skinneri albonitens* Hook. loc. cit.

*Desmodium scutatum* Hemsl. Diag. Pl. Mex. 3: 46. 1880.

*Meibomia scutata* Kuntze, Rev. Gen. Pl. 198. 1891.

Type locality, "Tierras templadas" of Mexico. The species was described from plants cultivated from seeds collected by Ghiesbreght.

We have seen no specimens corresponding to the plates cited and to Hemsley's description of the species. That author describes the lomenta as subsessile and the joints as being one to one and one-half inches in diameter. The leaflets are illustrated as having a lighter, silvery stripe running along the midribs. None of our specimens of the section *Nephromeria* agree with these requirements. *Meibomia lunata* seems to be very closely related and comes from about the same region where *M. albonitens* was probably collected, but that species has conspicuously stipitate lomenta and its leaflets are of the same shade of green throughout.

**7. *Meibomia lunata* (T. S. Brandeg.) Rose & Standley.**

PLATE 51, *f*.

*Desmodium lunatum* T. S. Brandeg. Zoe 5: 246. 1908.

Stems somewhat woody below, climbing, slender, the older ones glabrous, the younger uncinat-hirtellous; leaves trifoliolate; stipules deciduous; petioles slender, 2 to 5 cm. long, uncinat; leaflets all of about the same size, 55 to 95 mm. long, lanceolate, acute, mucronate, dull green above, paler beneath and densely sericeous, sparingly strigillose above, the veins few and inconspicuous; petiolules stout, 2 to 3 mm. long, villous; inflorescence of terminal or axillary simple racemes or panicles, with uncinat-puberulent branches; flowers on slender pedicels 2 or 3 mm. long; bracts deciduous, less than 4 mm. long, lanceovate, acuminate, reddish, pilose with yellowish hairs; calyx sparingly villous, the teeth ovate, acuminate; corolla purplish, 5 or 6 mm. long; joints large, 24 mm. long or less and almost as wide, quadrate-orbicular, with an acute suture 5 mm. deep on the upper edge, conspicuously reticulate-veined, puberulent, usually with an acute beak at the apex; constrictions 1 to 2 mm. wide.

Type locality, "In openings of forests near Zacuapan," Vera Cruz, Mexico. Type collected in 1906 by C. A. Purpus, no. 1907.

*Specimens examined:*

MEXICO: Zacuapan, Vera Cruz, 1906, *Purpus* 1907, type collection; Zacuapan, January, 1907, *Purpus* 2961.

**8. *Meibomia angustata* Rose & Standley, sp. nov.**

PLATE 51, *g*.

Stems slender, flexuous, herbaceous, the older ones almost glabrous, the younger very finely and rather sparingly uncinat-puberulent; leaves numerous,

trifoliolate; petioles slender, 17 to 30 mm. long, angled, finely retrorse-pubescent; stipules deciduous; leaflets ovate-lanceolate, rounded at the base, obtuse, 24 to 80 mm. long, of about the same color on both surfaces, sericeous on both sides, more densely so beneath; petiolules stout, 3 mm. long, densely pubescent; inflorescence of few, rather remote, simple racemes 17 cm. long or less, the slender branches puberulent; flowers on slender pedicels 1 to 2 mm. long; bracts subulate or lanceolate, very small, early deciduous; calyx finely pubescent, the teeth triangular, acute; corolla deep purple, 5 mm. long; loment of a single joint, raised on a slender stipe 2.5 mm. long; joints semiorbicular, 15 mm. long, conspicuously narrowed and acute at the base, rounded at the apex, with an obtuse sinus 2 mm. deep on the upper edge, finely puberulent, the walls very thin and transparent, the persistent and very slender style 3 mm. long.

Type in the U. S. National Herbarium, no. 327048, collected along the roadside between San Sebastian and Las Palmas, Jalisco, Mexico, altitude 300 to 600 meters, March 30, 1897, by E. W. Nelson (no. 4126).

This plant is more closely related to *M. skinneri* than to any other member of the group, but it differs in the uniformly solitary joint, deep sinus, narrow base of the joint, and more scanty and open inflorescence. It is impossible to tell from our specimens whether the stems are erect or climbing.

9. *Meibomia barclayi* (Benth.) Rose & Standley.

PLATE 51, e.

*Desmodium barclayi* Benth. Bot. Voy. Sulph. 83. 1844.

Stems herbaceous, climbing, flexuous, uncinat-hirtellous, the branches diverging almost at right angles to the main axis; leaves trifoliolate; petioles 2 to 3 cm. long, uncinat-hirtellous; leaflets broadly ovate to rhombic-ovate, the terminal one largest, about 4 cm. long, the lateral ones 2 to 3 cm. long, all puberulent on both surfaces, paler beneath; petiolules about 1 mm. long; stipules semiovate, acuminate, 4 mm. long, striate; inflorescence of terminal or axillary, sparingly branched panicles, these usually about 10 cm. long, the branches sparingly uncinat; flowers not seen; loment of usually 2 joints connected by a very narrow isthmus, raised on a stipe 3 mm. long, the pedicels 4 or 5 mm. long; joints reniform-orbicular, 9 to 12 mm. long and almost as wide, with an acute suture 2 mm. deep upon the upper edge, the central portion hard and turgid, brown, surrounded by a broad and thin, green wing, the whole conspicuously reticulate, glabrous except along the puberulent edges.

Type locality, "Central America." Type collected by Barclay. Hemsley cites<sup>1</sup> a specimen of Barclay's from Nicaragua. This is probably the type.

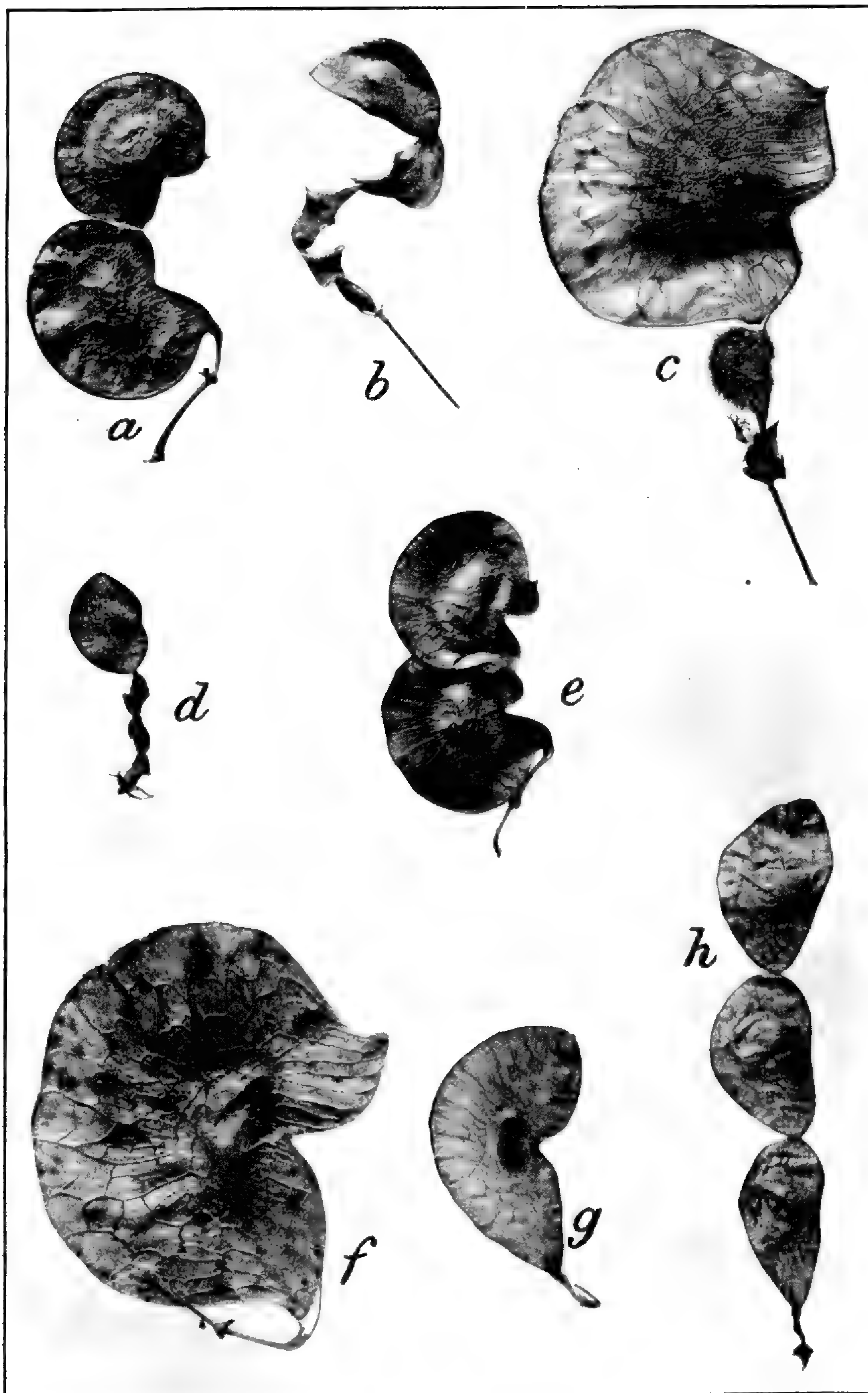
*Specimens examined:*

COSTA RICA: Buissons á Nicoya, January, 1900, *Tonduz*, Inst. Fís. Geogr. Costa Rica, no. 13577.

The specimen cited answers the original description of *Desmodium barclayi* very well, and is the only such plant examined.

EXPLANATION OF PLATE 51.—Loment, *a*, of *Meibomia painteri*, from type specimen; *b*, of *M. scopulorum*, from a specimen of the type collection; *c*, of *M. metallica*, from type specimen; *d*, of *M. mollis*, from a specimen collected by Ricksecker (no. 198) at Jerusalem, St. Croix; *e*, of *M. barclayi*, from Nicoya, Costa Rica, *Tonduz* 13577; *f*, of *M. lunata*, from a specimen of the type collection; *g*, of *M. angustata*, from type specimen; *h*, of *M. skinneri*, from specimen collected by Heyde and Lux, near Garrucha, Guatemala (no. 3287). All twice natural size.

<sup>1</sup> Biol. Centr. Amer. Bot. 1: 275. 1880.



FRUITS OF EIGHT SPECIES OF MEIBOMIA.

# RAIMONDIA, A NEW GENUS OF ANNONACEAE FROM COLOMBIA.

By W. E. SAFFORD.

While studying the Annonaceae in the United States National Herbarium the writer came upon a specimen from the interior of Colombia, collected by Prof. Henry Pittier, with peculiarities rendering it so distinct from all recognized genera of that family as to require its segregation as a new genus.

The flowers and fruit of the plant bear a superficial resemblance to those of chirimoya (*Annona cherimola* Mill.) and its allies; but the plant is monœcious, and the inner petals instead of being minute and scale-like, as in the flowers of the chirimoya, are valvate and triangular, forming a tent-like covering to the sexual organs. The most radical difference, however, which requires this plant to be set apart from all other Annonaceae is in the peculiar form of the stamens. In *Annona* and *Rollinia*, which have compound fruits (syncarpia), as well as in our own *Asimina* and many other genera of the family, the connective of the stamens is more or less expanded into a terminal head or hood-like covering above the two pollen sacs. In Professor Pittier's plant the two pollen sacs are terminal without the slightest indication of the elongation or expansion of the connective. Indeed, the stamens differ so radically from those of typical Annonaceae that one would be inclined to separate the plant from that family were it not that its other characteristics are those of the Annonaceae, namely: Two-ranked, alternate leaves without stipules, 6-petaled flowers with the petals in 2 series, and seeds with copious, ruminant albumen and minute basal embryo. In addition to these general features, the punctate, short-petioled, feather-veined, entire leaves, and the compound fleshy fruit (syncarpium) point to its alliance with the custard apples or *Annonas*.

**RAIMONDIA** gen. nov.

Arborescent; leaves deciduous, 2-ranked, entire, minutely punctate; flowers monœcious, nodding, closely crowded on extra-axillary branchlets often opposite a leaf or issuing from old bark; sepals 3, valvate, persistent, much smaller



than the petals, broadly ovate or triangular, cohering at the base; petals 6, hypogynous, in 2 series, coriaceous, valvate; outer petals lanceolate, concave at the base, when mature much longer than the inner; inner petals (those only of male flowers observed) ovate forming a pyramidal covering to the andrœcium; receptacle (torus) hemispherical or conoid; stamens closely crowded in a broadly ovoid or conoid mass; filaments short and thick, bearing at their extremity a pair of contiguous pollen sacs, somewhat like those of the genus *Annona*, but much shorter and without the characteristic annonaceous hood-like or capitate, expanded connective above them; female flower long-peduncled (when mature); carpels numerous, coherent, closely crowded on the torus; ovules solitary; fruit oblong, resembling that of an *Annona*, formed by the consolidation of the carpels into a fleshy mass around the elongated torus as an axis; seeds enveloped when fresh by a thin membranous aril; testa thin, glabrous, impressed with shallow pits; albumen ruminant as in other *Annonaceae*, with the minute embryo embedded in its base.

Type species, *Raimondia monoica*.

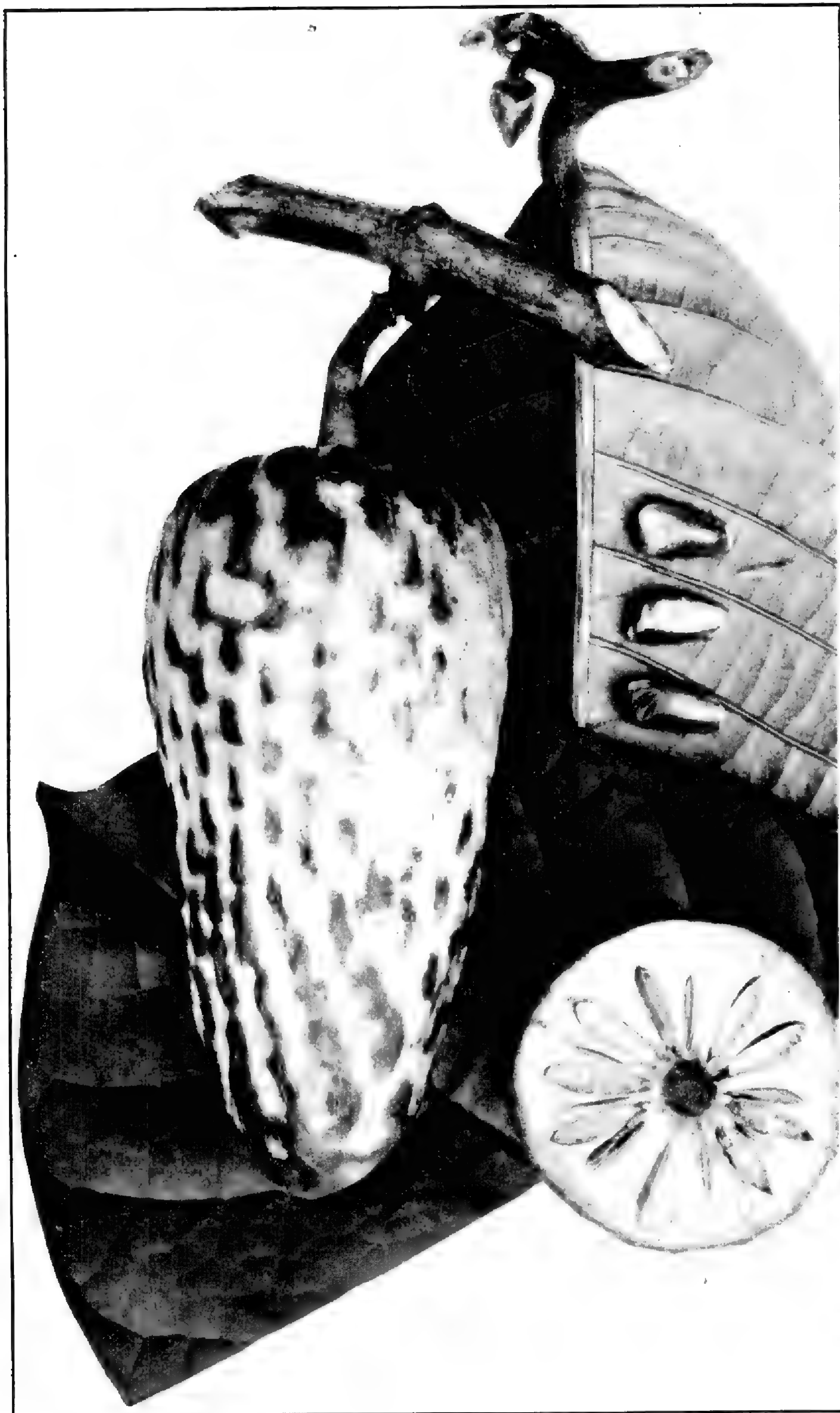
The genus is named in honor of the eminent geographer and naturalist, Prof. Antonio Raimondi, in recognition of his valuable scientific work in many fields and in grateful acknowledgment of his kindly assistance to a young botanist studying the vegetation of the shores and mountains of his adopted country.<sup>1</sup>

***Raimondia monoica* sp. nov.**

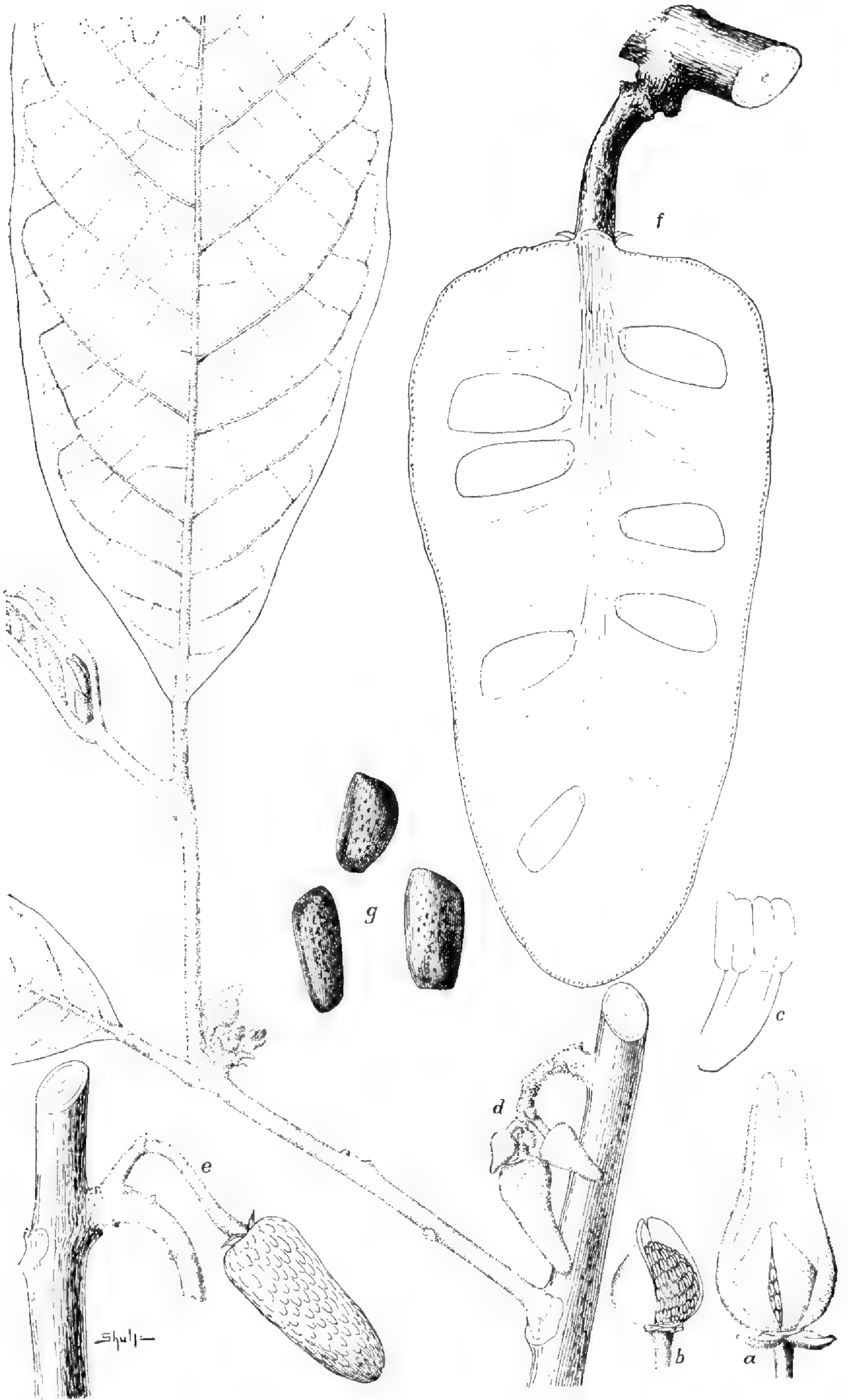
PLATES 52, 53.

A small tree with the younger parts densely ferruginous-tomentose; branches at length glabrate, terete, grayish brown; leaf blades obovate to oblanceolate, 13 to 23 cm. long and 5 to 12.5 cm. broad, membranaceous, usually acute at the base (sometimes somewhat rounded), abruptly acuminate, feather-veined, undulate, at first densely ferruginous-tomentose on both sides, at length sparsely so except along the prominent midrib and lateral veins beneath, these persistently ferruginous-tomentose; petioles with a similar indument, 10 to 15 mm. long, with a longitudinal groove above, this a continuation of the impressed channel along the midrib; inflorescence densely ferruginous-tomentose, consisting of several flowers closely crowded on short extra-axillary branchlets, these often issuing from the old wood or from a point opposite a leaf; peduncles 5 to 15 mm. long, densely ferruginous-tomentose with a broad, clasping, ovate, acuminate bracteole below the middle and one at the base; flowers monœcious, the pistillate flower issuing from the base of the flowering branchlet (in the specimens examined) and several staminate flowers occupying the remainder; calyx divisions broadly ovate or triangular, abruptly acuminate, 2.5 mm. long and 2.5 mm. broad at the base, ferruginous-pubescent; outer petals valvate, lanceolate, rounded at the apex, 15 to 20 mm. long and 7 to 8 mm. broad, with

<sup>1</sup> Raimondi, Antonio. Born at Milan, 1825; died at Lima, Peru, December, 1890. An eminent geographer and naturalist. He went to Peru in 1850, and spent twenty years in traveling and collecting material for his great work on the geography and natural history of the Republic. This was to have been printed at the expense of the nation, and three preliminary volumes appeared (1874, 1876, and 1880). The edition of the fourth volume was destroyed by the Chileans in 1881, and after the war the publication was interrupted; but the materials collected by Raimondi, including his valuable herbarium, are preserved by the Peruvian Geographical Society. Included in his great work, *El Peru*, are accounts of the vegetation of various parts of the Republic. He also published *Elementos de la Botánica* for the use of schools (Lima, 1857), and during the latter part of his life he was professor of botany and zoology at Lima. See Amat di San Filippo, Stud. Biogr. Vlagg. Ital. p. 597. 1882.



RAIMONDIA MONOICA SAFFORD.



RAIMONDIA MONOICA SAFFORD.

a ferruginous, silky pubescence on the outside; inner petals triangular, concave, rounded at the apex, 7 to 8 mm. high and 6 to 7 mm. broad at the base, forming a cone-like covering over the sexual organs; receptacle hemispherical or conoid in the male flower, in the female flower elongating at length into a linear axis, the carpels radiating around this at right angles; male flowers without vestiges of carpels; stamens very numerous, the pollen sacs terminal contiguous, oval, dehiscing on the back by a median longitudinal slit; filament stout and fleshy; female flowers with very numerous one-ovuled carpels closely crowded and cohering, forming an oblong gynœcium, this developing into a glabrous, thin-skinned compound fruit about 10 cm. long and 5 cm. in diameter, shaped somewhat like an ear of maize, depressed at the base, and rounded at the apex, borne on a peduncle 2 to 2.5 cm. long; seeds oblong-obovate, flattened laterally and usually obliquely truncate at the apex, sharp-edged, enveloped when fresh in a thin membranous aril as in the genus *Annona* and surrounded by scant pulp; testa chestnut-colored, thin and brittle, with the surface glabrous and shining but punctate with shallow pits, rough on the inner surface to conform with the grooves of the endosperm, this ruminant as in other Annonaceae and with the minute embryo embedded in its base.

The staminate flowers shrivel up and fall off after having performed their function, and the peduncles of the pistillate flower elongate and thicken as the fruit matures. The large obovate, membranaceous, undulate leaves with their short petioles, somewhat resemble those of *Annona purpurea*. The branches, however, are not conspicuously covered with lenticels, as in many Annonaceae, though these are present in the grayish brown bark of the older branches.

Type in the United States National Herbarium, nos. 531655 and 531656, collected from the same tree, at the Alto de Primicias, near Jambaló, Rio Palo basin, Tierra Adentro, Cordillera Central of Colombia, altitude 2,600 meters, latitude about 2° 25' north, February 5, 1906, by Prof. Henry Pittier (no. 1456). Only a single tree was observed.

EXPLANATION OF PLATES 52, 53.—Plate 52, leaf and fruit. Reproduced from a field photograph taken by C. B. Doyle. Natural size. Plate 53, details of inflorescence and fruit. *a*, Male flower from which one outer petal has been removed, showing the three inner valvate petals covering the andrœcium; *b*, male flower from which the calyx, outer petals, and one inner petal have been removed, showing the andrœcium; *c*, stamen composed of thick fleshy filament and a pair of pollen sacs, seen from the outside or back; *d*, inflorescence from the base of which a female flower has been broken; *e*, young fruit with persistent calyx; *f*, mature fruit: cross-section showing the seeds inclosed in their membranous arils; *g*, seeds with aril removed showing the glossy, glabrous testa. *a*, *b*, Scale about 2; *c*, scale 20; *d*, *e*, *f*, *g*, natural size. Drawings by J. M. Shull.

# FOUR NEW SPECIES OF GOLDENROD FROM THE EAST-ERN UNITED STATES.

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BY E. S. STEELE.

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The *Solidagos* here described are all kindred plants, but the first seems to connect more with the American *virgaurea* types and the other three rather with the *speciosa* group. The latter would all probably be referred to *S. rigidiuscula*, if to any recognized species.

Consulting on the one hand the original description<sup>1</sup> and on the other the material in the National Herbarium, by *S. rigidiuscula*, we should understand a plant 50 to rarely 90 cm. high with the leaves thick, crowded throughout, none of them much enlarged, the inflorescence (at least normally) narrow and dense, the heads distinctly smaller than those of *S. speciosa*. This would admit several Northern specimens with somewhat thinner leaves and a much less xerophytic aspect, which may eventually be regarded as distinct, but would exclude forms from east of Lake Michigan with the lower leaves more separated and enlarged. It would also exclude *S. venulosa* Greene,<sup>2</sup> a plant ranging from Texas to Kansas, sharply distinguished by its larger heads. The three new species all have the heads rather small, but differ in inflorescence and foliage.<sup>3</sup>

*Solidago castrensis* Steele, sp. nov.

Stem erect, 60 to probably 75 cm. high, rather slender, very smooth, glabrous nearly or quite to the inflorescence, upwards increasingly though moderately hispidulous; foliage sparse, the lower internodes 3 to 5 cm. long, those above gradually somewhat shortened; about five of the lower leaves clearly petiolate, the longest petioles 5 cm. long, somewhat margined but involute and appearing slender, a few of the lowest with vestiges of a hispid ciliation near the insertion; largest leaves 12 to 14 cm. long, their blades narrowly elliptic-obovate, 25 to 35 mm. wide, acute or often apiculate, at length cuneately narrowed into the petiole, serrate for at least the upper half with strongly mucronate teeth; remaining leaves subpetiolate or at last merely attenuate at the base, more finely serrate or sometimes almost entire; all the leaves moderately thick, coriaceous, the slightly upturned margin obscurely roughened, otherwise smooth and glabrous,

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<sup>1</sup>Torr. & Gray, Fl. N. Amer. 2: 205. 1842.

<sup>2</sup>Pittonia 5: 138. 1903.

<sup>3</sup>The note may be here appended that the plant intended by me in Contributions, volume 13, page 371, under the name *Solidago missouriensis* was *S. glaberrima* Mart.

with two or three pairs of fairly distinct pinnate veins, the reticulation obvious but not obtrusive; bracts leaf-like and exceeding the clusters for more than half the length of the inflorescence, this loose at the base, more compact above, cylindrical, the racemes usually only 2 cm. long, but sometimes more developed, slightly if at all compounded, rather acutely ascending; heads narrowly campanulate, 5.5 to 6.5 mm. deep; longer tegules<sup>1</sup> linear to linear-oblong, obtuse, especially in broader states, the tips sometimes wider than the body, sometimes with an incipient isthmus, an oval, herbaceous spot on the back extending as a line far downward; disk flowers 8 to 10; ray flowers 6 to 8; blade of rays oval, 2 mm. long, 1 to 1.2 mm. wide; achenes small, glabrous.

Type in the U. S. National Herbarium, no. 670444, collected at Camp Douglas, Juneau County, Wisconsin, September 9, 1890, by Dr. E. A. Mearns (no. 96).

Besides the type specimen there are from the same collector and the same locality another sheet of the same number, but dated September 13, and two others numbered 98 dated September 9. There are two sheets of *Mearns* 96 which belong apparently to two other species.

The specimens more resemble *S. erecta* than does any other Western material seen, having not only a cylindrical inflorescence but a similar distribution of the foliage. I think, however, that the species really connects most directly with *S. sciaphila*<sup>2</sup> and *S. gillmani*,<sup>3</sup> a view countenanced by the location; in any case it is not remote from these. It differs from *S. erecta* in its much lower stature, its less spreading branches, the more petiolate tendency of the lower leaves, and its smaller heads and narrower rays and tegules. It differs from *S. sciaphila* in its much narrower and differently shaped leaves, these also somewhat thicker and firmer, and in its somewhat smaller heads with less herbaceous involucre. It is a much less heavy plant than *S. gillmani* and erect in habit, with far smaller heads.

***Solidago chandonnetii* Steele, sp. nov.**

Stem 50 to 75 cm. high, of medium thickness, somewhat decumbent at the base and moderately arcuate, also irregularly somewhat flexuous, glabrous well into the inflorescence, the summit and the distal part of the branches thinly clothed with short, stout, ascending hairs; lower internodes little longer than the upper, the leaves rather numerous but not crowded; foliage habit unequally fusiform, the leaves longest about one-third the distance from base to inflorescence; none of the leaves much lengthened, the largest about 12 cm. long, the lower all petiolate, the upper subpetiolate or at last merely with an attenuate base; blades of the lower leaves oblong, at least a few of them ovately narrowed or even rounder at the apex, those of the middle leaves obovate-lanceolate, acute or nearly so, the remaining leaves reducing to oblanceolate, continuing 3 cm. long up to the inflorescence; all the leaves of medium thickness, firmly coriaceous, roughened on the slightly upturned margin, otherwise smooth and glabrous, pinnately veined but the veins conspicuous only in the lower leaves, rather densely reticulate all over, the lines somewhat more prominent beneath; inflorescence paniculate, ovoid, in weaker specimens more narrowly so, rather dense, the racemes contiguous or a little separated, the upper racemes simple, the lower moderately compounded, the heads numerous; heads narrowly campanulate, only 4 to 5 mm. deep; medial tegules oblong, the inner linear-oblong, both varying somewhat in width, ovately tipped or more rounded; all firm in texture, slightly herbaceous in the middle as indicated by a brown line, somewhat glutinous, minutely double-keeled, the ridges tending to form a loop above, but this mostly obscure; disk flowers about 6 to 8, ray flowers about 5 to 7.

<sup>1</sup> Involucre bracts.

<sup>2</sup> Contr. Nat. Herb. 13: 371. 1911.

<sup>3</sup> Op. cit. 367.

Type in the U. S. National Herbarium, no. 691211, collected at Perham, Ottertail County, Minnesota, August 6, 1912, by Rev. Z. L. Chandonnet.

The National Herbarium has a second specimen of the same collection and another from the same locality, August 10, 1911, *Chandonnet* 3789; also (later received) from the same collector, unnumbered, two specimens from the Ottertail River, August 13, 1912; three from Perham, August 22, 1912; and two from Luce, Ottertail County, August 23, 1912. There is besides these also a sheet with two good plants from Zumbrota, Goodhue County, Minnesota, August, 1892, *C. A. Ballard*.

The habitat is indicated as sometimes dry, sandy soil, sometimes prairie.

This species differs from *S. rigidiuscula* in its sparser, biserial foliage and its ovoid panicle. It has in its foliage a distinct look toward *S. fisheri*, but it is a lower and relatively stouter plant with a larger and more dense inflorescence, smaller heads, and heavier involucres.

The National Herbarium is indebted to Father Chandonnet for other important communications.

***Solidago fisheri* Steele, sp. nov.**

Stem 80 to 90 cm. high, reducible to 60 cm., slender, smooth nearly or quite to the inflorescence, there thinly or distally more thickly, hispidulous; lower and upper stem leaves well differentiated; four or five lower internodes 3 to 5 cm. long, the corresponding leaves (excluding imperfect ones at base) well petioled, the largest 11 to 17 cm. long, the blades oblong or, especially below, narrowly obovate, 20 to 42 mm. wide, obtuse or apiculate, rather finely feather-veined, reticulate in the intervals, the margin entire or commonly with a few low teeth or crenations toward the summit, the petioles always margined, rather variable in length and breadth; remaining leaves subpetiolate nearly throughout, gradually reduced in length and breadth, entire; all the leaves slightly thick and somewhat coriaceous, rather firm, smooth except the margin, apparently rather green when fresh; inflorescence paniculate, narrowly ovoid or cylindraceous, 15 to 21 cm. long, sometimes reduced, rather loose, the slender branches placed at an angle of about 45 degrees, only a few of the longest racemes at all compounded, the bracts of the inflorescence linear to filiform, the pedicels slender, the longer 3 to 5 mm. long; heads narrowly campanulate, 5 to 6 mm. long; lower tegules oblong, the following linear-oblong, both ovate at the tip, rather thick and firm; disk flowers 5 to 7; ray flowers 5 to 9; rays oblong-oblancheolate; achenes very small, glabrous.

Type in the U. S. National Herbarium, no. 619303, collected at Michigan City, Laporte County, Indiana, August 12, 1909, by George L. Fisher (no. 107). On sand hills.

The National Herbarium has three other specimens from the same source, and a small specimen almost surely the same from sandy bluffs at Kilbourn, Wisconsin (August 26, 1909, *Steele* 40). The type sheet bears two large individuals.

***Solidago jejunifolia* Steele, sp. nov.**

Stem about 77 cm. high, light colored, striate-angled, smooth to the inflorescence, the summit with the branches thinly clothed with very short, coarse, ascending hairs; internodes 2 to 3 cm. long for nearly half the leafy segment, the upper moderately shorter, a few reduced to 1 cm.; longest leaves about the fourth to the sixth from the base, 7 to 8 cm. long, somewhat petiolate, the blade oblanceolate or lanceolate, 9 mm. wide, acute or nearly so, the petiole flat and rather broad, the leaves below shorter, a little broader and doubtless more blunt, the leaves above linear-oblancheolate, ovately acute at the tip, short-attenuate at the base; all the leaves rather thick, firmly coriaceous, hispidulous-

ciliate, otherwise smooth and glabrous, light colored; inflorescence about 20 cm. long, rather even in width, after pressing, 5 or 6 cm. wide, loose below, denser above, the branches slender, strongly ascending, the racemes with 7 to 12 heads, a few of the middle ones very slightly compounded, the peduncles slender, 2 to 4 mm. long; heads campanulate, 5 mm. long; involucre scarcely at all herbaceous, the tegules double-keeled but the lines not obviously looped above, the middle tegules oblong, ovately tipped; flowers about 17 to 20, of these 5 to 8 radiate, the rays oblanceolate-oblong, 2.5 mm. long; achenes glabrous.

Type in the U. S. National Herbarium, no. 619303, collected on Indian River, Cheboygan County, Michigan, August 8, 1890, by C. F. Wheeler.

Allied to *S. fisheri*, but differing conspicuously in its greatly reduced foliage and in its cylindraceous instead of ovoid inflorescence; also substantially in its lower stature and relatively stouter habit and in the slightly shorter but fuller heads. There is only one specimen, but the essential characters are entirely clear.



# THREE NEW GENERA OF STILT PALMS (IRIARTEACEAE) FROM COLOMBIA, WITH A SYNOPTICAL REVIEW OF THE FAMILY.

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BY O. F. COOK AND C. B. DOYLE.

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## FAMILY CHARACTERS.

The palms of the strictly American family Iriarteaceae are readily distinguished in nature by the fact that the trunk does not reach the ground but is supported by a cluster of large, stilt-like, aerial roots. In the smooth trunk and the long sheathing bases of the leaves the stilt palms have a superficial resemblance to the royal palms (Acris-taceae), but the floral and foliar characters show altogether different lines of specialization.

The leaves of the Iriarteaceae differ from those of any other pin-nate palms in the strong development and radial position of the veins. Even when the segments are narrow and parallel so that the clusters closely resemble the pinnæ of other palms, there is no specialization of a definite midvein larger than the others. This lack of specialization may be considered an explanation of the peculiar irregular or premorse margin of the leaves, a feature that is par-alleled, among American palms, only in certain genera of Co-caceae, such as *Tilmia* and *Curima*.

## SURVEY OF THE GENERA.

The classification of *Iriartea* and the related genera has received very diverse treatment at the hands of Martius, Karsten, Wendland, and Drude. The very incomplete original description of *Iriartea* by Ruiz and Pavon was supplemented by Martius from his knowledge of the Brazilian species. Karsten in establishing two new Colom-bian genera, *Deckeria*<sup>1</sup> and *Socratea*,<sup>2</sup> accepted the characters as-cribed to *Iriartea* by Martius and thus invited criticism by Wendland for not considering the true type of the genus, the Peruvian *I. deltoidea*.

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<sup>1</sup> *Linnaea* 28: 258. 1856.

<sup>2</sup> *Op. cit.* 28: 263. 1856.

Finding in the female flowers of *I. deltoidea* the series of rudimentary stamens which Karsten had considered distinctive of his genus *Deckeria*, Wendland reunited this to *Iriarteia*, though he accepted Karsten's second genus *Socratea* as well founded. Three new genera, *Iriartella*,<sup>1</sup> *Catoblastus*,<sup>2</sup> and *Dictyocaryum*, were proposed by Wendland, who also transferred to this group the genus *Wettinia*, previously established by Poeppig and Endlicher, but not at first recognized as a palm because of its peculiar, somewhat cycad-like inflorescence.

Wendland's association of Karsten's *Deckeria* with *Iriarteia* was later found by Drude<sup>3</sup> to have been a mistake, for the type species of *Iriarteia* proved to have the embryo basal instead of lateral, as Wendland had supposed, and to have the first leaves divided, as well as the terminal segments of the adult leaves, which are united in *Deckeria*. The spadix of *Deckeria* has thickened branches, with the flowers inserted in pits. Thus Karsten's genus *Deckeria* must evidently be retained, making seven genera which Wendland would probably have recognized if he had been acquainted with the fruits of the type species of *Iriarteia*. In distinguishing these genera, Wendland relied largely on the fruits, but Drude has supplied additional characters by which some of the groups can be more readily separated.<sup>4</sup>

The seven genera could be arranged in two series with reference to the distribution of the flowers. One series is characterized by the presence of functional flowers of both sexes in the same inflorescence, the other by having flowers of the two sexes in separate inflorescences, though still on the same individual. The first series, with the flowers of the two sexes together, is composed of the five genera *Iriarteia*, *Dictyocaryum*, *Deckeria*, *Socratea*, and *Iriartella*, leaving *Catoblastus* and *Wettinia* for the other series with the flowers of the two sexes separated.

In Drude's classification of the palms, in Engler and Prantl's *Natürlichen Pflanzenfamilien*,<sup>5</sup> the genera *Catoblastus* and *Wettinia* are associated with *Iriarteia*. They differ very distinctly in the characters of the flowers, having the sexes separated in different inflorescences and the carpels unequally developed, only one producing a normal ovule. Of the three new forms described in the present paper, two may be considered to be intermediate between *Iriarteia* and *Wettinia*, in that male flowers are still present in rudimentary form on the pistillate inflorescence. The first of these is more

<sup>1</sup> *Bonplandia* 8:103. 1860.

<sup>2</sup> See p. 231, below.

<sup>3</sup> *Bonplandia* 8:106. 1860.

<sup>4</sup> See Mart. Fl. Bras. 3<sup>2</sup>: 535. 1882.

<sup>5</sup> 2<sup>5</sup>:60, 61. 1889.

closely associated with *Iriartea* in having the carpels of the young flowers equally developed, but the petals are narrow and separate, while those of *Iriartea* are broadly imbricate. The embryo is also basal instead of being lateral or apical as in most of the species referred to *Iriartea*.

The second of the new types, also with rudimentary male flowers on the pistillate inflorescence, has the carpels extremely unequal, even more so than in *Catoblastus*, and entirely lacks a style. The sharply three-lobed, star-like stigma is seated at the base of the long, subcylindrical fertile carpel. The albumen of the seed differs from that of *Catoblastus* in being quite uniform, instead of ruminant.

The third of the new forms has the sexes entirely separated as in *Wettinia* and the pistillate flowers and fruits closely crowded together as in that genus, but the inflorescence is branched instead of simple, and the long, narrow petals are separate instead of overlapping at the base as in *Wettinia*.

The fruits of the last species, though narrowed and angled at the base by mutual pressure, remain shorter than those of the other two species, which are scattered upon the longer branches and are of a regular long-oval form. In all three species the surface is rough and hairy and the outer layer or pericarp has a loose corky texture not a little suggestive of that of the fruits of *Manicaria* and *Phytelephas*.

### TRIBAL DIVISION.

Taking these additions into account, a division of the family into three tribes seems desirable. Though *Catoblastus* and *Wettinia* seem to agree in some of the characters that separate them from *Iriartea* and its immediate relatives, they are very unlike in other important respects. Moreover, *Catoblastus* and *Wettinia* no longer appear as isolated genera, but rather as members of two series of related genera, like those that cluster about *Iriartea*.

#### SYNOPTICAL KEY TO THE TRIBES.

- Flowers of both sexes borne on the same spadix; a single inflorescence in the axil of each leaf..... **IRIARTEAE.**
- Flowers of the two sexes in separate inflorescences; several inflorescences from each axil.
- Flowers and fruits scattered on the numerous slender branches of the inflorescence; styles short or wanting. **CATOBLASTEAE.**
- Flowers and fruits densely crowded on the thickened simple or few-branched spadix; styles long and slender.... **WETTINIEAE.**

## DESCRIPTIONS OF THE COLOMBIAN GENERA AND SPECIES.

## CATOBLASTEAE.

## SYNOPTICAL KEY TO THE GENERA.

- Pistillate flowers with three equal carpels at the time of flowering ..... ACROSTIGMA (p. 228).  
 Pistillate flowers with one greatly enlarged fertile carpel at the time of flowering.  
 Petals not imbricate; stigma sessile at the base of the long, cylindrical fertile carpel..... CATOSTIGMA (p. 230).  
 Petals imbricate at base; stigma rostrate or borne on a columnar style..... CATOBLASTUS (p. 231).

## ACROSTIGMA gen. nov.

Trunk solitary, rather short (6 meters long) not so thick below (10 cm.) as above (16 cm.); smooth, distinctly ringed; internodes short (10 cm.)

Leaves with rather short sheaths (120 cm. long); pinnæ triangular-lanceolate, not inserted on a fleshy pulvinus; petiole short (16 to 18 cm. long); segments of unequal length, united; both surfaces smooth; terminal pinnæ broad, united to near the end.

Spathes 5 or 6, two or three of them small, basal, three large.

Spadix compound, divided near the middle into several (about 5) long, tapering, flexuous branches; female inflorescence bearing irregularly scattered flowers each subtended by 2 minute rudiments of male flowers; female flowers with sepals rounded-triangular, broader than long, slightly connate at base; petals triangular, nearly as broad as long, less than twice as long as the sepals, distinctly separated at base, soft and fleshy in texture, not ribbed on the back; staminodes 6, minute, delicate, of soft texture, less than one-fourth the length of the sepals; pistil triangular with three equal lobes, not exceeding the petals; stigmas completely sessile, forming a minute 3-pointed slit in the apex of the pistil.

Fruit elliptical, slightly compressed and slightly angled on one side above the stigma, one and one-half times as long as broad. Stigmas persistent at base, close to the persistent calyx; sepals united at base, one much larger than the other two; mesocarp of rather loose, corky, granular texture, composed of coarse cellular tissue and coarse, irregular fibres, often spine-like; inner surface of mesocarp closely and obscurely wrinkled without evident indication of a fibrous network as in *Catostigma*; numerous bundles of raphids imbedded in the mesocarp immediately around the inner surface; endocarp rather thick and corky, covered with a very close network of rather coarse, strongly flexuous fibres.

Seed compressed-oval, smooth or very faintly impressed under the fibres of the endocarp; albumen uniform; embryo basal, extremely small, not covered by the albumen, indicated by a minute rounded prominence on the outer wall of the very small cavity.

Type species, *Acrostigma equale*.

Distinguished from *Catoblastus* Wendl. in having the pistil formed of three equal carpels with minute sessile stigmas, and by the presence of rudimentary male flowers in the female inflorescences.

*Acrostigma equale* sp. nov.

PLATE 54 (A), 55, 56 (A), 57, 58.

Trunk 6 meters long by 10 cm. in diameter at 1 meter from base, becoming thicker toward the crown, there reaching a diameter of 16 cm.; internodes 10 cm. or less in length.

Leaves 8 to 12 in a head, largest in the middle, tapering gradually toward base and tip; leaf bases 120 cm. long by 50 cm. broad at base, splitting into numerous fragile fibers; petiole short, 16 to 18 cm. long by 4 cm. in diameter; lower surface rounded and covered with dark brownish tomentum; upper surface rounded and also tomentose, excepting a central strip 1 cm. wide, light green in color, free from tomentum or scurf and running the entire length of the petiole.

Rachis 350 cm. long by 4 cm. in diameter at base, gradually tapering toward the tip; lower surface rounded, becoming flat toward the tip, sparsely covered with greenish tomentum; upper surface with a prominently rounded central ridge 6 to 8 mm. wide at base, gradually becoming narrowed to a sharp ridge; on either side of this median ridge a shallow groove, in this the pinnæ inserted; the surfaces of these grooves, as well as of the central ridge, marked with about 12 longitudinal, slightly elevated ridges or striations, these 1 to 2 mm. apart, covered with very loosely adherent, brownish, scurfy material easily detached with the finger; toward the end of the leaf the grooves becoming shallow and disappearing; below each pinna for a distance of about 2 cm. the rachis entirely free from scurf or tomentum, but the striations still distinct; these naked spots of much lighter color and visible at some distance from the tree; upper central ridge slightly lighter in color than the grooves, toward the end of the leaf taking on the same color as the naked spaces below the pinnæ; striations and naked spots also disappearing toward the end of the leaf, the last three or four pinnæ thus inserted on a comparatively smooth rachis.

Pinnæ 33 or 34 on each side, consisting of 11 to 18 segments; upper surface dark green; lower surface slightly lighter, smooth; midribs very prominent on the under side, raised 1 to 2 mm. above the surface and of much lighter color; segments of pinnæ unequal, premorse, the lower segments of each pinna being the longest; lowest pinnæ 34 cm. long by 7 cm. wide, consisting of 7 or 8 segments 1 cm. or less in width, 1.5 cm. wide at point of insertion; middle pinnæ 105 cm. long by 16 cm. wide at the broadest part, 5 cm. wide at base, consisting of 15 segments 2 cm. or less in width; terminal pinnæ 28 to 34 cm. long by 10 to 15 cm. broad, becoming 19 to 24 cm. wide at insertions, consisting of from 12 to 16 segments 2 cm. or less in width.

Inflorescence infrafoliar, 105 cm. long; peduncle 36 cm. long by 6 cm. wide at base, the fruiting portion 10 cm. long by 2 cm. in diameter; branches 5, the longest 59 cm. by 1.5 cm.; peduncle and bases of branches densely hirsute; flowering portion when young with a very sparse covering of long, gland-tipped hairs, these also occurring on the petals and pistils; between the hairs the surface appearing naked, but seen to be very minutely papillose under sufficient magnification; flowers inserted in depressions, these continued on each side to form a distinct transverse groove accommodating the rudimentary male flower.

Spathes 5, the outer 12 cm. long; inner spathe densely covered, when young, with soft silky hairs 2 mm. or less in length.

Fruits 40 to 50 on each branch, ovoid or slightly flattened on one side, 5 cm. long by 3 cm. in diameter or less, covered with closely adherent grayish hairs like those on the branches and peduncle; pericarp corky, 5 mm. thick, tough; kernel 3 cm. long by 1.5 cm. in diameter, ovoid or slightly flattened, the outer surface covered with a web-like coating of closely adherent fibers.

Type in the U. S. National Herbarium, nos. 690426-690428 (all from one tree), collected in deep, marshy forests about Cordoba, Cauca, Colombia, by C. B. Doyle, December, 1905.

Native names, "zancona" or "zancuda," meaning "stilt" or "mosquito" palm, evidently in allusion to the long aerial roots. Also called "crespa," perhaps with reference to the stiff leaves or to the hairy fruits.

EXPLANATION OF PLATES 54-58.—Plate 54, whole leaf and inflorescence, A, of *Acrostigma equale*; B, of *Wettinella quinaria*. From field photographs taken at Cordoba, Cauca, Colombia, December, 1905. Plate 55, tip of leaf of *Acrostigma equale*. From a photograph taken in Washington. Reduced. Plate 56, bases of pinnæ, A, of *Acrostigma equale*; B, of *Catostigma radiatum*; C, of *Wettinella quinaria*. All natural size. From photographs of dried specimens taken in Washington. Plate 57, young spathes and female flowers of *Acrostigma equale*. From a field photograph taken at Cordoba, Cauca, Colombia in December, 1905. Natural size. Plate 58, fruit and female flowers of *Acrostigma equale*. From field photographs taken at Cordoba, Cauca, Colombia, December, 1905. Natural size. All photographs taken by C. B. Doyle.

#### CATOSTIGMA gen. nov.

Trunk solitary, rather short (6 meters), slender (7 to 8 cm. thick), tapering upward; surface smooth, distinctly ringed; internodes rather short (16 cm.), becoming shorter above (10 cm.).

Leaves with rather short sheaths (108 cm.), densely brown-tomentose without; petiole rather long (34 cm.), cylindrical, smooth, and naked; pinnæ triangular, the lower unequally divided into 5 to 7 obliquely diverging segments, each segment inserted on a fleshy pulvinus; tips of pinnæ irregularly notched; both surfaces smooth; terminal pinnæ rather narrow, completely united, the rachis continued to margin.

Inflorescence with 5 spathes, 3 short basal ones and 2 complete ones; also two or three spatheless ring-scars; spadix compound, divided below the middle into a few (about 3) long, tapering, flexuous branches bearing irregularly scattered flowers and fruits; surface not hirsute but very minutely granular-hispid; female flowers inserted in shallow rounded depressions, each subtended by two rudimentary male flowers, one on either side.

Female flowers with sepals subtriangular, somewhat broader than long, slightly connate at base; petals triangular, pointed, twice as long as broad, about 4 times as long as the sepals, distinctly separated at base, in texture firmly coriaceous, distinctly 5-costate on the back, the middle rib strongest; staminodes 6, of firm texture, conic-subulate, about half as long as the sepals, strongly reflexed, opposite and alternate with the petals; pistils distinctly 3-lobed, the fertile carpel conic-cylindric, about 3 times as long as broad, greatly exceeding the others (about 7 times as long), twice as long as the petals, stigmas about twice as long as broad, triangular-conic, sharp-pointed, strongly recurved, strongly rugose-tuberculate; rudimentary male flowers accompanying the female containing a cluster of minute staminodes.

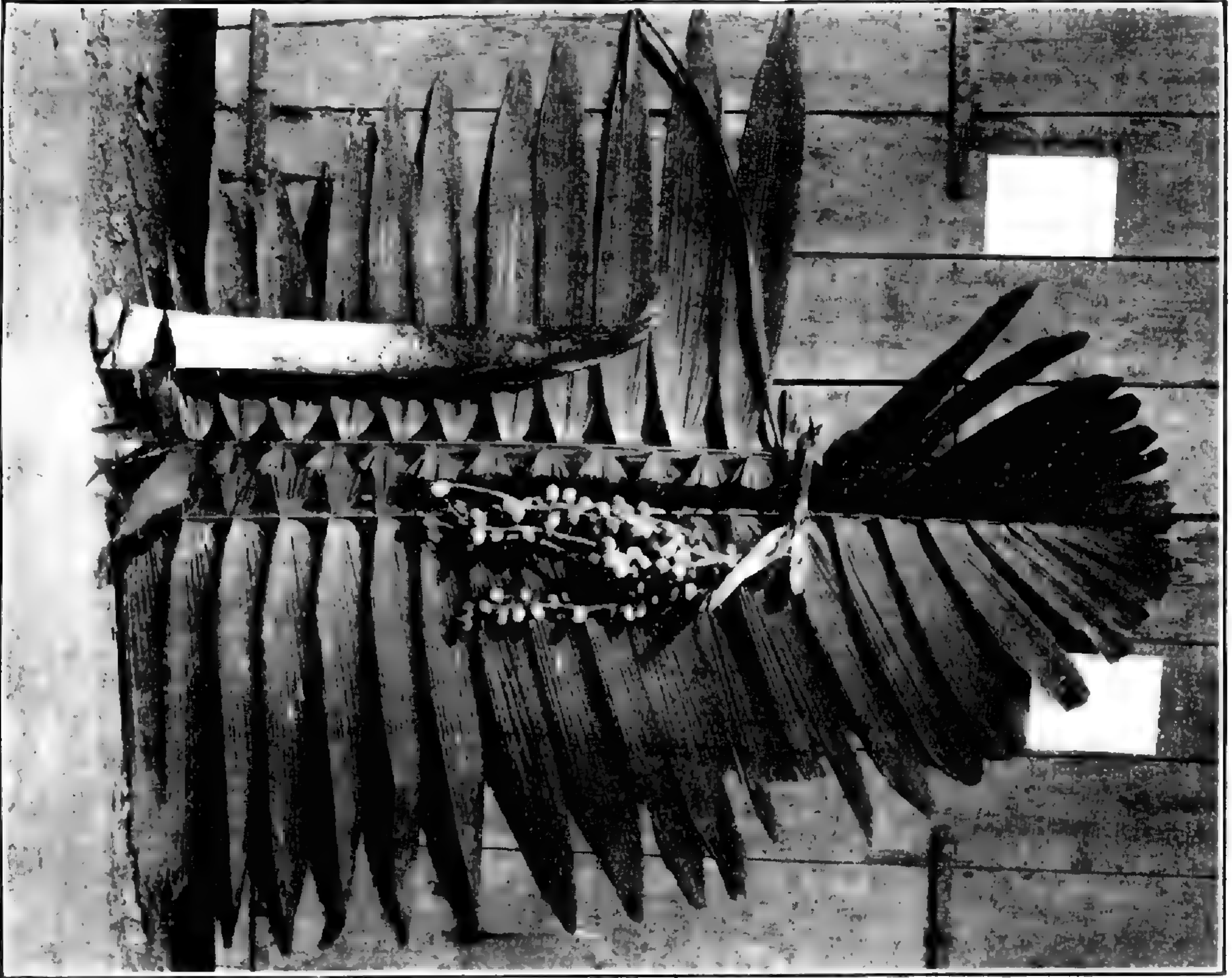
Fruits narrowly oval, symmetrical, about two and one-half times as long as broad; surface even, minutely granular-tuberculate, bearing the persistent stigmas at the base, close to the persistent calyx, one lobe of this distinctly larger than the other two; mesocarp of a rather firm corky texture, composed of coarsely cellular material and stout irregular fibers; inner surface of mesocarp showing an open-meshed network of distinct, slender fibers similar to the fibers of the endocarp, but entirely separate, often with a layer of gelatinous material between; endocarp delicately membranous, the fibers very delicate, not very numerous, those of the inner layer parallel at the base on the side opposite the embryo, anastomosing into a fine network on the other side.

Seed narrowly oval, its surface smooth and even or with very faint impressions; albumen uniform except for a median canal and a semielliptic cavity at the base, the cavity as broad as long, covered by a rather thick lid of albumen to which the disk-like or top-shaped embryo is attached.

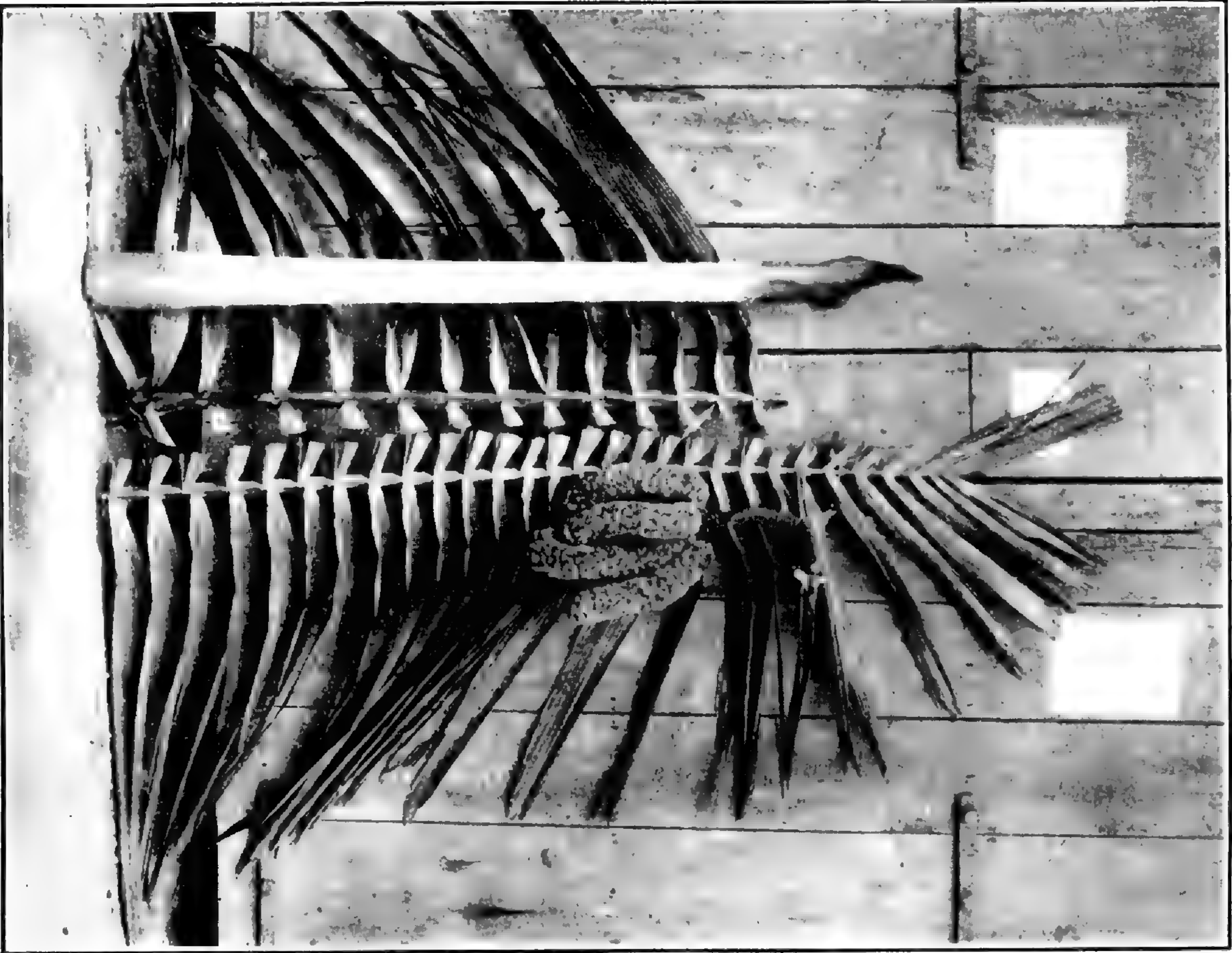
Type species, *Catostigma radiatum*.

Distinguished from *Catoblastus* Wendl. by the narrow spathes, slender inflorescences, and large, strongly recurved, sessile stigmas, and by the presence of rudimentary male flowers on the female inflorescences.

A. ACROSTIGMA EQUALE COOK & DOYLE.



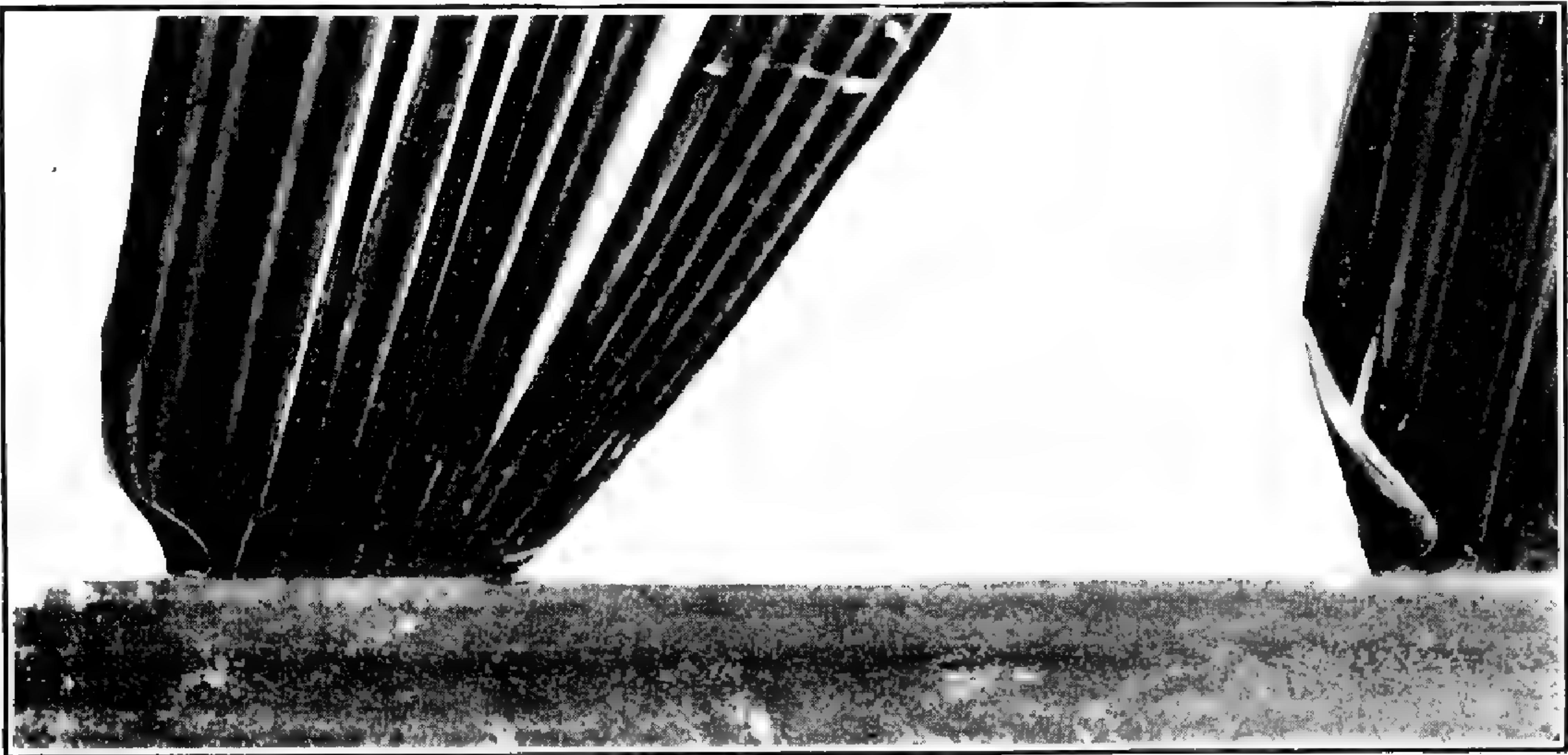
B. WETTINELLA QUINARIA COOK & DOYLE.



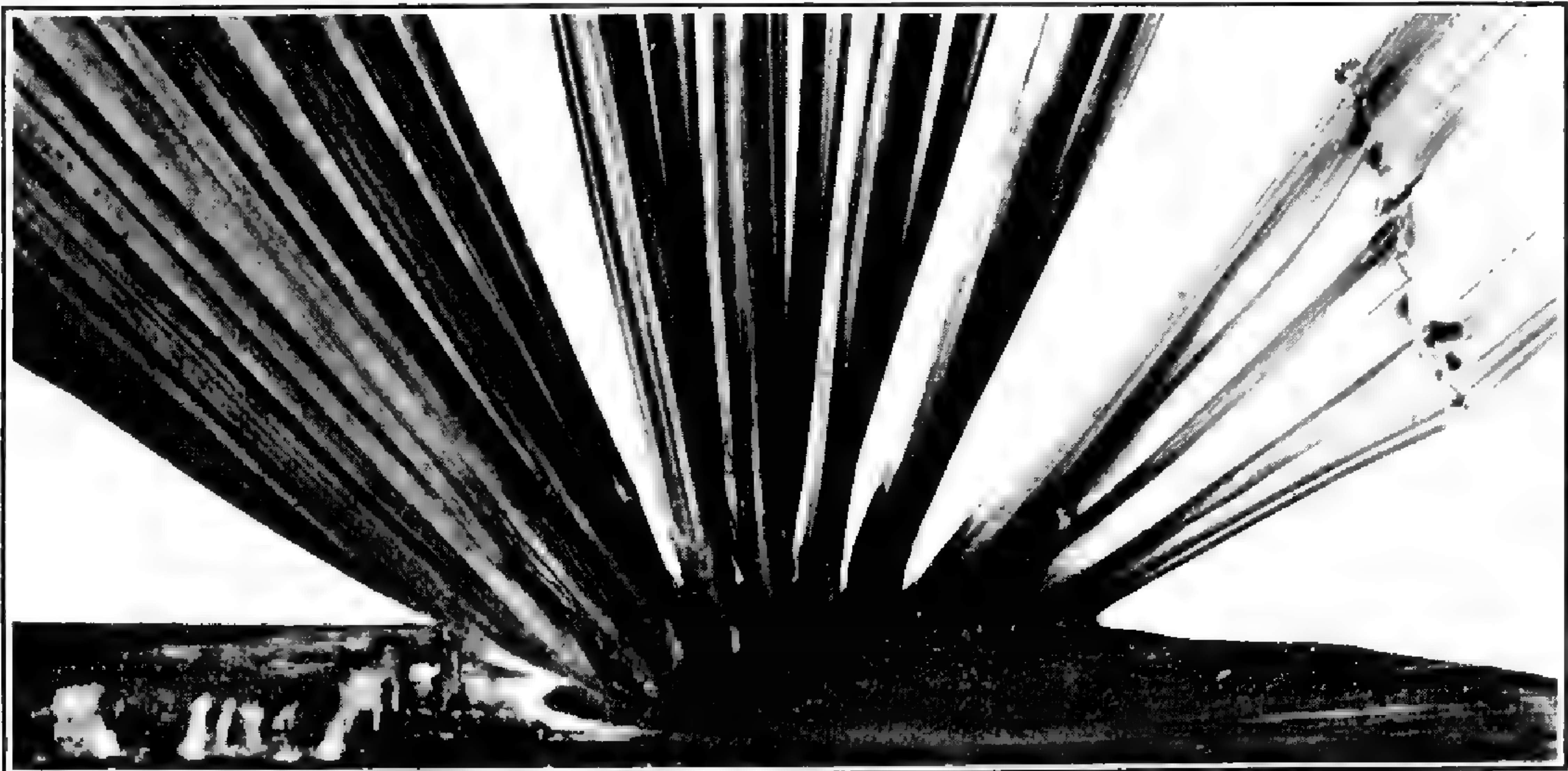


ACROSTIGMA EQUALE COOK & DOYLE.

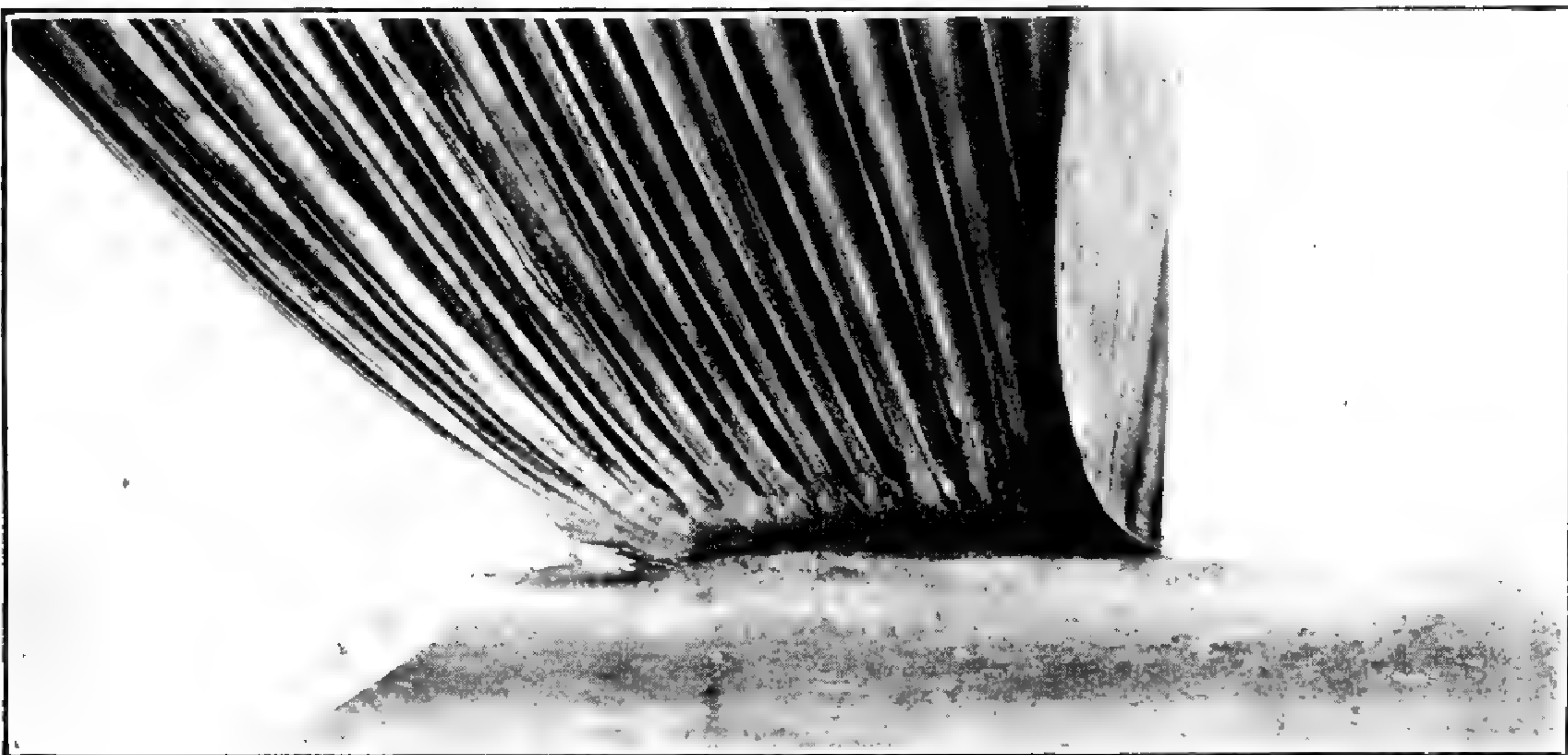




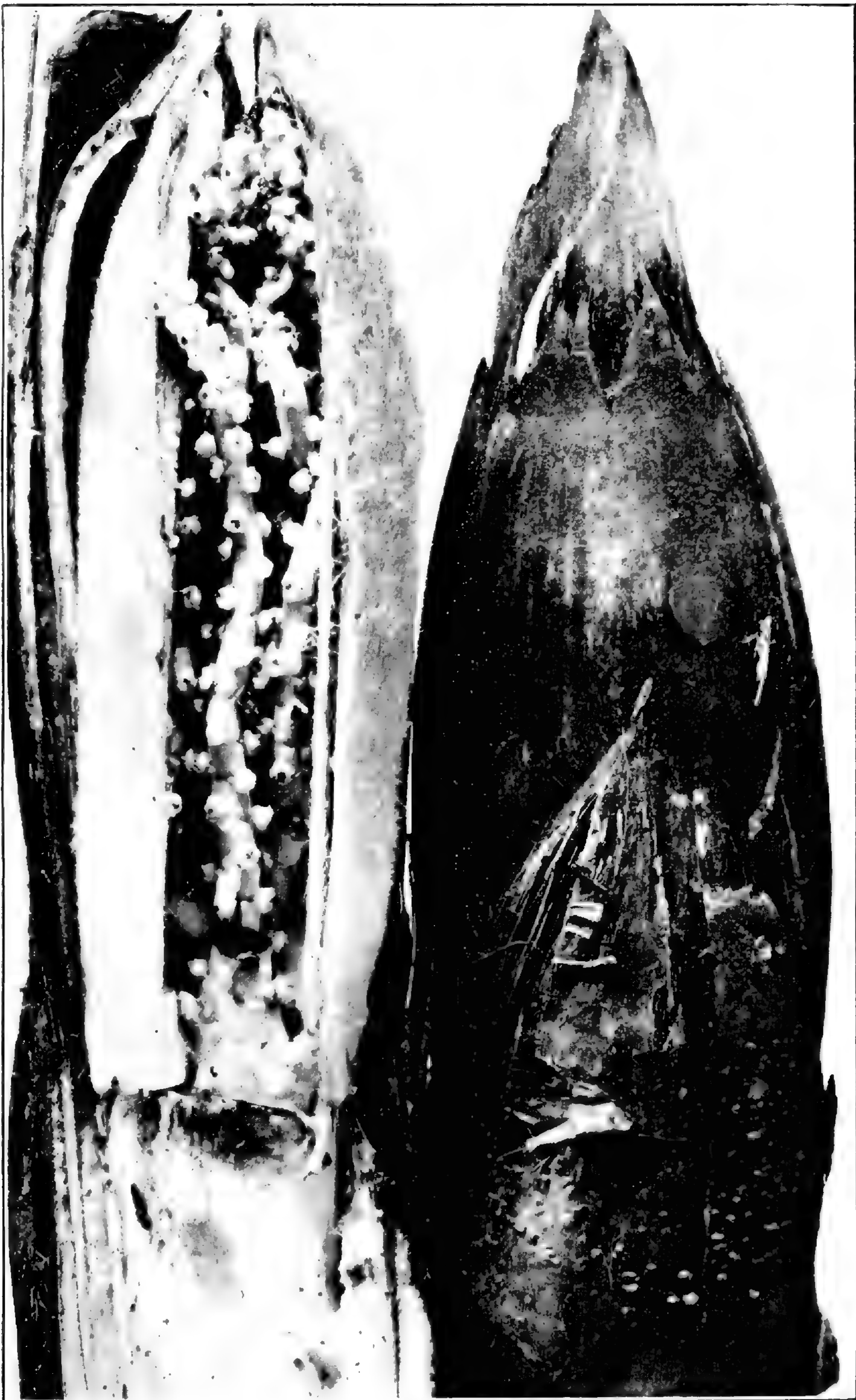
A. ACROSTIGMA EQUALE COOK & DOYLE.



B. CATOSTIGMA RADIATUM COOK & DOYLE.



C. WETTINELLA QUINARIA COOK & DOYLE.



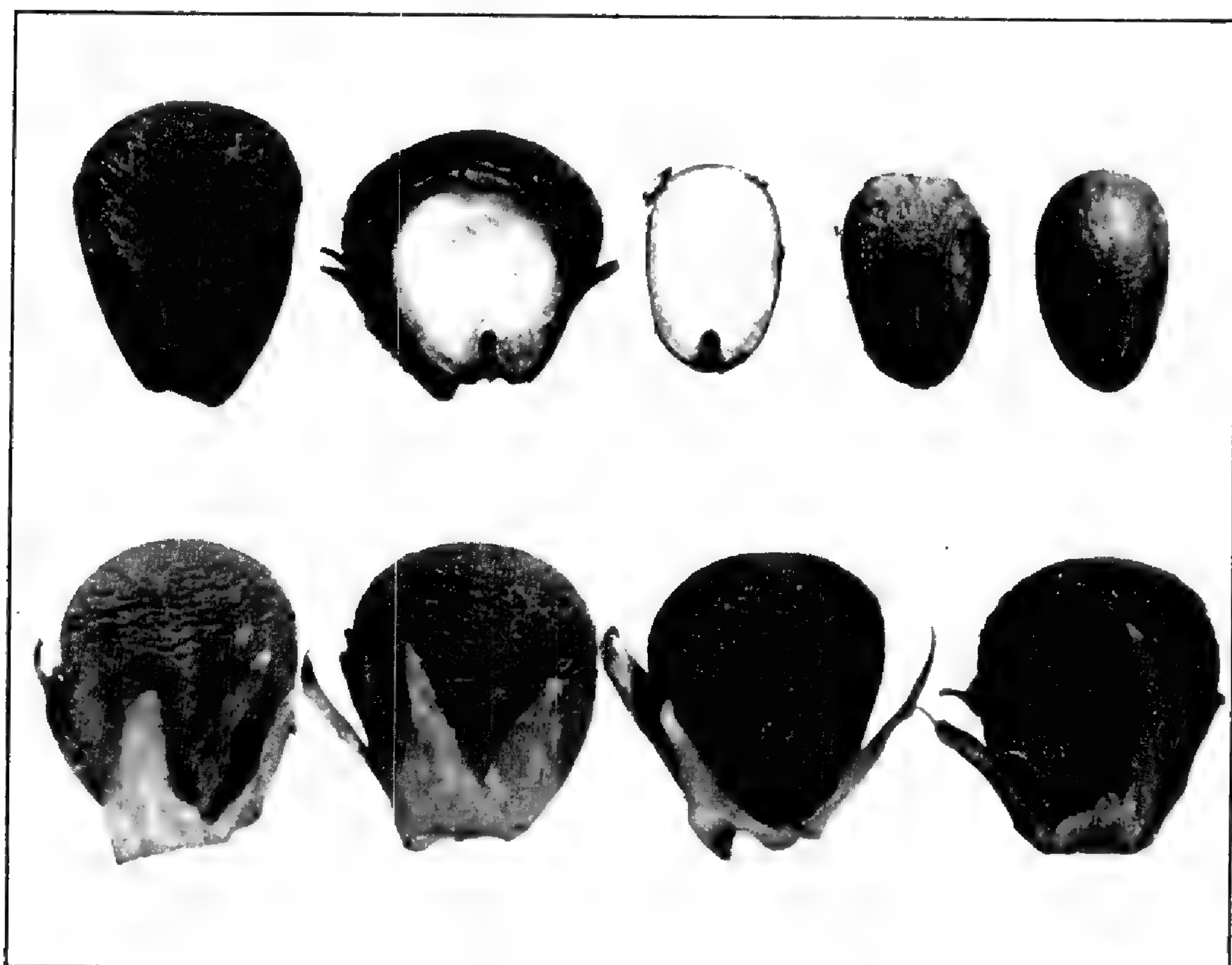
ACROSTIGMA EQUALE COOK & DOYLE.



ACROSTIGMA EQUALE COOK & DOYLE.



A. FRUITS OF *CATOSTIGMA RADIATUM* COOK & DOYLE.



B. FRUITS OF *WETTINELLA QUINARIA* COOK & DOYLE.



CATOSTIGMA RADIATUM COOK & DOYLE.

*Catostigma radiatum* sp. nov. PLATES 56 (B), facing p. 230, 59 (A), 60.

Trunk 6 meters long, 5 meters to first inflorescence, the diameter 7 to 8 cm. at 1 meter from base, 6.5 cm. at base of first leaf; wood very hard and fibrous.

Leaves 10 to 12 in a head, largest in the middle, tapering gradually toward base and tip; leaf bases 108 cm. long, splitting into numerous fragile fibers; lower surface densely brown tomentose for about one-half its length; petiole 34 cm. long by 2.5 cm. in diameter, cylindrical; surface densely tomentose in young leaves, smooth in adult specimens; rachis 272 cm. long by 2.5 cm. thick at base, tapering gradually toward the tip; lower surface rounded, becoming flat; upper surface for 50 cm. outward from base with a prominent, rounded, central ridge becoming more prominent; upper surface also marked with minute grooves; toward the tip the latter disappearing and becoming flat surfaces, the central ridge becoming more prominent; upper surface also marked with minute longitudinal raised lines running the entire length of the leaf, less prominent toward the tip.

Pinnæ 57 to 62 on each side, simple or split into 2 to 7 divisions and consisting of from 1 to 10 segments ranging in width from 1 to 3 cm., the divisions standing at different angles to the rachis; tips of pinnæ notched, due to unequal termination of segments, the lower segments generally the longest; upper surface of pinnæ dark green, the lower surface lighter; at the point of insertion of each pinna a fleshy cushion or pulvinus; just below the insertion of each pinna the rachis naked and lighter in color for 2 cm. or less; for 2 to 3 cm. below the insertion of each group of pinnæ the lower surface clad with a dense tomentum easily removed with the fingers; lowest pinnæ 29 cm. long by 6 to 7 cm. wide, consisting of 6 segments 1 cm. or less in width; lower and terminal pinnæ inserted singly; middle pinnæ 33 to 56 cm. long by 4.5 to 13 cm. wide, consisting of 2 to 9 segments 2 cm. or less in width; terminal pinnæ 17 cm. long by 7 to 9 cm. wide, consisting of 8 or 9 segments 2 cm. or less in width.

Inflorescences infrafoliar, as many as five maturing fruit at one time; total length 105 cm.; peduncle to first branch 30 cm. long by 2.5 cm. in diameter at base and 2 cm. at first branch; fruiting portion 4 cm. long by 1.5 cm. in diameter; both peduncle and fruiting portion light green, smooth; branches 3 or 4, 71 cm. or less in length by 2 cm. in diameter.

Spathes 5, the lowest 4 cm. long by 4 cm. in width at base; inner spathe 26 cm. long, smooth; usually three inflorescences, two male and one female, appearing in a group at the same node.

Fruits densely clustered along the branches, oval 3.5 cm. long, 1.8 cm. in diameter; outer husk corky, brittle, 2 to 3 mm. thick; seed broadest below the middle, covered with a closely adherent, fibrous, fragile epidermis; texture bony; embryo basal.

Type in the U. S. National Herbarium nos. 690429–690432 (all from one tree), collected along bank of stream near Cordoba, Cauca, Colombia, by C. B. Doyle, December, 1905.

Native names, "gualte," "sape."

EXPLANATION OF PLATES 59, 60.—Plate 59, A, fruits of *Catostigma radiatum* Cook & Doyle; B, of *Wettinella quinaria* Cook & Doyle. Plate 60, young spathe and tip of leaf of same species. From field photographs taken at Cordoba, Cauca, Colombia in 1905, the latter in December. All natural size.

### CATOBLASTUS Wendl.

*Catoblastus* Wendl. *Bonplandia* 8: 104. 1860.

Trunks slender, cespitose, supported on a cluster of short superficial roots.

Leaves 3 to 4 feet long, with 24 pairs of simple pinnæ.

Inflorescences in verticillate clusters, 10 to 12 inches long.

Spathes numerous, the outer short.

Male flowers in pairs; sepals valvate, pistillodes small.

Female flowers with separate sepals and petals; staminodes none (Wendland); present in the type species (Klotzsch); ovary trilocular.

Fruits oblong-ovate; stigma scar close to the base; epicarp subrugose or puberulous; mesocarp grumous; endocarp membranous.

Seeds oblong-ovate with immersed bundles rising from the base on the ventral side, running close together to the apex, then anastomosing and coming together again at the embryo; albumen ruminant (Wendland) or uniform (Klotzsch); embryo basal, erect.

Type species, *Catoblastus praemorsus*.

*Catoblastus praemorsus* (Willd.) Wendl. Bonplandia 8: 104. 1860. PLATE 61.

*Oreodoxa praemorsa* Willd. Mém. Acad. Sci. Berlin 1804: 36. 1807.

*Iriarteia praemorsa* Klotzsch, Linnaea 20: 448. 1847.

Trunks erect, cylindrical, very smooth, 12 to 15 meters high; stoloniferous.

Leaves pinnate, very long, the pinnæ broadly cuneiform, narrowed at base, unequally premorse-dentate at apex, alternate; color dark green.

Fruit ashy gray, ovate; seed ovate, of the size of a pigeon's egg; endosperm brown, marbled with numerous veins.

Forests of the high mountain chain of Buenavista, Province of Caracas, Venezuela, growing with *Oreodoxa acuminata*, but much more rare.

The natives call this palm "pyra," a name they apply to all the palms which have terminal buds that can be used for food.

The above data are drawn from Willdenow's original description. The species was described at greater length by Klotzsch, but it does not appear certain that he had the same palm; at least the particulars differ considerably, as may be judged from the following transcription of additional or divergent facts:

Trunks about 15 from the same root, 30 to 50 ft. long, 3 inches thick, borne on a cluster of warty brown roots about as thick as the little finger.

Leaves 3 to 4 feet long; rachis compressed, margined above, and with the margin pubescent; pinnæ 5 to 24 pairs, 10 to 12 inches long, 1½ to 2½ inches broad, alternate, herbaceous, pale green, distant, nearly smooth, irregularly rhomboidal-cuneate, united at the base, repand-erose toward the apex, below with 6 to 8 parallel, prominent veins; terminal pinna flabelliform, at apex dentate-truncate, sometimes bifid, short-cuneate at base, 7 to 11 inches long, 6 to 9 inches broad.

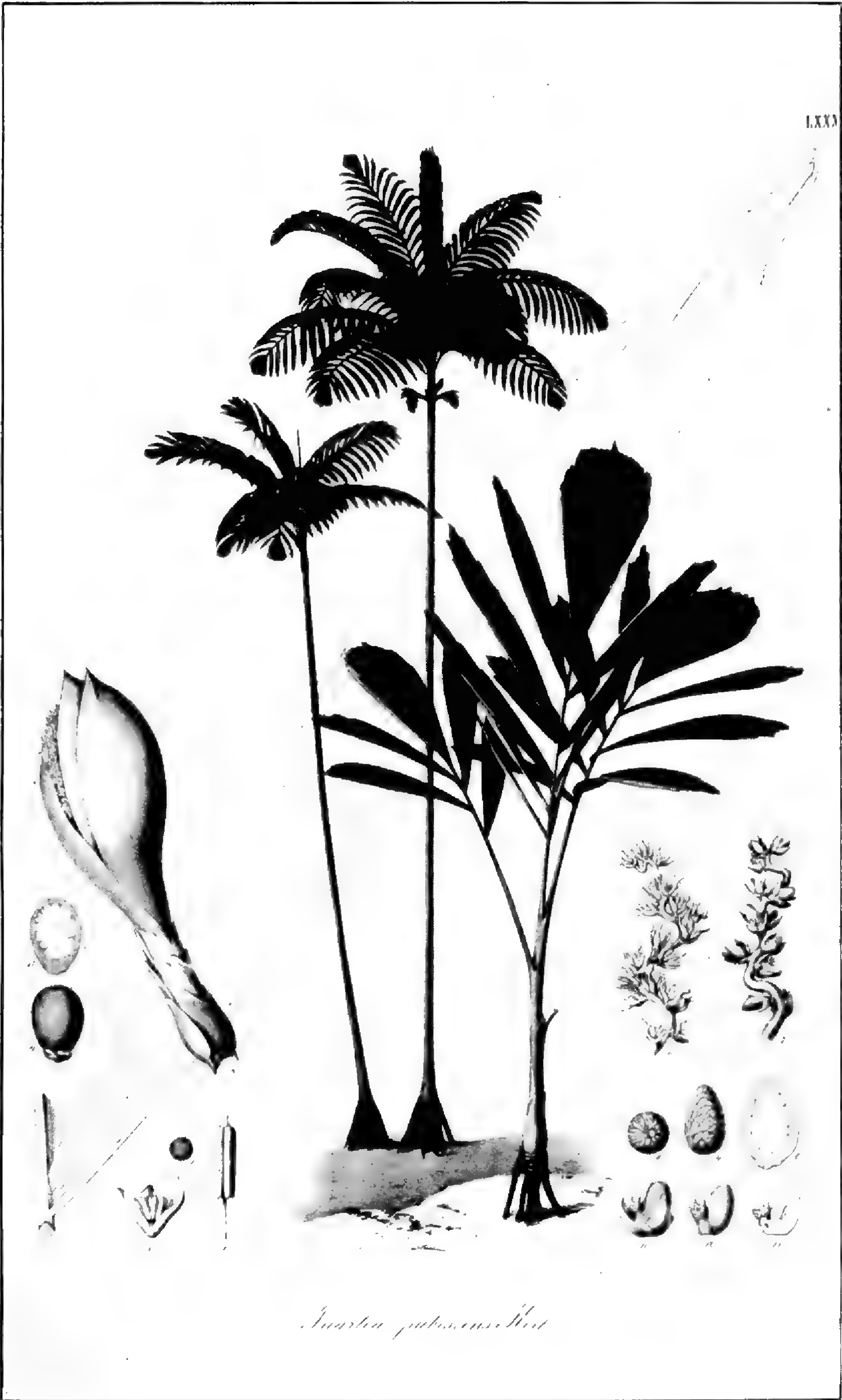
Spadices numerous (10 to 20), cylindric-fusiform, 10 to 12 inches long, 2½ inches broad, thickened near the apex and obtusely pointed, narrowed toward the base.

Spathes coriaceous, the interior ones complete, closed, at length opening on the ventral side, the exterior shorter, incomplete, imbricate, tubulous, open at apex.

Flowers sessile, without bracts, yellowish, monoecious in separate, simply branched spathes; male flowers in pairs; calyx of three triangular, fleshy, minute sepals, valvate in the bud; petals three, acute-triangular, fleshy, 8 times as long as the sepals; stamens 9 to 15, hypogynous, the filament free, filiform, the anthers linear, attached at the base, opening by two longitudinal slits; pollen grains round, echinate; pistillode very small; female flowers solitary, sepals and petals triangular, fleshy, the petals twice as long; staminodes few, rudimentary; ovary with 3 carpels, the ovules basal, solitary, rarely two, anatropous; stigmas three, sessile, beak-like, connivent.

Fruit ovate, somewhat wrinkled, green, at length blackish, of the size of a pigeon's egg, 1-celled and 1-seeded; albumen uniform, horny; embryo basal.

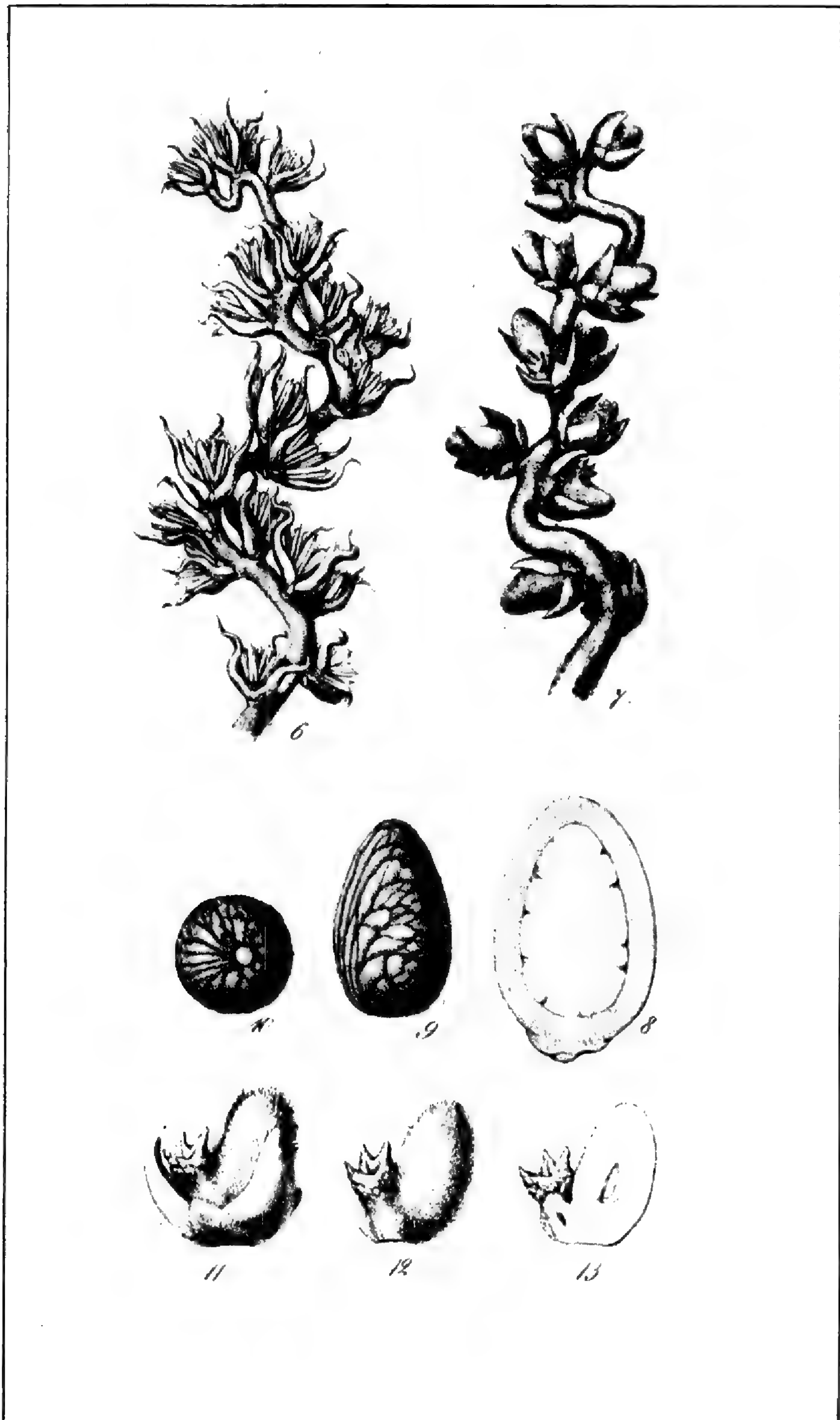
LXX



*Quartus pubescens* Willd.

CATOBLASTUS PUBESCENS (KARST.) WENDL. AND C. PRAEMORSUS (WILLD.) WENDL.





FLOWERS AND FRUIT OF CATOBLASTUS PUBESCENS (KARST.) WENDL.

Flowers from June to October. Puerto Cabello, Colonia Tovar, Colombia. Moritz no. 914.

EXPLANATION OF PLATES 61, 62.—Plate 61, *Catoblastus pubescens* (Karst.) Wendl.; at the right a seedling of two years. Fig. 1, a pinna; fig. 2, an inflorescence; fig. 3, a male flower; fig. 4, an anther; fig. 5, a pollen cell. Figs. 14, 15, fruit of *Catoblastus praemorsus* (Willd.) Wendl. Reduced. Reproduced from Karst. Fl. Columb. 1: pl. 81. 1858–1861. Plate 62, flowers and fruit from the same plate at natural size. Fig. 6, tip of male inflorescence; fig. 7, tip of female inflorescence; fig. 8, section of fruit; figs. 9 and 10, views of the seed; fig. 11, female flower; fig. 12, same after removal of calyx and corolla segments; fig. 13, section of pistil.

As this species is the type of the genus *Catoblastus*, its characters are of special interest, but some of the most important are still in doubt. Klotzsch, and more recently Jahn, have described the carpels as distinct and with separate stigmas, and neither of these writers gives any intimation that the carpels are unequal at the time of flowering.

Karsten's *Iriarteia pubescens*,<sup>1</sup> which Wendland placed as a second species of *Catoblastus*, has the stigmas united into a short, cylindrical style, not half as long as the very large fertile carpel. The figure of *Catoblastus pubescens* given by Drude in Engler and Prantl's *Pflanzenfamilien* shows a long, columnar style rising above the fertile carpel and is likely to mislead regarding the principal generic character. Karsten says that the staminodia are wanting or very small and hidden under the carpels, whereas Drude's figure shows large staminodia with anthers. To avoid further confusion from this erroneous figure in so prominent a work of reference it may be best formally to recognize the fact that Drude's *Catoblastus* is a different species.<sup>2</sup> Unfortunately its origin is not indicated unless by the fact that Drude includes Peru in the range of the genus, while Venezuela is omitted.



FIG. 41.—Ovary of *Catoblastus drudei* with fertile and sterile carpel, a staminode below. At the right, same in section. After Engler and Prantl.

It is also evident that the true characters of *Catoblastus* are not to be learned from Drude's account of the genus nor from Karsten's beautiful figures of *C. pubescens*. It is quite possible that one or both of these species will eventually be removed from the genus. For the present it may be sufficient to note that *C. pubescens* has an obvious alliance with our new genus *Catostigma*. The completely sessile stigmas of *Acrostigma* and the presence of the rudimentary male flowers on the female inflorescences afford apparent distinctions, but if they do not prove to be adequate, *C. pubescens* will need to be transferred to *Catostigma* instead of *Catostigma* being united with *Catoblastus*.

The true affinities of *Catoblastus*, as represented by *C. praemorsus*, may lie with *Acrostigma* rather than with *Catostigma*, but the beak-like connivent stigmas indicated by Klotzsch do not suggest the condition found in *Acrostigma*.

Wendland and Drude both describe the albumen of the seeds of *Catoblastus* as ruminant, perhaps relying upon Karsten's drawing, but Klotzsch says that the albumen of *praemorsus* is uniform and describes the seed as marbled with numerous veins, which, however, may refer to the endocarp (*écorce*) rather than to the endosperm itself.

<sup>1</sup> *Linnaea* 28: 262. 1856.

<sup>2</sup> *CATOBLASTUS DRUDEI*.

*Catoblastus pubescens* Drude in Engl. & Prantl, *Pflanzenfam.* 2<sup>3</sup>: 61. f. G1, G2. 1887, not *Iriarteia pubescens* Karst. 1856, nor *Catoblastus pubescens* Wendl. 1860.

There is no reason to doubt that Karsten's species *pubescens* is ruminata, but he gives us no indication of the origin of the still more strongly ruminata seed that he figured as representing *prae-morsus* (see Pl. 59, Fig. 15). It is not to be assumed that Klotzsch would have called such a seed uniform.

The most recent account of this species is by Jahn<sup>1</sup> who gives additional data from Venezuela, probably based on palms growing near the original habitat of the species. Jahn's description may be translated as follows:

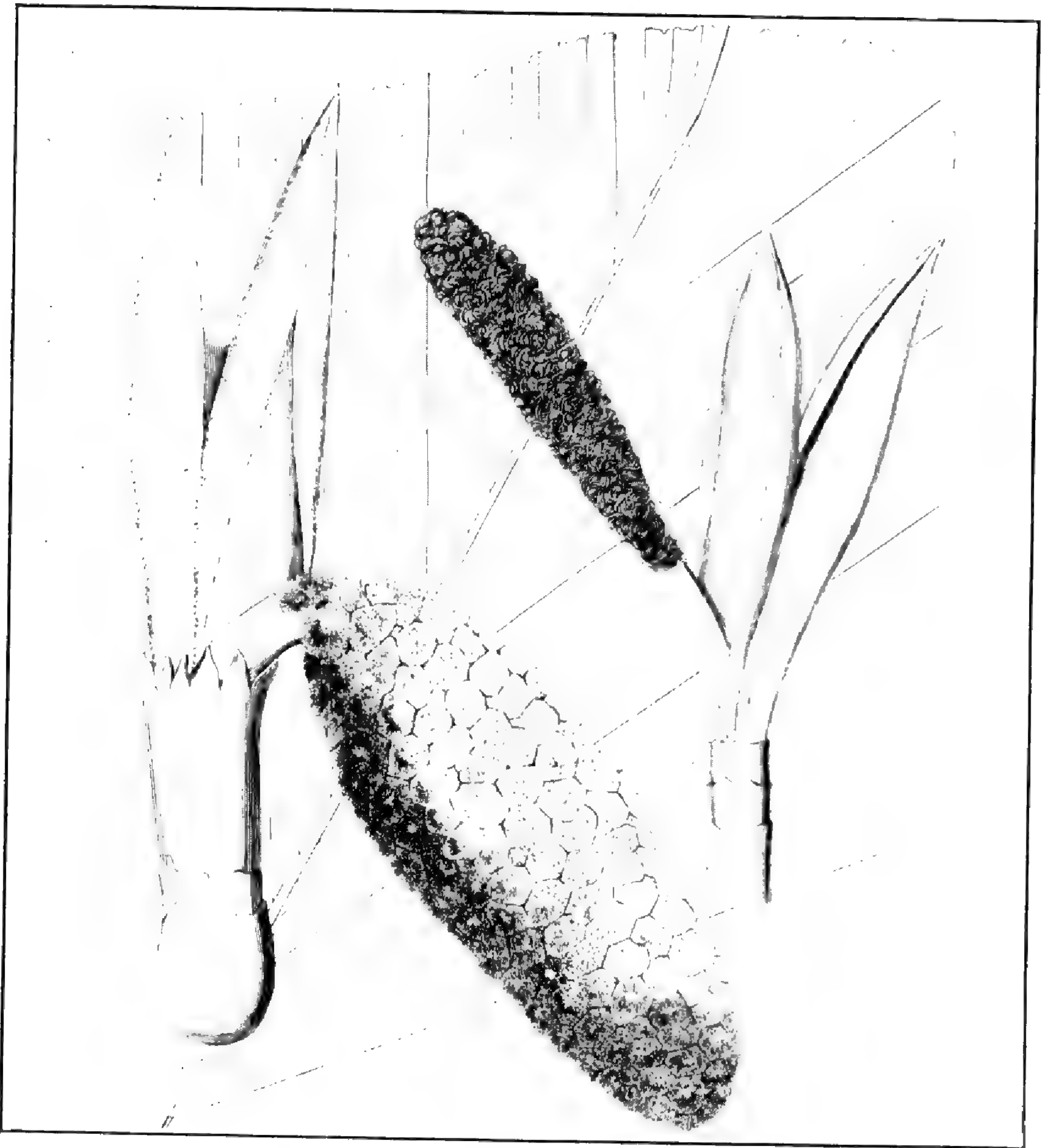
"This species is very abundant throughout the subalpine region (1,500-2,000 meters) of our Caraiibe cordilleras where it is given the name 'prapa' by the indigenes. Its smooth cylindrical trunk reaches 6 to 8 meters in length and 10 to 15 cm. in diameter. The woody part is very hard, black, and heavy (specific gravity in dry state 1.25 according to Ernst) and incloses a soft central pith. Leaves few, pinnate, 2 meters long and composed of 10 to 20 pinnae on either side of the rachis or common petiole with a terminal pinna. The pinnae are alternate, herbaceous, pale green, situated some distance from each other, irregularly rhomboidal, toward the tip more or less deeply incised. The 6 to 8 longitudinal veins or nerves run parallel with the pinnae, and are prominent on the under side. Pinnae 20 to 30 cm. long by 6 to 8 cm. broad. The terminal leaf is triangular or in the form of a half-open fan, cuneiform at base and truncate or gnawed at the tip, whence comes the specific name *prae-morsus*. The aerial roots form a pyramid of radiating pillars that gives strong support to the trunk. They are distinguished by their rough surface filled with spine-like protuberances that protect them from the herb-eating animals, principally the vaquira (Dicotyles) and the tapir (Tapirus) which inhabit the same region. The inflorescences have many spathes (10 to 12), fusiform, almost cylindrical, 20 to 25 cm. long and 5 to 6 cm. thick at the largest point, which is slightly below the tip. Inflorescences springing directly from the nodes of the trunk and not (as in the Iriarteas) from the base of the crown or leaves. Every spadix has 5 or 6 spathes, three interior and complete, closed until the time of flowering, and three exterior and shorter and incomplete; that is to say, always open at the upper end like short tubes. The flowers are seated in depressions, and are yellow and without bracts, the male and female on the same tree, but in different inflorescences. The male flowers have a three-parted calyx and a corolla of three triangular, somewhat fleshy petals, and have 9 to 15 stamens with free filaments and with anthers which split with two longitudinal apertures, this permitting the dispersion of the somewhat roughened pollen grains. The female flowers have the same number of sepals and petals as the male, with 4 to 6 staminodes. The ovary is three-celled, with the carpels very distinct, the style very short, and the three stigmas quite large, thick, with the interior somewhat channeled. The fruit is an egg-shaped berry with grumous pericarp, black, with a bluish luster, about the size of a pigeon's egg, inclosing a single seed. The 'prapa' flowers from August to October, and in the following April or May the fruits are mature."

#### WETTINIEAE.

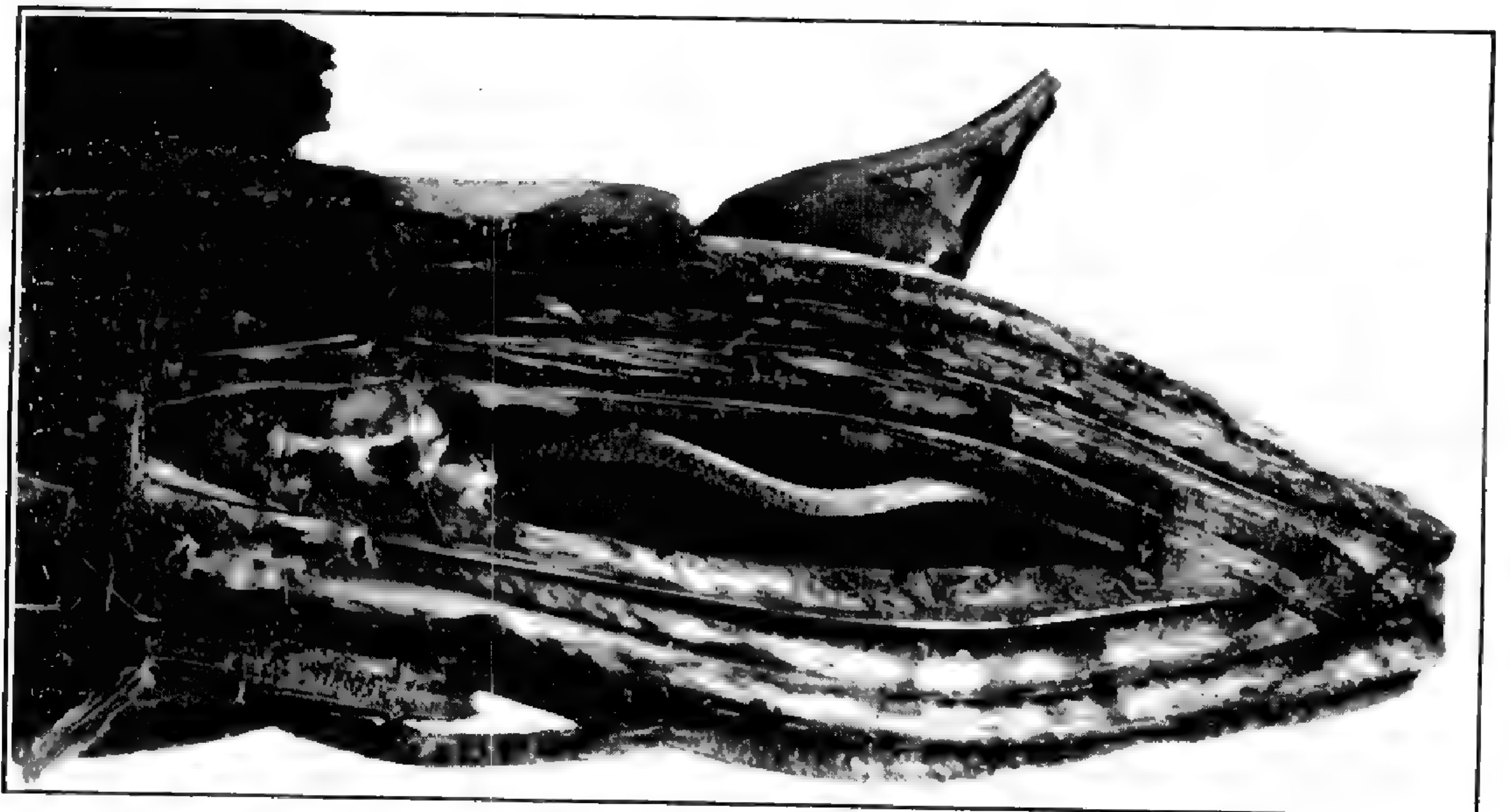
##### SYNOPTICAL KEY TO THE GENERA.

- Inflorescences simple; many (8 to 15) from each node.. WETTINIA (p. 235).  
 Inflorescences with 4 or 5 branches; five inflorescences  
 from each node but only the middle one maturing.. WETTINELLA (p. 235).

<sup>1</sup> Jahn, Alfredo, jr. Las Palmas de la Flora Venezolana 49-50. 1908.



A. WETTINIA AUGUSTA POEPP. & ENDL.



B. WETTINELLA QUINARIA COOK & DOYLE.

## WETTINIA Poepp. &amp; Endl.

*Wettinia* Poepp. & Endl. Nov. Pl. Poepp. 2: 39. pls. 153, 154. 1838;<sup>1</sup> Wendl. Bonplandia 8: 104–106. 1860.

Trunk solitary, 8 to 12 meters high, 15 to 20 cm. thick.

Leaves with opposite simple pinnæ.

Inflorescences simple, in verticillate clusters of 8 to 15, bearing flowers of one sex, but spathes of both sexes intermixed on the same trunk.

Spathes five, three short and two much longer and complete.

Male flowers with 4 or 5 minute sepals and 3 or 4 petals, valvate in the bud; stamens 12 to 16; female flowers with 3 sepals and 3 petals; staminodes?; ovary with 1 carpel and 1 ovule, obverse-pyramidate, villose; style filiform, rising at one side, from the base of the ovary; stigmas three, narrowly lanceolate.

Fruits obverse-pyramidate, flattened at the apex, strigose, hirsute, the endocarp delicately parchment-like.

Seed elliptical or obovate, surrounded with bundles rising from the base, running together to the apex, then laxly anastomosing and coming together again at the embryo; albumen solid, uniform; embryo basal, erect. (PLATE 63, A.)

Type species, *Wettinia augusta* Poepp. & Endl. loc. cit.; from the Huallaga Valley in eastern Peru.

EXPLANATION OF PLATE 63.—A. Male and female inflorescences of *Wettinia augusta* Poepp. & Endl. B. Young female inflorescence of *Wettinella quinaria* Cook & Doyle. A, reduced; B, natural size. A, reproduced from Poeppig and Endlicher; B, from a field photograph taken at Cordoba, Cauca, Colombia, December, 1905, by C. B. Doyle.

## WETTINELLA gen. nov.

Trunk solitary, rather short (7 meters long), rather thick (12 to 20 cm.), becoming smaller above; smooth, distinctly ringed; internodes long (20 cm.).

Leaves with long (168 cm.) scurfy sheathes; petiole short (15 cm.); pinnæ lanceolate, not inserted on a fleshy pulvinus; segments of unequal length but not divided; upper surface nearly smooth; lower surface densely brown hirsute, more pronouncedly so on the ribs; terminal pinnæ deeply divided.

Inflorescences with 6 spathes, three small incomplete basal ones inserted close together and, well separated from these, three large complete ones, the latter inserted farther from each other; spadix compound, divided into several (about 4) rather short, thick, fleshy branches which bear flowers of one sex densely crowded together; surface of spadix below the flowers densely hirsute; flowers monœcious in different inflorescences, usually one female inflorescence and two to four male inflorescences at each node.

Fruits obovate, variously flattened and angled by mutual pressure, as broad as long or narrower, the surface rather coarsely wrinkled on the exposed end and densely beset with minute tubercles each bearing a long hair; style persistent, woody, inserted some distance (about 8 mm.) above the base of the fruit and bearing three linear, compressed, grooved stigmas equal in length to itself and scarcely exceeded by the apex of the ripe fruit; mature calyx and corolla also nearly as long as the fruit, the petals narrower and slightly longer than the sepals, the latter united at the base, the petals distinct; mesocarp of rather firm corky texture, thicker at broadest part of fruit; inside coat of mesocarp a thin

<sup>1</sup>The Index Kewensis credits this genus to Poeppig alone, with a reference to Endlicher's Genera Plantarum (p. 243) with the date 1837. But Endlicher's account of the genus contains no reference to a species that could serve as a type.

membrane traversed by numerous web-like fibers; endocarp also a thin membrane traversed by numerous fragile fibers.

Seed oval, larger above the middle; seed coat a very thin membrane, delicately fibrous; albumen uniform; embryo basal, protected by a fragile, rather fleshy cap, the flattened, disk-like outer end of the embryo attached to the cap; embryo cavity large, conical.

Type species, *Wettinella quinaria*.

Distinguished from *Wettinia* Poepp. by the compound spadix and the very large sepals, broader than the petals and nearly as long.

***Wettinella quinaria* sp. nov.**

PLATES 54 (B), facing p. 230, 56 (C), facing p. 230, 63 (B), facing p. 235, 64, 65.

Trunk 7 meters long, 12 to 20 cm. in diameter 1 meter from base; internodes 20 cm. long; surface smooth.

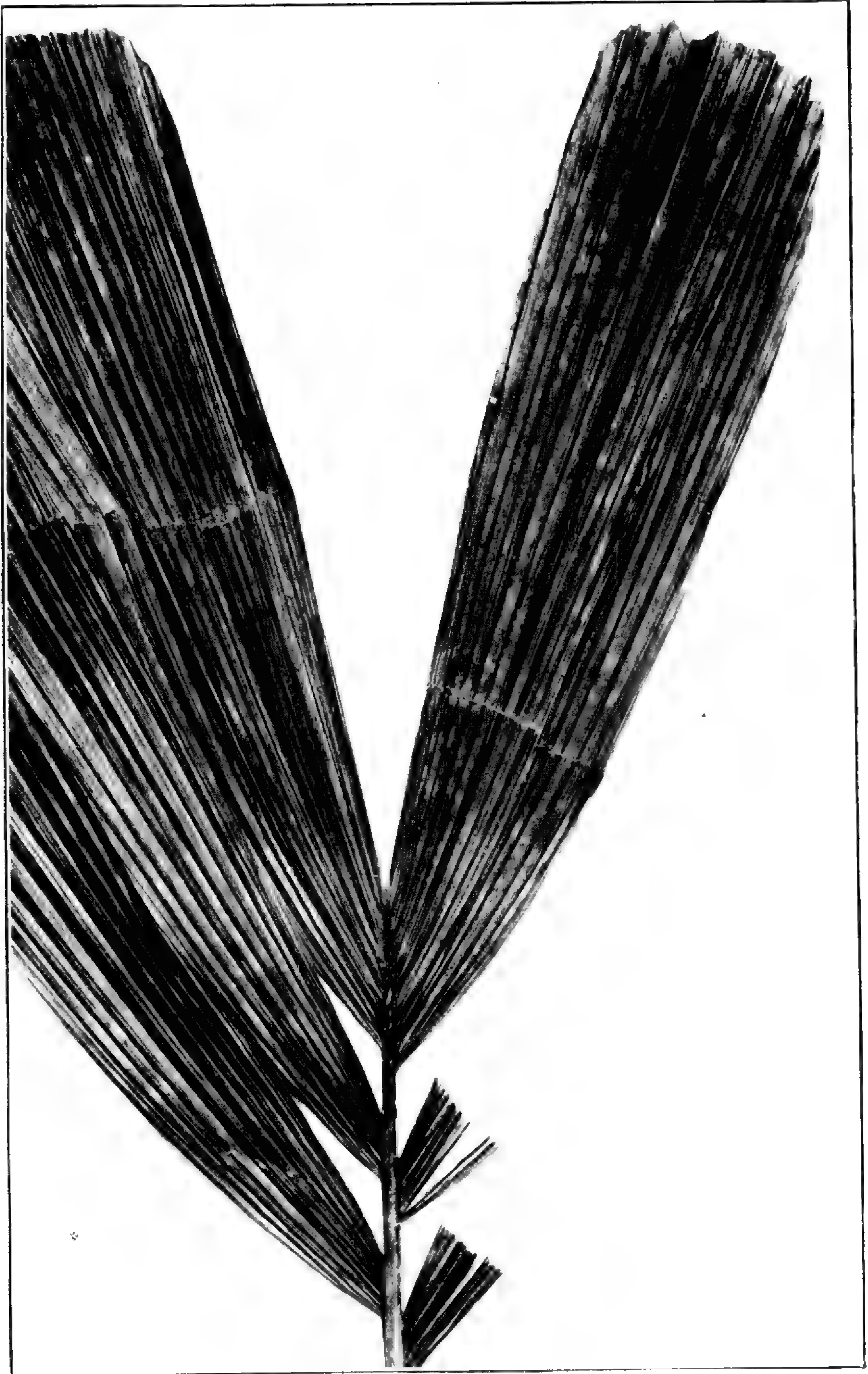
Leaves pinnate, 12 to 15 in a head, largest below the middle; leaf bases woody, 168 cm. long by 34 cm. wide at base, splitting into coarse, strong fibers; surface covered with a very closely adherent grayish scurf; with age the leaf bases becoming black and deeply wrinkled; young bases pale blue; petiole very short (15 cm. long) by 3 to 4 cm. in diameter; lower surface rounded, covered with grayish scurf like that on base; upper surface with deep central groove 1.5 cm. wide and 1 cm. deep.

Rachis 315 cm. long by 3.4 cm. broad at base, the deep groove of the petiole gradually becoming a broadly rounded ridge 1 cm. in width; on either side this central ridge paralleled by rather deep grooves, the pinnæ inserted in these; toward the tip of the leaf the grooves becoming flattened and the central ridge more prominent and rather sharp; lower surface rounded, flattening toward the tip, tomentose, except a narrow strip along the center, this smooth and light colored; central ridge and grooves of the upper surface covered with a rich brownish tomentum becoming grayish toward the tip; upper surface also marked with longitudinal striæ 1 mm. apart, distinct at base, gradually disappearing toward tip; just below the insertion of each pinna the rachis bare and smooth for 4 cm. or less.

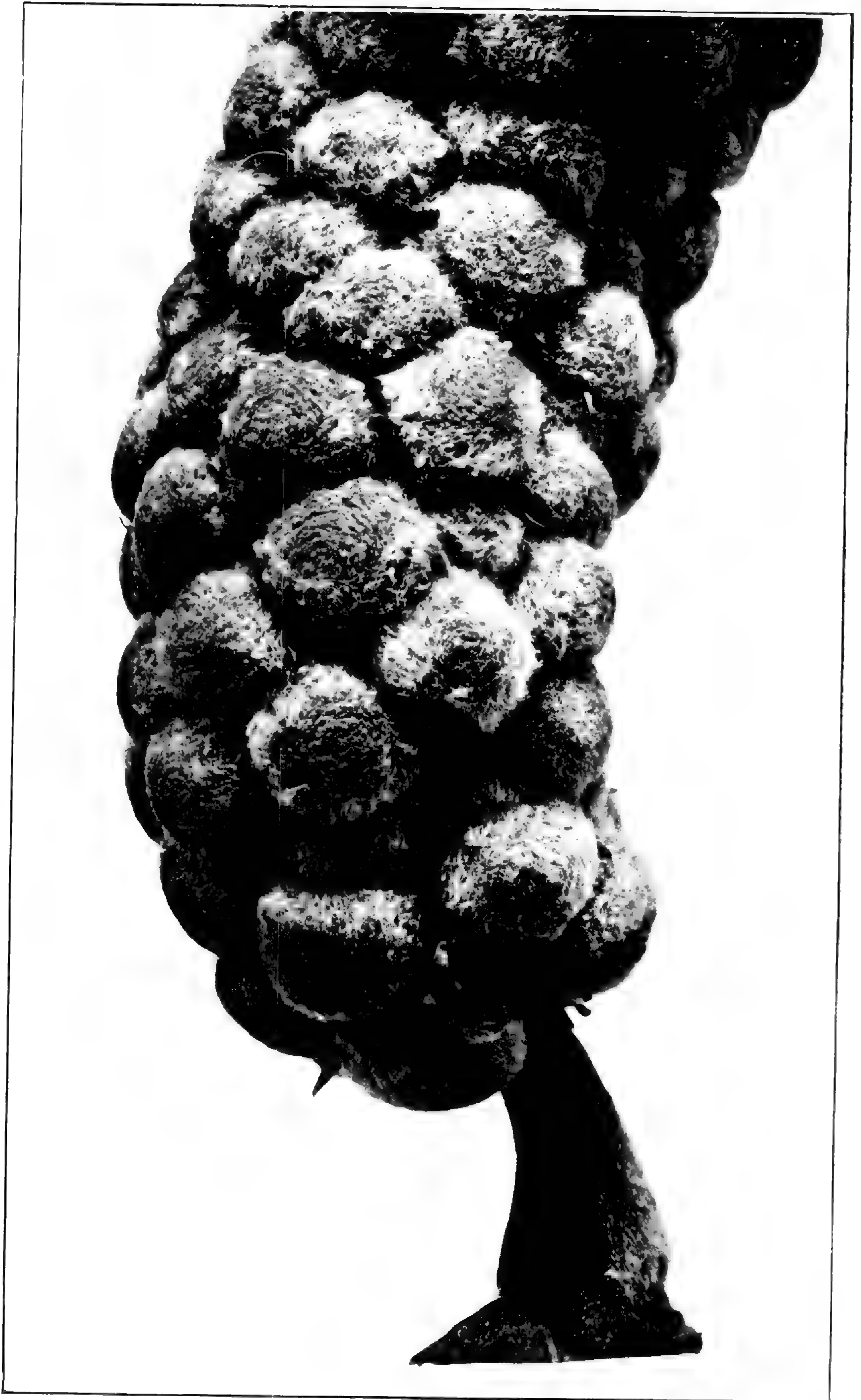
Pinnæ 40 to 44 on each side, divided irregularly into 3 to 20 segments, 12 mm. or less in width; upper surface dark green, covered for 15 cm. or less outward from point of insertion with tomentum like that found on lower part of rachis; on the pinnæ of the upper half of the leaf the tomentum changing to a light gray color and extending for only 2 cm. or less; lower surface of pinnæ of slightly lighter shade than the upper and very densely covered with reddish brown tomentum about 1 mm. in length; all the prominent veins more densely tomentose; lowest segments the longest in some pinnæ and the central ones in others, each segment notched at the apex, giving the whole margin a very ragged appearance; toward the end of the leaf the segments becoming more nearly equal in length.

Lowest pinnæ very small, scarcely 10 cm. in length and only 2 cm. broad at widest part, 1 cm. at base, consisting of 3 or 4 narrow segments; second pinnæ larger, 58 cm. long, 6 cm. wide just below the middle, consisting of 10 segments, each less than 1 cm. in width; middle pinnæ 112 cm. long by 10 to 11 cm. in width and 3 cm. at base, consisting of 16 narrow segments, the widest only 1 cm. wide; terminal pinnæ 40 cm. long by 4 to 8 cm. in width and 3 to 9 cm. at base, consisting of 11 to 16 segments, less than 1 cm. in width; largest pinnæ found between the base and the middle of the leaf, reaching a length of 110 cm. and a width of 14 cm. and consisting of about 20 segments.

Spathes 6, woody, covered with reddish hairs.



WETTINELLA QUINARIA COOK & DOYLE.



WETTINELLA QUINARIA COOK & DOYLE.



Inflorescences infrafoliar, five from one node, one or two female, the rest male; total length of female inflorescence 75 cm.; peduncle 36 cm. long by 8 cm. in diameter at base, abruptly narrowing to 2 cm., then widening again to 4 cm. at base of first branch, densely covered with light brownish tomentum, this more pronounced toward the base; branches 4, 39 cm. or less in length, 7 cm. in diameter at point of insertion, abruptly narrowing just above.

Fruit densely crowded along the branches, quadrangular top-shaped by mutual pressure, 2.5 cm. long by 2 to 2.5 cm. in diameter at widest point; densely gray-tomentose; outer shell corky, 1 to 3 mm. thick; seed oval, broadest above the middle; embryo basal.

Type in the U. S. National Herbarium, nos. 690424, 690425, 690433 (all from one tree), collected in deep damp forests about Cordoba, Cauca, Colombia, about 10 miles inland from Buenaventura, by C. B. Doyle, in December, 1905.

Native name, "gualte."

EXPLANATION OF PLATES 64, 65.—Plate 64, tip of leaf of *Wettinella quinaria*. From photograph of a dried specimen taken in Washington by C. B. Doyle. Reduced. Plate 65, branch with fruit of *Wettinella quinaria* Cook & Doyle. From field photograph taken at Cordoba, Cauca, Colombia, December, 1905, by C. B. Doyle. Natural size.

#### *Wettinella maynensis* (Spruce).

*Wettinia illaqueans* Spruce, Journ. Linn. Soc. Bot. 3:191. 1859.

*Wettinia maynensis* Spruce, Journ. Linn. Soc. Bot. 3:191. 1859; 11:130. 1869.

Notes Bot. Amazon & Andes 2: 136, 443. 1908; Kew Bull. Mis. Inf. 1909: 221. 1909.

This palm was described by Spruce as a second species of *Wettinia*, the differential characters being stated as follows:

"*Wettinia maynensis* differs from *W. augusta* chiefly in the more numerous pinnae (38–40 pairs, while in *W. augusta* they are but 18–20 pairs), and in the spadices, which are only three from one leaf-ring, and put forth 5–8 fastigate branches at their apex; while in *W. augusta* they are simple, and as many as from 8 to 15 grow from the same ring. There is a further difference, in the spathes, which in *W. maynensis* are 6 in number, the three outer (corresponding to what are called by Martius in other genera 'spathae incompletae') much smaller, and persisting on the peduncle in the form of sheaths; while the three inner and larger ones ('spathae completae') fall away before the fruit is ripe, or persist only in fragments. In *W. augusta* the spathes are said to be two, and the peduncle is said to be furnished with remote coriaceous sheaths—undoubtedly the remains of the incomplete spathes. In both specimens the sepals vary in number, and the stamens are from 12 to 16, nor does there seem to be much difference in the form of the fruit; but in *W. maynensis* the arilliform raphe is in every stage thin and papery, while in *W. augusta* it is fleshy. In Endlicher's description, the scale-like external sepals are considered bracts; but as they quite correspond to what are called sepals in other palms, I describe them as such."<sup>1</sup>

It would seem that Spruce's palm is more closely allied to our *Wettinella quinaria*, which has a branched spadix, and it is therefore placed as a second species of this new genus. Its chief characters which separate it from *quinaria* lie in the fewer inflorescences from each node, 3 instead of 5, and in the much shorter sepals and petals. Spruce says that in *W. maynensis* the female spadix is very constantly 5-branched, while in *W. quinaria* there are only 4 branches. The following additional details are given by Spruce, mostly in the form of a long Latin description:

Habitat in the shady valleys of the Andes of Maynas in eastern Peru.

<sup>1</sup> Spruce, Richard. Five New Plants from Eastern Peru. Journ. Linn. Soc. Bot. 3: 192. 1859.

Trunk erect, unarmed, 30 to 40 feet tall, 4 inches in diameter; internodes 4 inches long; leaves 5 or 6 in a head; leaf sheath  $3\frac{1}{2}$  feet long, smooth; rachis  $9\frac{1}{2}$  feet long, triangular above, rounded below, pinnate to the very base, somewhat channelled but only at the base; pinnæ 38 to 40 pairs, about equidistant, the lowest very minute, the middle 3 feet long with a breadth of 3 inches, inserted at an angle of 40 to 50 degrees; base semivertical, reduplicate; apex obtuse or truncate, premorse; outer margin and apex with premorse or subacute teeth.

Inflorescences clustered, 3, one female and two male rising in the same axil, those with ripe fruit usually on the fourth ring below the leaves; spathes 6, three complete, three incomplete; outer incomplete spathes 4 inches long, inner 11 inches long, 3 inches broad, fusiform; spathes covered with appressed hairs.

Male inflorescence with 8 simple branches 6 inches long, twisted to the left in the early stages before flowering, afterwards nearly straight, densely covered with flowers; sepals scale-like, short, rigid, chestnut colored, valvate in the bud, 3 to 5 (for the most part 4), broadly subulate, rather obtuse, a line long, free or sometimes 2-parted; petals 3, very long (7 lines), narrowly subulate, subflexuous; stamens 12 to 16, usually 13; anthers 4 lines long, obtusely 4-angled, 2-celled, attached a little above the base to a short, subulate, compressed filament  $\frac{1}{2}$  to 1 line long; longitudinally dehiscent, covered with white, flexuous, deciduous hairs, the slender connection produced into a somewhat curved point; pollen lobes smooth.

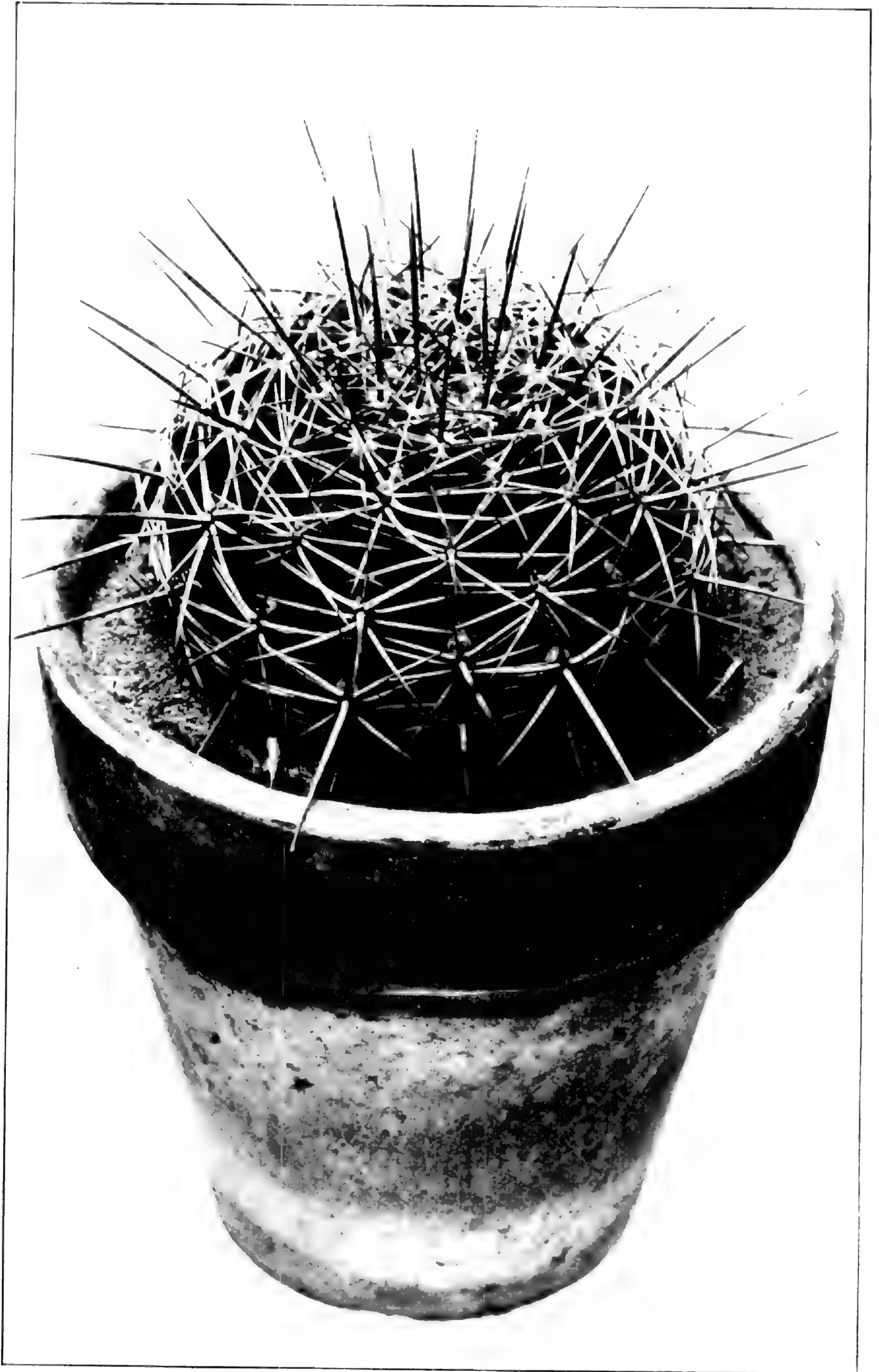
Female inflorescence similar to the male; branches 5 to 7, crowded, 8 inches long, diameter including fruit almost 4 inches; sepals 3, 2 to 3 lines long, subequal; petals 3, 5 to 6 lines long; ovaries 3, oval,  $3\frac{1}{2}$  lines long, united to each other and with the style; ovule single from the internal angle of the base, almost erect, sessile, anatropous; style single, central, 7 lines long, subulate, sometimes 3-angled, villous for the most part, with the abortive ovaries at the base of the ovule rarely deciduous; stigmas 3, terete, erect, flexuous, 3 lines long.

Fruits 1-seeded, dry and crowded on the spadix, 3 to 6-angular by mutual pressure, obpyramidate, the apex broadly convex, covered with ashy hairs; pericarp softly woody, rather delicate, thicker at apex; endocarp membranous, adhering to the vessels of the raphe; seed 11 by 6 lines, narrow below, obovate-subtriangular; testa thin, firm, blackish, marked from the base to the apex with the delicate raphe and reticular with the flattened white adherent fibers of it grown together with the kernel; albumen uniform, somewhat bony; embryo in basal cavity, conical-cylindrical, directed toward the center of the seed.

In a more recent publication of Spruce's field notes is the following paragraph on this palm:

"*Wettinia maynensis* (Palmae) is now very frequent and grows occasionally close by the margin, along with the Iriartas, from which it is distinguished at sight by the pinnæ being equidistant and all spreading out from the rachis horizontally, but pendulous (from their weight) toward the apex, so that the entire frond has a widely channelled form. In the Iriartas the laciniae of the pinnæ are in fascicles, the uppermost of each fascicle standing out above the rachis, the lowest pendulous, the rest at intermediate angles. Female spadix very constantly five-branched."<sup>1</sup>

<sup>1</sup> Kew Bull. Misc. Inf. 1909: 221. 1909.



ECHINOCACTUS ALAMOSANUS BRITT. & ROSE.



ECHINOCEREUS LUTEUS BRITT. & ROSE.

# STUDIES IN CACTACEAE—1.

BY N. L. BRITTON AND J. N. ROSE.

In continuance of our studies of Cactaceae, after examining a large series of additional specimens, both living and herbarium, we find a number of new species to be described and a few old ones which need to be transferred to genera other than those to which they have been referred. All the new species here published have been studied from living material either seen in the field or grown in the greenhouse, and specimens have in all cases been photographed.

## NEW SPECIES.

**Echinocactus alamosanus** Britt. & Rose, sp. nov.

PLATE 66.

Plants usually single, sometimes in clusters, somewhat flattened from above, 30 cm. or more in diameter; ribs about 20, narrow; spines all yellow; radials usually 8, slightly spreading; central single, porrect or erect, somewhat flattened laterally, 6 cm. long and a little longer than the radials; flowers and fruit still unknown.

Type in the United States National Herbarium, no. 535974, collected high up in the canyons of Alamos Mountain, Sonora, Mexico, March 18, 1910, by Rose, Standley, and Russell (no. 12850).

This species is unlike anything we have yet seen from the west coast of Mexico. A small living plant was brought back to Washington, a photograph of which is here reproduced.

EXPLANATION OF PLATE 66.—From a photograph of the living plant taken in Washington.

**Echinocereus luteus** Britt. & Rose, sp. nov.

PLATE 67.

Stem short, sometimes branching near the base, bluish green, more or less purplish, strongly 8 or 9-ribbed; ribs rather thin, hardly, if at all, undulate, their margins rounded; areoles small, 10 to 12 mm. apart; spines small, the radials 6 to 8, unequal, 2 to 8 mm. long, widely spreading, white with darker tips; central spine single, porrect; flowers on each rib appearing near the top of the plant and from the axil of the second or third areole; buds acute, reddish, covered with long, brownish bristles; areoles on ovary and flower tube bearing white wool and light-colored spines with dark tips; flowers pale yellow, sweet-scented, 7 cm. long including the ovary; petals oblanceolate, acute; filaments yellow; stigmas deep green.

Type in the United States National Herbarium, no. 535975, collected in the high mountains above Alamos, Sonora, Mexico, March 19, 1910, by Rose, Standley, and Russell (no. 15207). Only a single specimen was seen, growing on the exposed rocks. The specimen was sent to Washington, where it produced four flowers in 1910 and two in 1911. The species is perhaps nearest *E. inermis*, but it has more ribs and different spines.

EXPLANATION OF PLATE 67.—From a photograph of the type specimen as it flowered in Washington. Natural size.

**Epiphyllum gaillardae** Britt. & Rose, sp. nov.

PLATE 68.

Much branched, especially below; joints terete at base, gradually widening above, 5 cm. broad at widest part, obtuse, light green or reddish when young; areoles separated by low scallops, the basal areoles (as also those of the seedling) bearing a tuft of white hairs; calyx tube slender, 18 to 20 cm. long, pinkish, bearing a few scattered bracts; petals white, 3.5 cm. long, very narrow, acute; style deep red; fruit narrowly oblong, 12 cm. long, 3 cm. in diameter, magenta-colored, the surface marked here and there by short ribs running down from the backs of the scattered bracts.

Type in the United States National Herbarium, no. 691240, collected in the Canal Zone, Panama, August 6, 1909, by Mrs. D. D. Gaillard.

Common in the Canal Zone and adjacent parts of Panama; first sent by Mrs. Gaillard, for whom it is named.

Mr. Pittier reports that the seeds of this species germinate while the fruit is still hanging on the plant. When he returned from Panama in March, 1912, he brought one fruit covered with the green seedlings.

The name *Epiphyllum* has priority over *Phyllocactus*. The later *Epiphyllum* of Pfeiffer, still in use by some writers, must revert to *Zygocactus*.

EXPLANATION OF PLATE 68.—From a photograph of a living plant collected at Porto Bello, Province of Panama, by H. Pittier, April, 1912. Slightly more than two-thirds natural size.

**Hylocereus minutiflorus** Britt. & Rose, sp. nov.

PLATE 69.

Very slender, high-climbing vines, 3-angled, the angles sharp but not winged, deep green; areoles distant (2 to 4 cm. apart), the spines 1 to 3, minute, brownish; flowers 5 cm. long, opening at night; flower tube wanting or nearly so (10 mm. long), red except the greenish base; sepals linear, red at the tip, 3 to 4 cm. long; petals white; stamens white, about 1 cm. long, borne in one series at the base of the petals; style white, 2 cm. long, thick.

Type in the United States National Herbarium, no. 619842, collected near Lake Izabal, Guatemala, in 1907 by R. H. Peters and flowered in Washington in June, 1909, and June and July, 1911, and in 1912.

The flowers of this species are unusually small, but the vines are healthy and produced a few flowers in 1909 and 1911, and an abundance in 1912. The plants have been under observation since 1907.

EXPLANATION OF PLATE 69.—Flowering branch from the type specimen, in cultivation. Natural size.

**Nyctocereus guatemalensis** Britt. & Rose, sp. nov.

PLATES 70, 71.

Stems half-erect, arching, creeping, or even prostrate, 3 to 6 cm. in diameter; ribs 8 to 12, very low; radial spines about 10; centrals 3 to 6, usually much longer than the radials, the longer ones 3 to 4 cm. long; flowers very fragrant, 4 to 5 cm. long; ovary somewhat tuberculate, each tubercle crowned by an areole bearing a cluster of pinkish or brownish spines; outer sepals brownish; petals lanceolate, acute, nearly white; stamens much shorter than the petals, attached all along the surface of the wide throat; style stout, 3 cm. long; fruit small (about 2 cm. long), spiny; seeds black, shining, 3 mm. in diameter.

Type in the United States National Herbarium, no. 535977, collected at El Rancho, Guatemala, April 4, 1905, by William R. Maxon (no. 8510).

The following collections have been examined:

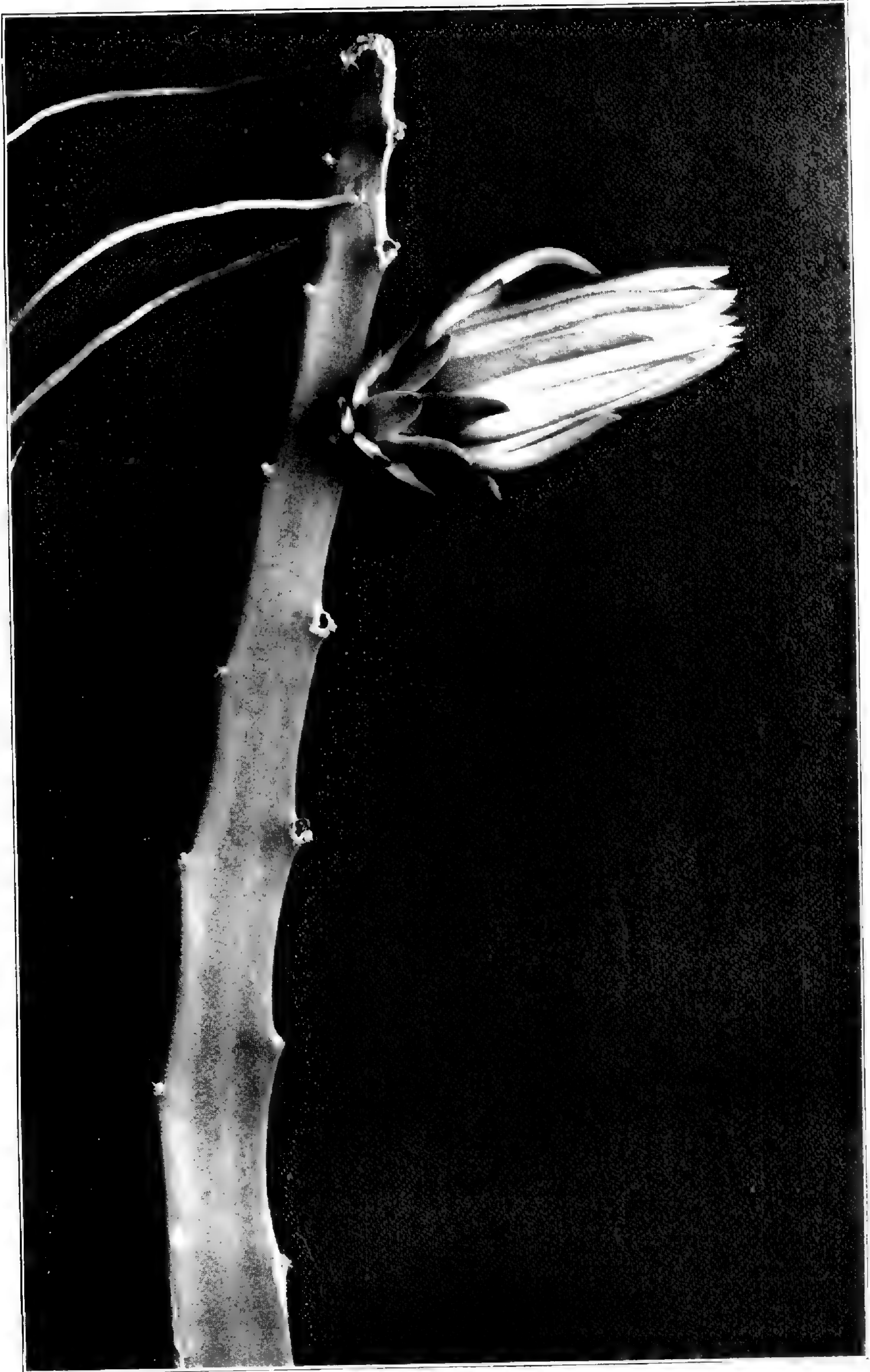
GUATEMALA: El Rancho, April 4, 1905, *Maxon* 8510; June 8, 1908, *Deam* 6249a; without definite locality, 1909, *F. Eichlam*.

Individuals from all three of these collections are now growing in Washington. Mr. Maxon's plant flowered in July, 1910, and Mr. Eichlam's in 1911.

EXPLANATION OF PLATES 70, 71.—Plate 70, part of a flowering plant, in cultivation. Natural size. Plate 71, A, B, two views from Guatemala showing the habit of this species. From negatives furnished by Charles C. Deam.

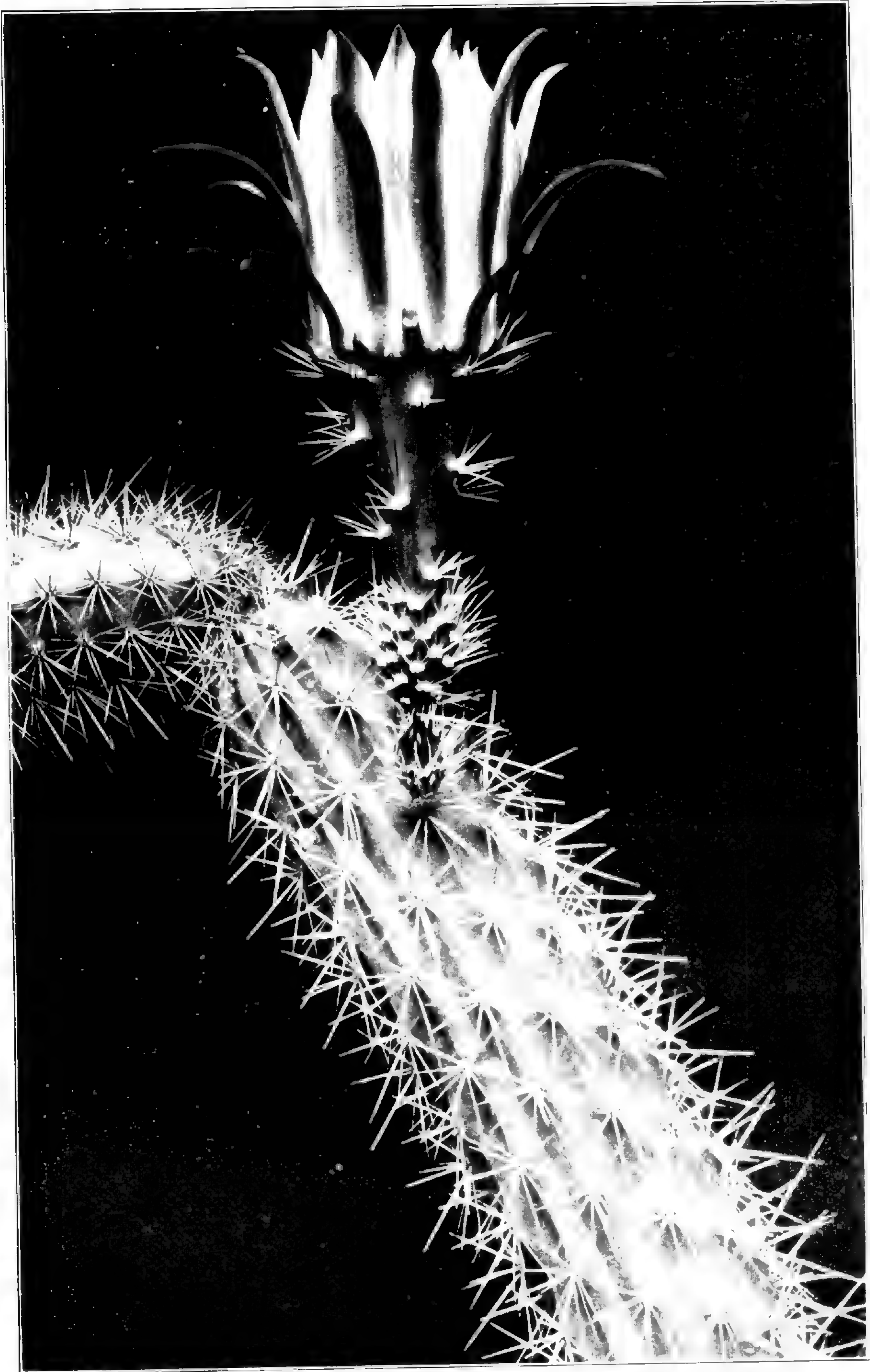


EPHYPHYLLUM GALLARDAE BRITT. & ROSE



HYLOCEREUS MINUTIFLORUS BRITT. & ROSE.





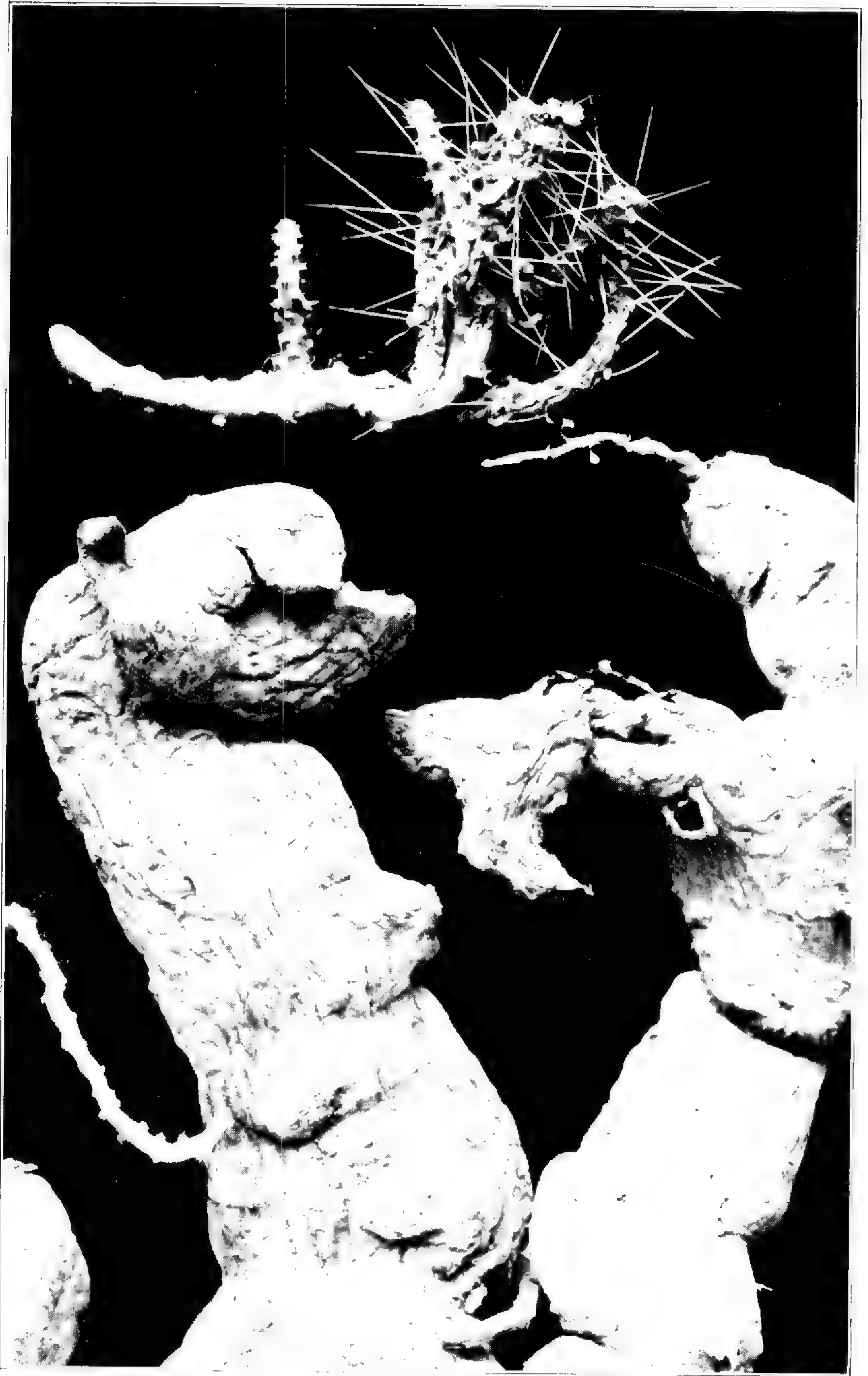
NYCTOCEREUS ATEMALENSIS BRITT & R.



A. NYCTOCEREUS GUATEMALENSIS BRITT. & ROSE.



B. NYCTOCEREUS GUATEMALENSIS BRITT. & ROSE.



OPUNTIA CHAFFEYI BRITT. & ROSE.



WILTIA PANAMENSIS BRITT & ROSE.

**Opuntia chaffeyi** Britt. & Rose, sp. nov.

PLATE 72.

Perennial, from a large, fleshy, deep-seated root often 35 cm. long and 4 cm. in diameter; stems annual, 5 to 15 cm. high, much branched near the base; joints elongated, 3 to 5 cm. long, in cultivated specimens 25 cm. long, 6 to 7 mm. broad, slightly flattened, glabrous, pale bluish green or sometimes purplish; areoles circular, bearing the spines surrounded by white wool in the lower part and the yellow glochids surrounded by brown wool in the upper part; spines 1, rarely 2 or 3, needle-like, 2 to 3 cm. long, whitish or pale yellow; leaves minute, caducous; flowers not seen, but said to be rose color, small; fruit unknown.

Type in the United States National Herbarium, no. 535976, collected on the Hacienda de Cedros, near Mazapil, Zacatecas, Mexico, May 20, 1910, by Dr. Elswood Chaffey.

This is a most remarkable *Opuntia*, being the only one known which has annual stems. Dr. Chaffey after a careful investigation assures us that the species has this habit, although in exceptionally wet years the stem may be carried over until the next growing season. In our greenhouse it persists for several years. The young shoots suggest *O. leptocaulis*. We were at first inclined to consider it only a form of that species, but when good material was examined, it was seen to be very distinct. The joints, while narrow and elongated like those of the *Cylindropuntias*, are somewhat flattened and the spines show no sign of a sheath. This indicates that the species is probably a *Platyopuntia* and related, but not closely, to *Opuntia pumila*.

The species has been under observation in the greenhouse for two years, while Dr. Chaffey has repeatedly examined it in the field; but so far no flowers or fruit have been obtained.

EXPLANATION OF PLATE 72.—Root and young branch, as received from the collector. Natural size.

**Wittia panamensis** Britt. & Rose, sp. nov.

PLATE 73.

Pendent; joints much flattened; flowers solitary from the upper areoles, purple throughout, 2.5 to 3.5 cm. long before the lobes open, decidedly 5-angled, stiff; outer sepals 5, equal, obtuse, angled on the back, the inner ones 5, similar but thinner, not angled, a little longer, all erect; petals 10, thinner paler, and much smaller than the sepals, apiculate, forming an inner compact cylinder; tube proper 5 to 6 mm. long, the throat 10 mm. long; stamens in two clusters, one from the base of the throat on long filaments, one from the top of the throat on short filaments, all included; stigma lobes 4, white, remaining in a close cluster, the top exerted beyond the petals; ovary globular, purple, bearing a few scarious scales; fruit greenish white to pink, about 1 cm. long.

Type in the United States National Herbarium, no. 691299, collected on mountains above Chepo, Panama, October 15, 1911, by H. Pittier (no. 4571), and flowered in Washington, April, 1912. Also collected by R. S. Williams at Marraganti, Panama, April 3 to 9, 1908 (no. 698).

The genus *Wittia* was described by Karl Schumann,<sup>1</sup> being based on a single species, *W. amazonica*. The present is a second species of this strange genus. As the illustration shows, the stem resembles that of species of *Epiphyllum* and of *Rhipsalis*, but the flowers are very different from those of either.

EXPLANATION OF PLATE 73.—A flowering branch of the type specimen, in cultivation. Natural size.

<sup>1</sup> Monatschr. Kakteenk. 13: 117. 1903.

## NEW BINOMIALS.

**Echinocereus chlorophthalmus** (Hook.) Britt. & Rose.

*Echinocactus chlorophthalmus* Hook. Curtis's Bot. Mag. 74: pl. 4373. 1848.

This *Echinocereus*, long ago described as an *Echinocactus*, has never been transferred.

**Leptocereus quadricostatus** (Bello) Britt. & Rose.

*Cereus quadricostatus* Bello, Anal. Soc. Españ. Hist. Nat. 10: 276. 1881.

This is a common species in Porto Rico and has all the characteristics of *Leptocereus*.

**Selenicereus urbanianus** (Gurke & Weing.) Britt. & Rose.

*Cereus urbanianus* Gurke & Weing. Monatsschr. Kakteenk. 16: 136. 1906.

This species was inadvertently omitted from our original treatment of *Selenicereus*.

**Selenicereus vagans** (K. Brandeg.) Britt. & Rose.

*Cereus vagans* K. Brandeg. Zoe 5: 191. 1904.

*Cereus vagans* in habit is exactly like *Selenicereus*, and while its flowers are not quite typical, it seems best to refer it here, its place being, perhaps, next to *S. spinulosus*.

*Cereus longicaudatus* Weber, stated by us to be probably identical with *S. vagans*, has recently been studied by Mr. W. Weingart and he reaches the same conclusion. *Cereus longicaudatus* was published the same year as *C. vagans*, but several months later.

**Wilcoxia viperina** (Weber) Britt. & Rose.

*Cereus viperinus* Weber; Gosselin, Bull. Mus. Nat. Hist. (Paris) 10: 385. 1904.

This species was re-collected at its type locality by C. A. Purpus in April, 1908 (no. 3301), and an examination of this material shows that it is a good *Wilcoxia*.

# RELATIONSHIPS OF THE FALSE DATE PALM OF THE FLORIDA KEYS, WITH A SYNOPTICAL KEY TO THE FAMILIES OF AMERICAN PALMS.

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By O. F. COOK.

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## THE GENUS PSEUDOPHOENIX AND THE FAMILY PSEUDOPHOENICACEAE.

### PSEUDOPHOENIX AN ISOLATED TYPE.

Though the false date palm (*Pseudophoenix sargentii* Wendl.) was discovered over twenty years ago, little attention has been given to the problem of its relationships. The fact that the natural distribution is limited, as far as known, to two or three islands of the Florida Keys does not make it less interesting from the standpoint of classification. Isolated types often have a special bearing upon questions of phylogeny and classification. Reasons are usually found for believing that such types are the remnants of ancient groups that have elsewhere become extinct. Several genera not known from other parts of the world are represented in the unique palm flora of Florida and Cuba. That the other peculiar genera are fan palms only makes *Pseudophoenix* the more interesting because it represents an intermediate stage of development between the fan palms and some of the pinnate-leaved families.

### ANALOGIES WITH FAN PALMS AND TRUE DATE PALMS.

The generic name applied by Wendl. may be taken to indicate that *Pseudophoenix* was looked upon at first as an American analogue of the true date palms of the Old World, which seem to be related, not very remotely, to *Chamaerops* and other Old World fan palms. The analogy with *Phoenix* is made somewhat closer by the form of the leaves of *Pseudophoenix*, with their rather narrow, closely folded pinnæ arranged in irregular groups and standing at different angles to the rachis. Yet the pinnæ are altogether different from those of *Phoenix*, for they are reduplicate or folded back, with the channel on the under side, as in all of the pinnate palms except *Phoenix*.

*Pseudophoenix* is also like *Phoenix* in sharing some of the characters of fan palms, such as the large, branching inflorescence, the stipitate flowers, and the fleshy fruits with equal development of two or

three carpels. But they are not the same resemblances that are shown in Phoenix and they afford no indication that Pseudophoenix is at all related to the true date palms. They furnish additional proof, if any were needed, of the derivation of the pinnate-leaved palms from fan-leaved ancestors, but the fact that some of the ancestral features have been retained should not cause profound differences in other respects to be overlooked.

#### ALLEGED RELATIONSHIPS WITH OTHER PINNATE-LEAVED PALMS.

Sargent states that the original example of the palm, on Elliotts Key, was at first mistaken for a royal palm (*Roystonea*). The resemblance lay in the smooth, columnar trunk, the irregular positions of the pinnæ, and the elongated, sheathing leaf bases, but it became apparent that these similarities were merely external, as soon as the inflorescences and fruits were examined.<sup>1</sup>

Wendland at first suggested an affinity with *Chamaedorea* and afterward with *Gaussia*, in which Drude seems to have agreed. *Gaussia* is a Cuban genus of *Synechanthaceae*, while *Chamaedorea* belongs to a strictly continental group, chiefly Central American. In addition to the geographical proximity there is a slight resemblance between *Pseudophoenix* and the *Synechanthaceae*, both in the habit of growth and in the crowded, deeply furrowed pinnæ. Moreover, the seeds of *Pseudophoenix* are marked on the surface with a few impressed branches of the raphe, much as in *Synechanthus*. But such similarities are shared by so many other palms that they are of very little account as evidences of relationship. There is a complete contrast between the highly specialized inflorescence characters of the *Synechanthaceae* and the relatively primitive condition represented by *Pseudophoenix*.

The characters that afford the most definite suggestions regarding the affinities of *Pseudophoenix* are found in the fruits. The fruit characters indicate that *Pseudophoenix* is much more closely related to the ivory palms, or even to the coconut palms, than to *Chamaedorea* or to *Gaussia*. With only the dried fruits, as represented in herbarium specimens, it is easy to overlook some of the most suggestive features. New characters have been learned from fresh material of the ripe fruits, sent in by Mr. E. Simmonds from Miami, Florida,

<sup>1</sup> Sargent, C. S. New or Little Known Plants. *Pseudophoenix sargentii*. Gard. & For. 1: 352. f. 55, 56. 1888. The figures consist of a photograph of a group of the palms on "Long's Key" and drawings of the fruits and seeds. Wendland's Latin diagnosis is given. A preliminary notice of the palm, with the name "*Pseudophoenix sargentii* H. Wendland," had been published two years before, in the Botanical Gazette (11: 314. 1886). Sargent's most complete account of *Pseudophoenix* is in the *Silva of North America* (10: 33. pl. 506. 1896.) The localities mentioned in the *Silva* are Elliotts Key and Key Largo.



in February, 1912, to the office of Seed and Plant Introduction of the Bureau of Plant Industry, U. S. Department of Agriculture. A specimen of the inflorescence with the fresh flowers was also received in August, 1912, from Mr. Simmonds, through the courtesy of Mr. R. A. Young of the same office.

One reason why it did not seem possible to assign *Pseudophoenix* to a satisfactory place in the classification was that the flowering stage was still unknown, the floral characters having been inferred from the parts that persist on the mature fruits. The most significant fact to be learned in this way was that the flowers of *Pseudophoenix* are borne on distinct pedicels. This feature alone would make it evident that there could be no very close alliance between *Pseudophoenix* and any of the genera with which it has been associated by previous writers. From the fresh inflorescence it is still more apparent that *Pseudophoenix* is not merely similar to the fan palms in having pedicellate flowers, but in several other floral characters that entirely exclude the idea of alliance with *Gaussia* or *Chamaedorea*.

#### FRUIT CHARACTERS.

In external appearance the fresh fruits of *Pseudophoenix* may be described as smooth, shining berries, orange red in color and very variable in form, depending on the number of seeds developed. Many of the fruits have only one or two seeds, but so large a proportion are three-seeded that this must be considered as the normal condition. The size and shape of the fruits, and the characters of the attached floral organs are shown at natural size in plates 74 and 75. The general structure of the fruit is much like that of some of the cocoid palms, such as *Bactris*, *Attalea*, and *Acrocomia*. A smooth, thin epidermis incloses a thick, fleshy, oil-bearing pulp with an embedded fibrous network, surrounding a firm endocarp. Though the endocarp is quite thin, it is very hard and bony and has a distinctly columnar structure as in *Manicaria* and *Phytelephas*. And as in the latter genera, the endocarps of the three pistils remain distinct instead of being united as in the *Cocaceae*.

Thus in the fruits of *Pseudophoenix* the exocarp characters of some of the *Cocaceae* may be said to be combined with the endocarp characters of the *Manicariaceae* and *Phytelephantaceae*. The method of germination is also closely similar to that of the ivory palms. Instead of being related to the *Synechanthaceae* or the *Chamaedoreaceae*, *Pseudophoenix* finds a closer alliance with the coconut palms and other families recently recognized as members of a cocoid series.<sup>1</sup>

<sup>1</sup> Cook, O. F. Relationships of the Ivory Palms. Contr. U. S. Nat. Herb. 13: 133-142. 1910.

In affording such a combination of the characters of the Cocaceae with those of Manicariaceae and Phytelephantaceae, *Pseudophoenix* adds to the evidences of relationship drawn from the characters of the other families. On account of their peculiar flowers and fruits the ivory palms of South America had not been considered genuine palms, but had been placed in other orders, usually in association with *Nipa*, an altogether different Old World type. The recognition of the Phytelephantaceae as true palms and their association with the Cocaceae appear the more completely justified, now that we have *Pseudophoenix* as well as *Manicaria* to illustrate intermediate conditions of development of the characters of the fruits. Indeed, *Pseudophoenix* is much more directly intermediate than *Manicaria* in the particular characters in which the coconut palms and the ivory palms appear most widely divergent. The exocarp of *Manicaria* is much like that of *Phytelephas* and quite unlike that of any of the Cocaceae, while *Pseudophoenix* appears closer to the Cocaceae in the exocarp and closer to the ivory palms in the endocarp.

#### PSEUDOPHOENIX THE TYPE OF A NEW FAMILY.

Though the characters of the fruits and the germinating seedlings afford consistent and substantial evidences of the affinity of *Pseudophoenix* with the ivory and coconut palms, it does not appear that any very close alliance can be established. *Pseudophoenix* would certainly appear as a very anomalous genus if placed in the Cocaceae, Manicariaceae, or Phytelephantaceae. The only reasonable course seems to be to assign it to an independent position in the classification as representing a new and distinct family, Pseudophoenicaceae. The salient characters are indicated in the following description:

#### Family PSEUDOPHOENICACEAE.

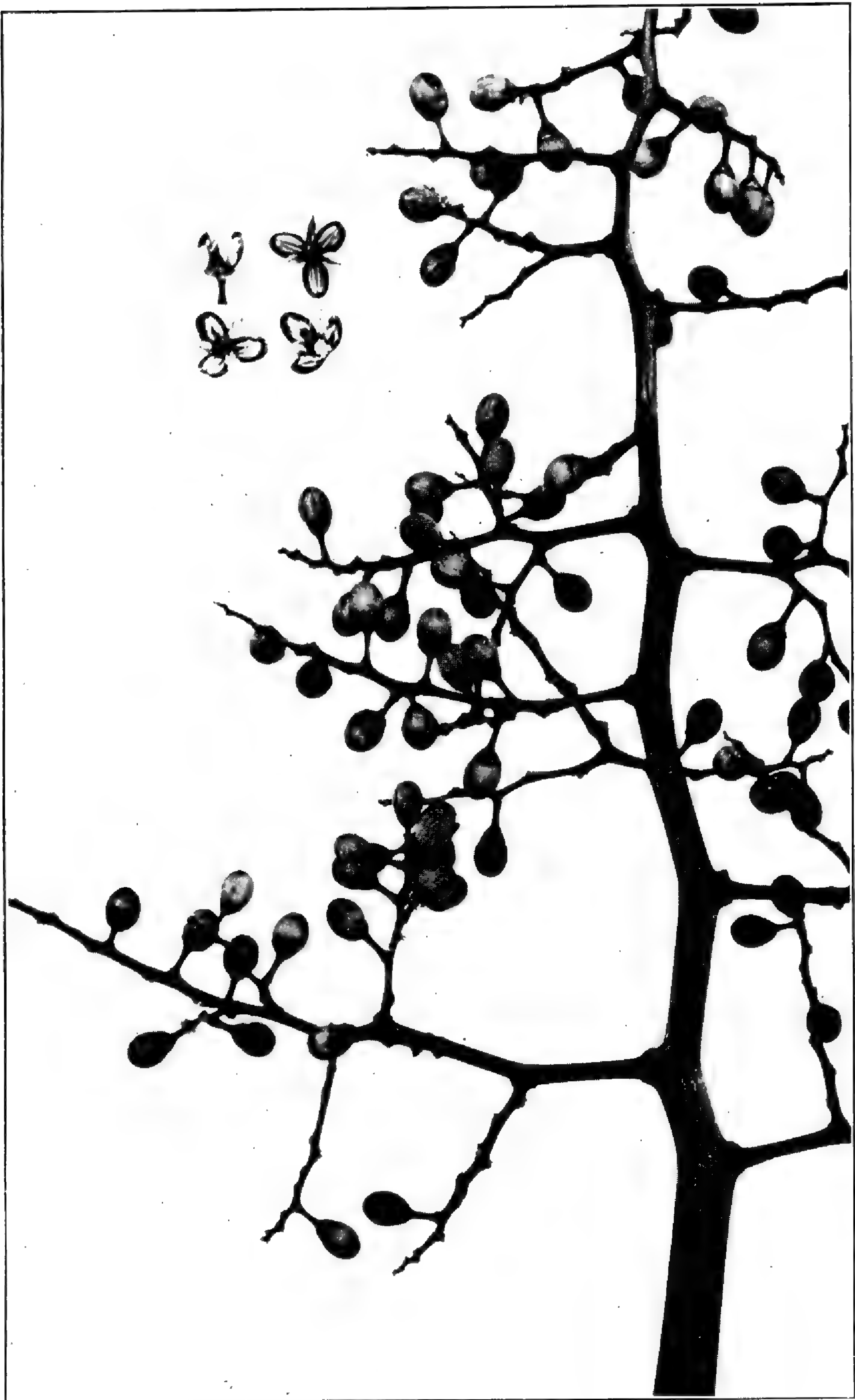
Inflorescence exerted on a long-jointed, naked peduncle, dividing into numerous compound, naked branches, the spathes confined to basal joints. (Pl. 75, c.) Flowers andromonœcious, male and bisexual in the same inflorescence, widely scattered on the ultimate branchlets, each flower supported on a slender pedicel articulated to the branch by an expanded hollow base. (Pl. 75, a, b.)

Calyx represented by a narrow, saucer-like rim of a thickened receptacle, the sepals indicated by slightly prominent, broadly rounded angles alternating with the petals.

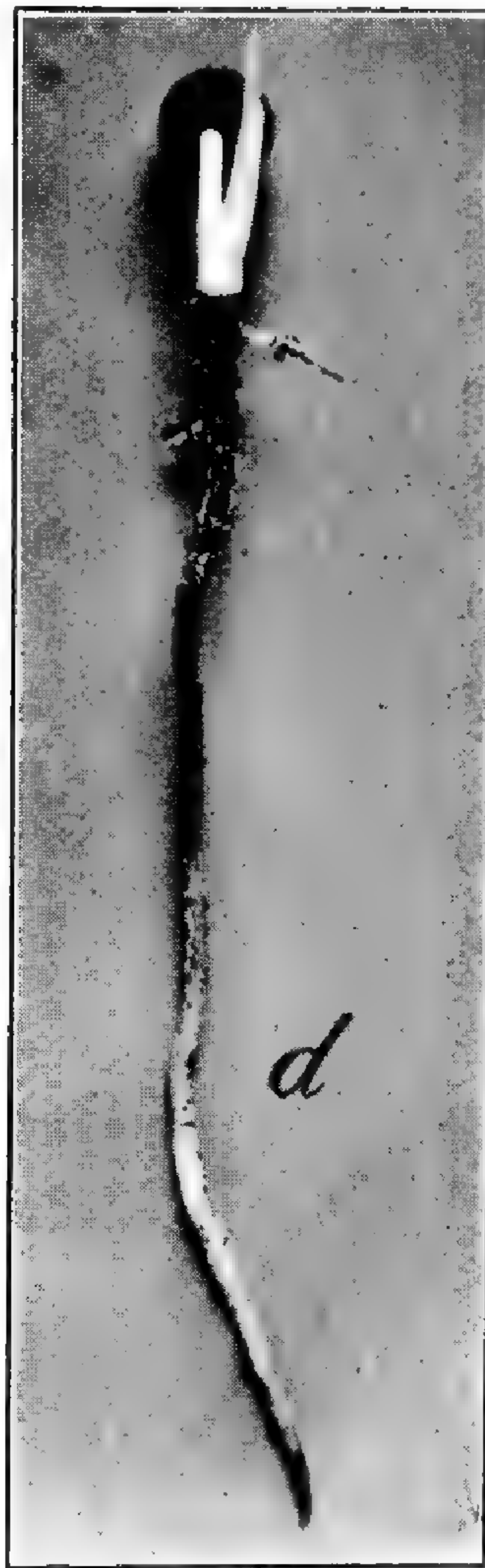
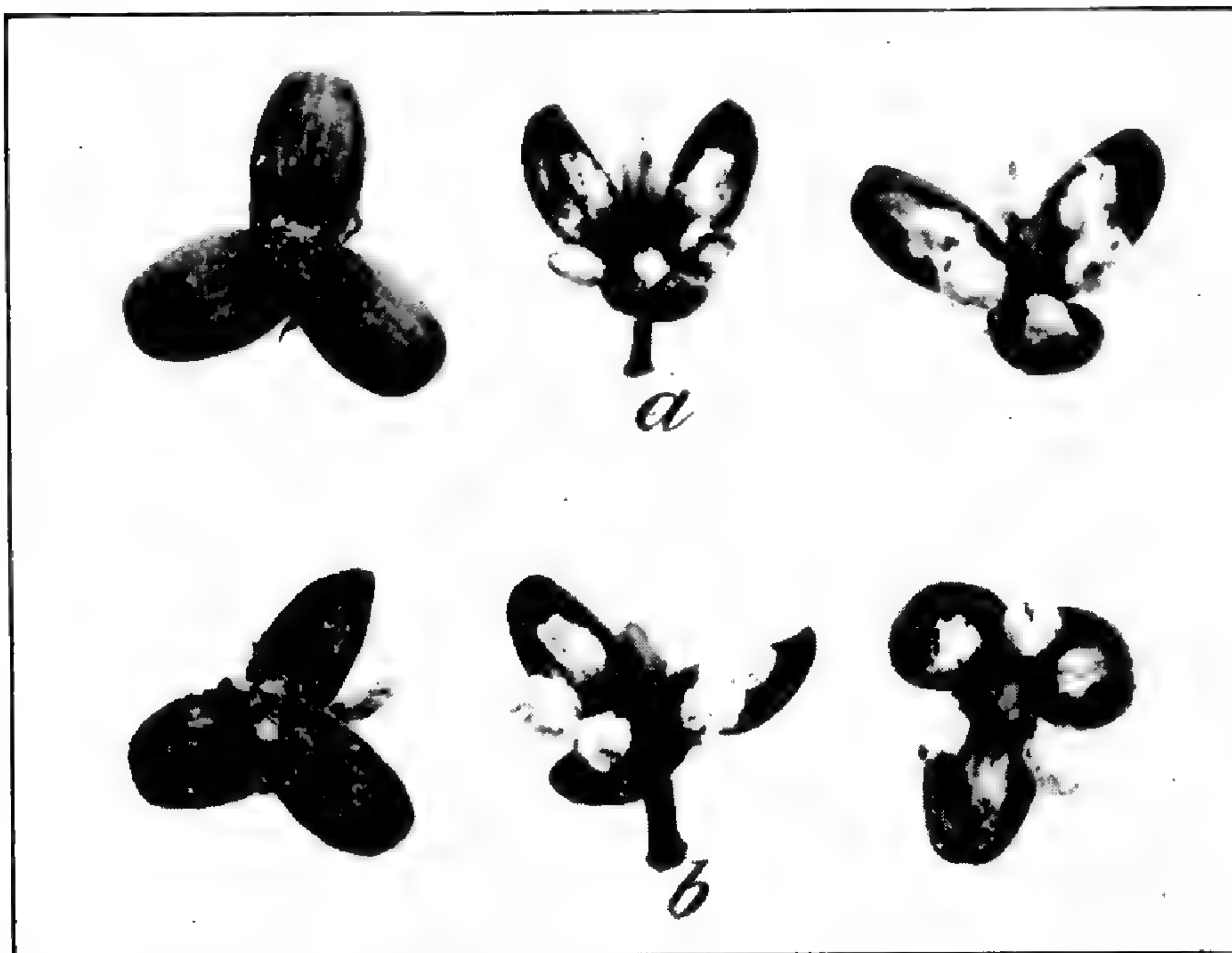
Corolla of three large, thick, valvate, persistent petals, firmly fleshy in texture and with distinct longitudinal veins. Stomata present on both surfaces. Tissues supplied with chlorophyll and with numerous bundles of raphides.

Stamens 6, borne on short, flattened, triangular-subulate filaments slightly united at base to form a narrow fleshy disk. Anthers triangular-cordate, about twice as long as broad, attached to the filaments at the base in a deep cavity of the outer face. Cells separated on the inner face by a distinct groove, but appearing completely coalesced on the smooth outer face, opening by lateral slits as soon as exposed. Pollen white.

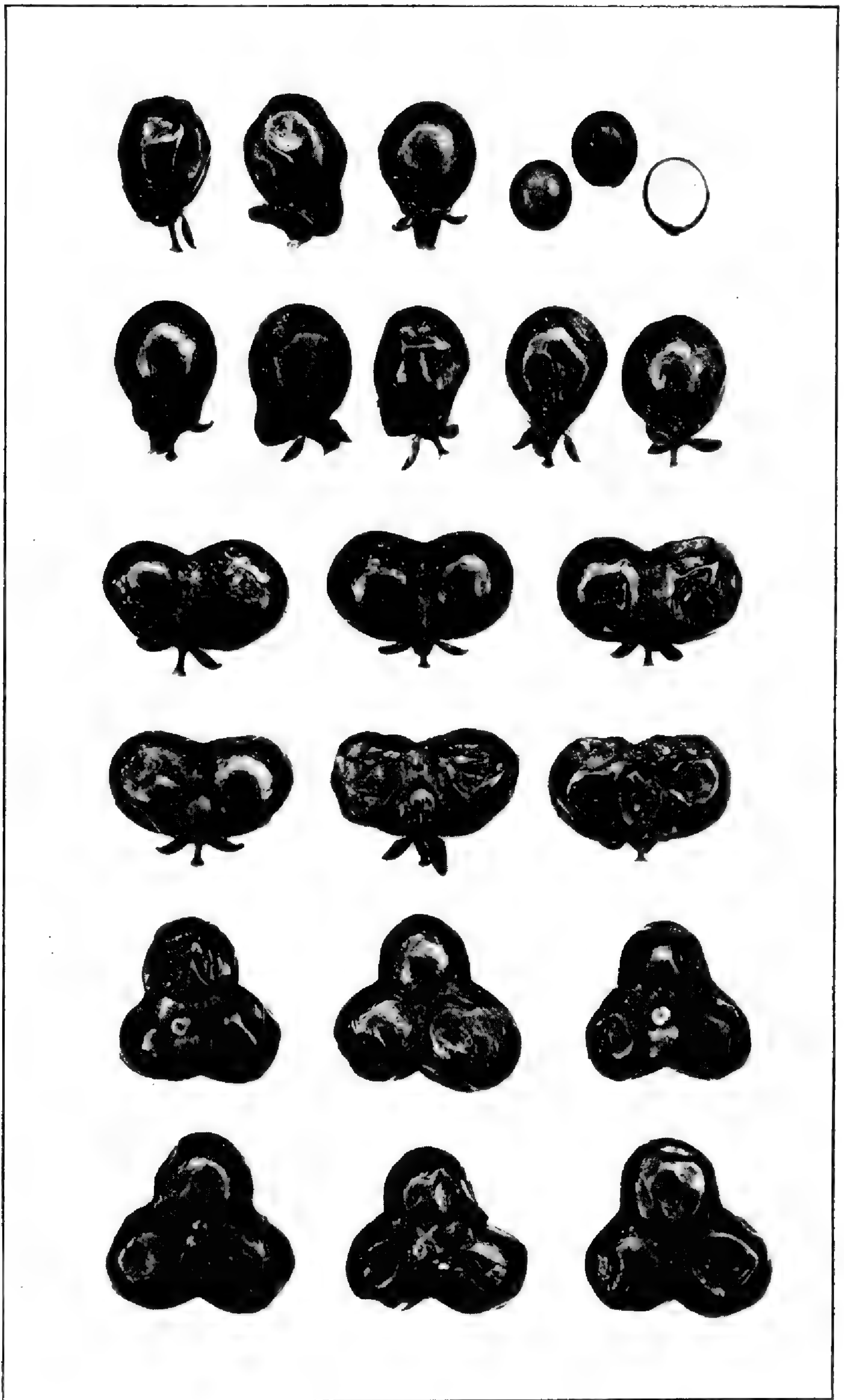
Pistils 3, united to near the apex into a rather narrow, triangular-conic pyramid shorter than the stamens. Styles not differentiated; stigmas represented by three obtuse, appressed apical lobes, separating only by narrow slits. Pistillodes of imper-



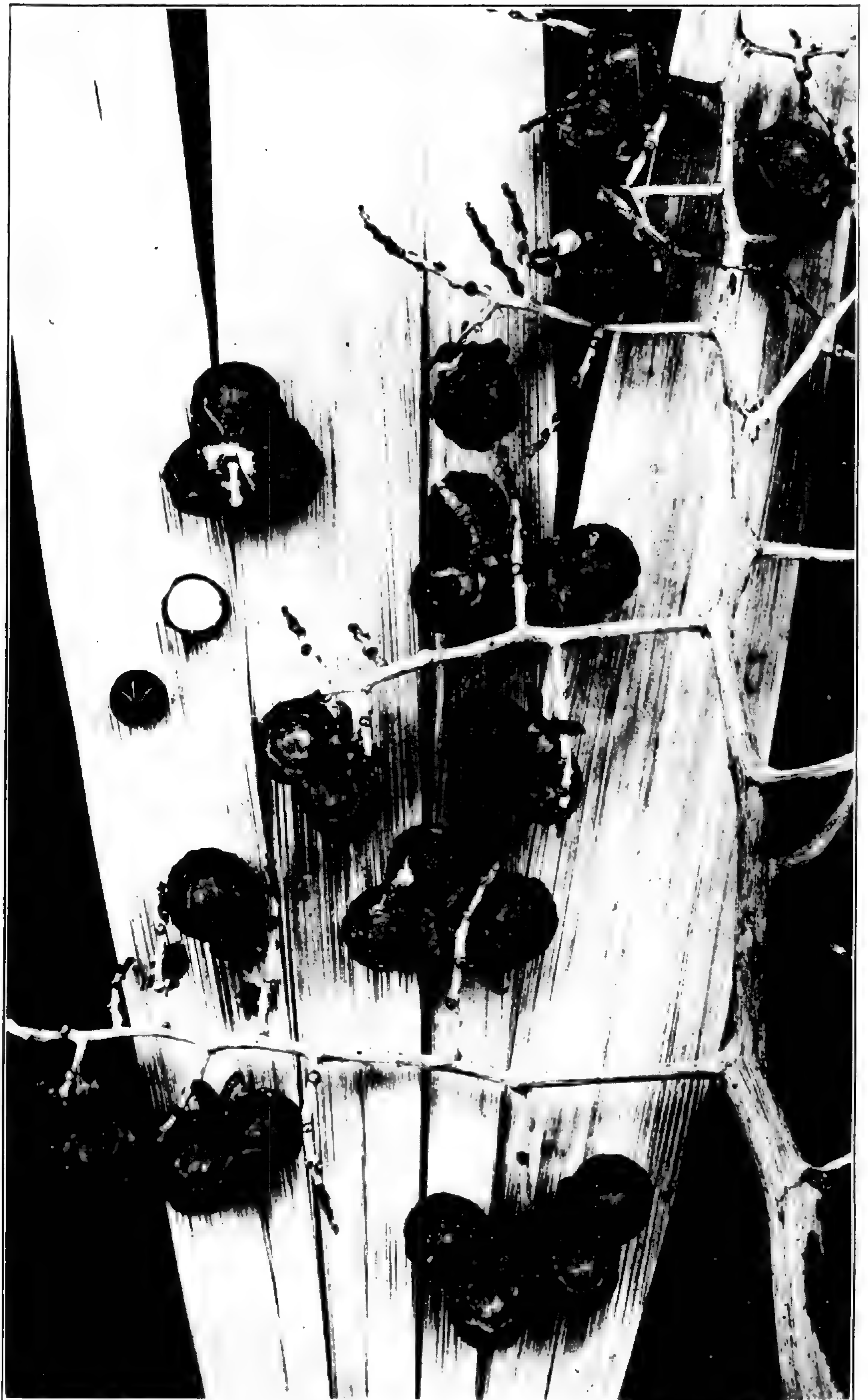
PSEUDOPHOENIX SARGENTII WENDL.



PSEUDOPHOENIX SARGENTII WENDL.



PSEUDOPHOENIX SARGENTII WENDL.



PSEUDOPHOENIX SARGENTII WENDL.

fect flowers as long as or longer than the pistils, but forming a much more slender-pointed column tapering to a narrow, three-pointed apex. (PLS. 74, 75, *a*, *b*.)

Fruits with a thin, smooth epidermis composed of a mosaic of polygonal cells very irregular in size and shape, with scattering stomata. Exocarp represented by a fleshy pulp with two distinguishable layers, the outer of rather watery consistency richly supplied with raphides, the inner firmer and more fibrous, containing oil globules and spiral vessels. Endocarp smooth, with a closely adherent outer coating of whitish material, as in *Phytelephas*, and an inner layer hard and bony, composed of columnar cells. (PL. 76.)

Seed covered with a closely adherent, fibrillar membrane. Surface slightly impressed by the branches of the raphe, these usually six in number, three on each side, the lower pair short. Albumen uniform, bony, solid. Embryo subbasal. (PLS. 76, 77.)

Germination as in *Attalea* and *Phytelephas*, by the emergence of a burrowing cotyledon that carries the plumule down into the soil. Cotyledon emerging through an operculate aperture of the endocarp, as in *Phytelephas*. First two leaves represented by bladeless sheaths. A long, fleshy primary radicle developed directly from the cotyledon before the leaves begin to grow. (PL. 75, *d*.)

EXPLANATION OF PLATE 74.—One of the primary branches of the inflorescence with mature flower buds and with four detached open flowers. Natural size.

EXPLANATION OF PLATE 75.—*a*, Staminate flowers; *b*, bisexual flowers; *c*, main axis of inflorescence with bases of primary branches showing smooth surfaces of axillary pulvini and subtending bracts; *d*, young seedling, showing method of germination with burrowing cotyledon and long primary radicle. *a*, *b*, Scale about 2; *c*, *d*, natural size.

EXPLANATION OF PLATE 76.—Ripe fruits with attached pedicels and floral parts, the different forms of the fruits depending on whether one, two, or three of the carpels develop; also three seeds with flesh removed, one with the endocarp, one naked, and one in vertical section. All natural size.

EXPLANATION OF PLATE 77.—Segments of leaf and branch of inflorescence with dried fruits; also a seed showing radiating branches of the raphe and a seed in vertical section showing the position of the embryo. All natural size.

Plates 74, 75, and 76 represent material from cultivated trees growing in the Plant Introduction Garden of the U. S. Department of Agriculture, at Miami, Fla.; received in February and August, 1912. Plate 77 represents a specimen collected on Long Key, Fla., by A. H. Curtiss (no. 5637), April 25, 1896; U. S. National Herbarium, no. 280541.

#### FLORAL PECULIARITIES OF PSEUDOPHOENIX.

The flowers of *Pseudophoenix* show several noteworthy peculiarities, although they are only slightly specialized in the direction followed by most other palms, the separation of the sexes. The sexual specialization extends only to the loss of function in the pistils of a part of the flowers, and especially in those that are borne at the ends of the branches. But the pistils of the staminate flowers are not much reduced and there are only slight differences in other respects. It was noticed by Mr. C. B. Doyle, in preparing the photographs for the plates, that the pedicels of the staminate flowers were somewhat more slender, the buds somewhat narrower, and the stamens a little larger, but all the differences are slight and might easily be overlooked. The lowest bud shown on plate 74 was probably staminate, while most of the others were bisexual. Wendland and Sargent described the flowers as monœcious, evidently on the assumption that the persistent filaments attached to the ripe fruits represented staminodes instead of functional stamens.

The floral specializations of *Pseudophoenix* are in the external organs rather than in the internal. The long pedicels jointed at the

base, the reduced limb of the calyx, and the very large, firm petals are the most peculiar features. The pedicels are as highly specialized as in any of the fan palms, or even more so. They are articulated to the branches by an expanded, circumscissile, hollow base leaving a conical persistent core. This might be mistaken for a short pedicel after the flowers have fallen. The calyx, receptacle, and pedicel are completely fused together. (PLS. 74, 75, *a*, *b*.)

The unusual development of the petals is doubtless connected with the fact that the inflorescences become exposed at an early stage of growth, whereas in most palms they are protected by spathes until just before the flowers open. The spathes of *Pseudophoenix* are so short that the flowers must become exposed while they are still very young. At the time of flowering the spathes extend only to about the middle of the longest joint of the peduncle. The spathes are narrow and compressed, with naked green surfaces and brown scaly margins, and are bilabiate at the aperture.

The equipment of the petals with stomata, chlorophyll-bearing cells, fibrovascular bundles, and raphides indicates that they are able to discharge vegetative functions. This makes it possible to understand how they are able to remain alive until the fruit ripens. The veins of the petals are usually five in number, but are often somewhat irregularly branched. The chlorophyll is more abundant along the veins. The epidermis is composed of an irregular mosaic of cells whose lateral walls are often interrupted or perforated. The bundles of raphides are irregularly scattered, but all lie in a longitudinal direction. It is not known whether stomata and raphides are to be found in the petals of other palms. The abundant development of raphides in the petals of *Pseudophoenix* may have relation to an unusual period of exposure of the flowers to the attacks of snails or insects.

The ease with which the pedicels separate from the branches, the great abundance of pollen, and the very prompt opening of the anthers indicate that the flowers are ephemeral and dependent on fertilization by the wind, though it is possible that nectar to attract insects may be secreted by the fleshy staminal disk.

Though the petals remain green, the anthers are of a bright orange color that may render the inflorescences conspicuous at flowering time. A broad, longitudinal band along the middle of the smooth outer surface of the unopened anthers is of a darker yellow than the pollen cells, which contrast in turn with the white pollen.

#### THE PSEUDOPHOENICACEAE AND ALLIED FAMILIES DISTINGUISHED BY FRUIT CHARACTERS.

The fact that the fruits are borne on distinct columnar pedicels at once distinguishes *Pseudophoenix* from any of the American pinnate-leaved palms. Only the wax palms (*Ceroxylon*) show structures



suggestive of pedicels, but these are only small, cushion-like prominences, whereas in *Pseudophoenix* the pedicels are an even more prominent and specialized feature than in any of the fan palms.

Apart from the pedicels, the fruit characters of *Pseudophoenix* suggest affinity with the *Cocaceae*, *Manicariaceae*, and *Phytelephantaceae*, as already stated. The external appearance, as well as the texture of the exocarp, is much the same as in *Bactris* and other related genera of cocoid palms, such as *Trichobactris*, *Curima*, and *Tilmia*. Yet there are three independent seeds, as in *Manicaria*, instead of a composite, fused endocarp as in the *Cocaceae*. The resemblance to the ivory palms is in the structure of the endocarp, in which there is almost complete agreement, in spite of the enormous differences in the size of the fruits and in the structures of the exocarp and epidermis.

The following analytical key states the most obvious external characters of the fruits, those that enable the *Pseudophoenicaceae* to be distinguished from the other related families, even without reference to the more minute details of structure or to other parts of the plant. Though these differences might not in themselves be considered of family importance, they afford simple means of recognizing the different groups.

#### ANALYTICAL KEY TO FAMILIES BASED ON FRUIT CHARACTERS.

- Fruits with endocarps completely coalesced to form a solid shell, usually with a single cavity containing a single embryo and endosperm..... **COCCACEAE.**
- Fruits with free endocarps, usually developing two or more separate seeds.
- Fruits with a thin, smooth, membranous epidermis.... **PSEUDOPHOENICACEAE.**
- Fruits covered with a thick, rough, corky epidermis.
- Fruits with numerous (4 to 9) seeds, borne in dense heads on a simple inflorescence..... **PHYTELEPHANTACEAE.**
- Fruits with only 1 to 3 seeds, borne in loose clusters on a branched inflorescence..... **MANICARIACEAE.**

#### COMPARISON OF PSEUDOPHOENIX WITH THE WAX PALMS OF COLOMBIA.

Another group of palms that may prove to have affinities with *Pseudophoenix* is the wax palms (*Ceroxylaceae*), which grow at high altitudes in the mountains of Colombia. Like *Pseudophoenix* the wax palms retain several obvious evidences of derivation from fan palms. In addition to large compound inflorescences, rather unspecialized flowers, and fruits borne on short pedicels, the *Ceroxylaceae* share with the palmettos the habit of producing in the juvenile stage a creeping rootstock before commencing to form an erect trunk. In this respect *Ceroxylon* shows a definite contrast with *Pseudophoenix*, in which the seed germinates by sending down a burrowing cotyledon quite as in *Phytelephas* and *Attalea*.

**COMPARISON OF CHARACTERS WITH THOSE OF COCOID PALMS.****GERMINATION CHARACTERS.**

Some of the cocoid palms, such as *Acrocomia*, afford a suggestion of the method of germination followed by the palmettos and wax palms by a creeping rootstock. The seedling of *Acrocomia* does not have a long burrowing cotyledon, but the first four or five joints of the stem grow downward into the ground, forming a thickened, subterranean bulb that serves apparently for the storage of the food materials that are soon removed from the seed. After this subterranean structure has been developed the stem turns abruptly upward to begin the formation of the trunk. In *Manicaria*, which grows only in very wet swamps; neither of these specializations is found. The young plant appears much like a young *Attalea*, but there is no elongated cotyledon to carry it away from the seed. The same unspecialized method of germination is found in some of the species of *Astrocaryum* that are natives of very damp forests.

The fact that *Acrocomia* and *Attalea*, both members of the family *Cocaceae*, have specialized in different ways in their methods of germination may be considered as evidence of derivation from the more simple state represented by *Manicaria* and *Astrocaryum*. The very close agreement of *Phytelephas* and *Pseudophoenix* with the more specialized *Attalea* method of germination is also suggestive of the idea that these aberrant genera may have arisen as offshoots of a primitive cocoid type.

**ENDOCARP CHARACTERS.**

But if such a history be projected to account for the agreement of *Pseudophoenix* with *Attalea* and *Phytelephas* in methods of germination, the divergence from the primitive cocoid stock must be supposed to have taken place before the development of the composite endocarp that now appears as the most striking characteristic of the cocoid series.

That the coalescence of the endocarps may have taken place independently in the ancestors of the different groups of *Cocaceae* is not to be considered as an impossibility in view of the several apparently independent cases of coalescence of the exocarps in other families of palms. The fact that many of the relatives of *Acrocomia* (subfamily *Bactridineae*) have the coalesced endocarps perforated by apical foramina, while other *Cocaceae* have only basal or peripheral foramina, would seem to support the idea that the coalescence of the endocarps might have occurred independently in the two groups. The coalescence of the endocarps would naturally have been preceded by a strong tendency to coalescence of the exocarps, as illustrated in *Phytelephas*, *Manicaria*, and *Pseudophoenix*.

**THE FAMILIES OF AMERICAN PALMS.****CHARACTERS AND SYNOPTICAL KEY.**

The determination of the status of *Pseudophoenix* as a distinct family has made it possible to complete a review of the classification of American families of palms. This was undertaken several years ago, but the impracticability of assigning *Pseudophoenix* to any of the groups caused it to be put aside. The following synoptical key indicates the characteristic features of the different families and may serve as a provisional arrangement of the family groups. The key is arranged to permit the diagnostic characters of a family to be followed in each case by a definitely contrasted statement of the characters of the other families. As several of the families have very definite ecological and geographical limitations, the habitat and distribution are indicated in the key. When the distribution extends over more than one region the principal center is mentioned first.

Some of the groups have been recognized by previous writers though usually only as subfamilies or tribes, but in addition to the *Pseudophoenicaceae* the last six, at the end of the key, may be considered as new families.

**KEY TO FAMILIES.**

- Fruits covered with thin, polished, retrorse scales. Genera numerous, *Lepidocaryum*, *Raphia*, *Mauritia*, etc. In coast swamps and flood lands, Brazil to Costa Rica. **THE SCALE PALMS..... LEPIDOCARYACEAE.**
- Fruits without scales, usually naked, but sometimes with warts, spines, or hairs.
- Leaves palmate or fan-shaped, the segments radiating from a thickened ligulate base. Genera numerous, *Sabal*, *Inodes*, *Copernicia*, *Thrinax*, *Paurotis*, etc. In swamps, forests, and deserts, North and South America. **THE PALMETTO PALMS..... SABALACEAE.**
- Leaves pinnately veined or divided, the segments or pinnæ inserted on a distinct midrib or rachis, not ligulate.
- Seedlings with creeping rootstocks as in the *Sabalaceae*; adults with massive, columnar trunks, whitened by a thick coat of wax. Genus *Ceroxylon*. On mountain summits in Colombia and Ecuador. **THE WAX PALMS..... CEROXYLACEAE.**
- Seedlings of columnar types without a creeping juvenile stage; trunks naked or only slightly waxy.
- Flowers borne on slender pedicels, staminate and bisexual in the same inflorescence. Genus *Pseudophoenix*. Florida Keys. **THE FALSE DATE PALMS.. PSEUDOPHOENICACEAE.**
- Flowers sessile or depressed in pits, of separate sexes, monœcious or dioecious.

- Endocarps of each fruit fused into a single bony shell.  
 Genera numerous, *Cocos*, *Attalea*, *Acrocomia*, *Bactris*, etc. In undergrowth and open forests, South and North America. THE COCONUT PALMS..... **COCACEAE.**
- Endocarps either not fused or not forming a bony shell.
- Pistils of 4 to 9 united carpels, usually maturing several large, bony seeds. Genus *Phytelephas*. In forests and coast plains, Panama to Peru. THE IVORY PALMS..... **PHYTELEPHANTACEAE.**
- Pistils with only 3 carpels, rarely maturing 2 or 3 small seeds, usually only 1.
- Inflorescences not emerging from the persistent, bag-like, fibrous spathes. Genus *Manicaria*. In tidal swamps, Brazil to Guatemala. THE BAG PALMS.... **MANICARIACEAE.**
- Inflorescences emerging from incomplete or deciduous spathes.
- Flowers inserted in deep, closed pits. Genera numerous, *Geonoma*, *Calyptronoma*, *Welfia*, etc. In forests, South and Central America. THE FISHTAIL PALMS..... **GEONOMACEAE.**
- Flowers superficial or in shallow depressions.
- Seeds inclosed in the three equally developed, coalesced carpels. Genera *Malortiea* and *Reinhardtia*. In forest undergrowth, Central America. THE LATTICE PALMS..... **MALORTIEACEAE.**
- Seeds inclosed in single carpels, the three pistils separate or attached but not coalesced.
- Dioecious, flowers of different sexes on different plants. Genera numerous, *Chamaedorea*, *Morenia*, *Eleutheropetalum*, *Dasystachys*, etc. In forest undergrowth, Central and South America. THE PACAYA PALMS... **CHAMAEDORACEAE.**
- Monœcious, the flowers of separate sexes, but both in the same inflorescence or on the same plant.
- Trunk not reaching the ground, entirely supported by a cluster of long stilt-like roots. Genera numerous, *Iriarteia*, *Catoblastus*, *Wettinia*, etc. In forests, South America to Nicaragua. THE STILT PALMS..... **IRIARTEACEAE.**
- Trunk rooted in the ground, not depending on the support of aerial roots.
- Flowers arranged in longitudinal rows; spathes several. Genera *Synechanthus*, *Aeria*, and *Gaussia*. On slopes and summits, Central America to Porto Rico. THE ROW-FLOWERED PALMS..... **SYNECHANTHACEAE.**
- Flowers arranged in clusters of 3; spathes 2. Genera numerous, *Acrista*, *Plectris*, *Catis*, *Roystonea*, etc. In swamps and forests and on mountain summits, South and North America. THE ROYAL PALMS..... **ACRISTACEAE.**

## ALLIANCES WITH OLD WORLD PALMS.

Though the relationships of the Old World and New World palms are still very imperfectly understood it is evident that only a few of the families extend over both hemispheres. The geographical limitations of the families do not appear so remarkable when the ecological limitations of this group of plants are considered. The palms grow too slowly to be able to compete with other types of vegetation and the large, heavy seeds are not readily disseminated. There may have been a palm age in some former geological epoch when the palms occupied a larger proportion of the land and enjoyed better facilities of distribution, but at the present time the tendencies are in the other direction. Even inside the continental areas the different groups of palms have local or definitely limited distributions. Thus only a few of the South American and Central American types have secured footholds on the West Indian Islands.

The land connection between North and South America has resulted in only a slight interchange of palm floras. The Chamaedorea-ceae, which are so richly developed in Mexico and Central America, have penetrated only to a slight extent into Colombia and Venezuela and are practically absent from the great Brazilian region. On the other hand, the distinctively South American families have as little to show in the way of any complete occupation of the tropical regions of North America. This is true of the Iriarteaceae, Geonomaceae, Ceroxylaceae, Manicariaceae, Phytelephantaceae, and especially of the Cocaceae, the most numerous and highly developed of the American families. None of these groups has any extra-American representatives, unless the coconut palm itself and the African oil palm (*Elaeis guineensis* Jacq.) be considered as such.<sup>1</sup>

The scale palms (Lepidocaryaceae) are the only family that can be said to have a cosmopolitan distribution. Some of the Old World fan palms, such as *Pritchardia* and *Livistona*, may belong with the American palmetto palms instead of with the Asiatic talipot palms (Coryphaceae). In geologic times the fan palms are known to have had a circumpolar distribution, which would account for their presence in both hemispheres.

The closest approach among the pinnate-leaved tropical types is between the royal palm family (Acristaceae) of the New World, and the betel palm family (Arecaceae) of the Old World. Several peculiar genera found on the Pacific Islands may connect the more divergent continental forms. Some of the American stilt palms have leaves that suggest those of the Old World sugar palms (Caryotaceae), but

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<sup>1</sup> Cook, O. F. Origin and Distribution of the Coconut Palm. Contr. U. S. Nat. Herb. 7: 257-293. 1901. Also History of the Coconut Palm in America. Contr. U. S. Nat. Herb. 14: 271-342. 1910.

in other respects they are entirely different. The toddy palms (Borassaceae) and the true date palms (Phoenicaceae) are also specialized Old World types apparently quite remote from any of the New World families.

The Old World palm flora as a whole seems to be much inferior to that of the New World from the standpoint of specialization of family types. The American preponderance is especially striking when the pinnate-leaved groups are compared. Apart from the Phoenicaceae and Caryotaceae, which are to be considered as independent derivatives from the ancestral fan palms, the Old World has only the Arecaceae to counterbalance the numerous pinnate-leaved groups of the American tropics.

# THE GENUS EPIPHYLLUM AND ITS ALLIES.

BY N. L. BRITTON AND J. N. ROSE.

## INTRODUCTION.

An examination of the literature relating to *Phyllocactus* convinces us that this name should be regarded as a synonym of *Epiphyllum*. The latter genus, published in 1812, was based on *Cactus phyllanthus*. The genus *Phyllocactus*, published in 1831, was based on two species, *Cactus phyllanthus* and *Cactus phyllanthoides*.

Unfortunately the name *Epiphyllum* has been retained by recent authors for another genus, of which *Epiphyllum truncatum*, the crab cactus, is the type, segregated from the true *Epiphyllum*. For this genus Schumann once proposed the name *Zygocactus*, but afterwards abandoned it. This name should be restored.

The subgenera *Disisocactus* and *Pseudepiphyllum* of the genus *Phyllocactus* of Schumann deserve, in our opinion, generic rank, under the names *Disocactus* and *Schlumbergera*, respectively.

To this relationship we refer *Wittia* and two new genera here described and typified, as well as *Epiphyllanthus*, which Mr. Alwin Berger places between *Zygocactus* and *Rhipsalis*.

The genus *Rhipsalis* will be discussed in a subsequent paper.

## SYSTEMATIC TREATMENT.

**EPIPHYLLUM** Haw. Syn. Pl. Succ. 197. 1812.

**PHYLLOCACTUS** Link, Handb. Gewächs. 2: 10. 1831.

Plants mostly epiphytic, generally with flattened, often thin, leaf-like branches; spines wanting, except on seedlings and juvenile forms; cotyledons rather large, often persisting for a long time; flowers large, regular, mostly nocturnal, the tube narrow; filaments slender and long; style elongated, white or colored.

Type species, *Cactus phyllanthus* L.

**Epiphyllum ackermannii** Haw. Phil. Mag. 6: 109. 1829.

*Cactus ackermannii* Lindl. Edwards's Bot. Reg. 16: pl. 1331. 1830.

*Cereus ackermannii* Otto in Pfeiff. Enum. Cact. 123. 1837.

*Phyllocactus ackermannii* Salm-Dyck, Cact. Hort. Dyck. 38. 1842.

TYPE LOCALITY: In Mexico.

DISTRIBUTION: Mexico.

ILLUSTRATIONS: Edwards's Bot. Reg. 16: pl. 1331, as *Cactus ackermannii*. Curtis's Bot. Mag. 64: pl. 3598, as *Cereus ackermannii*. Blühende Kakt. pl. 49; Cycl. Amer. Hort. Bailey 3: f. 1773; Dict. Gard. 3: f. 133; Karst. Deutsch. Fl. f. 6; Först. Handb. Cact. ed. 2. f. 111; Rümpl. Sukkulente f. 81—all as *Phyllocactus ackermannii*.

**Epiphyllum acuminatum** Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 222. 1890.

*Phyllocactus acuminatus* Schum. Gesamtb. Kakt. 213. 1899.

TYPE LOCALITY: In the Province of Rio de Janeiro, Brazil.

DISTRIBUTION: Brazil; in cultivation in Mexico.

ILLUSTRATIONS: Mart. Fl. Bras. 4<sup>2</sup>: pl. 45. Engl. & Prantl, Pflanzenfam. 3<sup>6a</sup>: f. 59. D, as *Phyllocactus acuminatus*.

**Epiphyllum anguliger** (Lem.) Don; Loud. Encycl. Pl. ed. 2. 1380. 1855.

*Phyllocactus anguliger* Lem. Jard. Fleur. 1: pl. 92. 1850-51.

TYPE LOCALITY: In Mexico.

DISTRIBUTION: Central Mexico.

ILLUSTRATIONS: Curtis's Bot. Mag. 85: pl. 5100; Cycl. Amer. Hort. Bailey 1: f. 306; Dict. Gard. Nicholson 3: f. 134; Lem. Jard. Fleur. 1: pl. 92; Palmer, Cult. Cact. 167; Paxton's Fl. Gard. 1: pl. 34—all as *Phyllocactus anguliger*.

**Epiphyllum cartagense** (Weber) Britt. & Rose.

*Phyllocactus cartagensis* Weber, Bull. Mus. Hist. Nat. 8: 462. 1902.

TYPE LOCALITY: Near Cartago, Costa Rica.

DISTRIBUTION: Costa Rica.

**Epiphyllum caudatum** Britt. & Rose, sp. nov.

Old stems terete and slender; lateral branches elongated-lanceolate, cuneately narrowed at base into a terete stalk, long-acuminate, 15 to 20 cm. long, 3 to 4 cm. wide, the margins crenate; flowers 12 to 15 cm. long, white; tube slender; ovary and most of the flower tube quite naked.

Type in the United States National Herbarium, no. 691390, collected near Comaltepec, Oaxaca, Mexico, altitude 540 to 900 meters, July 30-31, 1894, by E. W. Nelson (no. 919).

**Epiphyllum caulorrhizum** (Lem.) Don; Loud. Encycl. Pl. ed. 2. 1380. 1855.

*Phyllocactus caulorrhizus* Lem. Jard. Fleur. 1: Misc. 6. 1854.

TYPE LOCALITY: Not given.

DISTRIBUTION: Known only from greenhouse material of uncertain origin.

**Epiphyllum costaricense** (Weber) Britt. & Rose.

*Phyllocactus costaricensis* Weber, Bull. Mus. Hist. Nat. 8: 463. 1902.

TYPE LOCALITY: Rio Virilla, near San José, Costa Rica.

DISTRIBUTION: Costa Rica.

**Epiphyllum crenatum** (Lindl.) Don; Loud. Encycl. Pl. ed. 2. 1378. 1855.

*Cereus crenatus* Lindl. Edwards's Bot. Reg. 30: pl. 31. 1844.

*Phyllocactus crenatus* Lem. Hort. Univ. 6: 87. 1845.

TYPE LOCALITY: In Honduras.

DISTRIBUTION: Honduras and Guatemala.

ILLUSTRATIONS: Edwards's Bot. Reg. 30: pl. 31, as *Cereus crenatus*.

**Epiphyllum darrahii** (Schum.) Britt. & Rose.

*Phyllocactus darrahii* Schum. Gesamtb. Kakt. Nachtr. 69. 1903.

TYPE LOCALITY: In Mexico.

DISTRIBUTION: Mexico.

ILLUSTRATIONS: Blühende Kakt. pl. 91, as *Phyllocactus darrahii*.

**Epiphyllum gaillardae** Britt. & Rose, Contr. U. S. Nat. Herb. 16: 240. 1913.

TYPE LOCALITY: In Canal Zone, Panama.

DISTRIBUTION: Panama and northern Colombia.

ILLUSTRATION: Contr. U. S. Nat. Herb. 16: pl. 68.





EPIPHYLLUM GUATEMALENSE BRITT. & ROSE.

**Epiphyllum grande** (Lem.) Britt. & Rose.*Phyllocactus grandis* Lem. Fl. Serr. 3: 255. 1847.

TYPE LOCALITY: In Cuba, according to Lemaire. The plant is not known in Cuba at the present time.

DISTRIBUTION: Honduras and Cuba, according to Schumann.

ILLUSTRATIONS: Monatsschr. Kakteenk. 20: 123, as *Phyllocactus grandis*.**Epiphyllum grandilobum** (Weber) Britt. & Rose.*Phyllocactus grandilobus* Weber, Bull. Mus. Hist. Nat. 8: 463. 1902.

TYPE LOCALITY: La Hondura, Costa Rica.

DISTRIBUTION: Costa Rica.

This must be *Phyllocactus macrolobus* of Schumann's Keys.**Epiphyllum guatemalense** Britt. & Rose, sp. nov.

PLATE 78.

A rather stout plant, in cultivation a meter high or more; old stem woody, with gray bark, terete; branches green, flat, 4 to 8 cm. broad, narrowed at base and there terete, coarsely crenate, obtuse at apex; flower bud pointed; flowers nocturnal, including the ovary about 28 cm. long; tube about 15 cm. long, straight or nearly so, green or yellowish green, somewhat angled, at least below, bearing only a few red-tipped scales, the inner and central part of the tube densely pilose; outer sepals scale-like with red reflexed tips; petals pure white, narrow, 8 or 9 cm. long, acuminate; stamens borne on the whole inner surface of the rather short throat, and therefore in more than one series; filaments pure white; style 25 cm. long, somewhat glossy, bright yellow; ovary pale, bearing only a few spreading bracts.

Type in United States National Herbarium, no. 691401, collected in Guatemala by F. Eichlam, but definite locality not given.

Living material, sent to Washington by the late F. Eichlam in 1910 as *Phyllocactus thomasianus*, flowered in Washington October 10, 1912. It is decidedly different from that species in its white filaments, yellow style, and other characters.

EXPLANATION OF PLATE 78.—Branch and flower of the living type plant, in cultivation. Scale  $\frac{1}{2}$ .

**Epiphyllum hookeri** Haw. Phil. Mag. 6: 108. 1829.*Cereus hookeri* Link & Otto, Cat. Sem. Hort. Berol. 1828.*Phyllocactus hookeri* Salm-Dyck, Cact. Hort. Dyck. 38. 1842.

TYPE LOCALITY: In Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Curtis's Bot. Mag. 53: pl. 2692, as *Cactus phyllanthus*. Pfeiff. & Otto, Abbild. Beschr. Cact. 1: pl. 5, as *Cereus hookeri*.

**Epiphyllum latifrons** Zucc. in Pfeiff. Enum. Cact. 125. 1837, as synonym.*Cereus latifrons* Pfeiff. Enum. Cact. 125. 1837.*Phyllocactus latifrons* Link in Walp. Repert. Bot. 2: 341. 1843.

TYPE LOCALITY: Mexico, between Vera Cruz and Cordova, according to Schumann.

DISTRIBUTION: Mexico, but not known from wild material.

ILLUSTRATIONS: Pfeiff. & Otto, Abbild. Beschr. Cact. 1: pl. 10. f. 2-3; Curtis's Bot. Mag. 67: pl. 3813—both as *Cereus latifrons*. Cact. Journ. 1: 55, as *Phyllocactus latifrons*.

**Epiphyllum lepidocarpum** (Weber) Britt. & Rose.*Phyllocactus lepidocarpus* Weber, Bull. Mus. Hist. Nat. 8: 462. 1902.

TYPE LOCALITY: Near Cartago, Costa Rica.

DISTRIBUTION: Known only from Costa Rica.

**Epiphyllum nelsonii** Britt. & Rose, sp. nov.

Stems 60 to 120 cm. long, perhaps erect, slender and terete below, flat and thin above, here 3 to 4 cm. broad; margin crenate; flowers appearing from near the tips of the branches, 8 cm. long, light rose red; tube of flower short, funnel-form; ovary globular, bearing minute scales.

Type in the United States National Herbarium, no. 255576, collected near Chicharras, Chiapas, Mexico, altitude 900 to 1,800 meters, February 12 to 15, 1896, by E. W. Nelson (no. 3761).

The plant grows on oak trees.

**Epiphyllum oxypetalum** (DC.) Haw. Phil. Mag. 6: 109. 1829.

*Cereus oxypetalus* DC. Prodr. 3: 470. 1828.

*Phyllocactus oxypetalus* Link in Walp. Repert. Bot. 2: 341. 1843.

*Phyllocactus grandis* Lem. Fl. Serr. 3: 255. 1847.

TYPE LOCALITY: In Mexico.

DISTRIBUTION: Mexico and Guatemala.

ILLUSTRATIONS: Mém. Mus. Hist. Nat. 17: pl. 14, as *Cereus oxypetalus*. Först. Handb. Cact. ed. 2. f. 112, as *Phyllocactus oxypetalus*. Monatsschr. Kakteenk. 20: 123, as *Phyllocactus grandis*. Gartenwelt 10: 560, as *Phyllocactus latifrons*.

**Epiphyllum phyllanthoides** (DC.) Sweet, Hort. Brit. 172. 1826.

*Cactus phyllanthoides* DC. Cat. Hort. Monsp. 84. 1813.

*Cereus phyllanthoides* A. DC. Prodr. 3: 469. 1828.

*Phyllocactus phyllanthoides* Link, Handb. Gewächs. 2: 11. 1831.

TYPE LOCALITY: In Mexico.

DISTRIBUTION: Mexico.

ILLUSTRATIONS: Curtis's Bot. Mag. 46: pl. 2092, as *Cactus phyllanthoides*. Schum. Gesamtb. Kakt. f. 42; Pfeiff. & Otto, Abbild. Beschr. Cact. 2: pl. 17; Monatsschr. Kakteenk. 7: 87; Safford, Ann. Rep. Smiths. Inst. 1908: f. 24—all as *Phyllocactus phyllanthoides*. Bonpl. Descr. Pl. Rar. pl. 3; Edwards's Bot. Reg. 4: pl. 304, both as *Cactus speciosus*.

**Epiphyllum phyllanthus** (L.) Haw. Syn. Pl. Succ. 197. 1812.

*Cactus phyllanthus* L. Sp. Pl. 469. 1753.

*Opuntia phyllanthus* Mill. Gard. Dict. ed. 8. no. 9. 1768.

*Cereus phyllanthus* A. DC. Prodr. 3: 469. 1828.

*Phyllocactus phyllanthus* Link, Handb. Gewächs. 2: 11. 1831.

TYPE LOCALITY: In Brazil.

DISTRIBUTION: Northern South America.

ILLUSTRATIONS: Petiver, Gazoph. Dec. pl. 59. f. 12. Pluk. Almag. Bot. pl. 247. f. 5. Mart. Fl. Bras. 4<sup>2</sup>: pl. 44. Curtis's Bot. Mag. 53: pl. 2692; DC. Pl. Succ. Hist. pl. 145; Vell. Fl. Flum. 5: pl. 33—all three as *Cactus phyllanthus*. Dill. Hort. Elth. pl. 64, as *Cereus*. Pfeiff. & Otto, Abbild. Beschr. Cact. 1: pl. 10. f. 1, as *Cereus phyllanthus*. Monatsschr. Kakteenk. 2: 73, as *Phyllocactus phyllanthus*.

**Epiphyllum pittieri** (Weber) Britt. & Rose.

*Phyllocactus pittieri* Weber, Dict. Hort. Bois 957. 1898.

TYPE LOCALITY: In Costa Rica.

DISTRIBUTION: Costa Rica.

**Epiphyllum pumilum** Britt. & Rose, sp. nov.

Old stems and lower branches woody and terete; upper branches rather thin, flat, 10 to 60 cm. long by 3 to 5 cm. wide, acute, sometimes with a long tip; margins remotely toothed; flowers small for the genus, including the ovary and petals only 10 cm. long; tube proper about 5 cm. long, greenish white, bearing a few very small, ascending and appressed red scales; sepals linear, greenish or reddish, acute; petals white, lanceolate, acuminate; stamens in two groups; style slender, white; fruit not known.

Type in the United States National Herbarium, no. 691392, collected in Guatemala by F. Eichlam and flowered in Washington, October 3, 1912.

This species has frequently been collected in Guatemala, but has usually passed under the name of *E. pittieri*. This it resembles somewhat in the size of the flower, but the style is always white.



DISOCACTUS EICHLAMII WEING. BRITT. & ROSE.

**Epiphyllum stenopetalum** (Först.) Britt. & Rose.*Phyllocactus stenopetalus* Först. Handb. Cact. 441. 1846.

TYPE LOCALITY: None given.

DISTRIBUTION: Mexico.

**Epiphyllum strictum** (Lem.) Britt. & Rose.*Phyllocactus strictus* Lem. Illustr. Hort. Lem. 1: Misc. 107. 1853.

TYPE LOCALITY: In Cuba. The plant is, however, unknown in the wild state in Cuba.

DISTRIBUTION: Cuba; Guatemala, fide Schumann.

ILLUSTRATIONS: Schum. Gesamtb. Kakt. f. 41. Monatsschr. Kakteenk. 6: 183, as *Phyllocactus strictus*.**Epiphyllum thomasianum** (Schum.) Britt. & Rose.*Phyllocactus thomasianus* Schum. Monatsschr. Kakteenk. 5: 6. 1896.

TYPE LOCALITY: Not given.

DISTRIBUTION: Costa Rica.

ILLUSTRATIONS: Blühende Kakt. pl. 41. Monatsschr. Kakteenk. 5: pl. [1], as *Phyllocactus thomasianus*.

## UNCERTAIN SPECIES.

**Phyllocactus purpusii** Weing. Monatsschr. Kakteenk. 17: 34. 1907.We know this species only from description. It seems to be closely related to *Epiphyllum oxypetalum*, and comes from near the home of that species.**Phyllocactus macrocarpus** Weber, Bull. Mus. Hist. Nat. 8: 464. 1902.This appears to be the same as *Epiphyllum thomasianum*.**Phyllocactus macropterus** Lem. Illustr. Hort. Lem. 11: Misc. 73. 1864.

Known to us only from the original imperfect description, which may apply to one of the Costa Rican species above listed.

**DISOCACTUS** Lindl. Edwards's Bot. Reg. 31: pl. 9. 1845.

DISISOCACTUS Kunze, Bot. Zeit. 3: 533. 1845.

Stems terete, usually erect, the branches flattened; flower regular, its tube very short; petals few, elongated, spreading; ovary naked, small; fruit nearly globular, not at all angled.

Type species, *Cereus biformis* Lindl.**Disocactus biformis** Lindl. Edwards's Bot. Reg. 31: pl. 9. 1845.*Cereus biformis* Lindl. Edwards's Bot. Reg. 29: Misc. 66. 1843.*Disisocactus biformis* Kunze, Bot. Zeit. 3: 533. 1845.*Phyllocactus biformis* Labour. Monogr. Cact. 418. 1858.

TYPE LOCALITY: In Honduras, but the species was described from a garden specimen.

DISTRIBUTION: Honduras.

ILLUSTRATIONS: Edwards's Bot. Reg. 31: pl. 9. Palmer, Cult. Cact. 175. Först. Handb. Cact. ed. 2. f. 120; Rümpl. Sukkulente f. 86—both as *Disisocactus biformis*. Blühende Kakt. pl. 54; Curtis's Bot. Mag. 101: pl. 6156; Dict. Gard. Nicholson 3: f. 135; Monatsschr. Kakteenk. 9: 141—all as *Phyllocactus biformis*.**Disocactus eichlamii** (Weing.) Britt. & Rose.

PLATE 79.

*Phyllocactus eichlamii* Weing. Monatsschr. Kakteenk. 21: 5. 1911.

TYPE LOCALITY: In Guatemala.

DISTRIBUTION: Guatemala.

EXPLANATION OF PLATE 79.—A plant in cultivation, received from F. Eichlam, showing old or half-withered flowers. Scale  $\frac{1}{2}$ .

**ZYGOCACTUS** Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 223. 1890.

Stems much branched, flattened, divided into short joints; flowers terminal, irregular, zygomorphic; ovary terete, smooth and bractless, gradually broadening from the base, bearing minute bracts above; sepals ovate; corolla tube abruptly bent just above the ovary, bearing scattered petals along its sides and ending in a serrate mouth; stamens slender, white, arranged in two clusters; outer stamens borne along the inside of the corolla tube from near the base to near the middle; inner clusters of stamens about 20 (Schumann says 10) arising from the center and forming a short tube about the base of the style with an inner, deflexed, toothed membrane, the upper part free; style purple, slender, as long as the stamens; stigma single, clavate, solid, purple.

Type species, *Epiphyllum truncatum* Haw.

**Zygocactus altensteinii** (Pfeiff.) Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 225. 1890.

*Epiphyllum altensteinii* Pfeiff. Enum. Cact. 128. 1837.

TYPE LOCALITY: In Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Pfeiff. & Otto, Abbild. Beschr. Cact. 1: pl. 28, as *Epiphyllum altensteinii*.

**Zygocactus delicatus** (N. E. Brown) Britt. & Rose.

*Epiphyllum delicatum* N. E. Brown, Gard. Chron. III. 32: 411. 1902.

*Epiphyllum delicatulum* Schum. Monatsschr. Kakteenk. 13: 9. 1903.

TYPE LOCALITY: In Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Gard. Chron. III. 32: f. 140. Schum. Gesamtb. Kakt. Nachtr. f. 9; Monatsschr. Kakteenk. 13: 7—both as *Epiphyllum delicatulum*.

**Zygocactus truncatus** (Haw.) Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 224. 1890. PLATE 80.

*Epiphyllum truncatum* Haw. Suppl. Pl. Succ. 85. 1819.

*Cactus truncatus* Link, Enum. Pl. 2: 24. 1822.

*Cereus truncatus* A. DC. Prodr. 3: 470. 1828.

TYPE LOCALITY: In Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Mart. Fl. Bras. 4<sup>2</sup>: pl. 46. Curtis's Bot. Mag. 52: pl. 2562; Edwards's Bot. Reg. 9: pl. 696; Reichenb. Fl. Exot. pl. 325—all as *Cactus truncatus*. Blühende Kakt. pl. 25; Cact. Journ. 1: 34, 114; Cycl. Amer. Hort. Bailey 2: f. 765; Engl. & Prantl, Pflanzenfam. 3<sup>6a</sup>: f. 61. A, B, C; Schum. Gesamtb. Kakt. f. 9, 43; Hort. Univ. 7: facing p. 132; Karst. Deutsch. Fl. 887. f. 3; Först. Handb. Cact. ed. 2. 129. f. 5; Rümpl. Sukkulente f. 87—all as *Epiphyllum truncatum*.

EXPLANATION OF PLATE 80.—Flowering branch of a greenhouse specimen. Natural size.

**SCHLUMBERGERA** Lem. Rev. Hort. IV. 7: 253. 1858.

Stems much branched, flattened; plants similar in habit to *Zygocactus*; flower regular, its tube very short.

The taxonomic history of the two species here recognized is interesting. *S. gaertneri* was first supposed to be conspecific with *S. russelliana* and was regarded as a variety of that species by Regel. In 1890 Schumann considered them distinct species, but congeneric, while in 1899 he referred them to different genera. Both species are probably from Brazil.

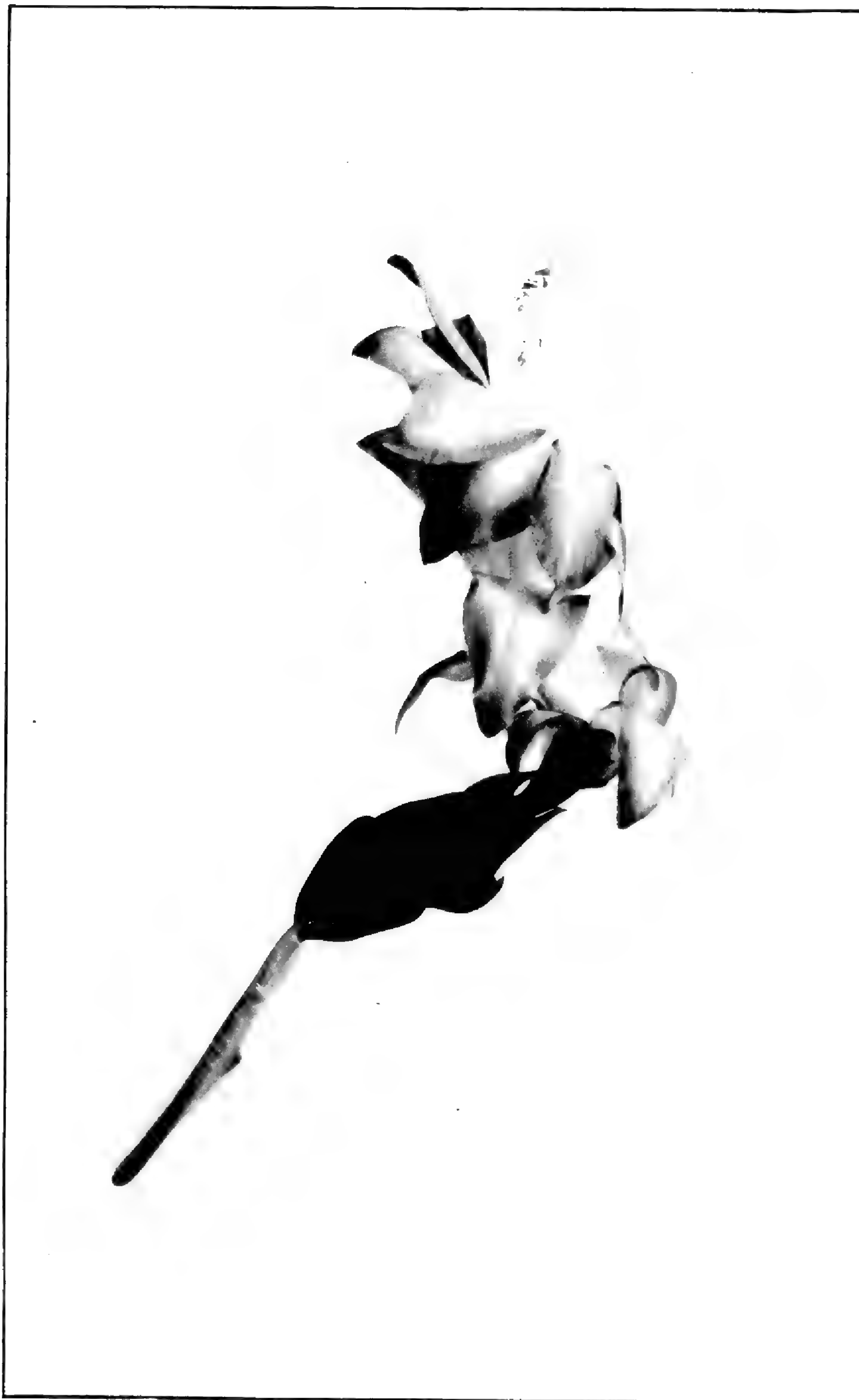
Type species, *Schlumbergera epiphyllodes* Lem.

**Schlumbergera gaertneri** (Regel) Britt. & Rose.

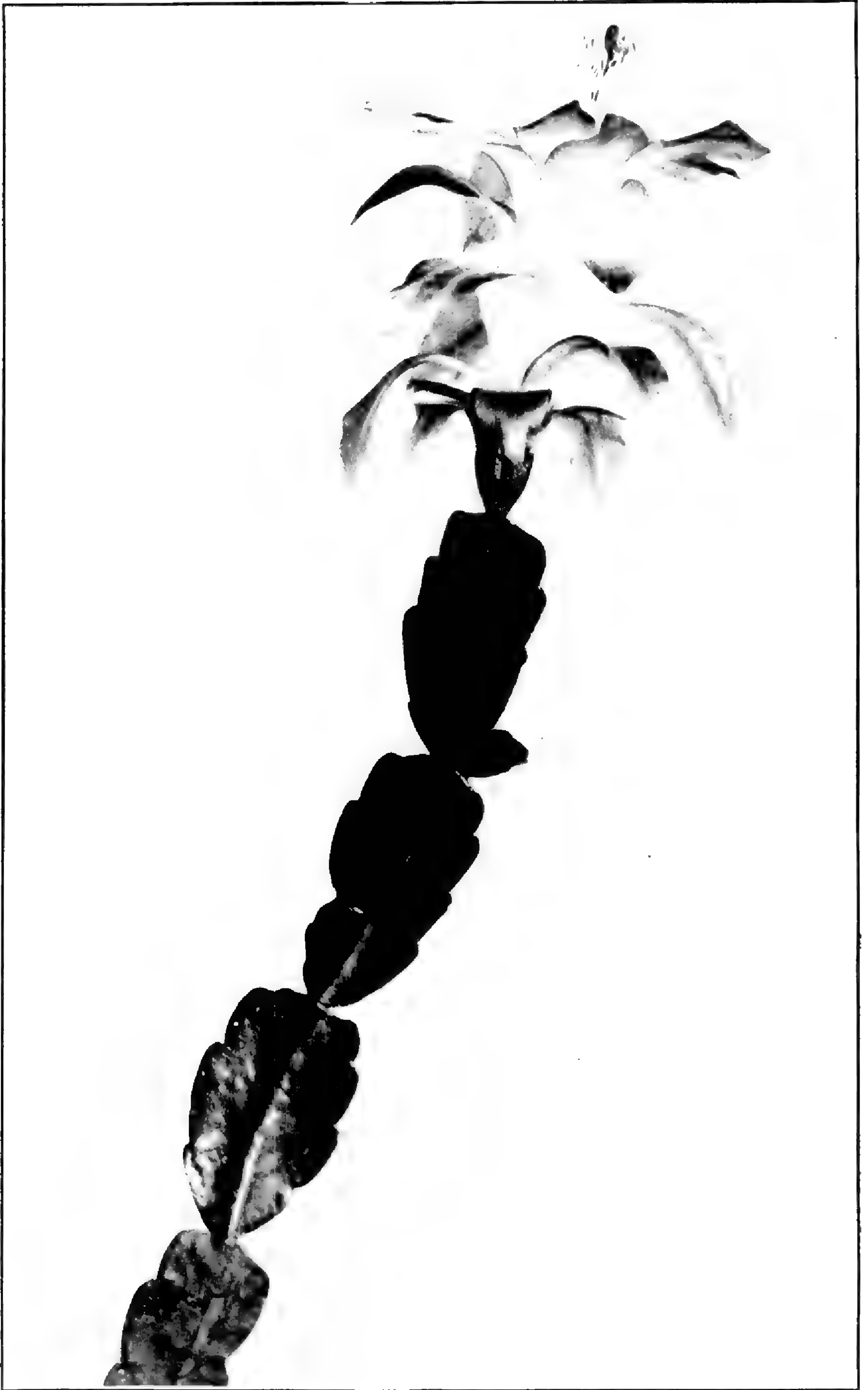
*Epiphyllum russellianum gaertneri* Regel, Gartenflora 33: 323. 1884.

*Epiphyllum gaertneri* Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 218. 1890.

*Phyllocactus gaertneri* Schum. in Engl. & Prantl, Pflanzenfam. 3<sup>6a</sup>: 218. 1894.



ZYGOCACTUS TRUNCATUS (HAW.) SCHUM.



SCHLUMBERGERA RUSSELLIANA (HOOK.) BRITT. & ROSE.





WITTIA COSTARCENSIS BRITT. & ROSE.

TYPE LOCALITY: Near Rio de Janeiro, Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Cact. Journ. 1: 9, 114; Gartenflora 39: f. 96; Rev. Hort. Belg. 15: 229. f. 2—all as *Epiphyllum russellianum gaertneri*. Curtis's Bot. Mag. 117: pl. 7201; Gartenwelt 10: 559—both as *Epiphyllum gaertneri*. Blühende Kakt. pl. 21; Gartenflora 33: pl. 1172; Monatsschr. Kakteenk. 4: 107; Rümpl. Sukkulente 148. f. 80—all as *Phyllocactus gaertneri*.

**Schlumbergera russelliana** (Hook.) Britt. & Rose.

PLATE 81.

*Epiphyllum russellianum* Hook. Curtis's Bot. Mag. 66: pl. 3717. 1840.

*Phyllocactus russellianus* Salm-Dyck, Cact. Hort. Dyck. 37. 1845.

*Schlumbergera epiphyллоides* Lem. Rev. Hort. IV. 7: 253. 1858.

TYPE LOCALITY: Organ Mountains, Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Curtis's Bot. Mag. 66: pl. 3717; Gartenflora 33: pl. 1172; Först. Handb. Cact. ed 2. f. 119—all as *Epiphyllum russellianum*. Cycl. Amer. Hort. Bailey 2: f. 766, as *Epiphyllum truncatum russellianum*. Rümpl. Sukkulente f. 79, as *Phyllocactus russellianus*.

EXPLANATION OF PLATE 81.—Flowering branch of a greenhouse specimen. Natural size.

**WITTIA** Schum. Monatsschr. Kakteenk. 13: 117. 1903.

Joints flattened, somewhat thickened, spineless, the margins more or less crenate; flowers small for this group, not fugacious, with a definite tube; lobes much shorter than the tube; style (so far as known) slender, white; ovary and fruit small. In many respects similar to *Rhipsalis*, but with very different flowers.

Type species, *Wittia amazonica* Schum.

**Wittia amazonica** Schum. Monatsschr. Kakteenk. 13: 117. 1903.

TYPE LOCALITY: Peru, near Laetica and Tarapoto.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Monatsschr. Kakteenk. 13: 119.

**Wittia costaricensis** Britt. & Rose.

PLATE 82.

Stems 40 to 50 cm. long, erect or curved, flat, 1 to 3 cm. broad, with horizontal branches narrowed at base, pointed, the margin low-serrate; areoles 12 to 15 mm. apart; ovary, tube, and sepals purplish; ovary 3 mm. long, bearing a few very short bracts; tube of flower about 8 mm. long; petals white, obtuse, spreading; stamens erect; style white; stigmas 4.

Type in the United States National Herbarium, no. 691402, collected on the west coast of Costa Rica in 1907 by H. Pittier.

EXPLANATION OF PLATE 82.—Growing plant of the type collection, raised from a cutting. Scale about  $\frac{1}{2}$ .

**Wittia panamensis** Britt. & Rose, Contr. U. S. Nat. Herb. 16: 241. 1913.

TYPE LOCALITY: Mountains above Chepo, Panama.

DISTRIBUTION: Panama.

ILLUSTRATIONS: Contr. U. S. Nat. Herb. loc. cit. pl. 72.

**ECCREMOCACTUS** Britt. & Rose, gen. nov.

Plants epiphytic, pendent, several-jointed, the joints flat and thin, with spine-bearing marginal areoles; flowers funnel-form, the short, nearly cylindrical tube bearing small scales, but no spines; perianth withering-persistent, its segments obtuse, rounded, or the innermost acutish; stamens and style white, included; fruit carmine red, oblong, with a few spineless areoles; seeds numerous, minute, black.

Type species, *Eccremocactus bradei* Britt. & Rose.

**Eccremocactus bradei** Britt. & Rose, sp. nov.

PLATE 83.

Joints 15 to 30 cm. long, 5 to 10 cm. broad, light dull green, flat, but the central axis somewhat elevated on both sides, the margins shallowly crenate, with small spine-bearing areoles in the sinuses; spines solitary or in twos or threes, dark brown, 6 mm. long or less; flowers about 5 cm. long; outer perianth segments pale yellow, the inner white, the tube nearly as long as the limb; fruit juicy, 2.5 to 4 cm. long, somewhat 5-ribbed, the ribs undulate; seeds 1.5 mm. long.

Type in the herbarium of the New York Botanical Garden, from a plant collected near Santo Domingo, Turruvares, Costa Rica, altitude 200 meters, by Brade in 1905 and brought from Costa Rica to the New York Botanical Garden by Mr. William R. Maxon in 1906 (*Maxon* 21). The plant flowered at the New York Botanical Garden in June and October, 1911.

The flowers of this plant resemble in form those of *Weberocereus*; its joints resemble those of some species of *Epiphyllum*.

EXPLANATION OF PLATE 83.—A growing cutting of the type collection, the three new branches beginning to assume the normal hanging position. Scale about  $\frac{1}{2}$ .

**STROPHOCACTUS** Britt. & Rose, gen. nov.

Plants epiphytic, climbing and twining, with aerial roots along the midnerve; stems thin, broad, somewhat branching, the margins bearing numerous closely set areoles; spines numerous, acicular; flowers large, red, nocturnal; ovary and flower tube with numerous hairs and bristles in the axils of the scales; corolla separating from the ovary as in *Cereus*; fruit egg-shaped, with a truncate apex; seeds black (?), ear-shaped, with an open (?) hilum.

Type species, *Cereus wittii* Schum.

**Strophocactus wittii** (Schum.) Britt. & Rose.

PLATE 84.

*Cereus wittii* Schum. Monatschr. Kakteenk. 10: 154. 1900.

TYPE LOCALITY: Swampy woods near Manaus, Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Schum. Gesamtb. Kakt. Nachtr. f. 6; Monatschr. Kakteenk. 10: 155; 12: 139; 15: 25—all as *Cereus wittii*.

EXPLANATION OF PLATE 84.—Reproduced from the illustration in the Monatschrift für Kakteenkunde, vol. 10, p. 155, showing: *A*, habit of plant; *B* and *C*, branches bearing young fruit; *D*, areole, with spines; *E*, fruit; *F*, seed. *A*, scale  $\frac{1}{16}$ ; *B*, scale  $\frac{1}{2}$ ; *C*, scale  $\frac{1}{2}$ ; *D* and *E*, natural size; *F*, scale 8.

**EPIPHYLLANTHUS** Berger, Rep. Mo. Bot. Gard. 16: 84. 1905.

Epiphytic; stems much branched, ribbed, jointed; joints slightly flattened, bearing several setae from the areoles; flowers similar to those of *Zygocactus*; ovary angular; inner stamens united at base.

Type species, *Cereus obtusangulus* Schum.

**Epiphyllanthus obtusangulus** (Lindb.) Berger, Rep. Mo. Bot. Gard. 16: 84. 1905.

*Epiphyllum obtusangulum* Lindb.; Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 198. 1890.

*Cereus obtusangulus* Schum. in Mart. Fl. Bras. 4<sup>2</sup>: 198. 1890.

?*Cereus anomalus* Schum. Keys Monogr. Cact. 16. 1903, name only.

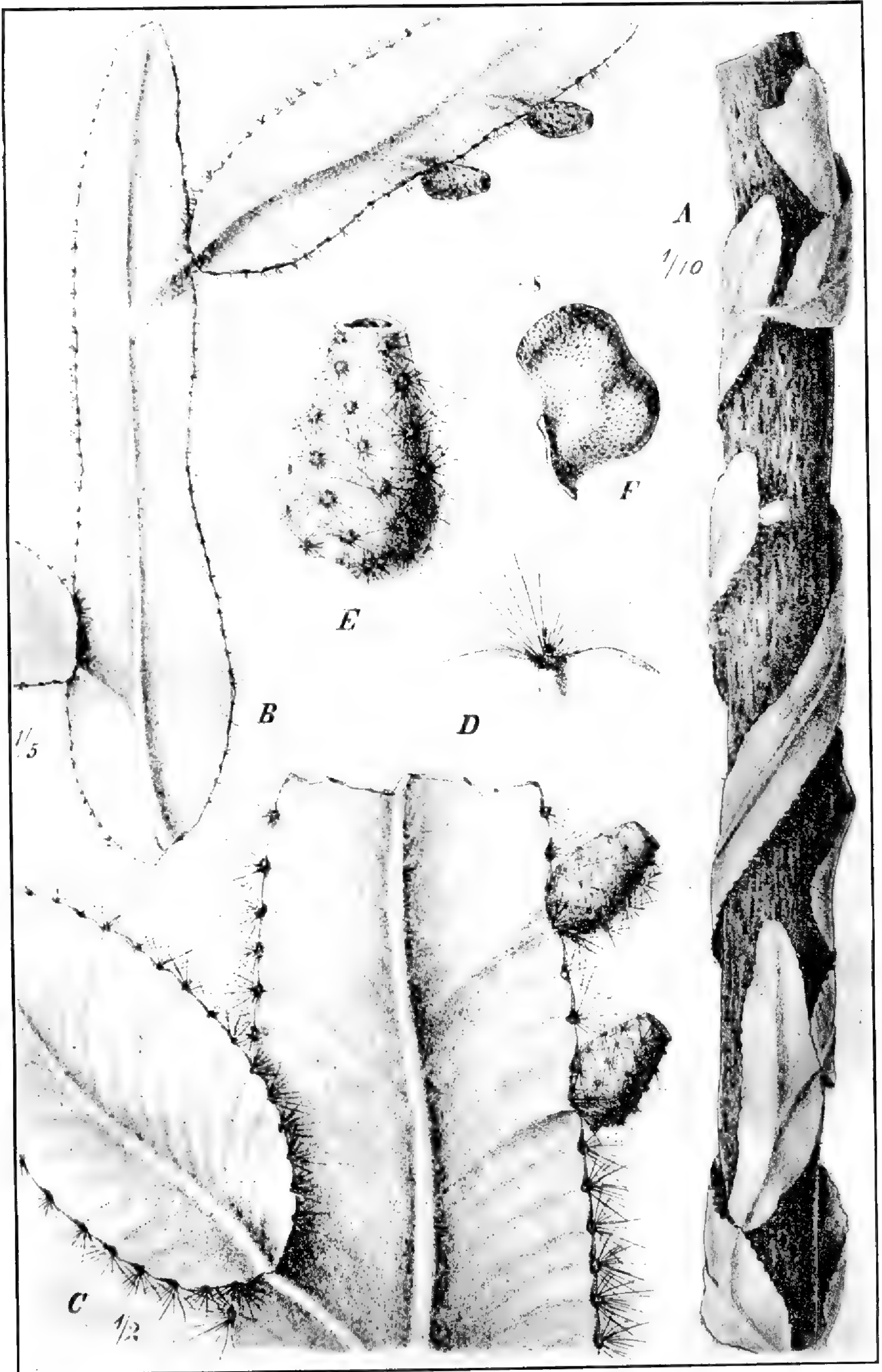
TYPE LOCALITY: In Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Schum. Gesamtb. Kakt. f. 30, as *Cereus obtusangulus*.



ECCREMOCACTUS BRAZEI BRITT. & ROSE.



STROPHOCACTUS WITTII (SCHUM.) BRITT. & ROSE.

# ANNONA SERICEA AND ITS ALLIES.

BY WILLIAM E. SAFFORD.

## INTRODUCTION.

In continuance of his studies in the Annonaceae, the writer finds that the silky annona of French Guiana (*Annona sericea* Dunal) is the type of a natural subgroup of the genus *Annona*, which should be segregated as a section. This will be composed of at least ten species, several of which have not hitherto received names. In addition to defining the section and characterizing the species, it has been possible in this paper to present photographs of a number of the type specimens, including that of *Annona echinata* and the flower of *A. sericea*, described and figured by Dunal in his classical monograph of the Annonaceae. For the photographs of the latter, the types of which are in the De Candolle Prodrromus Herbarium, the writer is indebted to M. Augustin de Candolle. For that of *A. trinitensis* he is indebted to the Director of the Royal Gardens at Kew. The remainder of the photographs, including those of *A. spraguei*, *A. holosericea*, and *A. jamaicensis* were taken in Washington under the writer's direction.

The accompanying drawings were made by Mr. A. B. Boettcher and Mr. J. M. Shull, those of the essential parts being reproduced from camera lucida drawings of the writer.

## SYSTEMATIC TREATMENT.

The species here described form a fairly well-defined genus section, for which the name *Pilannona* is proposed, to give it coordinate rank with the sections *Euannona* (based upon *Annona muricata* L.), *Atta* (including *Annona squamosa*, *A. cherimola*, and their allies), *Ilama* (based upon *A. diversifolia* Safford), *Annonella* (based upon *A. globiflora* Schlecht.),<sup>1</sup> and *Chelonocarpus* (based upon *A. scleroderma* Safford).<sup>2</sup> As in other natural plant groups there are

<sup>1</sup> See Safford, W. E. The Genus *Annona*: The Derivation of its Name and its Taxonomic subdivisions. Journ. Washington Acad. Sci. 1: 118. 1911.

<sup>2</sup> See Journ. Washington Acad. Sci. 3: 103-109. 1913.

certain species which appear to form connections with allied groups, so in the section *Pilannona* the type species, *A. sericea* Dunal, appears to be allied to the 6-petaled *A. paludosa* Aubl. and sometimes has 3 imperfectly developed inner petals; while, at the opposite end of the series, *A. jamaicensis* Sprague approaches *A. cherimola*, belonging to the section *Atta*. Notwithstanding these connecting links, the group may be regarded as sufficiently distinct, and the species composing it are most conveniently set apart for study as a section by themselves.

The section may be characterized as follows:

**ANNONA, section PILANNONA Safford.**

Flowers normally 3-petaled, spheroid or rarely oblong in bud, the petals valvate, thick, concave, and not keeled within nor triquetrous; receptacle convex, often clothed with short fine straight bristle-like hairs; stamens numerous, with the connective expanded into a terminal head above the two parallel pollen sacs, the surface of the head being either minutely papillose or echinate, and in some cases bearing a number of erect or slightly curved hairs; carpels numerous, crowded, more or less covered with sericeous hairs, with club-shaped styles and minutely tuberculate or echinate ovoid stigmas.

As compared with the common custard apples of commerce (*Annona reticulata*, *A. cherimola*, and their allies), the fruits of this group are small, in many cases no larger than a plum or peach and sometimes the size of a strawberry. In nearly all the species the surface of the fruit is velvety, especially during the early stages, and the seeds are surrounded by scant pulp. As the name indicates, the young growth of the type species and its close allies is sericeous or velvety, and the leaves of most of the species are more or less velvety or sericeous, at least on the lower surface. In a few cases they become glabrate at length.

KEY TO THE SPECIES.

- Peduncles in clusters of 2 or 3; flower buds depressed-globose; leaves oblong-acuminate, membranaceous, clothed beneath with soft brown velvety pubescence. A small tree of British Guiana and northern Brazil. . . . . 2. *A. jenmanii*.
- Peduncles solitary (in no. 1 sometimes geminate).  
 Lower leaves of flowering branches orbicular; stigmas and connectives of stamens densely pilose or velvety. A small tree of Nicoya, Costa Rica. . . . . 5. *A. holosericea*.
- Lower leaves not orbicular.  
 Bracteoles of peduncles linear-lanceolate, acuminate; leaves small, long-acuminate, membranaceous, glabrate. A small tree of Panama. . . . . 9. *A. acuminata*.
- Bracteoles of peduncles not linear-lanceolate, acuminate.  
 Peduncle usually 3 times as long as the petioles, slender, softly pilose and recurved in fruit; leaves ovate or elliptical, membranaceous, persistently soft-tomentose beneath; fruit strawberry-shaped, without projecting points. A tree of southern Veracruz, Mexico. . . . . 4. *A. longipes*.
- Peduncles less than three times the length of the petioles.  
 Leaves thickly tomentose beneath, oblong, acuminate; fruit covered with fleshy claw-like projections. A forest tree of Panama. . . . . 6. *A. spraguei*.

Leaves sericeous or subtomentose beneath or at length glabrate.

Leaves acute or gradually acuminate, membranaceous; midrib and lateral nerves reddish-sericeous beneath; fruit ovoid, echinate; flowers solitary or geminate. A tree of the savannas of French Guiana.

1. *A. sericea*.

Leaves abruptly or obtusely acuminate.

Fruit verrucose, strawberry-shaped; leaves shortly and obtusely acuminate. A tree growing on the island of Trinidad.....

3. *A. trinitensis*.

Fruit echinate, or with the carpels produced into points or tails.

Lowermost leaves of flowering branches broadly ovate-cordate, the carpels terminating in minute tail-like appendages. A tree growing on the Magdalena River, Colombia.....

7. *A. cercocarpa*.

Lowermost leaves elliptical or obovate.

Flowers globose in bud; fruit ovoid, the carpels terminating in recurved points. A tree of French Guiana.....

8. *A. echinata*.

Flowers oblong or ovoid in bud; fruit spheroid or oblate, the carpels terminating in incurved points. A tree of the island of Jamaica.....

10. *A. jamaicensis*.

### 1. *Annona sericea* Dunal.

#### SILKY ANNONA OF FRENCH GUIANA.

*Annona sericea* Dunal, Monogr. Anon. 69. pl. 5. 1817.

A small tree; young branches slender, clothed at first with soft ferruginous or dark red silky hairs; leaves distichous; petioles short (4 to 8 mm. long), ferruginous-sericeous; upper leaves on flowering branches longer and relatively narrower than those near the base, oblong to oblong-lanceolate or obovate-oblong, 10.5 to 18 cm. long and 3.5 to 5.5 cm. broad, acute or acuminate at the apex, short-acute or rounded at the base, membranaceous, finely and densely pellucid-punctulate, glabrate above with impressed midrib and inconspicuous lateral nerves (18 to 25 on each side), subtomentose beneath, the prominent midrib and slightly curved parallel nerves clothed with dark red or maroon silky hairs; lower leaves on the flowering branches ovate or elliptical, often obtuse or emarginate as in many other Annonaceae; flowers normally 3-petaled, globose in bud; peduncles solitary or sometimes in pairs, extra-axillary, straight, 11 to 16 mm. long, 1-flowered, appressed ferruginous pubescent, with a minute caducous tomentose scale at the base and an inconspicuous bracteole near the middle; unopened flower buds 10 to 12 mm. in diameter; calyx gamosepalous, 3-lobed, the lobes broadly triangular-ovate, abruptly acuminate or cuspidate, clothed on the outside with appressed dark red hairs; petals broadly ovate or suborbicular (12 to 16 mm. long and 10 to 12 mm. broad), obtuse, thick, valvate, concave, clothed on the outside with fine ferruginous-sericeous pubescence and on the inside with golden brown or pale fulvous tomentulum; torus 6 mm. in diameter, convex, clothed with straight yellowish diaphanous caducous hairs and bearing numerous crowded stamens 1.8 to 2.2 mm. long; filaments very short, flat; pollen sacs linear, parallel, 1.5 to 1.7 mm. long, pale straw-colored, the connective expanded above them into a hood-like covering, yellowish, finely papillose, covered with minute points and bearing a number of erect stiff



sharp whitish diaphanous hairs; carpels together with the styles about as long as the stamens, the ovaries rufous-sericeous, the styles club-shaped, chocolate brown, microscopically granular on the surface, the terminal stigmas swollen at the time of pollination and minutely tuberculate; fruit (immature specimen collected by Poiteau) ovoid or heart-shaped, muricate with sharp fleshy points, like a miniature fruit of *A. muricata* in appearance, 2.5 cm. long, 1.8 cm. in diameter; seeds small, ovoid, somewhat compressed and bearing a swollen caruncle at the base. (PLATES 85, 86, 91, A, facing p. 270. FIGURE 42.)

Type in the Prodromus Herbarium of De Candolle at Geneva, collected some time during the latter part of the eighteenth century in French Guiana by Patris.<sup>1</sup>

DISTRIBUTION: Guiana to Brazil.

SPECIMENS EXAMINED: FRENCH GUIANA—"Cayenne," 1795?, Patris, flower of type collection, also specimen from same locality with geminate peduncles, from Prodromus Herbarium of De Candolle; Karouany, 1855, *P. Sagot* 7; without definite locality, 1817-1822, Poiteau, photograph of specimen in Kew Herbarium, from the Gay Herbarium, presented by Poiteau in July, 1824, to Gay, and by Dr. Hooker to the Kew Herbarium in February, 1868.

*Annona sericea*, though normally 3-petaled, has sometimes 3 additional inner petals. These when present are linear-lanceolate in shape and are sometimes imperfect, as in abnormal flowers of *A. globiflora*. They are alternate with the 3 outer petals and appear to close the seams between them, as if to protect the essential parts of the flower from moisture, as in the case of *A. angustifolia* Huber, a closely allied shrub of Brazil, regarded by Martius as a narrow-leaved variety of *A. sericea* (*A. sericea* var. *angustifolia* Mart.).<sup>2</sup> These 6-petaled forms appear to connect *A. sericea* with *A. paludosa* Aubl., in which the flowers are normally 6-petaled. *Annona paludosa* further resembles *A. sericea* in the soft, velvety lining of its leaves and its small, ovoid fruit covered with fleshy prickles, very much like the fruit

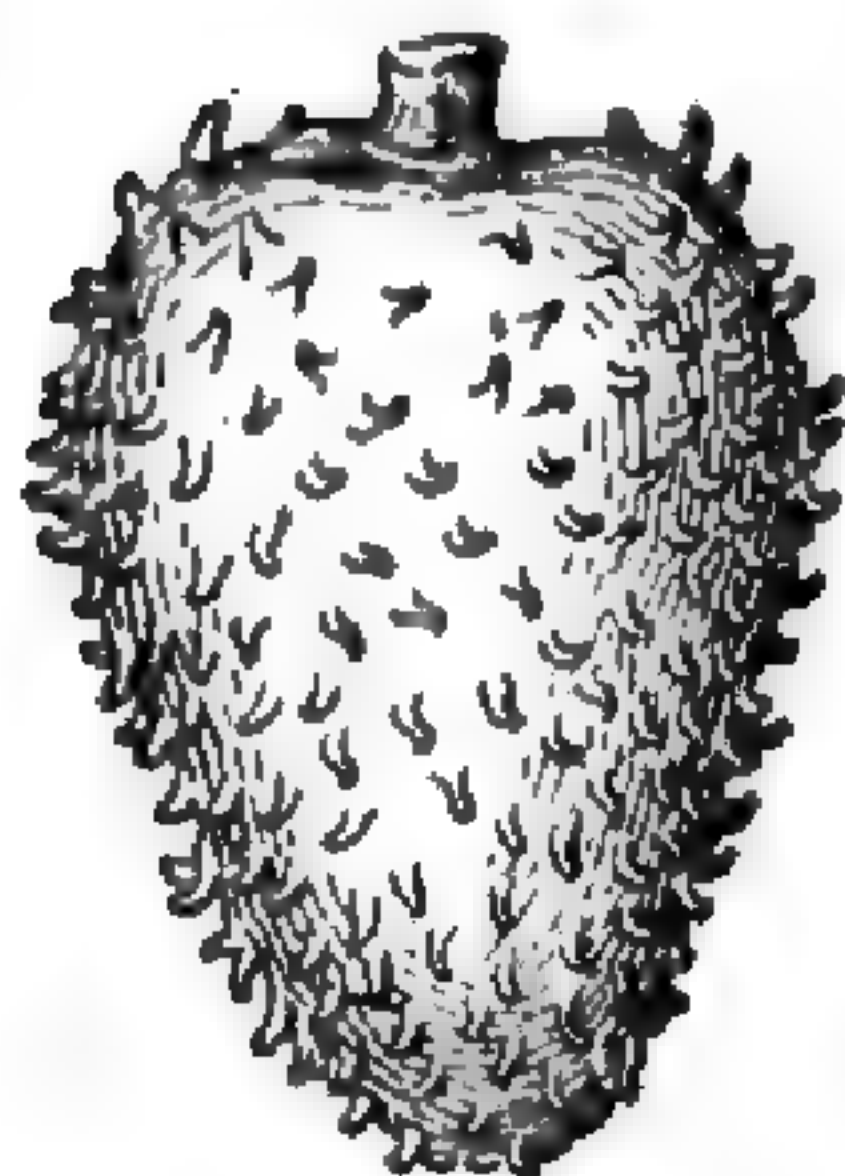
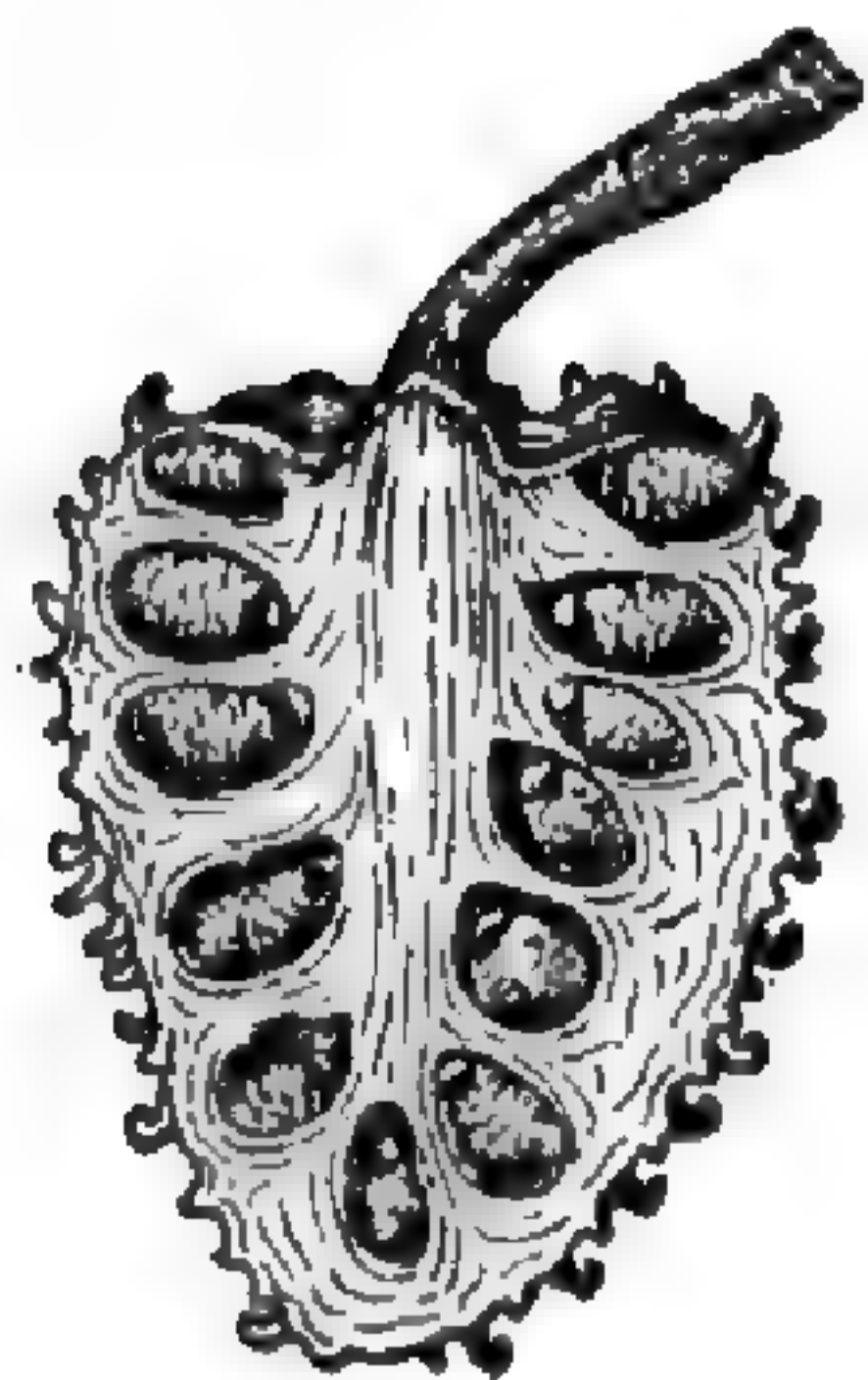


FIG. 42.—Fruit of *Annona sericea*. Natural size.

collected by Poiteau in French Guiana (fig. 42).<sup>3</sup> The two species are undoubtedly distinct, both of them being recorded as common in French Guiana, where they are known by the common name *guimamé*. According to Sagot *A. sericea* is distinguished from *A. paludosa* as *guimamé savane*. The latter is known simply as *guimamé*, or as *corossol sauvage* (from the resemblance of its fruit to a miniature soursop).<sup>4</sup>

<sup>1</sup> Patris, J. B. "Médecin et botaniste du roi, et conseiller au Conseil-supérieur de Cayenne," for whom the genus *Patrisa* was named by Richard. "He collected with great zeal in French Guiana about the year 1795. His collection, which probably included twelve or fifteen hundred species, and which has been estimated at two thousand, on account of duplicates, was presented by the chevalier Turgot to Lhéritier and was acquired by A. P. de Candolle, when he purchased Lhéritier's herbarium Patris's plants, which form more than half the Guiana species of the original herbarium of the Prodromus, bear neither the signature of Patris nor a record of the exact locality in which they were collected. Patris was in communication with de Rohr and Rolander. His specimens were prepared with great care, and were probably represented by either a single sheet or by two or three." Sagot, *Catalogue des Plantes de la Guyane Francaise*. Ann. Sci. Nat. VI. Bot. 10: 367.

<sup>2</sup> Huber, *Bol. Mus. Goeldi* 5: 353. 1909.

<sup>3</sup> See Aubl. *Pl. Guian.* 1: 611. *pl.* 246. 1775.

<sup>4</sup> Sagot, *Ann. Sci. Nat. VI. Bot.* 11: 134. 1880.



ANNONA SERICEA DUNAL.



ANNONA SERICEA DUNAL.

In the original description of *Annona sericea* by Dunal the collector's name is not given nor does it appear in De Candolle's Prodrômus. It is, however, to be found in the Systema.<sup>1</sup> The type is in an excellent state of preservation, and the drawing of it here presented (pl. 86) proves that Dunal's figure is fairly accurate, showing the flower to be extra-axillary, though he erroneously describes it as axillary, and the peduncles possibly to have been geminate, as shown in plate 85. He does not, however, figure the details of the essential parts of the flower, a deficiency supplied in plate 86. The flower of the type itself (see pl. 91, A), kindly lent for the occasion by M. Augustin de Candolle, is in excellent condition and has not the least appearance of being, as it actually is, more than a century old. In this type specimen the carpels and stamens are cemented in place by the glue-like exudation from the stigmas, to which some of the pollen grains still adhere.

The type plant collected by Patris formed part of Lhéritier's herbarium.<sup>2</sup> In another specimen of the same collection (pl. 85) and bearing a similar label the peduncles are geminate. The leaves are exactly similar to those of the type specimen, the lower surface of the young ones being covered with reddish silky hairs, while the older ones are subtomentose beneath and of an olivaceous color between the nerves, sharply contrasting with the bright reddish silky-tomentose midrib and lateral nerves.

*Annona sericea* is represented in Brazil by a narrow-leaved form, *A. angustifolia* Huber, to which reference has already been made. A broad-leaved ally on the Island of Trinidad, which was included by Sprague in *A. sericea*, is below segregated as *A. trinitensis*.

EXPLANATION OF PLATES 85, 86.—Pl. 85, photograph of specimen from type locality in the De Candolle Prodrômus Herbarium, showing geminate peduncles. Natural size. Pl. 86, drawing of type. Natural size. Fig. a, flower of same with two petals truncated and one removed to show the essential parts; b, stamens of same showing the stiff hairs borne on the terminal, swollen connective; c, carpel composed of hairy ovary and style terminating in a minutely tuberculate stigma; d, apex of leaf, showing silky indument of lower surface. Fig. a, scale 3; b and c, scale 15; d, natural size.

## 2. *Annona jenmanii* Safford, sp. nov.

### SILKY ANNONA OF BRITISH GUIANA.

A shrub or small tree; young branches slender, clothed with dense appressed ferruginous hairs; leaves distichous; petioles 6 to 10 mm. long, frequently recurved, ferruginous-sericeous; blades obovate-oblong to oblanceolate, the lowermost on the branchlets lanceolate, smaller than the succeeding ones but not broad and retuse as in *A. sericea*, 6 cm. long by 2 cm. broad, the larger 10 to 19 cm. long by 2.5 to 5.5 cm. broad, gradually acuminate at the apex and acute or cuneate at the base, membranaceous, pellucid-punctulate, sparsely pubescent above except along the impressed hairy midrib, at length glabrescent, clothed beneath with persistent chocolate-brown velvety pubescence except along the ferruginous-sericeous midrib and parallel slightly curved lateral nerves (20 to 25 on each side); flowers normally 3-petaled; peduncles geminate or fascicled, extra-axillary, usually recurved, 10 to 15 mm. long, clothed with ferruginous appressed hairs and with a minute broadly ovate obtuse bracteole near the middle and one at the base; unopened flower-buds 12 to 15 mm. in diameter, spheroid; calyx lobes broadly triangular, shortly and abruptly acuminate, clothed on the outside like the peduncle with appressed ferruginous hairs; petals broadly ovate or suborbicular, obtuse (14 to 16 mm. long by 16 to 18 mm. broad), thick and coriaceous, clothed on the outside with fine dense velvety ferruginous pubescence and on the inside with fulvous tomentulum; receptacle convex, clothed with short stiff fulvous hairs; stamens numerous, crowded, 1.9 to 2.4 mm. long, with a short broad filament and linear parallel pollen sacs surmounted by the swollen expanded

<sup>1</sup> DC. Reg. Veg. Syst. 1: 471. 1818.

<sup>2</sup> See footnote 1, p. 266 above.

connective, the latter papillose and bearing stiff erect or spreading somewhat curved acute hairs, abundant on the immature stamens and visible under an ordinary lens, at length more or less deciduous; carpels including the styles about as long as the stamens, club-shaped, terminating in a swollen tuberculate stigma; fruit not observed. (PLATE 87.)

Type in the U. S. National Herbarium, no. 703145, collected near Rockstone, British Guiana, April, 1899, by G. S. Jenman (no. 7546). This specimen was kindly sent to the U. S. Department of Agriculture by Mr. John F. Waby, acting government botanist at Georgetown, Demerara.

DISTRIBUTION: British Guiana and northern Brazil.

SPECIMENS EXAMINED: BRITISH GUIANA—Near Rockstone, April, 1899, *Jenman* 7546 (type). Brazil: Barra do Rio Negro [Manáos], October, 1851, *R. Spruce* 1868 (in Herb. De Candolle).

*Annona jenmanii*, though closely related to *A. sericea*, has its peduncles normally geminate or fascicled and is readily distinguished from the latter species by the dull chocolate brown, tomentose indument of the lower surface of the leaves, very much like that of *A. paludosa*, in which the midrib and lateral nerves are not conspicuous. In *A. sericea* the contrast of the bright reddish-sericeous midrib and nerves with the tomentose area between them is quite striking.

EXPLANATION OF PLATE 87.—Flowering branches, showing extra-axillary, clustered flowers. Natural size. Figs. *a, a'*, carpels with hairy ovaries and club-shaped styles terminating in tuberculate stigmas; *b, b'*, mature stamens, ventral view, with the heads of the connectives partly denuded of hair; *b'*, immature stamen, dorsal view, showing the two parallel pollen sacs, dehiscent along their median line, and the heads of the connective bearing spreading, stiff hairs. Figs. *a* to *b''*, scale 20; after camera lucida drawings of the author.

### 3. *Annona trinitensis* Safford, sp. nov.

#### SILKY ANNONA OF THE ISLAND OF TRINIDAD.

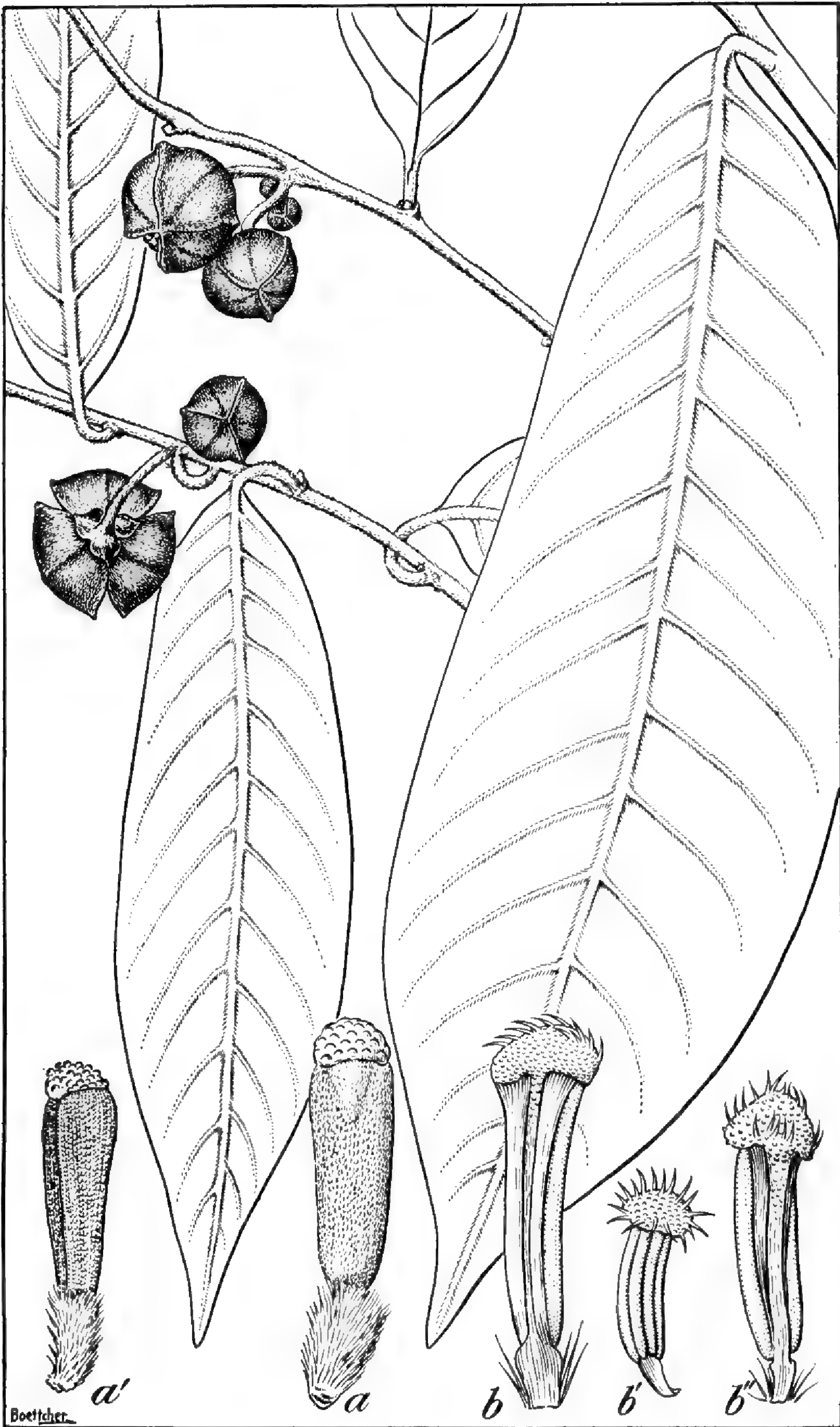
*Annona sericea* Sprague, Bull. Herb. Boiss. II. 5: 700. 1905, in part, not Dunal, 1817.

A tree 5 or 6 meters high; branches rather slender, the younger sericeous-tomentose with ferruginous hairs; petioles 4 to 10 mm. long, sericeous-tomentose; blades ovate, elliptical, or obovate, obtuse or shortly and rather obtusely acuminate at the apex, cuneate or rounded at the base, 9.5 to 15 cm. long, 5.5 to 6.5 cm. broad, puberulous above except along the pubescent midrib, dark chestnut brown, clothed beneath with brown tomentulum or pubescence except along the midrib and nerves, these sericeous-tomentose; lateral nerves 12 to 16 on each side, slightly curved, not impressed above, prominent beneath; peduncle extra-axillary, solitary, 1-flowered, tomentose, at length glabrate, with a bracteole at or below the middle; flowers 3-petaled; calyx lobes broadly ovate, shortly acuminate, sericeous-tomentose on the outside, within sparsely sericeous at the base, elsewhere glabrate; petals ovate, obtuse, 18 to 20 mm. long, 15 mm. broad, sericeous on the outside; filaments 0.5 mm. long; anthers 1.5 to 1.75 mm. long; connective above the anthers broadly expanded into a head, papillose and bearing long hairs (Sprague); lower part of the style together with the ovary 1.25 to 1.5 mm. long, the upper part 0.75 to 1.25 mm. long; stigma broadly and obtusely ovoid, 0.25 to 0.35 mm. long; fruit similar to that of a strawberry (*Fragaria vesca*), 2.5 to 3.5 cm. long, about 2 cm. in diameter, warty; seeds 4.5 to 5 mm. long, 2.5 mm. broad. (PLATE 88.)

Type in the Kew Herbarium, collected on the Island of Trinidad, 1877-80, by August Fendler (no. 205).

DISTRIBUTION: Known only from type locality.

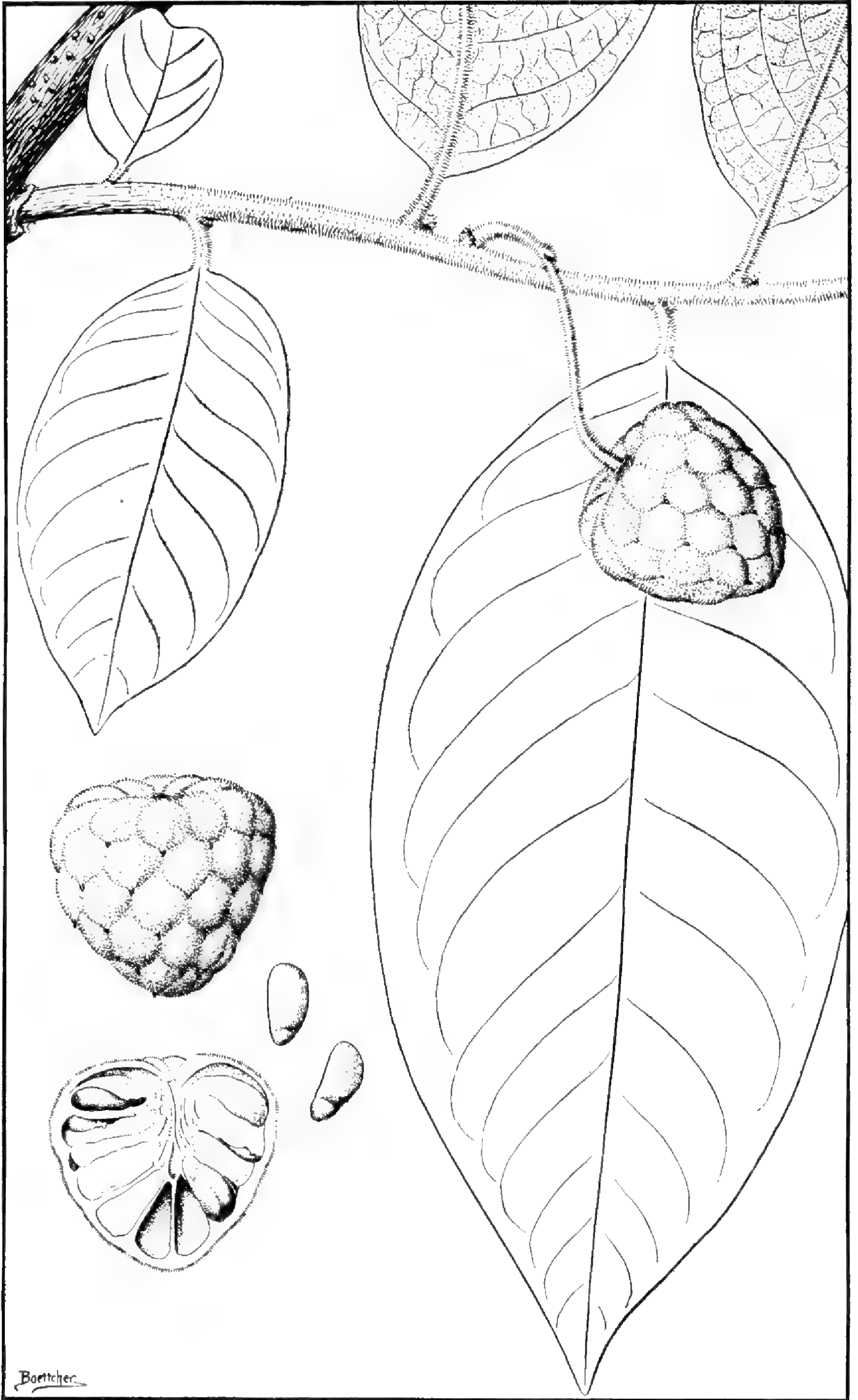
The type of this species was referred by Sprague to *Annona sericea* Dunal of French Guiana. From this species, however, it is separated by its relatively broader and more obtuse leaves, described by Sprague as "breviter obtusiuscule acuminata" at the apex, which is not true of *A. sericea* Dunal, and by its fruit, de-



ANNONA JENMANII SAFFORD.



*ANNONA TRINITENSIS* SAFFORD.



ANNONA LONGIPES SAFFORD.



scribed as verrucose and resembling a strawberry, instead of echinate or muricate like that of the true *A. sericea* Dunal growing in French Guiana (fig. 42). It may be regarded as a broad-leaved representative of *A. sericea*, growing on the Island of Trinidad, intermediate, perhaps between *A. sericea* and *A. jamaicensis* Sprague, just as *A. angustifolia* Huber may be regarded as a narrow-leaved representative of the same species growing in Brazil, intermediate, perhaps, between *A. sericea* and *A. paludosa* Aubl.

EXPLANATION OF PLATE 88.—Branch, showing lower surface of leaves and base of old, extra-axillary peduncle from which flower has been broken. Photographed from type in Kew Herbarium. Natural size.

#### 4. *Annona longipes* Safford, sp. nov.

##### LONG-STEMMED ANNONA OF VERACRUZ.

A tree 10 meters high; young branches slender, clothed with dense long soft fulvous pubescence, at length glabrate, with cinnamon-colored or reddish brown bark bearing numerous white lenticels; leaves distichous; petioles 8 to 13 mm. long, densely clothed with long fulvous velvety pubescence; blades ovate, 9 to 14 cm. long and 4 to 6.5 cm. broad, acute or acuminate at the apex, usually rounded at the base, membranaceous, pellucid-punctulate, olive green when dry, sparsely pubescent above except along the impressed hairy midrib, clothed beneath with sparse white hairs except along the fulvous or pale rufous midrib and lateral nerves (12 to 14 on each side), these densely hairy, somewhat prominent beneath and connected by oblique veins scarcely visible above; lower leaves of flowering branches smaller than the upper and sometimes obtuse or retuse at the apex; peduncles solitary, extra-axillary, very long (30 to 42 mm.), persistently slender, clothed with persistent dense fulvous velvety pubescence with a scale-like pubescent bracteole at the base and a second smaller bracteole below the middle; flowers not observed; fruit shaped like a strawberry, broadly conoid, rounded at the apex, 25 mm. long and 21 mm. in diameter, the surface finely ferruginous-tomentose, without projections but covered with gibbous areoles corresponding to the individual carpels, the latter closely cemented together and terminating each in an inconspicuous appressed point; seeds asymmetrically obovate, often obliquely truncate at the apex and with a swollen caruncle at the base, light brown, smooth, 10 to 11 mm. long and 5 to 6 mm. broad, easily separable from the scant pulp. (PLATE 89.)

Type in the U. S. National Herbarium, no. 45591, collected on the slope of a hill near the outlet of Lake Catemaco, Canton de los Tuxtlas, southeastern Veracruz, Mexico, April 28, 1894, by E. W. Nelson (no. 430).

DISTRIBUTION: Southern Veracruz, near the coast of the Gulf of Campeachy, at an altitude of 300 meters. Known only from the type locality.

Although undoubtedly related to the silky annonas, this species is separated from them by the dense, erect, velvety, fulvous or pale rufous pubescence of its younger parts, which are never appressed ferruginous sericeous, as in *A. sericea* and its close allies. It is also set apart by its fruit, which is not echinate nor muricate, and above all by its long, persistently slender and velvety peduncles.

EXPLANATION OF PLATE 89.—Drawing, by Mr. A. B. Boettcher, of fruit-bearing branch; also longitudinal section of fruit and seed. Natural size.

#### 5. *Annona holosericea* Safford, sp. nov.

##### VELVETY ANNONA OF NICOYA.

A small tree; ultimate branches densely fulvous-tomentose when young, at length glabrate, with grayish brown bark, this plicate-striate when dry and bearing very small inconspicuous lenticels; old leaf scars prominent, each bearing a tuft of fulvous tomentum; leaves distichous; petioles 4 to 5 mm. long, densely fulvous-tomentose; blades orbicular to obovate, rounded or cuneate at the base, the lowermost on the

flowering branches subreniform and often retuse; upper obovate leaves (young specimens only observed) 7 cm. long and 4 cm. broad; orbicular leaves 5 or 6 cm. in diameter; lowermost emarginate leaves 3 to 4 cm. in diameter; all of them membranaceous, punctulate, above velvety-pubescent and at length glabrate except along the impressed midrib, beneath clothed with dense soft fulvous or pale rufous tomentum on the prominent midrib and lateral nerves (8 to 12 on each side) and with grayish or olivaceous tomentum between the nerves; lateral nerves of the lowermost leaves connected by veins at right-angles to them; peduncles short, solitary, 1-flowered, extra-axillary, 7 to 9 mm. long, densely clothed with tomentum like that of the young branchlets and bearing a small tomentose bracteole below the middle; sepals broadly ovate-triangular, 4 or 5 mm. long, obtusely acuminate, clothed on the outside with dense fulvous tomentum; petals 3, broadly ovate, 12 mm. long and 10 or 11 mm. broad, acute or obtuse, thick and leathery, clothed with short pale brown velvety tomentum without and within; receptacle convex, clothed with straight erect pale fulvous hairs between the stamens and carpels; stamens numerous, 2 to 2.5 mm. long, the connective expanded above the parallel linear pale yellow pollen sacs, its surface velvety, densely covered with short fine brown hairs; carpels 1.5 to 2 mm. long, entirely clothed with pale fulvous hairs and bearing broadly ovoid or spheroid stigmas, these densely covered with erect pale fulvous or straw-colored hairs and resembling minute echinate burs under the lens, at the time of pollination becoming suffused with a viscous brown fluid and at length falling off; fruit not observed, but undoubtedly short-peduncled and velvety. (PLATES 90, 91, B.)

Type in the U. S. National Herbarium, no. 592568, collected on the wooded hills of Nicoya, Pacific coast of Costa Rica, May, 1900, by A. Tonduz (no. 13930); duplicate in the herbarium of the New York Botanical Garden.

DISTRIBUTION: Pacific coast of Costa Rica; known only from the type locality.

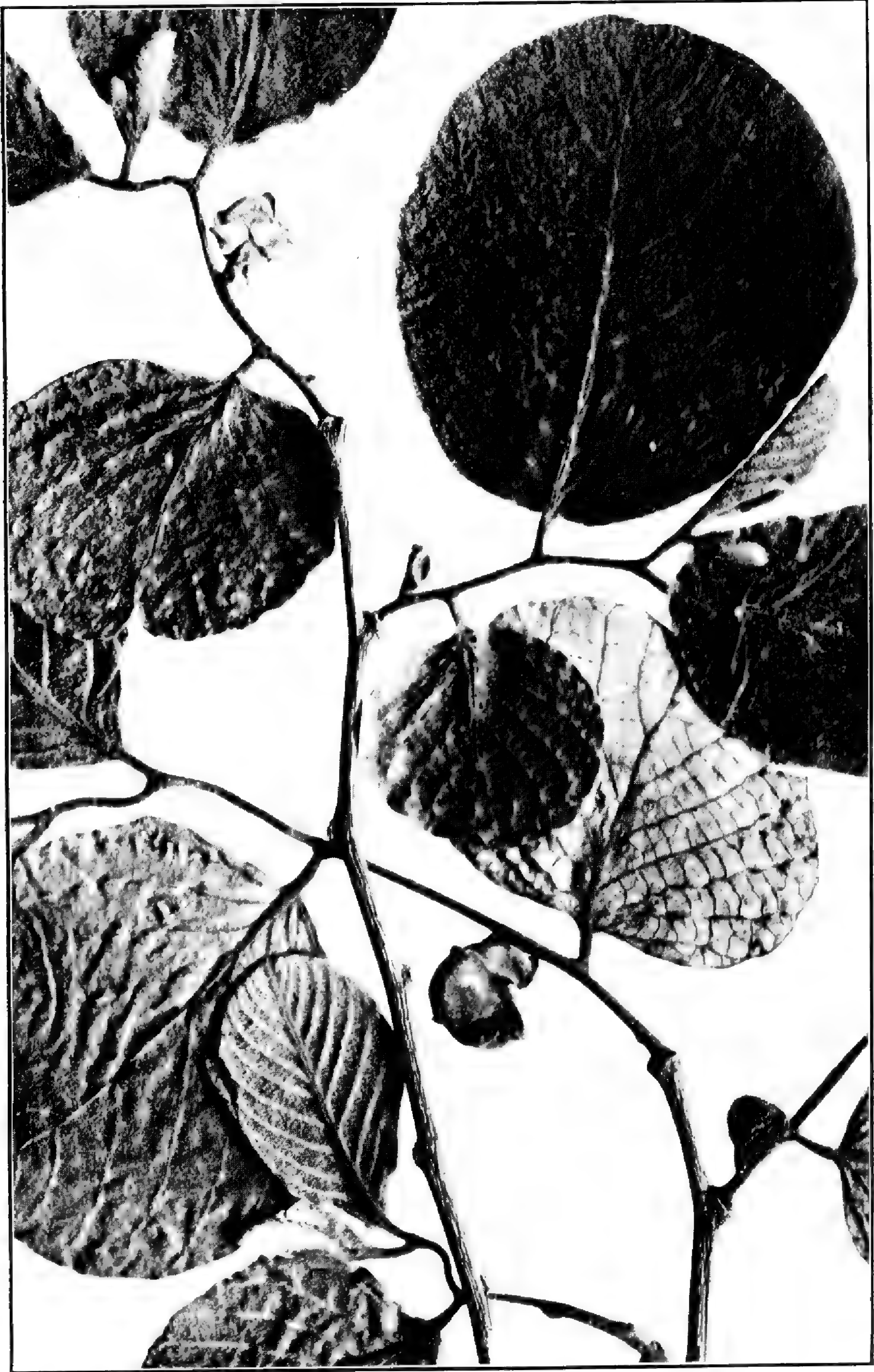
*Annona holosericea* is distinguished from all its congeners by its orbicular leaves and its velvety essential parts, of which both the connectives of the stamens and the outer stigmas (before becoming cemented together at the time of pollination) are conspicuously hairy, as seen under the lens. The connectives differ from those of the stamens of *A. sericea* and its close allies in being covered with very many fine hairs instead of comparatively few coarse ones, and the stigmas resemble miniature echinate burs instead of being covered with rounded tubercles as in the species referred to.

EXPLANATION OF PLATES 90, 91.—Pl. 90, photograph of the type specimen. Natural size. Pl. 91, A, photograph of flower of *Annona sericea*, type collection, figured by Dunal. B, photograph of flower of *A. holosericea*, type collection. Both scale 6.

## 6. *Annona spraguei* Safford, sp. nov.

### VELVETY ANNONA OF PANAMA.

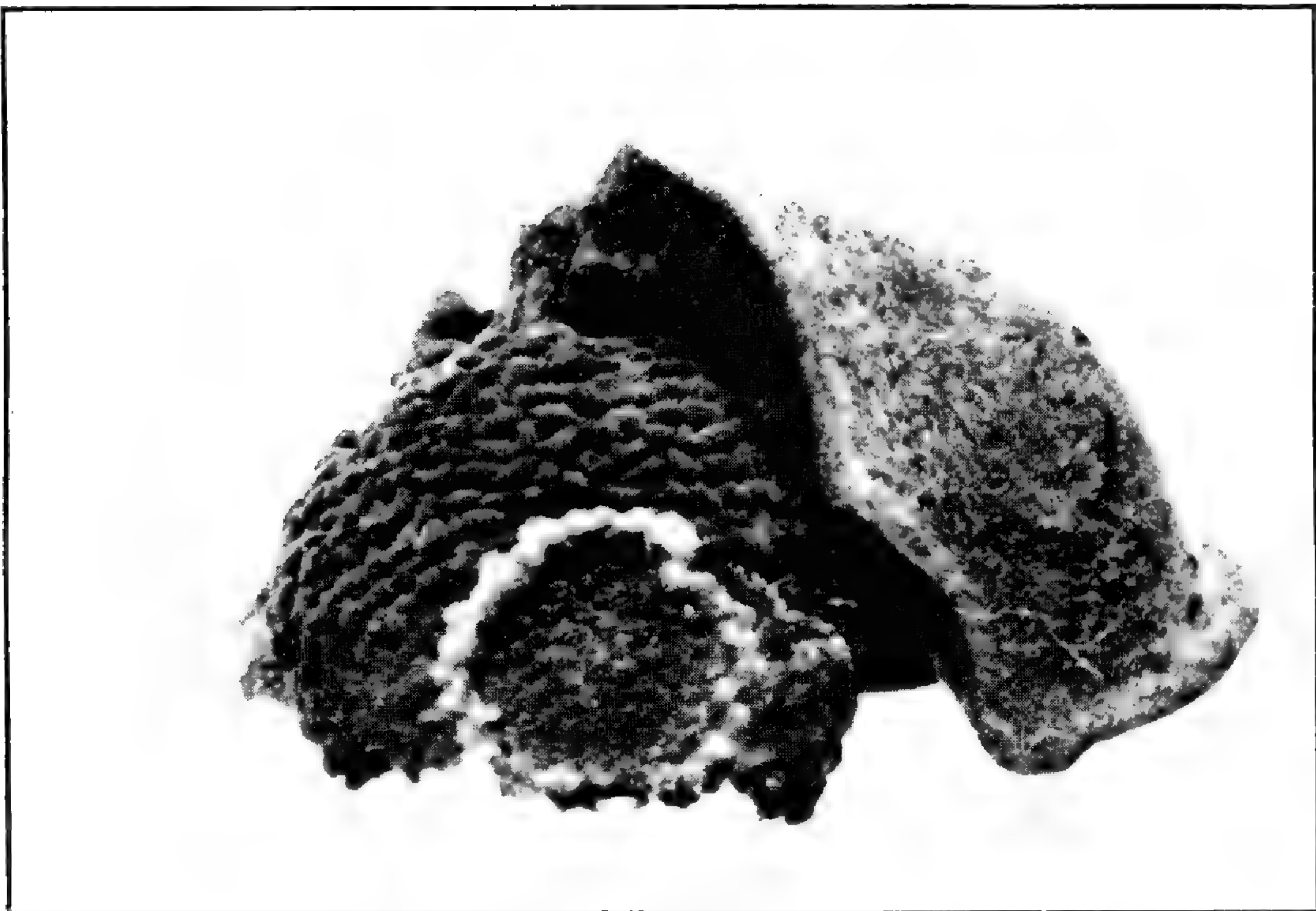
A tree 6 to 16 meters high; ultimate branchlets rufous-tomentose when young, soon becoming glabrescent, and at length glabrate, with reddish brown bark thickly dotted with small whitish lenticels; old leaf scars prominent, lined with dense rufous tomentum; leaves distichous; petioles (of young leaves) 7 to 9 mm. long, densely rufous-tomentose; blades oblong-lanceolate to obovate-oblong, 10 to 20 cm. long and 3 to 6 cm. broad, acuminate at the apex and rounded or obtusely cuneate at the base, pellucid-punctulate, sparsely pubescent above with scattered grayish hairs, densely and softly sericeous-pubescent beneath with appressed grayish olivaceous hairs except along the rufous-tomentose midrib and lateral nerves; lateral nerves 20 to 26 on each side, prominent beneath; blades of the lowermost leaves on the flowering branches rounded or retuse at the apex, cuneate at the base, much smaller than the rest, sometimes obcordate; flowers 3-petaled, large, yellow, subglobose in bud; peduncles solitary, extra-axillary, usually issuing from a point near the base of a young branchlet, 9 to 14 mm. long, ferruginous-tomentose, with a small ovate bracteole above the



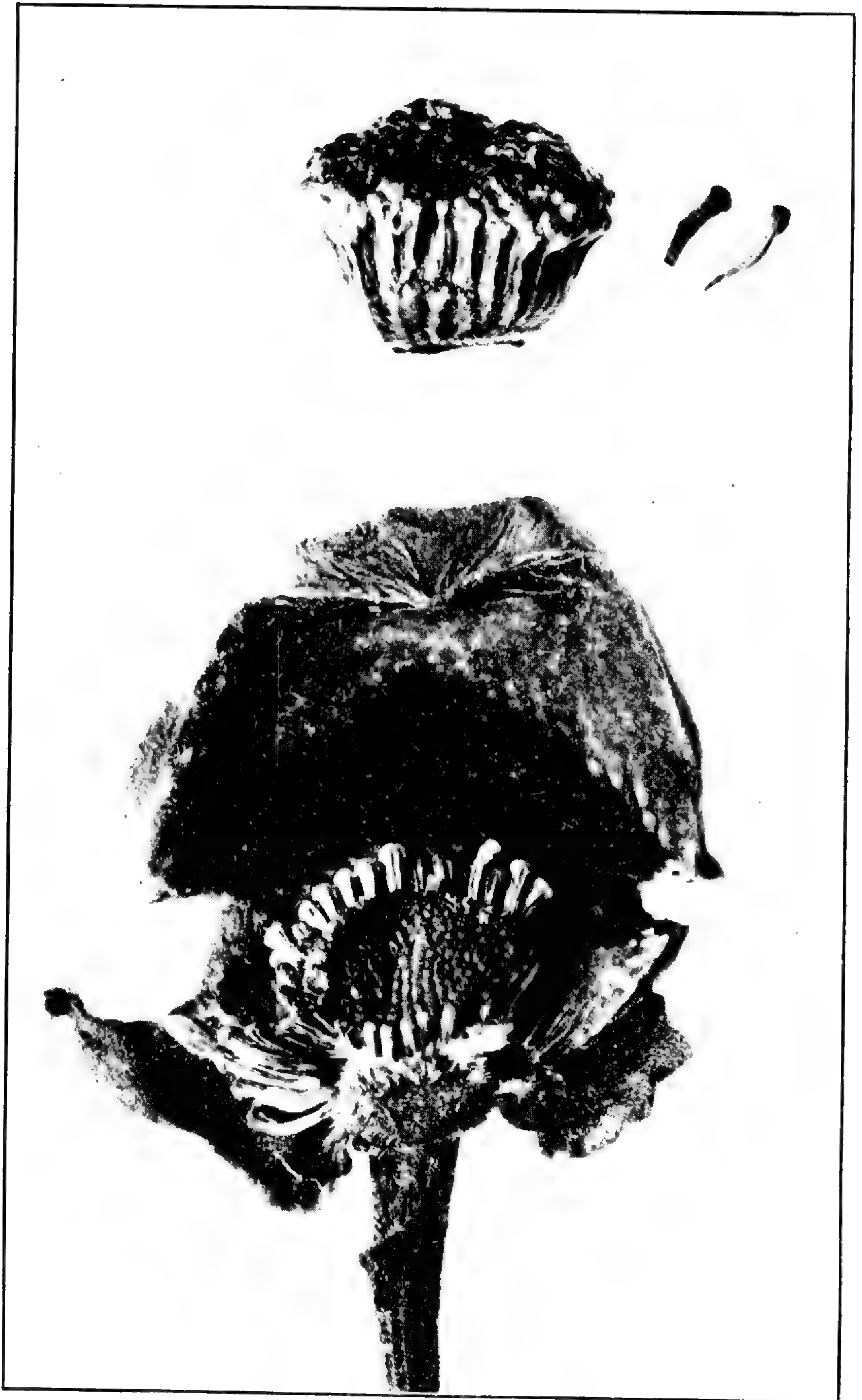
*ANNONA HOLOSERICEA* SAFFORD.



A. *ANNONA SERICEA* DUNAL.



B. *ANNONA HOLOSERICA* SAFFORD.



ANNONA SPRAGUEI SAFFORD.



ANNONA SPRAGUEI SAFFORD.

middle; sepals ovate-acuminate, 8 to 10 mm. long, 6 mm. broad at the base, clothed on the outside with ferruginous tomentum like that of the petiole, within glabrous at the base, elsewhere shortly appressed-pubescent; petals suborbicular, obtusely apiculate, thick and leathery, concave, 18 to 23 mm. long and 17 to 19 mm. broad, clothed on the outside with short dense velvety fulvous puberulence and on the inside with fine tomentulum, olive yellow with a broad dark brown spot covering the lower half; receptacle convex, clothed with very short straight fine whitish hairs; stamens numerous, crowded, 3.3 to 3.8 mm. long, with a very short flat filament and parallel linear pollen sacs 2 to 2.7 mm. long; connective expanded above the pollen sacs into a yellow head, this minutely muriculate with glossy points; gynoecium 7 to 9 mm. in diameter, composed of crowded carpels about 4 mm. long, united into a solid mass, the ovaries about equal to the styles in length, clothed with whitish sericeous hairs, the pale yellow styles more or less prismatic, terminating in a rounded stigmatic head, the whole surface minutely velvety as seen under the microscope; fruit spheroid, 5 cm. in diameter, the component carpels produced into long-attenuate fleshy claw-like protuberances, the surface velvety and each with a median longitudinal groove on the side remote from the peduncle; seeds oblong, 7 to 9 mm. long by 4 to 5 mm. broad, dull brown, with a caruncle at the base. (PLATES 92, 93. FIGURE 43.)

Type in the U. S. National Herbarium, no. 716048, collected at Gamboa, Canal Zone, Isthmus of Panama, April 9, 1911, by H. Pittier (no. 3409). "A tree 5-6 meters high; leaves soft, tomentose; petals thick."

DISTRIBUTION: Isthmus of Panama, Canal Zone to Rio Tuyra, Darien.

SPECIMENS EXAMINED: CANAL ZONE—Gamboa, near Matachin, type collection, flowers and leaves. DARIEN—Marraganti and vicinity, Rio Tuyra, 10 to 200 feet elevation, *R. S. Williams*, April, 1908, flowers, fruit and leaves, "A tree 50 feet high, with a trunk 14 inches in diameter."

To this species should probably be referred Sutton Hayes's no. 127, collected at Obispo Falls, near Barbacoas, Isthmus of Panama, cited by Hemsley as "*Anona* sp. (?*Anonae sericeae*, var. *foliis pedalis*),"<sup>1</sup> and described by T. A. Sprague under the name *Anona uncinata*.<sup>2</sup> The latter name is unavailable, having been previously used by Lamarck.<sup>3</sup> If Hayes's plant, which I have not had the opportunity of comparing with the material upon which the present species is based, proves to be identical with the latter, it must assume the new specific name.

The leaves of Hayes's plant are considerably larger than those of the material examined, and a photograph of the fruit in the Kew Herbarium shows it to differ from that of Williams's specimen in the New York Botanical Garden in being ovoid-globose instead of spheroid and in having the claw-like tips of the carpels directed toward the peduncle instead of away from it, as in the latter (fig. 43).

*Annona spraguei* is named in honor of Mr. Thomas Archibald Sprague, of the Royal Botanic Gardens, Kew, by whom Dr. Hayes's plant was described, as a tribute to his valuable work in botanical taxonomy.

EXPLANATION OF PLATES 92, 93.—Pl. 92, photograph of a flower of the type collection, preserved in alcohol, with two petals removed, so as to show the essential parts, and also of the gynoecium of another flower showing the consolidated mass of carpels with the sericeous-hairy ovaries surmounted by the prism-shaped styles terminating in swollen stigmas. Scale 5. Pl. 93, photograph of the type in the United States National Herbarium. Natural size.

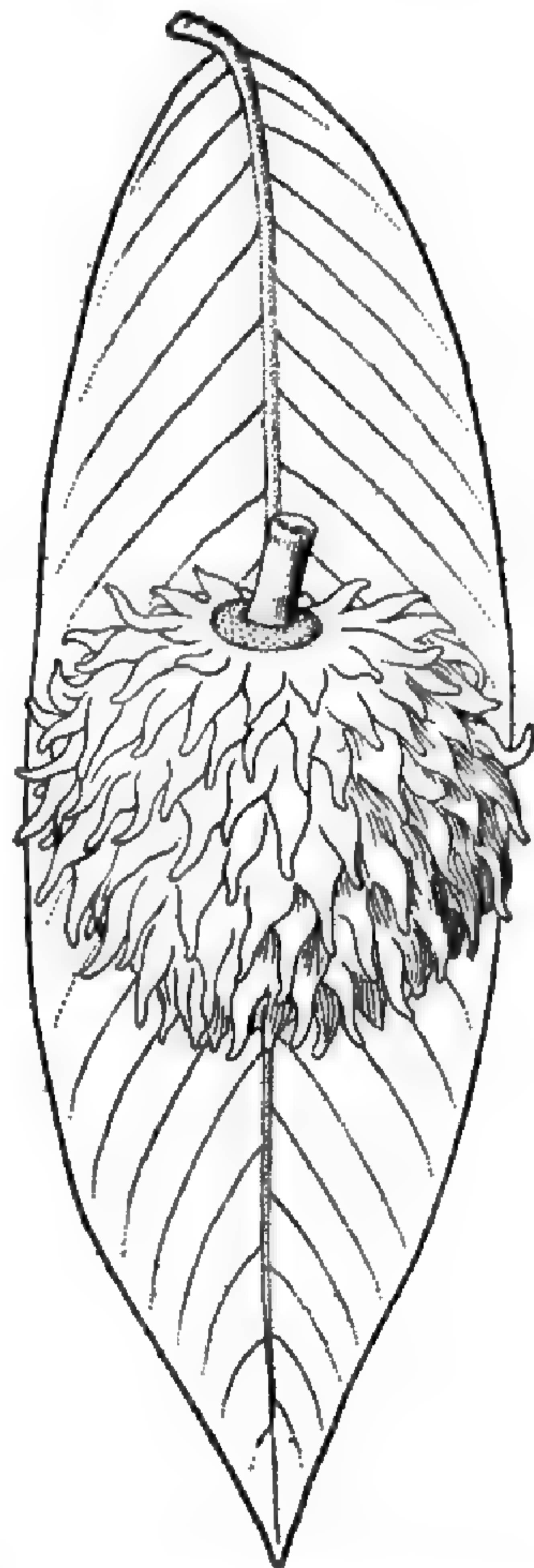


FIG. 43.—Leaf and fruit of *Annona spraguei*. Scale  $\frac{1}{2}$ .

<sup>1</sup> Biol. Centr. Amer. Bot. 1: 19.

<sup>2</sup> Bull. Herb. Boiss. II. 5: 701. 1905.

<sup>3</sup> Lam. Encycl. 2: 127. 1786.

7. *Annona cercocarpa* Safford, sp. nov.

ANONCILLO OF THE MAGDALENA RIVER.

*Anona echinata?* Triana & Planch. Prodr. Fl. Novogran. 28. 1862, not *A. echinata* Dunal, 1817.

Branchlets at first ferrugineous-pubescent, soon becoming glabrate, dark reddish brown to black, set with whitish lenticels; petioles 4 to 5 mm. long, broadly channeled above, at first appressed-pubescent, at length glabrate; blades membranaceous, punctulate, those on the upper part of the flowering branches ovate to obovate-oblong, acute or acuminate at the apex and rounded or cuneate at the base, 9 to 9.5 cm. long and

3.5 to 3.9 cm. broad, with 10 to 12 secondary nerves on each side the midrib; lower leaves shorter and broader, 6.7 cm. long and 4.2 cm. broad, with 9 to 11 lateral nerves on each side; lowermost leaves smallest, broadly cordate, 2.4 cm. long and 2.3 cm. broad; all of them at first pubescent above, densely so along the impressed midrib and lateral nerves, at length glabrate; beneath conspicuously veined, with the veins at right angles to the secondary nerves, these together with the midrib clothed with short pale rufous pubescence, the remainder of the blade beneath sparsely rufous-pubescent; peduncles solitary, extra-axillary, 17 mm. long in fruit, at length glabrate; flowers not observed; calyx lobes broadly triangular, acute; carpels numerous; fruit spheroid, about 28 mm. in diameter, the component carpels pilose, terminating each in a slender appressed-hirsute more or less curled tail; seeds obovate or obpyramidal, 5 to

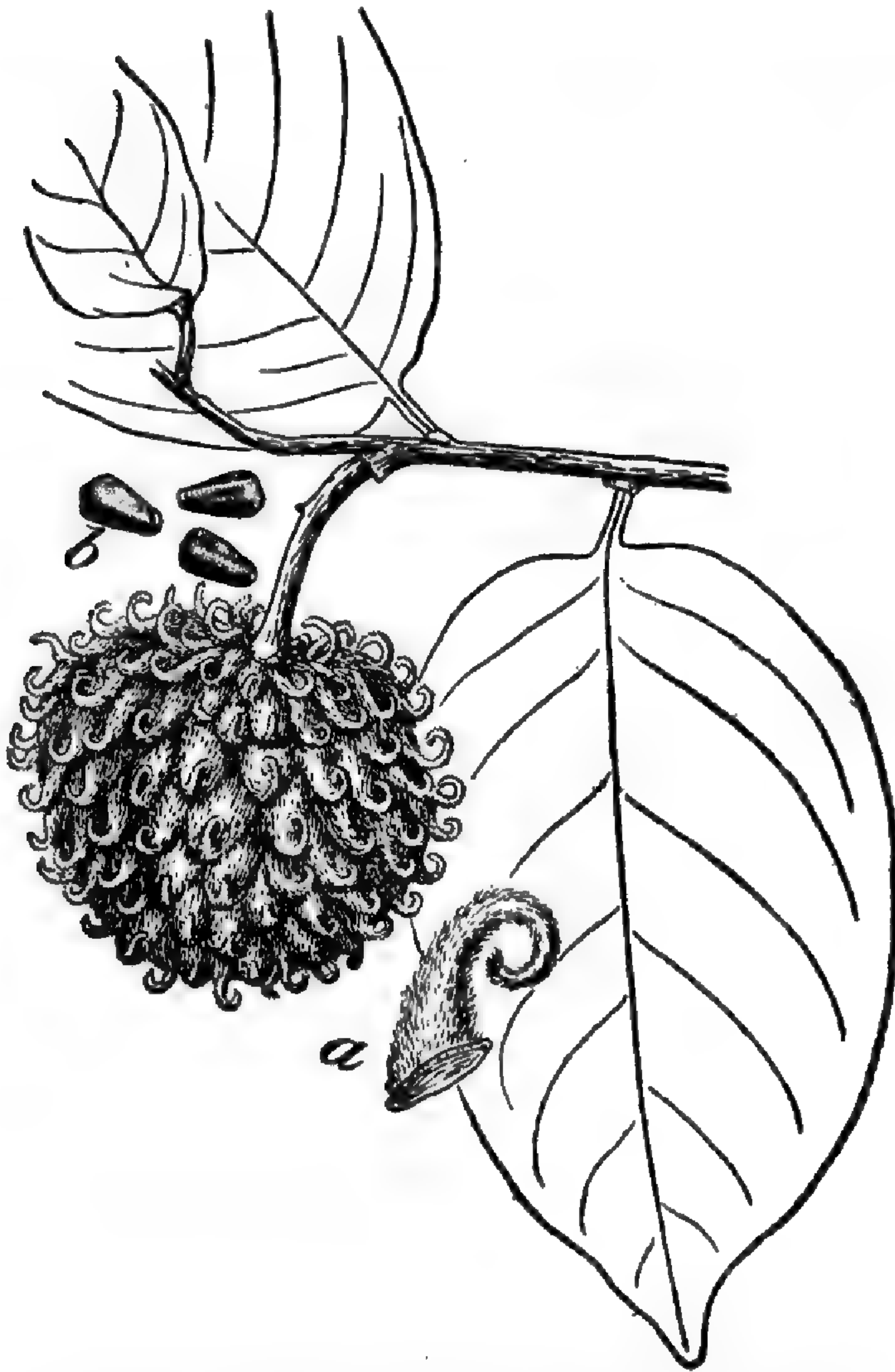


FIG. 44.—Leafy twig and fruit of *Annona cercocarpa*, the fruit somewhat enlarged. *a*, Tail-like tip of carpel; *b*, seeds. *a*, Scale 5; *b*, slightly enlarged.

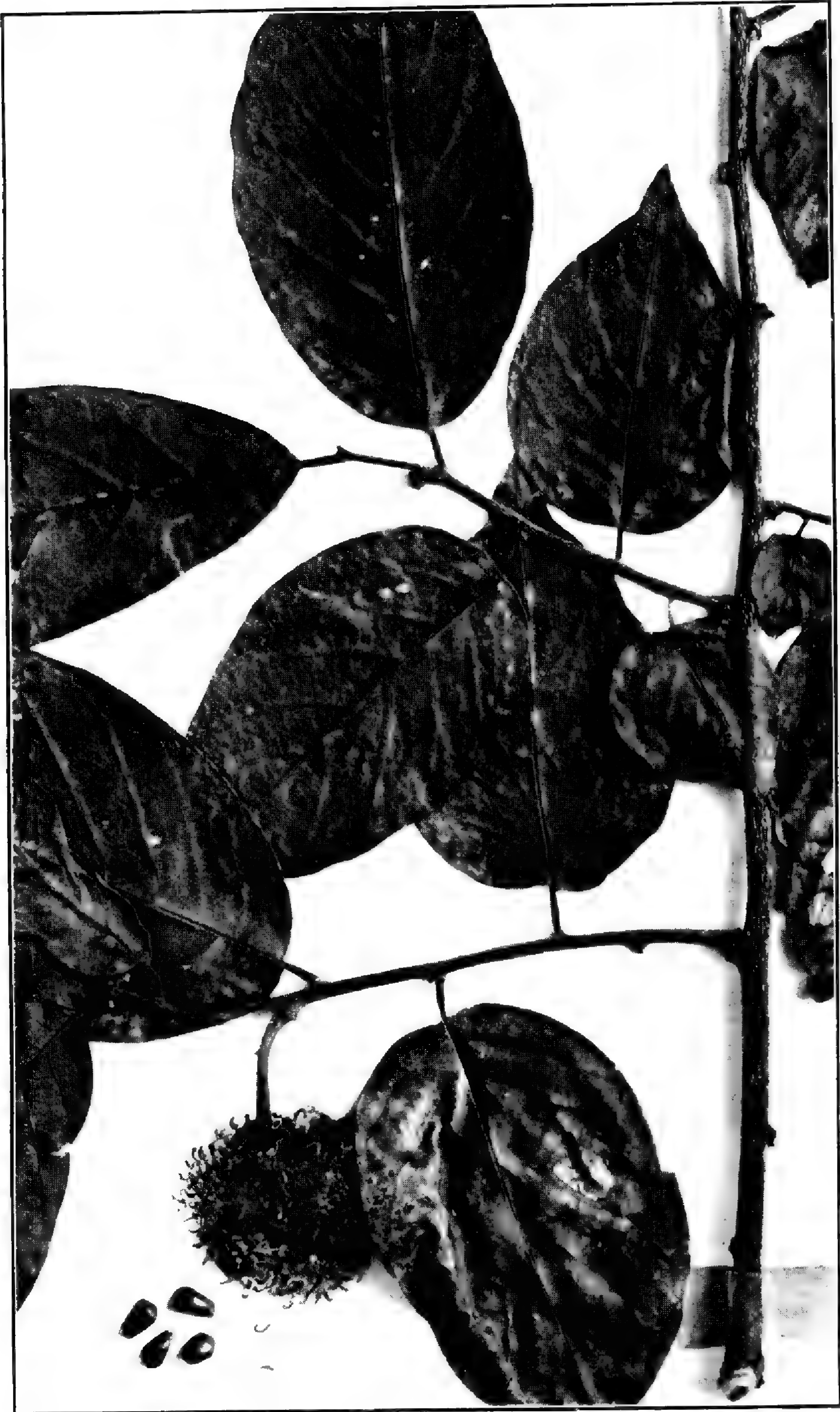
7 mm. long by 4 mm. broad, somewhat compressed, with a smooth hard brown testa and a conspicuous caruncle at the base. (PLATE 94. FIGURE 44.)

Type in the Kew Herbarium (from Herbarium Hookerianum, 1867), collected at San Pablo on the Magdalena River, Province of Mompox, New Grenada [Colombia], 1851-1857, by J. Triana; duplicate in De Candolle Herbarium.

DISTRIBUTION: Known only from type locality.

EXPLANATION OF PLATE 94.—Photograph of type specimen.





ANNONA CERCOCARPA SAFFORD.



*ANNONA ECHINATA* DUNAL.



ANNONA ECHINATA DUNAL.

8. *Annona echinata* Dunal.

## PRICKLY ANNONA OF FRENCH GUIANA.

*Annona echinata* Dunal, Monogr. Anon. 68. pl. 4. 1817.

Branches divaricate, clothed when young with ferruginous hairs, at length glabrate, blackish, rugose, and bearing many lenticels; petioles 5 mm. long, deeply grooved above, at first minutely appressed-pubescent, at length glabrescent; blades membranaceous or subcoriaceous, thicker than those of *A. sericea*, pellucid-punctate, those on the upper parts of the flowering branches ovate-oblong or ovate-lanceolate, somewhat acute or obtusely acuminate at the apex, rounded or cuneate at the base, glabrous above, the midrib impressed and bordered on each side with numerous very short raised veins at right angles to it, the secondary nerves (8 to 10 on each side) sharply defined, connected by reticulating veins; beneath clothed with fine short dull grayish ferruginous pubescence or tomentulum and reticulated between the prominent midrib and secondary nerves; lowermost leaves on flowering branches smaller and relatively broader, sometimes obtuse or retuse at the apex as in many other species of the genus; peduncle solitary, 1-flowered, 11 mm. long (in the type specimen), extra-axillary, issuing from the base of a new branchlet and apparently terminal on account of the abortion of the portion of the branchlet beyond it (as in many other Annonaceae), ferruginous-tomentose or hirtellous and bearing a small tomentose bracteole below the middle; flowers similar in size and shape to those of *A. sericea*, spheroid in bud, normally 3-petaled, but sometimes in the rainy season (according to Sagot) with 3 additional inner petals alternating with the outer and closing the seams between them; calyx 3-lobed, 5 mm. in diameter, the divisions broadly triangular and obtuse, clothed on the outside like the peduncle with ferruginous hairs; petals broadly ovate or suborbicular, obtuse, thick, coriaceous, concave, 11 mm. long and 10 mm. broad (in type flower), clothed on the outside with minute ferruginous pubescence; stamens numerous 2 to 2.5 mm. long, with a short broad filament, linear pollen sacs, and a connective expanded into a swollen head, this minutely papillose or muriculate but devoid of hairs; carpels numerous, united in a conoid gynœcium, the ovaries clothed with appressed ferruginous hairs; fruit ovoid, small, 24 mm. long by 17 mm. broad (fruit of type possibly immature), bearing numerous recurved protuberances corresponding to the individual carpels, the surface clothed with fine appressed ferruginous pubescence; seeds oblong, 6 mm. long and 3 mm. broad; peduncle at length thickened and woody, sometimes apparently terminal from the abortion of the portion of the branch beyond it. (PLATES 95, 96.)

Type in the Prodromus Herbarium of De Candolle at Geneva (ex Herb. Lhéritier), collected about 1795 at "Cayenne" (French Guiana) by J. B. Patris.

DISTRIBUTION: Guiana and probably Brazil.

SPECIMENS EXAMINED: FRENCH GUIANA—"Cayenne," Patris, type collection, leaf, stamens, and tip of carpel; Mana, Sagot 6, leaf and stamens, from Kew Herbarium.

This species is undoubtedly closely related to *A. sericea* Dunal, but differs conspicuously from that species in the character of the indument of the leaves and the absence of hairs on the swollen terminal head of the connective of the stamens. Its ovoid, echinate fruits resemble miniature soursops (*A. muricata* L.). The recurved carpel tips are somewhat like those of *A. cercocarpa* described above, but differ from them in their less length and in their much finer, appressed pubescence, the carpels of *A. cercocarpa* being prolonged into tail-like appendages covered with relatively coarse, strigose hairs (fig. 44). The present species is also sharply distinct from the preceding in the shape and texture of its leaves, as indicated by the accompanying illustrations.

EXPLANATION OF PLATES 95, 96.—Pl. 95, photograph of type specimen in De Candolle Prodromus Herbarium. Natural size. Pl. 96, drawing from type material, that of fruit reproduced from original plate; a, petal; b, stamen; c, cross section of fruit; d, tip of mature carpel; e, immature carpel bearing style. Figs. a and c, natural size; b and e, scale 20; d, scale 8.

9. *Annona acuminata* Safford, sp. nov.

SMALLER WILD ANNONA OF PANAMA.

*Annona echinata* Hemsl. Biol. Centr. Amer. Bot. 1: 19. 1879, not Dunal, 1817.

A small tree 5 to 7 meters high with slender branches roughened by thickly crowded prominent reddish brown lenticels; very young branchlets clothed with minute appressed ferruginous hairs scarcely visible even with the aid of a lens, very soon glabrate; leaves small, thin, membranaceous, glabrate, pellucid-punctulate (those of flowering branches only observed), 6.5 to 8 cm. long and 1.8 to 2.2 cm. broad, lanceolate or oblong-elliptical, gradually acuminate at the apex, the tip usually rounded, acute at the base, the blade decurrent on the short thick channeled petiole (1.5 to 3 mm. long), often conduplicate or revolute; midrib impressed above, prominent beneath, ferruginous or cinnamon brown, and bearing minute scattered appressed hairs when young, but at length glabrous or nearly so; lateral nerves 10 to 12 on each side, not impressed above, distinct beneath and colored like the midrib, glabrous, dichotomously branching and anastomosing before reaching the margin; peduncles solitary, 1-flowered, extra-axillary, sometimes nearly opposite a leaf, at first minutely appressed-pilose, at length glabrate, 12 to 16 mm. long, remarkable in comparison with closely related species for two linear-lanceolate acuminate bracteoles 2 to 4 mm. long, one situated at the base and one at or a little above the middle; flower subglobose in bud, about 15 mm. in diameter; calyx gamosepalous, subtriangular, with three slender acuminate points projecting from the broad base, appressed-pilose on the outside and with a fringe of stiff rufous hairs within at the base of the receptacle; receptacle convex, clothed with pale yellow hairs between the bases of the stamens; stamens numerous, 2.5 mm. long, the connective expanded into a broad flat hood above the pollen sacs, its surface muriculate with short stiff points but without hairs; pollen bright orange yellow, in two vertical columns of tetrads; carpels numerous, the minutely hirtellous ovaries united into a disk-like mass and bearing club-shaped, easily detached styles 1.5 mm. long; fruit not observed. (PLATE 97.)

Type in the Kew Herbarium (from Herbarium Hookerianum, 1867), collected at the Bojfo Station, Panama Railroad, Isthmus of Panama, June, 1861, by Sutton Hayes (no. 142). "A small tree, 15 to 20 feet high."

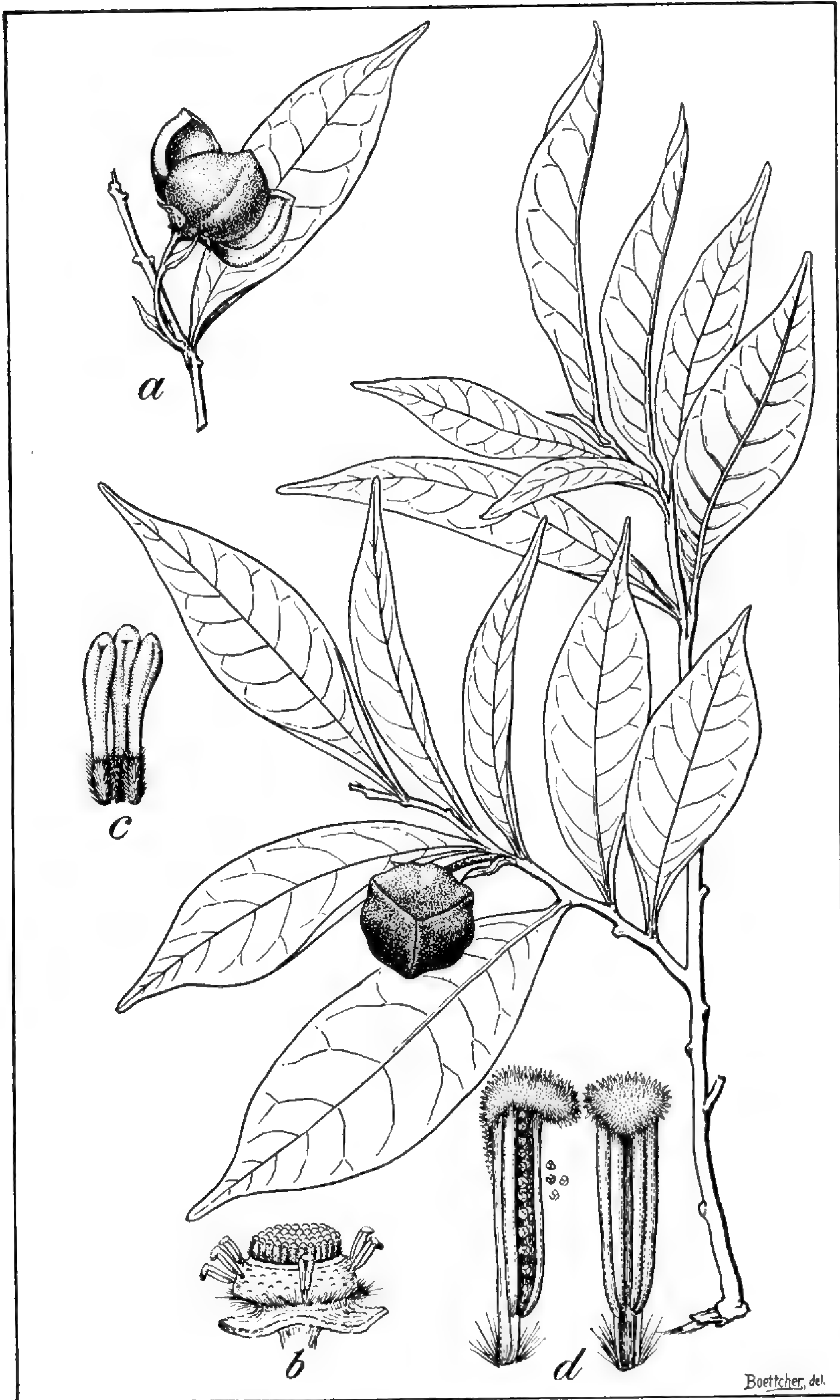
EXPLANATION OF PLATE 97.—Main figure, drawing of type by A. B. Boettcher. Natural size. Fig. a, flower, showing long peduncle with acuminate bracteoles; b, receptacle, bearing a few stamens and the mass of ovaries denuded of their styles; c, carpels, composed of short hairy ovaries surmounted by club-shaped styles; d, stamens, showing linear pollen sacs, one of which has opened, displaying the pollen grains in tetrads, and the expanded, muriculate connective heads. a, Natural size; b, scale about 2; c, scale about 10; d, scale 16.

10. *Annona jamaicensis* Sprague.

WILD ANNONA OF JAMAICA.

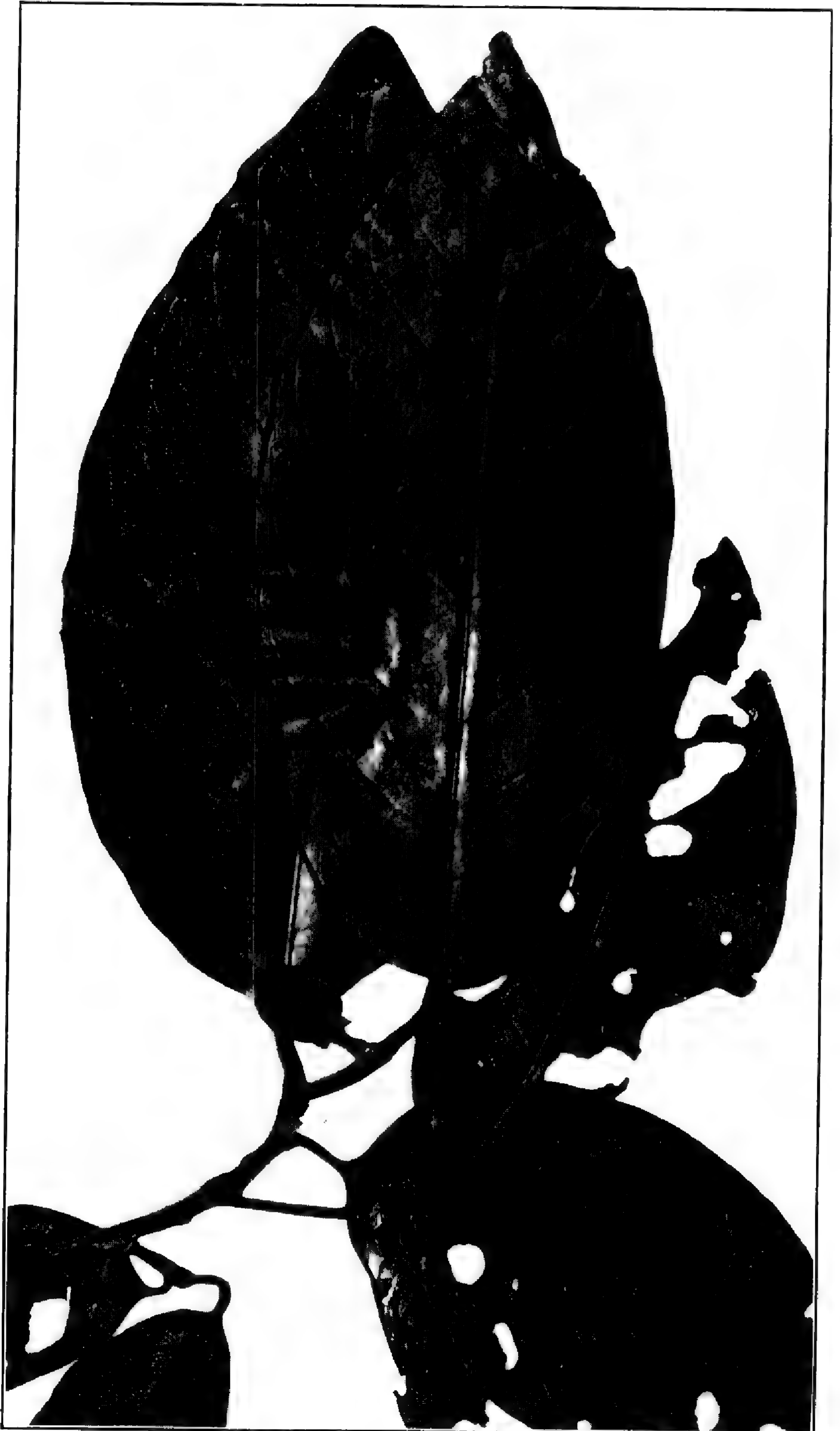
*Annona jamaicensis* Sprague, Bull. Herb. Boiss. II. 5: 701. 1905.*Annona sericea* Griseb. Fl. Brit. W. Ind. 5. 1864, not Dunal, 1817.

A slender tree 3 to 9 meters high; young branchlets ferruginous-pubescent, soon glabrescent; branches grayish brown or reddish brown, bearing many inconspicuous brownish lenticels; old leaf scars prominent, lined with ferruginous tomentum; petioles 7 to 18 mm. long, channeled above, finely appressed-pubescent at first, at length glabrescent; blades ovate or obovate to obovate-oblong, shortly and obtusely acuminate at the apex and rounded or obtusely cuneate at the base, 10 to 20 cm. long, 4.5 to 8.5 cm. broad (those near the base of young branches often considerably smaller), glabrous above, finely appressed-pubescent beneath, at length sparsely so except along the ferruginous midrib and lateral nerves; midrib impressed above, prominent beneath; lateral nerves slightly curved, 11 to 18 on each side the midrib,

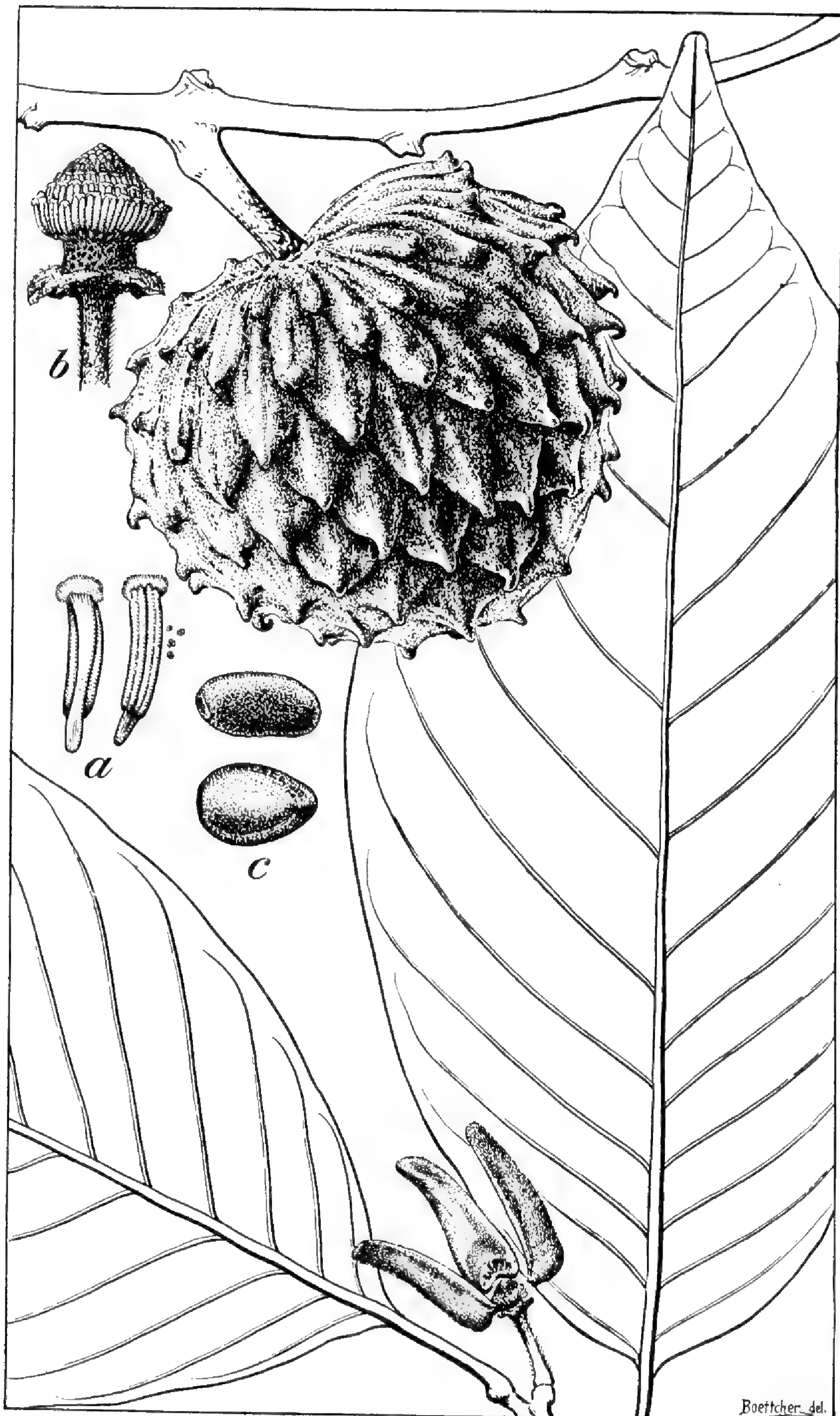


Boettcher, del.

ANNONA ACUMINATA SAFFORD.



*ANNONA JAMAICENSIS* SPRAGUE.



ANNONA JAMAICENSIS SPRAGUE.



not impressed above, prominent and sharply defined beneath; peduncle 8 to 12 mm. long, ferruginous-tomentose, with a small tomentose bracteole near the middle; flowers ovoid to oblong in bud, 3-petaled; calyx 3-parted, the lobes broadly ovate, obtuse or obtusely acuminate, 3 mm. long and 3 mm. broad at the base, clothed on the outside with ferruginous tomentum like that of the peduncle; petals ovate to oblong, obtuse, 11 to 20 mm. long and 6 to 8 mm. broad, thick and leathery, clothed on the outside with fine ferruginous velvety tomentum, lined within except near the reddish brown base with fine grayish tomentum; stamens numerous, 1.6 to 2 mm. long, the connective somewhat broader than the lobes of the whitish pollen sacs, minutely papillose (under the microscope); carpels numerous, closely crowded in a conoid gynoecium, the styles together with the ovaries about 1.25 mm. long, the latter clothed with ferruginous sericeous hairs; stigmas compressed-ovoid, 0.5 mm. long, cemented together at the time of pollination by a reddish brown viscous fluid; fruit globose or somewhat oblate, more or less umbilicate at the base, 4 to 6 cm. in diameter, clothed with grayish brown pubescence, with the carpels produced into tubercles usually hooked or incurved at the tips; seeds 12 to 16 mm. long, 6 to 10 mm. broad, obovate, somewhat compressed, reddish brown or tan-colored, with a smooth thin testa more or less wrinkled by the inclosed ruminant albumen. (PLATES 98, 99.)

Type in the Kew Herbarium, collected near Bath, eastern Jamaica, by William Purdie, 1844. Cotypes, without definite locality, collected by March (nos. 4, 7, 1571) and Alexander Prior (also cited by Grisebach under "*A. sericea*").

DISTRIBUTION: Known only from the island of Jamaica.

SPECIMENS EXAMINED: JAMAICA—Without definite locality, 1849-50, *Alexander Prior*, in Gray Herbarium (with ovoid flower bud); roadside near Hampton, Santa Cruz Mountains, alt. 700 meters, September 4, 5, 1907, *N. L. Britton* 1196, in herb. New York Botanical Garden (with almost mature fruit); Sheldon Road, St. Andrew, alt. 750 meters, September 10, 1897, *William Harris*, 6861, in U. S. National Herbarium (with fully developed flower and fruit).

*Annona jamaicensis* has been known hitherto from specimens in which the flowers were evidently immature. The petals were described by Sprague as ovate, obtuse, 11 to 12 mm. long and 8 mm. broad. The accompanying drawing (pl. 99) shows them to be longer and relatively narrower when fully developed, approaching the shape of the petals of *A. cherimola* and its allies, but distinguished from them in not being triquetrous or keeled on the inner face. Moreover, the connective of the stamens is not so much swollen as in the section to which those species belong; and the incurved tips of the mature carpels serve also to prevent the confusion of this species with *A. cherimola* Mill., which is sometimes cultivated in the mountains of Jamaica. The flower buds somewhat resemble those of *A. sericea* when immature, but the indument of the petals in the present species is more velvety and of a more reddish color, while the stamens never bear hairs on the connective terminal. In addition to these points of difference the leaves are relatively broader and are never clothed with the dark red, soft, velvety lining of the leaves of *A. sericea* and its close allies.

EXPLANATION OF PLATES 98, 99.—Pl. 98, photograph of Alexander Prior's specimen in the Gray Herbarium (cotype collection), with immature, ovoid, unopened flower bud. Pl. 99, main figure, drawing of specimen in the U. S. National Herbarium (from herb. Public Garden, Jamaica), by A. B. Boettcher, showing leaves, flower, and fruit. Natural size. Fig. a, stamens; b, flower with petals and some of the stamens removed; c, seeds. Fig. a, scale 12; b, scale nearly 3; c, natural size.

# NOMENCLATURE OF THE SAPOTE AND THE SAPODILLA.

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By O. F. COOK.

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## INTRODUCTION.

The botanical investigation of tropical trees, notwithstanding their economic importance, has been greatly neglected. This is shown by the lack of any general agreement among botanists regarding the names of some of the most familiar species. In the case of the sapote the nomenclatorial complications are so numerous and intricate as to become almost interesting, and they may be useful as examples of some of the taxonomic problems that still remain to be solved.

Though the method of types is now widely recognized, especially in the United States, as necessary to secure stability in the application of names, many of the consequences of its adoption have yet to be worked out. Indeed, it is evident from the codes of nomenclature proposed in recent years that our European contemporaries have continued to overlook the necessity of dealing with genera on the basis of types.<sup>1</sup>

The Vienna code of 1905 has a curious provision regarding the subdivision of a genus, namely, that when "one of the parts detached contains a great many more species than the others, the name is reserved for that part of it." The framing of such a rule makes it evident that the idea of a generic name being permanently associated with a type species had not yet dawned. The regulations adopted by the Brussels congress of 1910, in seeking to establish lists of *nomina conservanda* and to set many different dates for beginning the nomenclature of the various groups of plants, would also introduce endless complications into the work of placing taxonomy on a basis of types. Restricting dates of publication does not simplify the problems of generic nomenclature unless there is also to be a consistent method of fixing the application of the accepted names.

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<sup>1</sup> The Method of Types in Botanical Nomenclature. *Science* n. ser. **12**: 475. 1900. Types and Synonyms. *Science* n. ser. **15**: 382. 1902. Types of Pre-Linnæan Genera. *Science* n. ser. **17**: 350. 1903. The Nomenclature of the Royal Palms. *Bull. Torrey Club* **31**: 349. 1904. An American Code of Botanical Nomenclature. *Bull. Torrey Club* **34**: 167. 1907.

Generic names must have definite relations to plants, as well as specific names. Uniformity in the application of names is one of the prime essentials of stability, and the use of types is the only method thus far suggested for supplying this deficiency in our taxonomic laws. Nomenclatorial legislation that fails to consider types can have little hope of permanence.

### CONFUSION OF VERNACULAR NAMES.

In some cases where the scientific names of tropical economic plants have fallen into confusion, resort can be had to the vernacular names, which often have very definite applications, but with the sapotes there is no hope in this quarter. The word "sapodilla" has only a limited use, even in the West Indies, and is scarcely known on the Continent. There it is the chicle tree that is usually called "sapote," while the tree with larger fruits is distinguished as "sapote grande" or "mammee sapota." But "mammee" is also the name of another tropical fruit belonging to a different family, though often confused with the sapotes. Thus there is special need of scientific names with definite applications. The only reason for adopting "sapote" as the English name of the larger fruit is that the name "sapodilla," for the smaller fruit, has already found lodgment in our English dictionaries.

In addition to serving as the common name for two important fruit trees, the word "sapote" is also used, with a qualifier, for many other fruits, some of them belonging to distinct families, just as we say "thorn apple," "May apple," "rose apple," or "custard apple." Sapote is supposed to have been derived from "tzapotl," the Aztec generic name for all of the soft, sweet fruits. The Spanish name "sapote chico" is also thought to mean "sapote chicle," or "sapote with the chicle gum," instead of signifying "small sapote."

### ESSENTIAL DIFFERENCES.

In spite of bearing the same name, the "sapote grande" and the "sapote chico" are essentially different and would never be confused by natives or residents in the tropics who have first-hand familiarity with both trees. One of the most obvious differences is in the fruit itself, which in the sapodilla has a grayish or brownish, granular flesh like a pear, while in the sapote the fruit has a yellow flesh and a firmer and more uniform texture, not crisp like the flesh of an apple, but more like that of a cooked carrot or squash. The trees are strikingly different, the sapote with an open crown of large, lanceolate, coarsely-veined, deciduous leaves and the sapodilla with a dense covering of smooth, delicately-veined, laurel-like, evergreen foliage. The triangular-fusiform seeds of the sapote are very large and thick and have

SAPOTA.

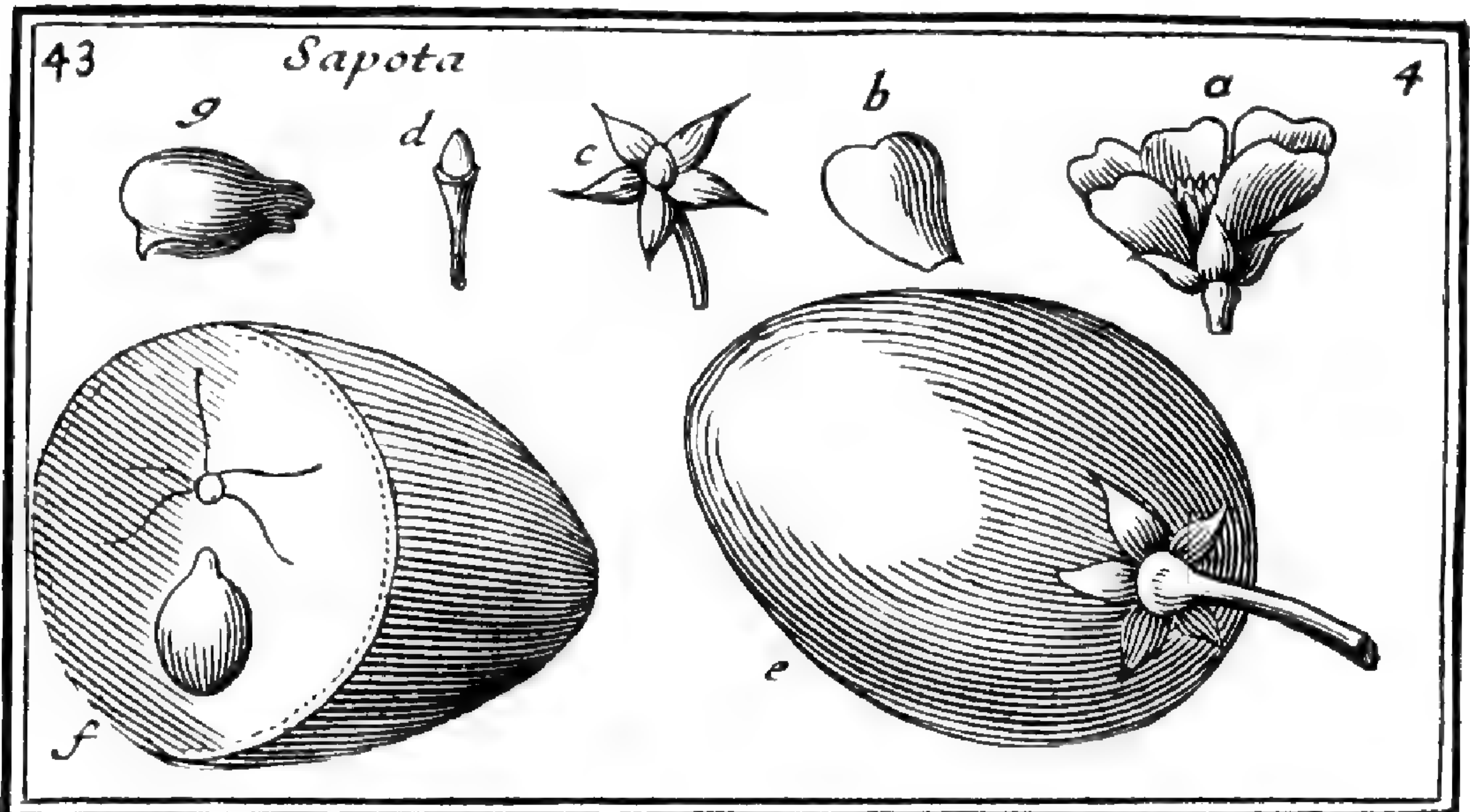
**L**icet iisdem prorsus characteribus insigniatur hujusce plan- Tab. 4  
 tæ genus, ac plantæ superioris; quia tamen tota facie, com-  
 muni omnium Americanorum consensu & usu, florum, fruc-  
 tuumque natura ab ipsa omnino differat, ut facile ipsam in  
 America consideranti patebit, ideo hujus genus peculiare insti-  
 tuendum censui. Est igitur Sapota plantæ genus flore rosaceo **A**,  
 plurimis scilicet petalis **B** in orbem positis, constante; e cujus  
 calyce **C** surgit pistillum **D**, quod deinde abit in fructum **E** fe-  
 re turbinatum, aut ovatum, mollem, carnosum, in quo nidu-  
 latur **F** unum, aut duo semina subrotunda **G**, compressa, poli-  
 ta & rostrata.

Sapotæ species sunt.

Sapota fructu turbinato, minori.

Sapota fructu ovato, majori.

*Sapota nomen est Americanum vulgare.*



PLUMIER'S DESCRIPTION AND FIGURES OF SAPOTA.

the whole inner face covered by an enormous hilum. The seeds of the sapodilla are many times smaller, strongly compressed, and with a relatively short, narrow hilum. These differences are really more significant than those that are usually enumerated as botanical characters, such as the greater number of carpels in the sapodilla and the more numerous sepals in the sapote. Such characters are subject to much variation in this group of plants.

The sapodilla tree not only produces a delicious fruit (now being grown in Florida) and a valuable wood, but is the source of chicle gum, which has become an important article of commerce. The sapote is of no commercial importance, though the fruit is used extensively for food by the native populations of Central American regions and the West Indies. The sapote ascends into the plateau regions of Central America, while the sapodilla is largely confined to regions of low elevation.

#### PLUMIER'S ACCOUNT OF THE SAPODILLA.

The taxonomic complications in this group began with Plumier, the first botanist to attempt a formal generic description of either of the fruits in question. Plumier used the word "sapote" in its latinized form "Sapota" as a generic name for the sapodilla and not for what we now call the "sapote." As that author traveled widely in the West Indies it may be argued that he must have known both fruits, but whether so or not there at least is nothing to show that he had anything but the sapodilla in mind in preparing the description and figures on which his genus was based. (Pl. 100.)

The seed and fruit represented in Plumier's plate are unmistakably those of the sapodilla. The calyx is shown with only 5 or 6 divisions, not 10 or 12 as in the sapote. The seed is of the proper size and shape, with a curved spine near the middle and with a narrow bidentate base. The fruit is a symmetrical rounded oval, as in many sapodillas, instead of being unsymmetrical and somewhat pointed at the end as in the true sapotes. Though not closely approaching the form of the sapote, the different kinds of sapodilla show a wide variation. Some are even narrower and more elliptical than in Plumier's figure, while others are broadly rounded or flattened. (Pl. 101.)

The most misleading feature in Plumier's plate is the indication of 5 dissepiments in the fruit, for there are 10 or 12 carpels in the sapodilla; but, on the other hand, only a few of the divisions remain conspicuous, that is, those that contain partially developed seeds. Moreover, no such obvious radiating figure appears in the ripe fruit of the sapote, where the enormous size of the seeds results in much more extensive distortion.

EXPLANATION OF PLATE 100.—Reproduction of plate 4 of Plumier's *Nova Plantarum Americanarum Genera* with text (p. 43). Figures original size.

EXPLANATION OF PLATE 101.—Three forms of sapodilla fruit found together in the market of Guatemala City, April, 1902. Natural size.

### ACHRAS SUBSTITUTED FOR SAPOTA.

The Linnæan genus *Achras* was based directly on Plumier's plate of *Sapota*, which is the sole reference in all the editions of the *Genera Plantarum*. In the first edition of the *Species Plantarum*, *Achras* is represented by a single species, *Achras zapota*, and the first reference under this is to Plumier's mention of the ovate-fruited form of *Sapota*, the form shown in the plate. Thus both the genus *Achras* and its type species, *Achras zapota*, are definitely established on Plumier's description and figures of the sapodilla. This feature of the case seems to have escaped the attention of Radlkofer and others who have dealt with the taxonomy of the Sapotaceae.

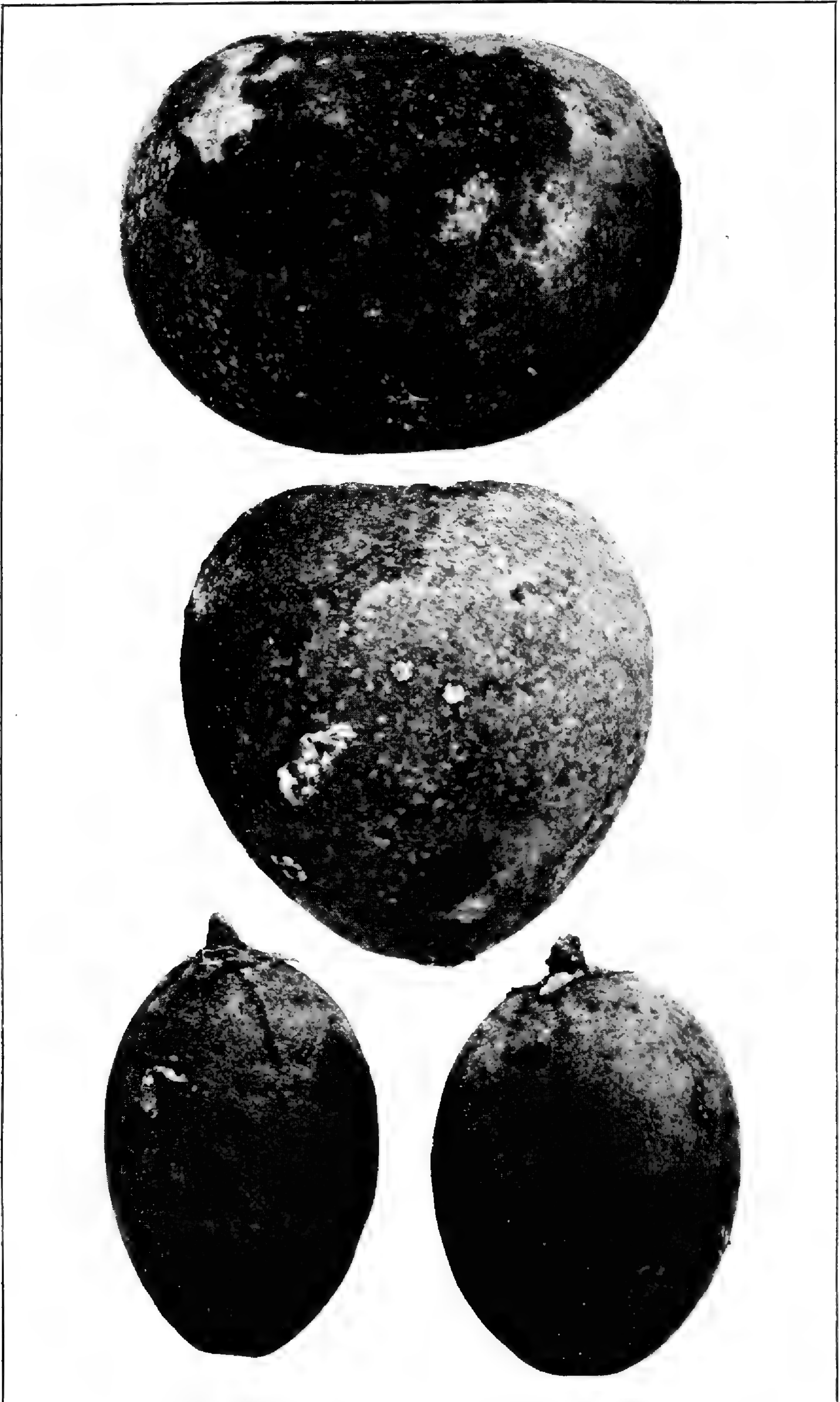
The same specific name, though with a different initial letter, was applied to the sapote in 1760 by Jacquin<sup>1</sup> under the genus *Sideroxylum*. The accompanying descriptive phrase, "*Sideroxylum inerme; calycibus decaphyllis*," undoubtedly alludes to the compound calyx or involucre, which is still used by botanists as a distinctive generic character of the sapote. Yet it can not be claimed that Jacquin had at that time any intention of separating the sapote from the sapodilla, for the latter tree is not listed in the *Enumeratio*. The only citation given by Jacquin under his *Sideroxylum sapota* is of Sloane's plate of "The *Mammee Sapota* tree" of Jamaica. Jacquin may have borrowed his specific name from the first edition of the *Species Plantarum*, where Sloane was cited, as well as Plumier.

### CONFUSION OF SPECIES BY LINNÆUS.

When the second edition of the *Species Plantarum* was prepared, Linnæus had become aware of the existence of more than one kind of sapote in the West Indies and undertook to distinguish between them in the works of his predecessors. The sapote received a new specific name, *Achras mammosa*, for Jacquin's *Sideroxylum sapota*, if not already a synonym of the Linnæan *Achras zapota*, would have become a homonym if transferred to the genus *Achras*. References to Jacquin's species and to Sloane's plate were the real basis of the new Linnæan species, but a reference to Plumier was also included, and this has been the occasion of much confusion.

Plumier had mentioned two forms of fruit, one turbinate and the other ovate, under his genus *Sapota*, and Linnæus, assuming that these were the two fruits that were to be assigned to different species, took Plumier's ovate fruit to be the same as Sloane's "mammee sapota." As a result of this mistake the same reference to Plumier's ovate sapodilla that had been given under *Achras zapota* in the first edition of the *Species Plantarum* was transferred in the second edition to the new species, *Achras mammosa*, while Plumier's reference to the

<sup>1</sup> Enum. Pl. Carib. 15.



THREE FORMS OF SAPODILLA FRUITS.

turbinate form of the sapodilla was cited under what was now called *Achras zapota*, the initial letter of the specific name being changed from the *zapota* of the first edition.

From the standpoint of that time this was a natural attempt on the part of Linnæus to improve the form and limit the application of his name *Achras zapota* of the first edition, while establishing a new species for the sapote, but we no longer admit the right to alter a name or change its original application.

#### ADJUSTMENT OF LINNÆAN NAMES.

As Plumier's drawing shows an ovate sapodilla fruit, this must be considered as the type of the genus *Achras*, and of the species *Achras zapota*, as established in the first edition of the species Plantarum. If Linnæus had been correct in placing Plumier's ovate (sapodilla) fruit with *Achras mammosa*, he would have been incorrect in applying a new name to this species, for it was the ovate sapodilla that had already received the name *Achras zapota* in his first edition. Thus, if the treatment of the second edition were taken at its face value, *Achras zapota* would be the name of the sapote, *Achras mammosa* would be a synonym, the sapodilla would be left without a Linnæan name, and the question of finding a post-Linnæan substitute would arise. But if, as seems certain, Linnæus was mistaken in supposing that Plumier's ovate fruit was a sapote, there is no occasion for following this line of reasoning any further. We have only to reject the reference to Plumier under *Achras mammosa* as a piece of erroneous synonymy. The exclusion of the reference is also justified by the fact that Linnæus gives a specific description of *Achras mammosa* which mentions the cuneiform-lanceolate leaves of the true sapote, in contrast with ovate-oblong leaves ascribed to the sapodilla. With the misplaced reference to Plumier excluded, the name *mammosa* can be supported by the references to Jacquin and Sloane, and remains available as a specific designation for the sapote.

#### TWO VARIETIES OF SAPODILLA NAMED BY JACQUIN.

In a later work<sup>1</sup> Jacquin recognized the fact that the two forms mentioned by Plumier were varieties of the same species and avoided the mistake made by Linnæus in associating Plumier's ovate fruit with the sapote. For the ovate-fruited form Jacquin adopted the correct Linnæan name *Achras zapota* and gave the subspecific name *zapotilla* to include the form with the broader, turbinate fruit. The sapote, though treated as a distinct species, was not designated by a binomial name, but was called *Achras zapota major*.

<sup>1</sup> Stirp. Amer. 56. 1763.



The name *zapotilla* has been given specific rank by Coville and may come into use when a classification of the many different forms of the sapodilla is attempted. Though a reference to Plumier's small, turbinate fruit is included by Jacquin under the subspecies *zapotilla*, it is preceded by references to varieties described from Jamaica by Brown and Sloane, in the latter case to Sloane's plate no. 230. This shows a variety with rather small, round fruits, which may be taken to represent the type of the species or subspecies *zapotilla*. Sloane's account, published in 1725, indicates that the tree had been introduced into Jamaica rather recently from the region of Campeche.

#### THE NAME SAPOTA NOT TO BE REVIVED.

These complications regarding the sapote do not affect the sapodilla, which remains in undisputed possession of the generic name *Achras*, with *Achras zapota* as the specific designation and *Sapota* of Plumier as a generic synonym. Later use of Plumier's name *Sapota*, as in Miller's *Gardener's Dictionary*, does not suffice to reestablish it as a valid generic name for either the sapote or the sapodilla. As *Achras* represented a direct substitution of a name without change of generic content, the only way to restore *Sapota* would be to return directly to Plumier's name. Some writers would take this course and deny the right of Linnæus to transfer the Greek name of the wild pear tree to a tropical genus.

Though such a policy would not be approved at present, a future revival of interest in Greek civilization might easily lead to a restoration of the ancient plant names to their proper uses. In any event we should be taking entirely unwarranted liberties in transferring Plumier's name from the sapodilla to the sapote. To do this it would have to be argued that Miller's use of the name *Sapota* served to reestablish it under the binomial system, and then the principle of elimination would need to be invoked as a reason for applying the name to a different genus, because Miller included the sapote with the sapodilla. This method of selecting generic types by elimination, though sometimes defended by zoologists, is very poorly adapted to botanical purposes.

Pre-Linnæan botany reached a much higher development than pre-Linnæan zoology and can not be wholly disregarded in the later development of the science. Nevertheless, some of the older names were discarded in the reform of botanical nomenclature by Linnæus, and these names are not available for further use. Unless the names that Linnæus rejected are to be allowed to rest in oblivion there is no good reason for following the proposals of Linnæus. Certainly

<sup>1</sup> Contr. U. S. Nat. Herb. 9: 369. 1905.

nothing is gained by admitting *Achras* and other Linnæan substitutes for pre-Linnæan names like *Sapota* and then allowing these same pre-Linnæan names to be brought back into the system because they happened to be misapplied by some of the early post-Linnæan writers.

If the Linnæan genus *Achras* had not been based on the same type, the placing of Plumier's name *Sapota* as a synonym would not stand in the way of restoration by a later author who used it in the original application, but it is certainly not in the interest of nomenclatorial stability to revive discarded pre-Linnæan names that have been replaced by direct substitutes, as in the case of *Sapota* and *Achras*. It is a rule of botanical nomenclature that the substitution of a new name does not alter the type of a genus. Still less should the type be changed by the casual use of a name for species not congeneric with the original type. Pre-Linnæan genera used by post-Linnæan authors should not be treated as having been adopted under the binomial system unless the pre-Linnæan type was included. Application of this rule to the present case requires us to seek a post-Linnæan generic name for the sapote.

#### LUCUMA AND VITELLARIA NOT APPLICABLE TO THE SAPOTE.

The name usually given to the sapote in post-Linnæan literature is *Lucuma mammosa*, but this generic assignment seems not to be correct. The genus *Lucuma* was established by Molina in 1782 on a Chilian tree not closely related to the sapote, and the tendency of recent writers has been in the direction of separating the sapote from *Lucuma*. Radlkofer, Pierre, Engler, and Urban are in agreement in this respect, though differing in their applications of generic names. Radlkofer proposed to revive the name of Gaertner's problematical genus *Vitellaria* and apply it to the sapote, but other writers have not followed this suggestion. As long as the type of *Vitellaria* remains unidentified the application of the name can not be determined. Many other genera have been segregated from *Lucuma* or are treated as synonyms, but none of them appears to have been based on the sapote or its closer relatives. Thus the sapote appears to have had no generic name of its own until 1890, when Pierre established a new genus, *Calospermum*, with *Achras mammosa* L. as the type species.

#### CALOSPERMUM AND CALOCARPUM AS HOMONYMS.

The name *Calospermum* was changed by Pierre to *Calocarpum* in 1897. The reason for this substitution was not stated, but may be found in the fact that Pfeiffer's nomenclator credits Rafinesque with having given the name *Calospermum* to a genus of algæ in 1814. Yet the name *Calocarpum* is open to even more serious objection,

for there was a still older name *Callicarpa* that had been applied by Linnæus himself to another genus of flowering plants from the same regions as the sapote. It is true that the forms of the name used by Linnæus and Pierre, "Callicarpa" and "Calocarpum," are capable of bibliographic discrimination, but essentially they are merely variants of the same word. Such names do not differ as words, but merely as combinations of letters. Instead of aiding in the recognition of plants these ambiguous designations serve rather to confuse them. Some writers have proposed to admit variations of spelling, or even typographical errors, as constituting distinct names. The danger of this tendency finds a striking illustration in the present instance. There would be no need to stop with a few variations like *Callicarpa* and *Calocarpum*, for *Kallikarpon*, *Kalokarpus*, and many others are possible. Indeed, this name is capable of no less than 64 variations of spelling, to say nothing of the possibilities of developing some genuine typographical errors. Each family of plants might have its *Calikarpum* or *Kalocarpon*, or a whole family might be provided with generic names based on the same flexible combination.

#### A NEW GENERIC NAME FOR THE SAPOTE.

Hence, it appears that no satisfactory generic designation is available in literature for the sapote, notwithstanding the many names that have been applied to it during the past two centuries. As no combinations of the word *Achras* are known to have been used hitherto, the name "Achradelphia," recently proposed,<sup>1</sup> may avoid the danger of homonymy. Allusion to the sapote as the "sister of *Achras*" is warranted by the fact of similarity which has been the occasion of so much confusion.

The type species of *Achradelphia* is *Achradelphia mammosa*, based on *Achras mammosa* L. Some might hold that the specific name previously used by Jacquin in the binomial *Sideroxylum sapota* should be revived under the new genus, instead of adopting the Linnæan name *mammosa*. This is one of the cases where the rule "Once a homonym, always a synonym" would find a useful application. Though it may not seem likely in the present case that the sapote will ever be referred back to *Achras* and thus cause a direct conflict of homonyms, if the alternative combination were adopted, there are other cases of more closely related genera where confusion would be created if the names of species were to be altered with each change of generic assignment. This course becomes necessary unless names that have been subject to rejection as homonyms are permanently discarded. Moreover, it is undesirable to have the same specific

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<sup>1</sup> An advance summary of the results of this study has been published in the *Journal of the Washington Academy of Sciences*, 3: 158, March 19, 1913.

name applied to two important economic species in two closely related genera.

In this particular case there is another reason for refusing to base a new combination on Jacquin's *Sideroxylum sapota*. There is nothing to show that this was an original name proposed for the sapote as distinct from the sapodilla. Jacquin, like Linnæus, at first did not discriminate between the sapote and sapodilla. Instead of distinguishing the two fruits and giving them different names, Jacquin's first treatment may be interpreted as a mere transfer of the composite Linnæan species from *Achras* to *Sideroxylon*. In his next work Jacquin accepted the genus *Achras* and used the Linnæan binomial *Achras zapota* in its correct application to the sapodilla, with a citation of the original place of publication in *Species Plantarum*. Thus it was not until Linnæus proposed the name *mammosa*, in the second edition of *Species Plantarum*, that the sapote can be said to have received a specific designation.

#### SUMMARY OF PRINCIPAL SYNONYMS.

The results of this study of the nomenclature of the sapote and the sapodilla are summarized in the following lists of the principal synonyms:

##### *Achradelphia mammosa* (L.) Cook. THE SAPOTE.

- Malus persica maxima foliis magnis*, etc. Sloane, *Voy. Jam.* 2: 124. *pl.* 218. 1725.  
*Sideroxylum sapota* Jacq. *Enum. Pl. Carib.* 15. 1760.  
*Achras mammosa* L. *Sp. Pl.* ed. 2. 469. 1762.  
*Achras zapota major* Jacq. *Stirp. Amer.* 56. 1763.  
*Sapota mammosa* Mill. *Gard. Dict.* ed. 8. no. 2. 1768.  
*Lucuma mammosum* Gaertn. f. *Fruct. & Sem.* 3: 130. *pl.* 203-4. 1807.  
*Lucuma mammosa* DC. *Prodr.* 8: 169. 1844.  
*Vitellaria mammosa* Radlk. *Sitzungsb. Math.-Phys. Akad. München* 12: 325. 1882.  
*Calospermum mammosum* Pierre, *Notes Bot. Sapot.* 11. 1890.  
*Calocarpum mammosum* Pierre in Urban, *Symb. Antill.* 5: 98. 1904.  
*Achradelphia mammosa* Cook, *Journ. Washington Acad. Sci.* 3: 160. 1913.

##### *Achras zapota* L. THE SAPODILLA.

- Sapota fructu ovato, majori* Plum. *Nov. Pl. Amer.* 43. *pl.* 4. 1703.  
*Achras zapota* L. *Sp. Pl.* 1190. 1753; Jacq. *Stirp. Amer.* 57. 1763.  
*Achras sapota* L. *Sp. Pl.* ed. 2. 1. 470. 1762.  
*Sapota achras* Mill. *Gard. Dict.* ed. 8. no. 1. 1768.  
*Sapota zapotilla* Coville, *Contr. U. S. Nat. Herb.* 9: 369. 1905.

# A MONOGRAPH OF THE HAUYEAE AND GONGYLOCARPEAE, TRIBES OF THE ONAGRACEAE.

By JOHN DONNELL SMITH and J. N. ROSE.

## INTRODUCTION.

A recent study of the genus *Hauya*, native of the mountains of Mexico and Central America, has led to the discovery of a new species and has shown that an outlying species, *Hauya arborea*, from the desert of Lower California, must be excluded and made the type of a new genus. The differences between *Hauya* and the new genus, here named *Xylonagra*, are so numerous that one feels the need of calling attention less to these than to the points they have in common which are requisite to keep them in the same tribe. Herbarium work on the group has been supplemented by field work on the part of Dr. Rose, who studied *Xylonagra* on Cedros Island and brought back a large number of herbarium specimens.

During his visit to Lower California Dr. Rose collected material of another species of the Onagraceae, which has been referred wrongly to the genus *Gongylocarpus*. This, too, proves to be of a new generic type, here named *Burragea*, which with *Gongylocarpus* forms a new tribe.

## SYSTEMATIC TREATMENT.

### Tribe HAUYEAE Raim.<sup>1</sup>

Calyx tube long-produced above the ovary, cylindrical, deciduous, the segments 4, elongated, reflexed in anthesis; petals 4, inserted at the apex of the calyx tube, sessile; stamens 8, inserted with the petals; filaments subulate or filiform, the anthers linear, versatile; ovary 4-locular, the ovules few or very numerous, affixed to the interior angle of the cells, ascending; capsule oblong, ligneous, loculicidal, the valves 4, septiferous in the middle; seeds few or very numerous, ascending, imbricate, obliquely produced upward into a subcartilaginous wing.

Trees or shrubs; leaves alternate, petiolate, simple, entire; flowers solitary or in leafy racemes.

*Hauya* was made the type of the tribe Hauyeae by Raimann, it being the only genus. As treated here, the tribe contains *Hauya* and *Xylonagra*.

### KEY TO THE GENERA.

- Arborescent; leaves large; flowers large, few, axillary; seeds  
biseriate..... 1. HAUYA (p. 288).  
A dwarf shrub; leaves small; flowers minute, numerous, in a  
terminal, leafy-bracted raceme; seeds uniseriate..... 2. XYLONAGRA (p. 294).

<sup>1</sup> In Engl. & Prantl, Pflanzenfam. 3<sup>7</sup>: 211. 1893.

## 1. HAUYA DC. Prodr. 3: 36. 1828.

Frutescent or arboreous; flowers large, axillary, solitary, sessile or pedunculate, from white to pinkish; calyx tube cylindrical, elongated, the segments narrow; stamens more or less exerted; filaments filiform; anthers about as long as filaments, awned at apex, reticulate, at length twisted; stigma globose or ellipsoidal; ovules most numerous, in 2 rows to the cell; capsule linear-oblong or ellipsoidal; seeds most numerous, biseriate, the testa coriaceous, the wing longer than the testa, unilaterally auriculate and incrassate; cotyledons oblong, compressed, flat; radicle very short.

The genus *Hauya* was described in 1828 by A. P. De Candolle in the third volume of the *Prodromus*, and a second description, probably prepared before the first, was published the next year. The genus contained a single species, *H. elegans*, based upon a drawing which was published along with the second description. This illustration was one of the few of the Mocino & Sessé drawings which De Candolle was able to reproduce, the others being known only from the tracings which were afterward distributed to a few institutions. Nothing more was learned of the genus until 1877, when M. Barcena, a Mexican, described and figured as *H. elegans* a plant which he had collected in the State of Hidalgo. His illustration is not very good and no specimens of the plant were preserved.

Mr. W. Botting Hemsley in 1878 described two additional species and in 1880 he amplified his descriptions and redescribed *H. elegans*, publishing with the text two plates to illustrate the three species. The first of his new species, *H. barcenae*, is based on Andrieux's no. 391 from Oaxaca, Mexico; the second, *H. cornuta*, upon two specimens, one collected by Salvin and one by Savage, in Guatemala. Neither of these species has been re-collected.

In 1883 Dr. Sereno Watson transferred *Oenothera arborea* Kellogg to *Hauya*, and was followed by Mrs. M. K. Curran, Dr. E. L. Greene, and others, but, as will be shown under *Xylonagra*, it is a very different plant from true *Hauya*.

In 1893 Mr. Smith described two new species of *Hauya* from Guatemala and in 1898 he assigned one of these, *H. rodriguezii*, to Costa Rica, publishing a new description, while in 1909 he and Doctor Rose described 5 new species from Central America. This in brief is the taxonomic history of the genus. There are a few more references to it in literature, but they are compiled from the papers mentioned above.

The genus has its center of distribution in Guatemala; in fact, it is largely Guatemalan, for, of the 11 species described below, 7 occur in that country. One species is known from Costa Rica. Three species are known only from Mexico and one of the Guatemalan species has been found just over the border. The Mexican species are widely scattered, one each coming from the States of Hidalgo, Oaxaca, Guerrero, and Chiapas.

This genus was named for Abbé René Just Haüy, celebrated as a mineralogist, being the discoverer of the true laws of crystallization, who was in early life a student of botany. He was born in 1743 and died in Paris in 1822. He was a friend of the elder De Candolle, who published the genus *Hauya* six years after Haüy's death.

## KEY TO THE SPECIES OF HAUYA.

Flowers distinctly peduncled.

- |   |                         |
|---|-------------------------|
| Peduncles much longer than the ovary.....               | 1. <i>H. heydeana</i> . |
| Peduncles shorter than, or at most equaling, the ovary. |                         |
| Calyx segments not appendaged.....                      | 2. <i>H. barcenae</i> . |
| Calyx segments appendaged.                              |                         |
| Calyx segments shorter than the tube.....               | 3. <i>H. lucida</i> .   |
| Calyx segments longer than the tube.....                | 4. <i>H. rusbyi</i> .   |

## Flowers sessile.

- Calyx segments not appendaged..... 5. *H. elegans*.  
 Calyx segments appendaged.  
 Appendages 3 to 4 mm. long.  
 Valves of the capsule with a central dorsal ridge.... 6. *H. cornuta*.  
 Valves of the capsule without a central dorsal ridge. 7. *H. microcerata*.  
 Appendages 10 to 15 mm. long.  
 Calyx segments about equaling the tube..... 8. *H. rodriguezii*.  
 Calyx segments much shorter than the tube.  
 Capsules 3.5 cm. long..... 9. *H. quercetorum*.  
 Capsules 6 to 8 cm. long.  
 Leaves orbicular to cordate-oval..... 10. *H. ruacophila*.  
 Leaves oblong-ovate to oblong-obovate..... 11. *H. lemnophila*.

1. *Hauya heydeana* Donn. Smith, Bot. Gaz. 18: 3. 1893. FIGURE 45.

Shrub or small tree, at most only 6 meters high, glabrous throughout; young branches purplish; leaf blades lanceolate, 6 to 12 cm. long, narrowed at the base, gland-tipped; petioles 2 cm. or less long; peduncles 12 to 35 mm. long; flowers small for the genus, 6 to 7 cm. long; calyx segments narrowly linear, longer than the tube, with short, blunt tips; petals as long as and twice as broad as the calyx segments, purplish; capsule 2.5 cm. long, the valves 4 mm. broad, plane on the back.

TYPE LOCALITY: Along the road from San Cristóbal, Department of Alta Verapaz, to Belejú, Department of Quiché, Guatemala.

## SPECIMENS EXAMINED:

GUATEMALA: Belejú, May, 1892, *Heyde & Lux* (*J. D. Smith* 2935). Cobán, von *Türckheim* (*J. D. Smith* 8210) in June, 1902, 604 in 1907.

This species is well marked in both foliage and flowers and especially by the long peduncles.

2. *Hauya barcenae* Hemsl. Diag. Pl. Mex. 1: 13. 1878. FIGURE 46.

Tree 13 meters or more high; young branches puberulent; leaves ovate to rotund, 5 to 6 cm. long, acute, rounded at the base, puberulent, becoming glabrate, subcoriaceous; petiole 25 mm. long; peduncle short but distinct; flowers 6 to 7 cm. long; calyx tube about 3.5 cm. long, the segments about as long as the tube, not appendaged; capsules 5 cm. long, the valves plane on the back; seeds small, 5 mm. long.

TYPE LOCALITY: "Huauapan" (Huajuapán), Oaxaca, Mexico.

## SPECIMENS EXAMINED:

MEXICO: Huajuapán, Oaxaca, *Andrieux* 391.

ILLUSTRATIONS: Hemsl. Biol. Centr. Amer. Bot. 5: pl. 29. f. 2; Engl. & Prantl, Pflanzenfam. 3<sup>7</sup>: f. 87.

3. *Hauya lucida* Donn. Smith & Rose, Bot. Gaz. 52: 48. 1911. FIGURE 47.

*Hauya donnellsmithii* Loes. Repert. Nov. Sp. Fedde 12: 236. 1913.

Tree 10 to 13 meters high, with a globose or spreading top; very young leaves pubescent on the nerves beneath; mature leaves glabrous and shining, obovate to elliptical, cuspidate, narrowed at the base, 8 to 13 cm. long, 4.5 to 6 cm. broad, with 8 or 9 lateral nerves; petioles 1.5 to 2.5 cm. long; peduncle very short, not over 7 mm. long; flower 8 to 10 cm. long; calyx tube 4 to 6 cm. long, the segments 3 to 4 cm. long, with appendages 3 to 4 mm. long; petals 3 cm. long; filaments 17 to 19 mm. long, or after flowering becoming 20 to 23 mm.; ovary 9 to 12 mm. long; stigma exerted beyond the petals; capsule 3 to 4.5 cm. long, the valves plane on the back; seeds oblong, 11 to 12 mm. long, obtuse; embryo oblong-obovate.

TYPE LOCALITY: Río Torres, San Francisco de Guadalupe, near San José, Costa Rica.

## SPECIMENS EXAMINED:

COSTA RICA: Near San José, June, 1893, *Tonduz* 8005 (type); same locality, April, 1894, *J. D. Smith* 4801; June 24, 1896, *Tonduz* 10118; October, 1898, *Tonduz* 7445, 12719.

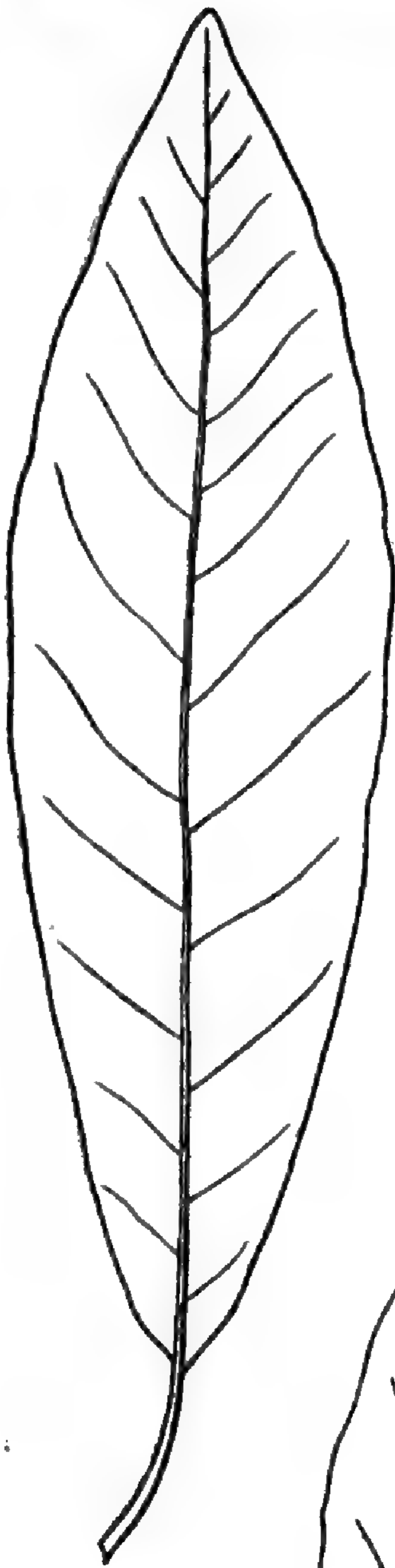


FIG. 45.—*Hauya heydeana*. J. D. Smith's 2936. Natural size.

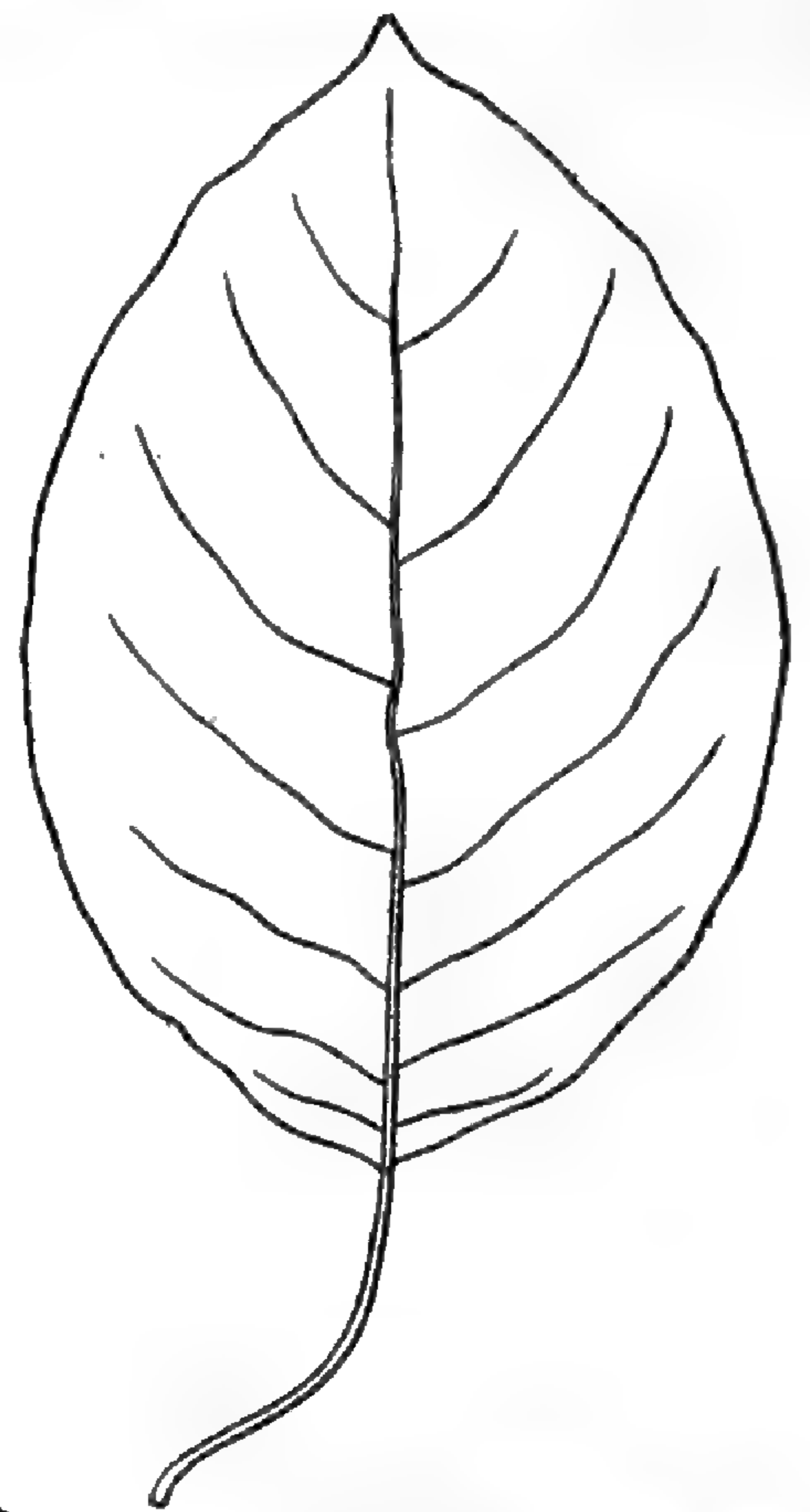


FIG. 46.—*Hauya barcenae*. Andrieux's 391. Natural size.

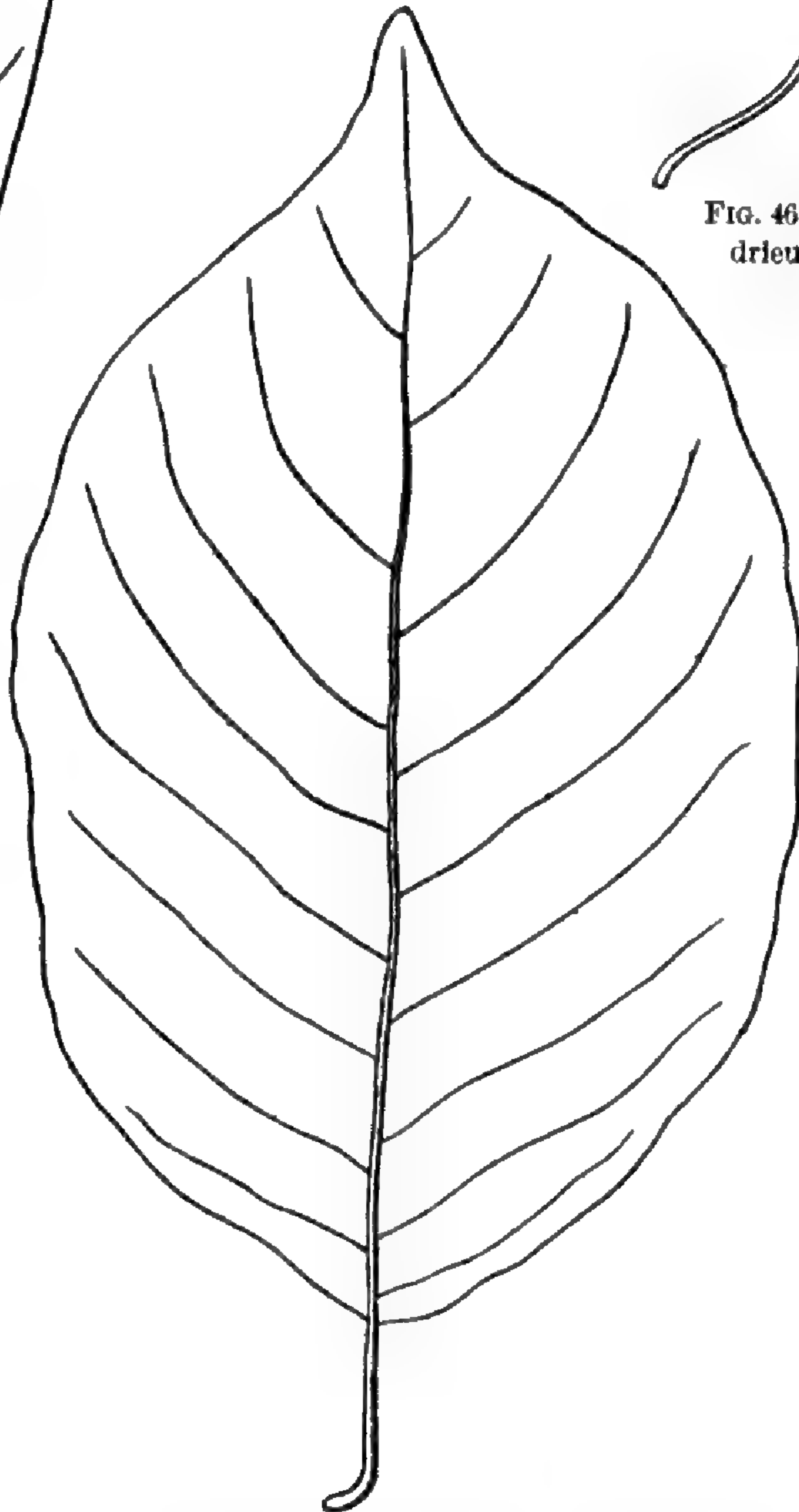


FIG. 47.—*Hauya lucida*. Tonduz's 12719. Natural size.



**4. *Hauya rusbyi* Donn. Smith & Rose, sp. nov.**

FIGURE 48.

Small tree; young branches greenish, pubescent with soft, spreading hairs; leaves broadly oblong-ovate, 8 to 12 cm. long, sometimes abruptly acuminate, rounded at the base, somewhat pubescent above, paler beneath and with dense soft pubescence; petiole 12 to 20 mm. long; peduncle 8 mm. long; flowers 7 to 8 cm. long; calyx tube 3 cm. long, the segments narrow, 4 to 5 cm. long, appendaged at the tip, very pubescent without, within greenish above, reflexed after flowering and purplish below; petals not seen; style purple; capsule 3.5 to 4 cm. long, plane on the back; seeds 8 mm. long.

Type in the United States National Herbarium, no. 574646, collected on Limón Mountain, Guerrero, Mexico, altitude 1,350 meters, July 28, 1910, by H. H. Rusby (no. 157). Also collected in the mountains near Iguala, Mexico, October 24, 1909, by C. G. Pringle (no. 9258).

*Hauya rusbyi* is probably nearest *H. barcenae*, differing from it in the shape of the leaves, in its somewhat shorter petioles, in having the calyx tube shorter than the segments and the segments appendaged, and in its somewhat shorter capsule.

**5. *Hauya elegans* DC. Prodr. 3: 36. 1828.**

Shrub or tree; young branches velvety-pubescent; leaves lanceolate to ovate, 27 to 62 cm. long, rounded at the base, acuminate, tomentose above, velvety-pubescent beneath; flowers sessile, 12.5 cm. long; calyx tube longer than the calyx segments, these not appendaged; petals nearly orbicular, rose-colored; capsule 3.7 cm. long, the valves plane on the back.

TYPE LOCALITY: Mexico.

The taxonomic history of this, the type species of the genus, has already been given with that of the genus. There is only to add that in 1880 Mr. Hemsley referred here Coulter's no. 172 from Zimapán, Mexico.

**6. *Hauya cornuta* Hemsl. Diag. Pl. Mex. 1: 13. 1878.**

FIGURE 49.

Shrub or small tree; young branches pubescent; leaves rather small for the genus, oblong-lanceolate to elliptical, 5 to 7.5 cm. long, short-acuminate, puberulent above, canescent-tomentose beneath; calyx tube 3 cm. long, puberulent, the segments about half the length of the tube; capsule 22 mm. long, the valves with a short ridge on the back.

TYPE LOCALITY: Volcán de Fuego, Guatemala.

Only the type specimen has been seen, which was collected in Guatemala, August 6, 1873, by Osbert Salvin.

The material was lent us by the director of the Kew Gardens.

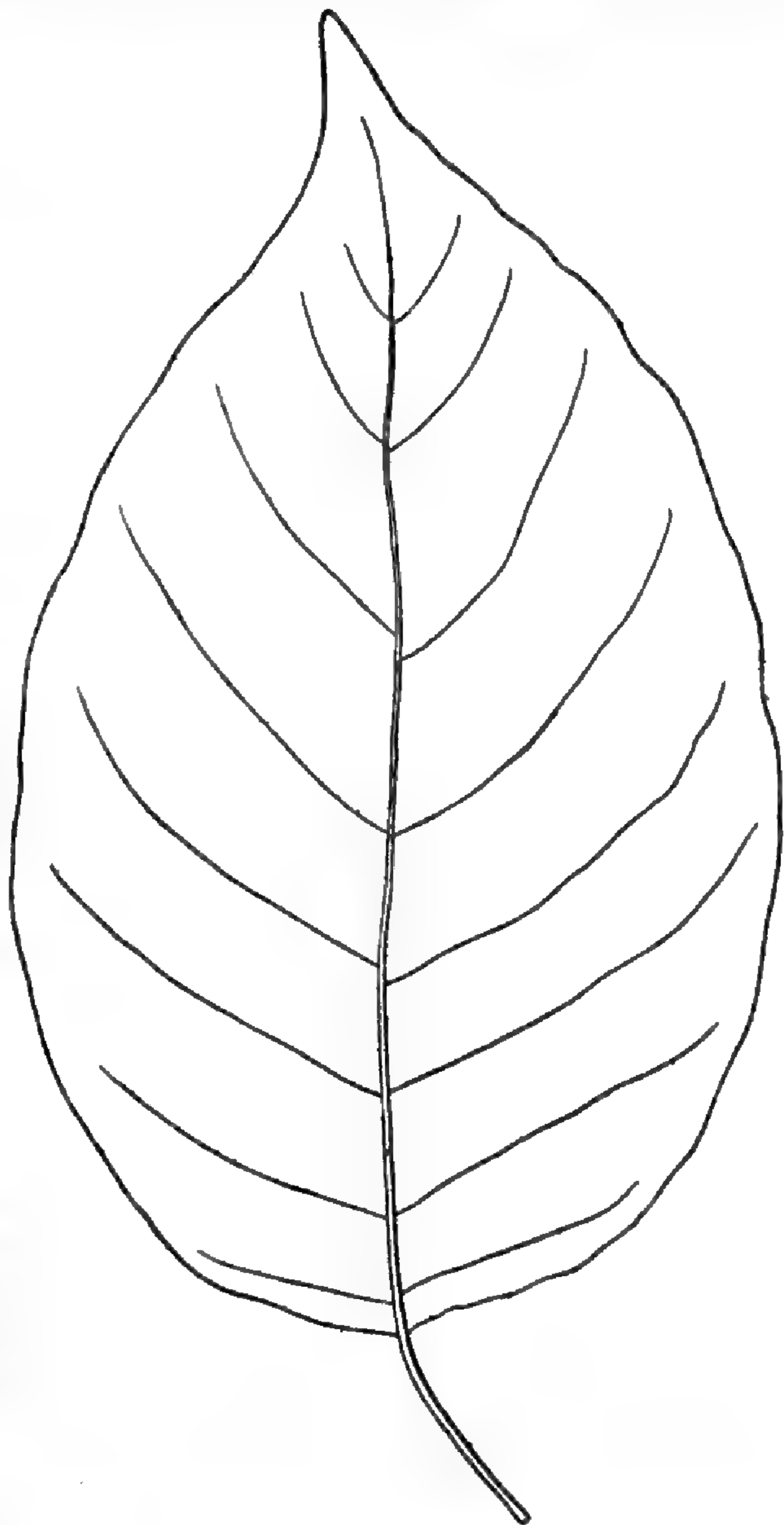


FIG. 48.—*Hauya rusbyi*. Rusby's 157. Natural size.

7. *Hauya microcerata* Donn. Smith & Rose, Bot. Gaz. 52: 46. 1911. FIGURE 50.

Probably a small tree; young branches and buds with appressed, canescent pubescence; leaves long-petiolate, obovate to oblong-obovate, 7 to 11 cm. long, 4 to 6 cm. broad, shortly cuspidate, glabrate above, tomentose beneath; flowers sessile; calyx tube 8.5 to 10 cm. long, the segments 3.5 to 4 cm. long, with appendages 3 to 4 mm. long; petals oval, 33 mm. long; ovary velvety-pubescent, 11 mm. long; capsule 5 cm. long, the valves plane on the back; seeds unknown.

TYPE LOCALITY: Santa Rosa, Department of Baja Verapaz, Guatemala.

SPECIMENS EXAMINED:

GUATEMALA: Santa Rosa, alt. 1,500 meters, September, 1888, *von Türckheim* (*J. D. Smith* 1423). Cuesta de Quililhá, near Purulhá, alt. 1,400 meters, April, 1905, *Pittier* 155.

MEXICO: Canjob, Chiapas, May 2, 1904, *Goldman* 923.

The specimen from Mexico is referred here with some doubt.

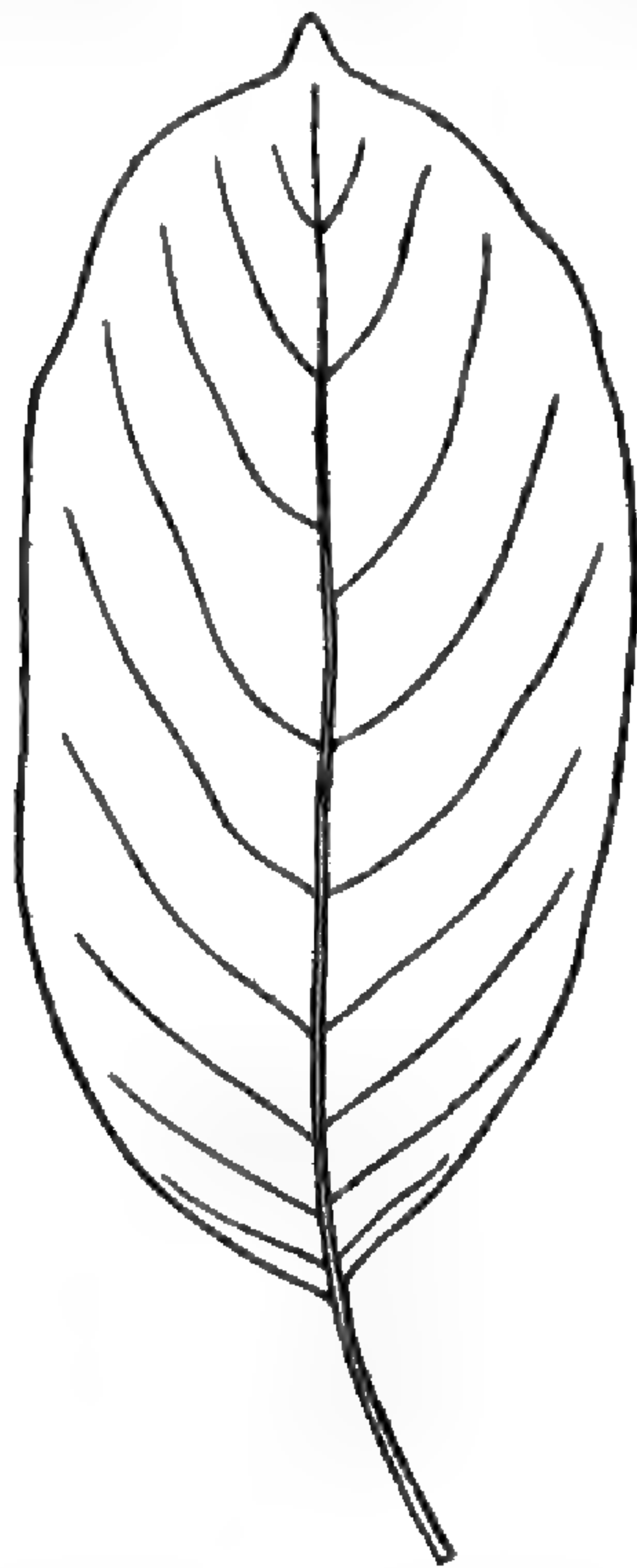


FIG. 49.—*Hauya cornuta*.  
Type. Natural size.

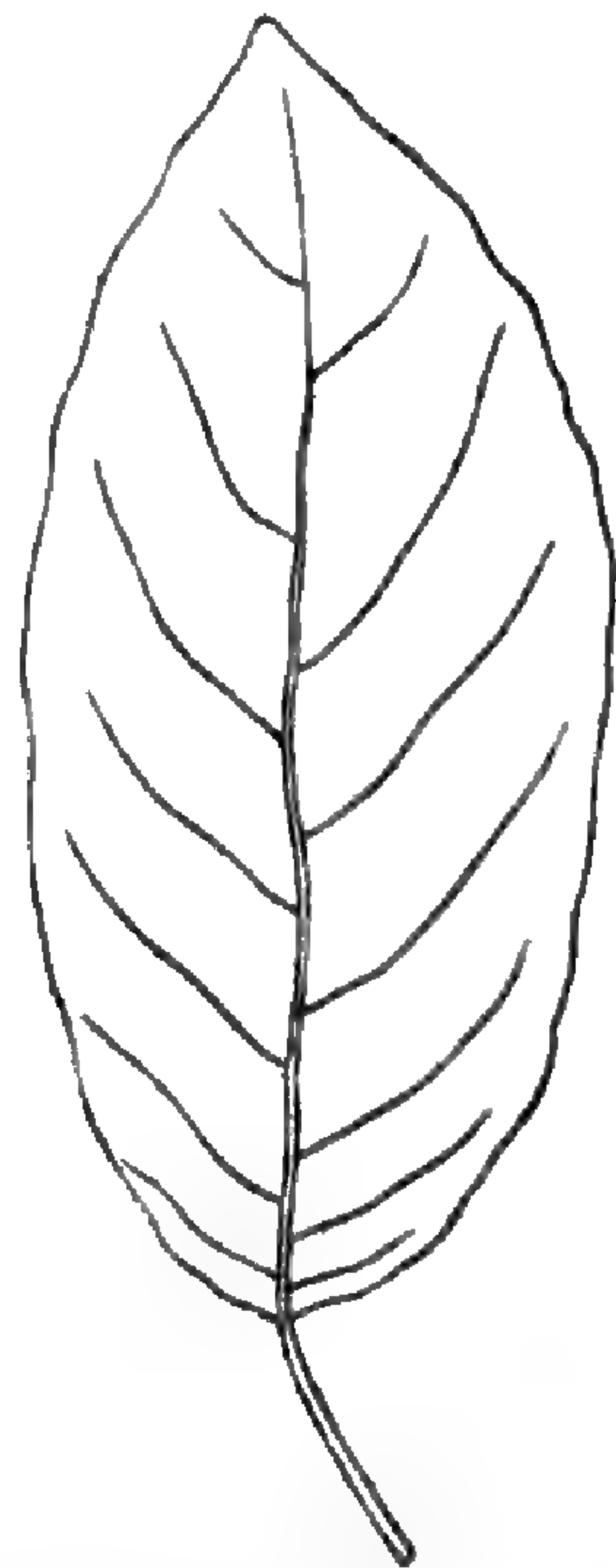


FIG. 50.—*Hauya microcerata*. *Pittier's* 155.  
Natural size.

8. *Hauya rodriguezii* Donn. Smith, Bot. Gaz. 18: 3. 1893. FIGURE 51.

Tree, 10 meters high, with a stout trunk; young branches slightly pubescent; leaves pubescent when young, soon glabrate except the angles, rhombic-oval to elliptical, 11 to 12 cm. long, abruptly acuminate, narrowed or rounded at base, with 8 or 9 pairs of nerves; petioles 1 to 3 cm. long; flowers sessile, 13 to 15 cm. long; calyx tube 6.25 to 7.5 cm. long, the segments of about the same length as the tube, with slender appendages; petals oval, two-thirds the length of the calyx segments; ovary canescent; capsule 5 to 5.25 cm. long.

TYPE LOCALITY: Acatepeque, Guatemala.

SPECIMENS EXAMINED:

GUATEMALA: The type specimen, collected at Acatepeque, March, 1892, by *J. D. Smith* (no. 2529).

9. *Hauya quercetorum* Donn. Smith & Rose, Bot. Gaz. 52: 47. 1911. FIGURE 52.

Probably a small tree; old branches glabrescent, the growing parts somewhat hirsute; leaves large, orbicular to lanceolate, obtuse to acuminate, glabrous or nearly so above,

glaucous and glabrous beneath except for the hairs along the midrib and lateral veins; petioles 2 to 3 cm. long; flowers sessile; calyx tube 7 to 9 cm. long, pubescent, the segments 3.5 to 5 cm. long, with appendages 5 to 6 mm. long; ovary very pubescent, 10 to 11 mm. long; capsule woody, 3.5 cm. long, the valves plane on the back; seeds lanceolate, 15 mm. long, 5 mm. broad, acute.

**TYPE LOCALITY:** Volcano of Juamaytepeque, Department of Santa Rosa, Guatemala.

Known only from the type locality; collected by Heyde and Lux in March, 1883. On the same volcano and at the same altitude Heyde and Lux collected additional material of a *Hauya* which may or may not belong here, the leaves being of somewhat

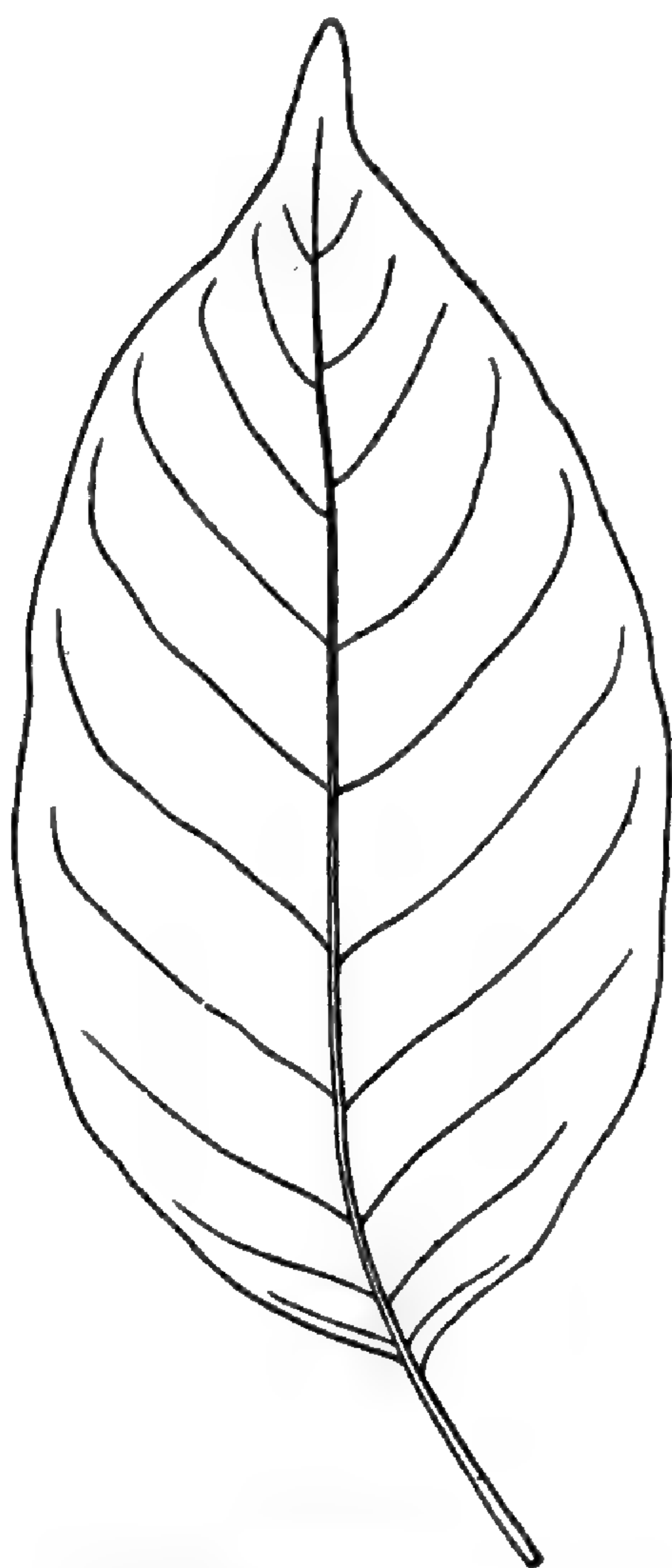


FIG. 51.—*Hauya rodriguezii*. Type. Natural size.

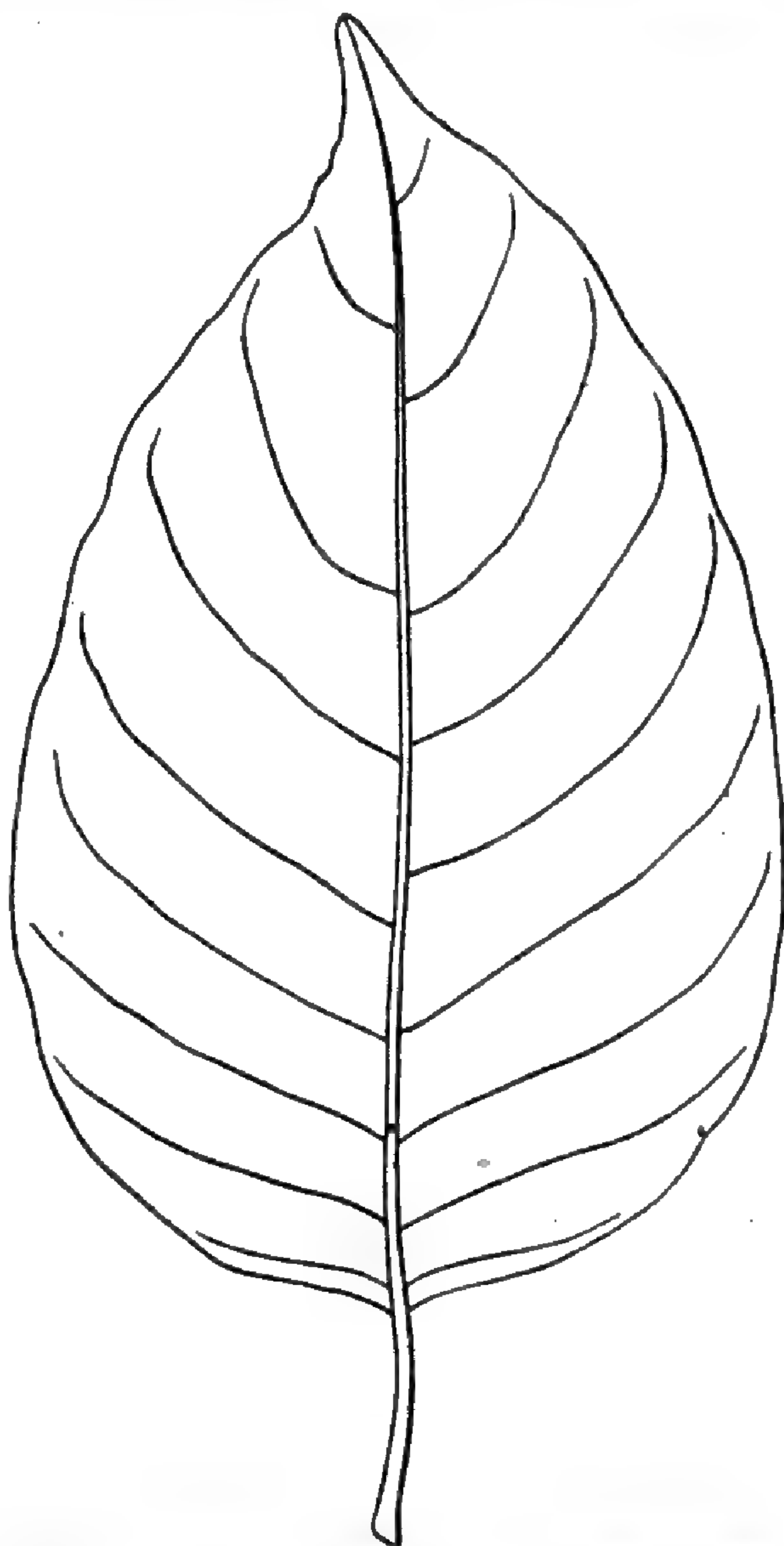


FIG. 52.—*Hauya quercetorum*. Type. Natural size.

different shape, the ovary more hirsute, and the flower somewhat different in several respects.

10. *Hauya ruacophila* Donn. Smith & Rose, Bot. Gaz. 52: 47. 1911. FIGURE 53.

*Hauya longicornuta* var. *a ovalifolia* Loes. Repert. Nov. Sp. Fedde 12: 237. 1913.

Small tree; young branches velvety-pubescent; leaves orbicular to ovate, 5 to 7 cm. long, 3 to 6 cm. broad, somewhat pointed, cordate or rounded at the base, glabrous above, densely cinereous beneath; flowers sessile; calyx tube 9.5 to 10 cm. long, pubescent, the segments 5 to 5.5 cm. long, with appendages 10 to 12 mm. long; petals elliptical, 4.5 cm. long, 2.5 cm. broad; ovary velvety; capsule woody, 6 cm. long, the valves plane on the back; seeds oblong, 13 mm. long.

TYPE LOCALITY: Volcán Acatenango, Guatemala.

SPECIMENS EXAMINED:

GUATEMALA: Volcán Acatenango, Department Zacatepéquez, alt. 1,700 meters, March, 1892, *J. D. Smith* 2528 (type). Alotenango, Department Zacatepéquez, alt. 1,300 meters, March, 1892, *J. D. Smith* 2527.

11. *Hauya lemnophila* Donn. *Smith & Rose, Bot. Gaz.* 52: 48. 1911. FIGURE 54.

*Hauya longicornuta* var. *b. oblongifolia* Loes. *Repert. Nov. Sp. Fedde* 12: 237. 1913.

Probably a small tree; young branches cinereous-hirsute; leaves oblong-ovate to oblong-obovate, 9 to 15 cm. long, 4.5 to 7.5 cm. broad, rounded at the base, somewhat pointed, glabrate above, hirsute beneath; flowers sessile, calyx tube 7.5 to 9 cm. long, the segments 4.5 to 5 cm. long, with appendages 12 mm. long; petals white, 33 to 35 mm. long; ovary hirsute, 13 to 14 mm. long; capsule linear-oblong, 7.5 to 8 cm. long, the valves plane on the back.

TYPE LOCALITY: Laguna de Carrazal, Department of Santa Rosa, Guatemala, altitude 1,500 meters.

Known from the type material, collected in May, 1892, by Heyde and Lux (*J. D. Smith* 2936), and also from Heyde's no. 516, which may be a part of the type collection.

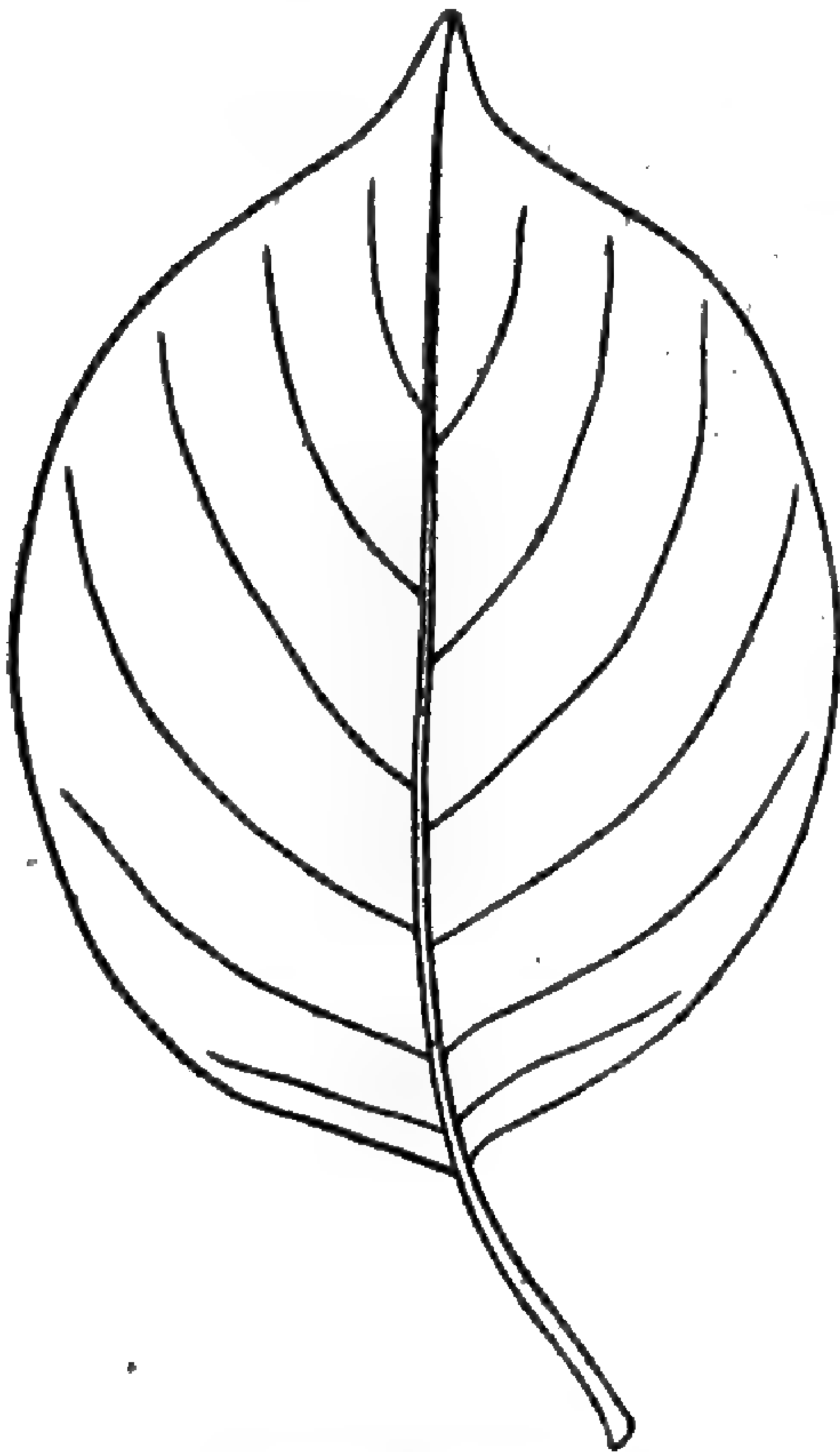


FIG. 53.—*Hauya ruacophila*. Type.  
Natural size.

2. **XYLONAGRA** Donn. *Smith & Rose,*  
gen. nov.

A low, bushy shrub with numerous short, ascending branches; leaves alternate, small, solitary or in fascicles, with glandular tips; inflorescence of elongated terminal racemes; flowers pediceled; calyx scarlet, the proper tube short, abruptly enlarging into a long, funnel-shaped throat, the segments 4, short, ovate to triangular, about one-third the length of the tube; petals 4, scarlet, shorter than the calyx segments; stamens 8, exerted a little beyond the petals, the filaments short, the anthers mucronate; style exerted beyond the stamens; stigma capitate; capsule small, 4-celled, loculicidal; seeds few to

the cell, in one row, with a small subterminal, acuminate wing; embryo oblanceolate, the cotyledons elliptical, thrice longer than radicle.

This genus differs from *Hauya* in its bushy habit and small leaves, in the character of the inflorescence, in its much smaller flowers, differently shaped calyx tube, highly colored petals, short filaments, merely mucronate and not reticulate anthers, much smaller capsules of different texture with cells containing one row of few seeds instead of two rows of very numerous ones, and in the very small seeds with a different kind of wing. It has, moreover, a very different range and habitat.

1. *Xylonagra arborea* (Kellogg) Donn. *Smith & Rose.*

*Oenothera arborea* Kellogg, *Proc. Calif. Acad.* 2: 32. *pl.* 1859.

*Hauya californica* S. Wats. *Proc. Amer. Acad.* 20: 366. 1885.

*Hauya arborea* Curran, *Proc. Calif. Acad.* II. 1: 253. 1888.

Low shrub, 60 to 120 cm. high (originally described as 6 to 8 feet), with slender woody branches, these when young red and covered with short, appressed, cinereous pubescence; leaves petioled, small, the blade lanceolate, 8 to 15 mm. long, entire, obtuse, tipped by a large orange yellow, sometimes red, gland, scantily pubescent on

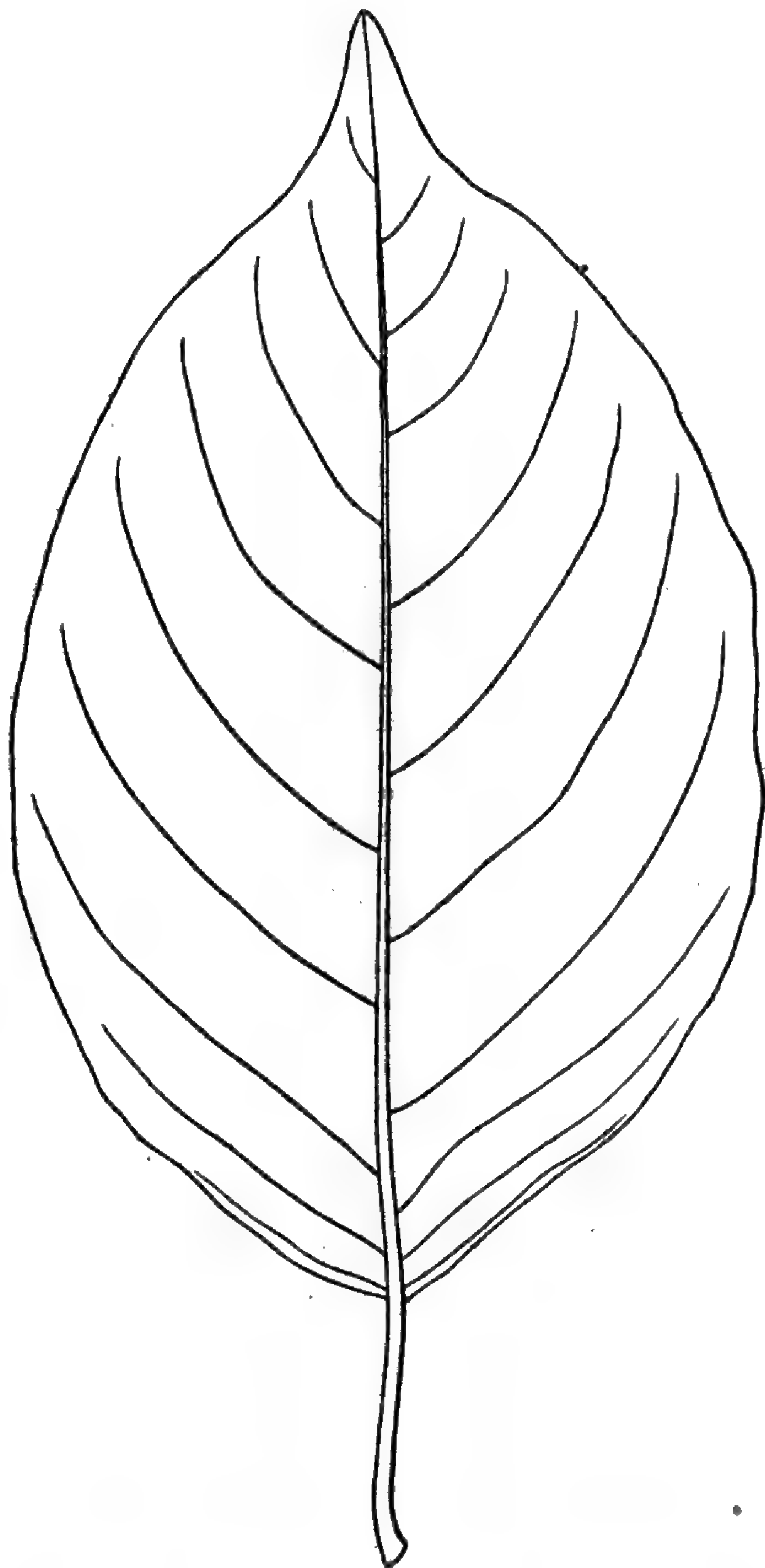


FIG. 54.—*Hauya lemnophila*. Heyde's 516. Natural size.

both surfaces; inflorescence a terminal, leafy raceme, sometimes consisting of only 1 to 3 flowers, sometimes much elongated (in one case measuring 50 cm. long) and bearing 100 or more flowers; pedicels 5 mm. long, becoming stout; flowers scarlet, 2 to 2.5 cm. long; petals erect, 5 mm. long; stamens only slightly longer than the petals; style slender, scarlet, pubescent, exserted; capsule 10 to 12 mm. long; seeds 5 to 8 in each cell, in one row, each slightly winged on one side and at the summit, the terminal portion as long and broad as the body itself.

The above description differs somewhat from Doctor Kellogg's rather extravagant one. He characterizes it as a tree primrose with a stem 5 to 8 cm. in diameter, the floral branches bearing glandular hairs, the leaves sessile, and the flowers in dense spikes.

The specific name *arborea* is unfortunate, as there is not the least suggestion of a tree in either the size or the habit of the plant.

TYPE LOCALITY: Cedros Island, Lower California.

The range and habitat are Cedros Island and the west coast of Lower California on the open desert hills and low mountains, along with Agaves and junipers.

SPECIMENS EXAMINED:

LOWER CALIFORNIA: Cedros Island, 1896, *Anthony* 46; March, 1911, *Rose* 16133.

San Andrés, September 21, 1905, *Nelson & Goldman* 7157. San Bartolome

Bay, April 29, 1889, *Pond*. Rosalia Bay, 1896, *Anthony* 46a.

This species was collected in considerable abundance on Cedros Island by Dr. Rose during his recent trip with the *Albatross*. He found it only after an all-day climb. Unfortunately, only a single flower was seen, but fruiting specimens with leaves were taken, and these will doubtless be a welcome addition to many herbaria.

The plant is low, usually 60 to 90 cm. high, a bush with many slender upright branches, often forming thickets along the dry ravines and stony hillsides. The leaves, as seen, were always small, and no evidence was met that they are ever large, so that doubtless the record of their being sometimes 2 inches long is due to a slip of some kind. Each leaf is tipped with a large gland, which suggests those found on the tips of leaflets in ant-inhabited Acacias. Whether these glandular bodies serve any special use in the economy of this plant we do not know. The inflorescence is somewhat curious, and it is not easy to decide whether the flowers should be said to be axillary or, taken together, to form a leafy raceme. The flowering branch seems to die after the fruit matures, although it may persist for years. In one case, however, a branch bearing perhaps a hundred capsules had stopped flowering and been continued as a leafy shoot. This was probably abnormal and doubtless due to its desert surroundings. This plant, like so many desert plants, must have a severe struggle all the time. The warm sunshine urges it into leaf and flower, while the dry soil withholds what little water it has. One day it puts forth its leaves; the next it must drop them or die. A day later a shower stimulates it to a new effort. Thus are produced these abnormal forms—stunted branches an inch long, which are 20 years old, and elongated branches measured in feet which have grown in a season.

Tribe GONGYLOCARPEAE Donn. Smith & Rose.

Calyx tube produced above the ovary, filiform, nearly closed at the apex by an annular disk; calyx segments 4, much shorter than the tube; petals 4, inserted at the base of the disk; stamens 8, inserted with the petals, inappendiculate, four longer than the others, all fertile, the anthers ovoid; ovary immersed; stigma capitate exindusiate; fruit immersed, subdrupaceous, rhomboidal, bilocular, 2-seeded; putamen ligneous.

Leaves alternate; flowers axillary, solitary.

The tribe Gongylocarpeae, here described as new, seems to be abundantly distinct from the Gaureae by its immersed ovary and 2-celled fruit.

## KEY TO THE GENERA.

- Herbaceous; leaves not crowded, petiolate, denticulate; disk glandular; ovary concrete with the stem and petiole, 2 or 3-celled, 2 or 3-ovuled; fruits remote. 1. **GONGYLOCARPUS** (p. 297).  
 Fruticose; leaves crowded, subsessile, entire; ovary immersed in the stem, 2-celled, 2-ovuled; fruits approximate in the thickened stems..... 2. **BURRAGEA** (p. 297).

1. **GONGYLOCARPUS** Schlecht. & Cham. *Linnaea* 5: 557. 1830.

An annual herb, glabrous, the stem becoming reddish; leaves petiolate, ovate-lanceolate, denticulate-ciliate; flowers remote; calyx tube adnate to both branch and petiole, the segments spreading, linear, cucullate; petals inserted on the glandular disk of the calyx, obovate-cuneate, shorter than the calyx segments, entire; ovary 2 or 3-celled, the style filiform and short, the ovules solitary in each cell; fruit concrete with branch and petiole.

Only a single species of *Gongylocarpus* (*G. rubricaulis*) has been described, which is extremely rare in collections. The type came from near Jalapa, Vera Cruz, Mexico, and the species has been reported also from the States of Jalisco and Chihuahua, widely separated localities. There is a possibility that more than one species is represented by this material. Owing to the weedy appearance of the plant and to its inconspicuous flowers and seemingly abnormal fruits, it is likely to be neglected by collectors.

1. **Gongylocarpus rubricaulis** Schlecht. & Cham. *Linnaea* 5: 558. 1830.

Stem 45 cm. long, erect; branches remote, shorter than the stem; leaves acuminate or acute, narrowed into the petiole, remotely and sharply denticulate, shortly or obsoletely ciliate, the cauline 6 cm. long and 2.5 cm. broad, petiole 1.25 cm. long; calyx tube above ovary 4 to 10 mm. long; segments 4 mm. long; petals deciduous; stamens and style equaling or exceeding the calyx segments.

TYPE LOCALITY: Jalapa, Mexico.

## SPECIMENS EXAMINED:

MEXICO: Near Jalapa, Vera Cruz, *Schiede & Deppe*. Naolinco, Vera Cruz, August, 1912, *C. A. Purpus* 6155. Mountains near Chapala, Jalisco, November 18, 1892, *C. G. Pringle* 5344. Southwestern Chihuahua, August to November, 1885, *Dr. E. Palmer* 34.

2. **BURRAGEA** Donn. Smith & Rose, gen. nov.

A perennial shrub; leaves alternate, closely set, subsessile, thickish, entire; sepals 4, in the bud free at the tip, highly colored, oblong, becoming reflexed, all similar; calyx tube very slender, much longer than the segments, partly closed at the apex by an annular disk; filaments 8, 4 longer; style slender; stigma capitate, at length bipartite; ovary imbedded in the branch, 2-celled; fruit somewhat diamond-shaped, 2-celled, 2-seeded, imbedded in the flowering shoot and tardily breaking away.

Type species, *Gaura fruticulosa* Benth.

This remarkable genus is dedicated to Commander Guy H. Berrage, United States Navy, who was in charge of the U. S. steamer *Albatross* during the spring of 1911, when Dr. Rose made his expedition to Lower California. We thus render a slight token of our appreciation of the facilities so richly supplied during this expedition.

The genus *Burragea* is to be associated with *Gongylocarpus*, but in its bushy, perennial habit, large, showy flowers, and elongated flowering branches it must be regarded as quite distinct. As in that genus the ovary is sunk in the flowering branch; but in *Gongylocarpus* the fruits are single and suggest little nuts, while in *Burragea* they represent a persistent collective fruit.

Mr. Bentham, who was the first to study the species, took the specimens for a deformed *Gaura*, and commented on them as follows: <sup>1</sup>

"In all specimens there is the same semiarticulation and thickening of the flowering part of the branches so as to enclose the ovaria, which Chamisso and Schlechtendal observed in an allied Mexican species, and which appeared to them to justify the constituting a distinct genus under the name of *Gongylocarpus*. It is, however, much more probably the effect of some disease or parasite. I could not indeed, any more than the above quoted authors, discover any traces of fungus or insect, but the distortion of the ovaries, as well as of the more enlarged capsules and seeds which may be found still remaining in their hardened state in the old woody branches, show that this is not the healthy natural form of the plant. The flowers appear in all other respects perfect, and are evidently showy."

#### KEY TO SPECIES.

Glandular-pubescent; leaves linear..... 1. *B. fruticulosa*.  
 Glabrous; leaves oblanceolate..... 2. *B. frutescens*.

#### 1. *Burragea fruticulosa* (Benth.) Donn. Smith & Rose.

*Gaura fruticulosa* Benth. Bot. Voy. Sulph. 15. 1844.

*Gongylocarpus fruticosus* T. S. Brandeg. Proc. Calif. Acad. II. 2: 158. 1889.

A low, bushy plant, 30 to 60 cm. high; young branches purple, covered with short, spreading, glandular (?) hairs; leaf branches often short and stunted, showing numerous closely set leaf scars; leaves numerous, often closely set, on vigorous branches more remote, linear, 2 mm. broad, entire, acute, slightly narrowed at base, not perceptibly veined, glandular-pubescent; calyx tube slender, 15 mm. long, the segments oblong, pointed, 7 mm. long, becoming reflexed; petals obovate, about 7 mm. long.

TYPE LOCALITY: Magdalena Bay, Lower California.

Collected on Santa Margarita Island, Lower California, March 19, 1911, by J. N. Rose (no. 16284).

Bentham evidently had both species of *Burragea* in his *Gaura fruticulosa*, for he says that some of the specimens are glabrous and others are pubescent. The pubescent form has been selected to serve as a type for Bentham's species. Both species grow about Magdalena Bay, but, so far as observed, not together.

#### 2. *Burragea frutescens* (Curran) Donn. Smith & Rose.

*Gongylocarpus frutescens* Curran, Proc. Calif. Acad. II. 1: 231. 1888.

A low, widely spreading shrub, rarely over 30 to 60 cm. high, glabrous throughout, with numerous short branches, the young ones dark purple; leaves alternate, narrowly oblanceolate, often 7 mm. broad, 3 cm. long, thickish, the midvein indistinct; calyx tube 2 to 2.5 cm. long, petals 12 mm. long; fruiting branches thick, 1 to 10 cm. long, turgid, purple, at first leafy but becoming naked.

TYPE LOCALITY: Magdalena Bay, Lower California.

Collected also on the shore of Santa Maria Bay, Magdalena Island, Lower California, March 18, 1911, by J. N. Rose (no. 16263).

#### NOTE.

While reading the final proof of this paper, our attention was called to two species, one with two varieties, just described by T. Loesener in Fedde, Repertorium Specierum Novarum Regni Vegetabilis, volume 12. These are based on the same collections which we have studied and, being clearly synonyms, are so referred. Two names, *H. hemsleyana* and *H. pedicellata*, also are mentioned, but doubtless have not been published.

<sup>1</sup> Bot. Voy. Sulph. 15. 1844.



# BOTRYCHIUM VIRGINIANUM AND ITS FORMS.

By IVAR TIDESTROM.

## BOTRYCHIUM VIRGINIANUM.

In 1905,<sup>1</sup> an account was given by me of a peculiar form of our Virginia plant. It showed a forking sporophyll, which phenomenon does not appear to be so unusual, for I have observed a number of similar cases since that time. The unusual, however, about the plant was the presence of two fertile pinnæ on one of the sterile segments (branches). The plant was collected in the woods along Chesapeake Bay, some 30 miles east of Washington. Along with typical specimens grew some very small plants which were referred to the small form of the species or *B. gracile* Pursh.

In 1907, while botanizing near Chevy Chase, Maryland, I came upon a rather large colony of the species and found also a large number of smaller plants growing under the shade, so to speak, of plants of normal size. The smallest fruiting specimen which I could find measured 10 cm. in height. The branches of the sterile frond measured about 2 cm. in length while the fertile frond somewhat exceeded this measure. The spore-bearing part alone (i. e., exclusive of the stalk) measured only 5 mm. The largest specimen of *B. virginianum* which I have collected in Maryland, measures about 70 cm. in height, while the sterile branches are 20 cm. or more and the pinnæ 6 cm. more or less in length. Much larger specimens may exist, but I give measurements only of those which I have collected and which are preserved in my own herbarium. The size of the plant seems to depend largely on its age and the perennial root appears to last many years. The variation, therefore, of the species in Maryland and Virginia (fruiting specimens alone being considered at this time) appears to lie between 10 and 70 cm., so far as the height of the plant is concerned. It is apparent that *B. gracile* Pursh (*B. virginianum* var. *gracile* Presl) is only a young fruiting plant of our typical *B. virginianum*.

One of the earliest records of our Virginia plant is found in the works of Morison<sup>2</sup> where it is under the name:

*Lunaria botrytis elatior Virginiana pinnulis tenuissimis*, etc.

<sup>1</sup> *Torreyana* 5: 160. f. 1.

<sup>2</sup> *Pl. Hist.* 3: 595. sect. 14. *pl.* 4. f. 5. 1799.

The plant was sent to England by the pioneer of Virginian botany, John Banister.

Gronovius and Linnæus referred it to the genus *Osmunda* in *Flora Virginica*.

The range given for the species by Professor Underwood<sup>1</sup> is: "In woods, Nova Scotia to British Columbia, Florida and Arizona. Also in Europe and Asia."

It is comparatively easy to clear up the history of a species when we are in a position to study the living individuals. If, on the other hand, we are limited to fragmentary material, as was often the case with the old botanists, it is not at all surprising that such simple, diminutive forms as the early fruiting fronds of *B. virginianum* were given a distinct name or referred to the species as a variety.

If we examine material from other parts of America as, for instance, the region from Mexico southward into Peru, we are confronted with the same difficulty as the earlier botanists, for the material from the Latin-American countries, besides being scant, shows a much greater range of variation than do the plants from the United States. With an insufficiency of material, therefore, and with practically no knowledge of the living plants, we can do little except to describe the herbarium material at hand and to attempt to refer it to forms already known. The record given by Linnæus<sup>2</sup> of his *Osmunda virginiana* (*Botrychium virginianum*) reads:

*Osmunda* scapo caulino solitario, fronde supra decomposito.

*Osmunda* fronde pinnata caulina, fructificationibus spicatis. *Gron. virg.* 196.

*Osmunda asphodeli* radice. *Plum. fil.* 136. *t.* 159. *Pet. fil.* 168. *t.* 9. *f.* 2.

*Habitat in America.*

From the above it is apparent that the concept of the species as held by Linnæus has not changed. It is doubtful also if he ever saw Plumier's plant. The account of this fern points clearly to *B. virginianum* or some close ally, but the figure is not of our plant in all its details. It should be stated also that the botanical artists of two centuries ago often disregarded the details and a striking result of this license is seen in the earliest representations of our handsome *Adiantum pedatum*. We cheerfully make allowance for the artist's fancy when we read Cornut's description of the plant, for in the description we find that very element, the treating of plants as living beings, which is necessarily of the most importance in the make up of any book on botany. Plumier<sup>3</sup> gives an account of the plant of which the following is a part:

"Je trouvay cette Plante dans les forests de l'Isle Saint Domingue, où j'en ay veu une autre espèce tres semblable, mais dont les feuilles étoient plus émoussées, un peu moins découpées & bordées d'une dentelure tres-delicate.

<sup>1</sup> Small, Fl. Southeast. U. S. 3. 1903.

<sup>2</sup> Sp. Pl. 1064. 1753.

<sup>3</sup> Trait. Foug. 136. pl. 159. 1705. (Parallel columns of French and Latin text.)

“Monsieur Sarrazin tres-habile Medecin, sçavant Anatomiste & Botaniste du Roy dans le Canada, envoya de ce même Pais, ces deux mesmes especes à Monsieur Vaillant aussi Botaniste du Roy, & tres-expert Anatomiste. Il luy manda en même temps que les Sauvages appelloient ces deux mêmes plantes *l'Herbe aux Serpens*, y ayant recours d'abord qu'ils en ont esté mordus, pour remedier à leur morsure par l'application de cette Herbe.”

It should be noted that Clayton<sup>1</sup> gave as the vernacular name in Virginia for this plant “Fern-Rattle-Snake-root,” a translation probably of the Indian name for which the French version is “l'Herbe aux Serpens” as given above.

Professor Underwood and Mr. Benedict<sup>2</sup> record three species of *Botrychium* from the West Indies: *B. virginianum*, *B. jenmani*, and *B. underwoodianum*. No definite locality is given for the first species, so we may conclude that it is not a local plant even in the West Indies. The second species is known only from Jamaica. The third is also known from Jamaica and Haiti (?). In Plumier's illustration<sup>3</sup> there is a portion of a frond which appears to represent a second species of which he speaks in the text. The latter plant he describes as having “les feuilles plus émoussées, un peu moins découpées & bordées d'une dentelure tres-delicate”—a description which suggests *B. underwoodianum* or some close ally. His *Osmunda Asphodeli radice* received the name *Osmunda cicutaria* in 1798.<sup>4</sup> It is represented as having the stalk of the fertile segment inserted nearly midway between the root system and the lowermost sterile pinnæ (or branches), a condition which probably led the earlier authors to regard the illustration as being representative of a distinct species.

Swartz<sup>5</sup> accepted the species upon the authority of Savigny and also cites Plumier's illustration, showing the low insertion of the fertile segment. That such a condition actually existed in Plumier's plant from Santo Domingo is probable, from the fact that I have observed a single instance of this sort in a Jamaican specimen. Prantl<sup>6</sup> in his review of the Ophioglossaceae refers *B. cicutarium* Swartz to *B. virginianum*. His statement with respect to the latter species, “Pedunculus e basi laminae vel rarius e petiolo oriundus,” might lead us to believe that he had also observed instances wherein the condition represented in Plumier's plate existed, but we have no direct proof that such was the case.

### BOTRYCHIUM DICHRONUM.

Professor Underwood described this species<sup>7</sup> from material collected by Mr. W. N. Clute at Morces Gap, Jamaica, at an altitude of 1,500 meters. The description of the species fits also *B. virginianum* in all particulars except two. From the latter *B. dichronum* is said

<sup>1</sup> Gronov. Fl. Virg. 196. 1739.

<sup>2</sup> N. Amer. Fl. 16<sup>1</sup>: 3-10. 1909.

<sup>3</sup> Trait. Foug. 136. pl. 159.

<sup>4</sup> Savigny in Lam. Encycl. 4: 650.

<sup>5</sup> Syn. Fil. 171. 1806.

<sup>6</sup> Ber. Deutsch. Bot. Gesell. 1: 350. 1883.

<sup>7</sup> Bull. Torrey Club 30: 45. 1903.

to differ in its peculiar short panicle and "especially in its persistent sterile leaf which remains fresh until the new one is fully developed, the plant thus having two growing leaves at the time of maturity, to which allusion is made in the specific name." All the West Indian material accessible to me has shown the above characteristics, and I have not seen any specimens referable to typical *B. virginianum*.

### BOTRYCHIUM BRACHYSTACHYS.

In describing this species <sup>1</sup> Kunze makes the following observation:

Die Kürze der fruchtbaren Fieder, welche nur an einem von 12 untersuchten Exemplaren etwa zur Hälfte über das sterile Laub hervorragte, an allen übrigen kürzer war, ist allerdings das auffallendste Unterscheidungszeichen; möchte aber für sich *allein* nicht zur Begründung einer eigenen Art hinreichen.

From the above it is apparent that the concepts of *B. dichrosum* and *B. brachystachys* agree as to the comparative length of the fertile segment. Although the author of the latter species did not consider this character as sufficient in itself to base a species upon, nevertheless in all specimens which I have examined it appears constant, and all <sup>2</sup> except one specimen show the persistent leaf.

All the West Indian and the Central American records for the plant show that it belongs to the Temperate Zone. The Panama material collected by Mr. William R. Maxon is by far the best and the most interesting. All the specimens show the persistent sterile segment. In one (no. 675552), collected "on moist forested slopes of Cerro de Lino, above El Boquete, Chiriqui, Panama, altitude 1,300 to 1,560 meters," the fertile segment is inserted at the base of the sterile branches, measuring 20 cm. in length (the stalk included) and exceeding the sterile branches by 2 to 3 cm. only. The entire plant measures 44 cm. Another specimen (no. 675968) shows a forking fertile segment equaling in length the central branch of the sterile part, which is 22 cm. long. The entire plant measures 71 cm., while the persisting frond measures 60 cm. in length.

The most interesting of Mr. Maxon's specimens is one (no. 675988) presenting several peculiarities, as shown in plate 102. Only the upper portion of the plant was collected. The fertile segment emerges from the common stalk about 3 cm. below the branching of the sterile segment, thus proving in a measure the possibility of the condition represented in Plumier's plate. It measures 41 cm. in length, the distance from the point of insertion to the lowermost pinnæ being 17 cm. These are bipinnate and measure 17 cm. in length. The

<sup>1</sup> *Linnaea* 18: 305. 1844.

<sup>2</sup> U. S. National Herbarium nos. 826306, 830774 (Guatemala, alt. 1380-1550 meters, coll. von Türckheim); no. 830770 (Guatemala, alt. 1,800 meters, coll. J. D. Smith); and from western Panama, no. 677413, alt. 1,000-1,300 meters, coll. Pittier; nos. 675552, 675610, 675968, 675969, and 675988, alt. 1,300-1,700 meters, coll. Maxon.



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*BOTRYCHIUM CICUTARIUM* (SAVIGNY) SWARTZ.

upper portion (16 cm.), with the exception of a few pinnules, is sterile, a condition which I have never before observed. (PLATE 102.)

EXPLANATION OF PLATE 102.—A specimen collected in humid forest along the upper Caldera River, near "Camp I," Holcomb's trail, above El Boquete, Chiriqui, Panama, altitude 1,450 to 1,650 meters, March 22 to 24, 1911, by William R. Maxon, no. 5569 (U. S. Nat. Herb. 675988). Scale slightly less than  $\frac{1}{2}$ .

Mr. C. G. Pringle collected a specimen<sup>1</sup> of nearly typical *B. virginianum* in the State of Hidalgo, Mexico. In this plant the fertile segment (including the stalk) is 31 cm. long, while the middle branch of the sterile segment is only half as long, a condition normal (at least in older plants) in typical *virginianum*. There is no trace of a persisting sterile leaf.

The South American and Old World material in our collections in Washington is too scant and fragmentary to permit much discussion. In one specimen<sup>2</sup> from Ecuador, however, the fertile segment is inserted about 1 cm. below the lowermost sterile pinnæ, and in another specimen on the same sheet the position of the fertile segment is normal. A further discussion of extra-North American plants belongs properly to botanists who are able to avail themselves of collections rich in European and Asiatic material and to those who have had the opportunity to botanize in South America.

### CONCLUSION.

The foregoing review of North American material seems to justify the recognition of two species, which may be distinguished as follows:

Plants with persistent leaves and with fertile segments equaling or somewhat exceeding the sterile segment.

*Botrychium cicutarium* (Savigny) Swartz, Syn. Fil. 171. 1806.

*Osmunda cicutaria* Savigny in Lam. Encycl. 4: 650. 1797.

*Botrychium virginicum*  $\beta$  *mexicanum* Hook. Bot. Misc. 3: 223. 1833.

*Botrychium brachystachys* Kunze, Linnaea 18: 305. 1844.

*Botrychium dichrosum* Underw. Bull. Torrey Club 30: 45. 1903.

Plants without persistent leaves and with long-exserted sporophyll (in older plants).

*Botrychium virginianum* (L.) Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 111. 1801.

*Osmunda virginiana* L. Sp. Pl. 1064. 1753.

*Botrychium gracile* Pursh, Fl. Amer. Sept. 656. 1814.

The excellent material collected by Mr. Maxon gives us a good insight into the very variable *B. virginianum* group and helps us to distinguish the two forms proposed by botanists long ago. It would save much confusion and add much to the credit of botany if only such material could be considered in plant descriptions.

<sup>1</sup> U. S. Nat. Herb. no. 461872.

<sup>2</sup> U. S. Nat. Herb. no. 50754.

# SPHENOCLEA ZEYLANICA AND CAPERONIA PALUSTRIS IN THE SOUTHERN UNITED STATES.

By IVAR TIDESTROM.

## SPHENOCLEA ZEYLANICA.

In 1903, a plant was sent to the United States Department of Agriculture for determination from Gueydan, Louisiana, with the intimation that it was a threatening weed in rice fields. It proved to be *Sphenoclea zeylanica* Gaert. and since then has been reported from time to time.

This species was described under its native name, "pongati," and also illustrated by Rheede<sup>1</sup> as early as 1692 and the illustration alone is almost sufficient for the identification of the plant. Adanson<sup>2</sup> mentions it under this vernacular name, citing at the same time the figure by Rheede. In 1788, Gaertner<sup>3</sup> diagnosed the genus and gave a description of the only species under the name here accepted. The illustration by Gaertner shows a pentamerous flower and an ovary with 2 cells and a central placenta. The vernacular name "tembulwaenna" is also given. Jussieu<sup>4</sup> characterized the genus the following year under the name "Pongatium." This author cites Rheede's figure. He places the genus among *Plantae incertae sedis* and in addition to the generic diagnosis he observes as follows:

"Herba aquatica (*Rheede Mal. II. t. 24*); folia alterna; flores dense spicati terminales; horum tubus staminifer mox deciduus. Character ex sicco. Habitus Phytolaccae junioris. An affinis Samolo p. 97, aut Portulacaeis?"

In 1790, Loureiro<sup>5</sup> diagnosed the genus *Rapinia* and described one species, *R. herbacea*, which has been referred by nearly all the great authors to *Sphenoclea zeylanica*. Loureiro evidently referred the bract and two bractlets which subtend the flowers to the calyx, hence his diagnosis of the calyx: "Perianthium 8-partitum, inferum: laciniis subrotundis, concavis: bino ordine, exteriori brevior." In all other respects the account given of *Rapinia* agrees well with the characters of *Sphenoclea*. Loureiro appears to have been the first to notice the flowers, for he placed the plant in the class Pentandria and in the order Monogynia of Linnæus's simple, provisional, but very excellent method for determining plants.

In 1791, Retzius<sup>6</sup> described the plant under the name *Gaertnera pangati*. He distinguished the subtending bracts, which he describes

<sup>1</sup> Hort. Malabar. 11: 47. pl. 24.

<sup>2</sup> Hist. Nat. Sénég. 83. 1757.

<sup>3</sup> Fruct. & Sem. 1: 113. pl. 24. f. 5.

<sup>4</sup> Gen. Pl. 423. 1789.

<sup>5</sup> Fl. Cochinch. 1: 127. 1790.

<sup>6</sup> Obs. Bot. 6: 24. 1791.

as "spatulate and distinct," from the inferior 5-lobed calyx. Martius<sup>1</sup> placed the genus in an order Sphenocleaceae by itself, but just preceding the Campanulaceae. Lindley<sup>2</sup> made a suborder Sphenocleaceae, but expressing a doubt as follows:

"This remarkable plant is very much like a campanulaceous genus in structure; but its exalbuminous seeds, the absence of collecting hairs from its styles, and the round sessile anthers, seem to indicate the type of a different order; and the peculiar habit of the only known species seems to confirm the propriety of the separation."

An excellent account of the species has been given by Wight.<sup>3</sup> In his work we find a series of illustrations from the unopened flower to the characteristic spongy, pendulous placenta, the small, oblong seed 0.5 mm. long, and the minute embryo. Figure 10 of plate 138 shows the capsule after the dehiscence has taken place. In specimens at hand this feature is very conspicuous and the remains of the capsule as well as of the placenta can be seen almost with the naked eye. Both Gaertner and Retzius had noted the circumscissile capsule.

The following is a description of the species:

*Sphenoclea zeylanica* Gaert. Fruct. & Sem. 1: 113. pl. 24. f. 5. 1788; Schoenl. in Engl. & Prantl, Pflanzenfam. 4<sup>5</sup>: 61. 1889.

*Pongati* Rheede, Hort. Malabar. 11: 47. pl. 24. 1692; Adans. Hist. Nat. Sénég. 83. 1757.

*Rapinia herbacea* Lour. Fl. Cochinch. 1: 127. 1790.

*Gaertnera pangati* Retz. Obs. Bot. 6: 24. 1791.

*Pongatium indicum* Lam. Tabl. Encycl. 1: 444. 1791.

*Sphenoclea pongatium* DC. Prodr. 7: 548. 1839; Wight, Illustr. Ind. Bot. 2: 115. pl. 138. 1850.

*Pongati zeylanica* Kuntze, Rev. Gen. Pl. 2: 381. 1891.

Herbaceous plant 1 meter high or more; stem branching, from a thick cluster of roots, 1.5 cm. in diameter at the base; leaves mostly oblanceolate, thin, light green, 9 cm. in length or less, tapering to a petiole 1 cm. long; flowers in terminal spikes, 3 to 6 cm. long, the flower subtended by one bract and 2 bractlets (?), these broad, rhombic towards the apex; calyx 5-cleft, the lobes rounded, persistent and inclosing the mature fruit; corolla minute, whitish, 5-lobed; stamens 5, sessile in the sinuses with the corolla lobes alternating; anthers 2-locular, round, dehiscing longitudinally; ovary 2-celled, the style short, the stigmas 2; ovules very numerous on a spongy, central placenta; mature capsule circumscissile, about 3 mm. in diameter; seed oblong, minute, of a light brown color.

The following North American specimens have been examined:

LOUISIANA: Gueydan (in the rice fields), *Pipes*; Crowley, *Aldrich*; southwest Louisiana, *Dodson*; Markville, *W. L. McAtee*.

I have also seen specimens from the Lower Orinoco, collected by Doctor Rusby and from Porto Rico, collected by Heller, by Underwood and Griggs, and by Sintenis.

Recent authors do not seem to have taken cognizance of this weed, although it was already established in Louisiana and other Southern States in Doctor Gray's time. This author gave an account of the plant in the Synoptical Flora of North America.<sup>4</sup>

<sup>1</sup> Consp. Regn. Veg. 31. 1835.

<sup>2</sup> Nat. Syst. ed. 2. 238. 1836.

<sup>3</sup> Illustr. Ind. Bot. 2: 115. pl. 138. 1850.

<sup>4</sup> 2<sup>1</sup>: 10. 1886.





CAPERONIA PALUSTRIS ST. HIL.

## CAPERONIA PALUSTRIS.

*Caperonia palustris* is another plant which has not been noticed very often, but in this country it appears to be of recent introduction. It was described and illustrated by Martyn<sup>1</sup> prior to 1737 (probably in 1735 or 1736). Seeds were introduced into England in 1731, when they were sent to the Chelsea Garden by Houstoun. Its first mention in literature, therefore, precedes the appearance of Linnæus's *Hortus Cliffortianus* (1737). Martyn's description is sufficient for the identification of the plant; his illustration of it is unmistakably the species in question. The description given by Martyn reads:

"*Ricinoides palustre*, foliis oblongis serratis; fructu hispido. Houstoun.

"Caulis huic viridis, pilis albicantibus hirsutus, striatus, concavus, foliis vestitus oblongis, serratis, quatuor uncias longis, tres uncias latis, & nervis donatis conspicuis, a costa media ad latera tendentibus, & in serris foliorum singulis desinentibus. Ex alis foliorum prodeunt pediculi, Flores masculinos longa serie gestantes, exiguos pentapetalos, candidos; infra quos conspiciuntur foemininii, quibus succedunt Fructus hispidi."

The plate is reproduced herewith to illustrate the excellent work which was done in the dawn of modern botany. According to recent authors<sup>2</sup> the species appears to inhabit Cuba, Haiti, Guadeloupe, Martinique, the territory from Mexico to Guiana, and tropical Africa. Its characters may be given as follows:

*Caperonia palustris* St. Hil. Hist. Pl. Brés. 245. 1824.

PLATE 103.

*Ricinoides palustre*, foliis oblongis serratis fructu hispido. Mart. Hist. Pl. Rar. 173. pl. 38. 1728; DC. Prodr. 15<sup>2</sup>: 755. 1866.

*Croton palustre* L. Sp. Pl. 1004. 1753.

*Caperonia castanaefolia* auct., not St. Hil. loc. cit.

*Androphoranthus glandulosus* Karst. Fl. Columb. 2: 15. pl. 101. 1862.

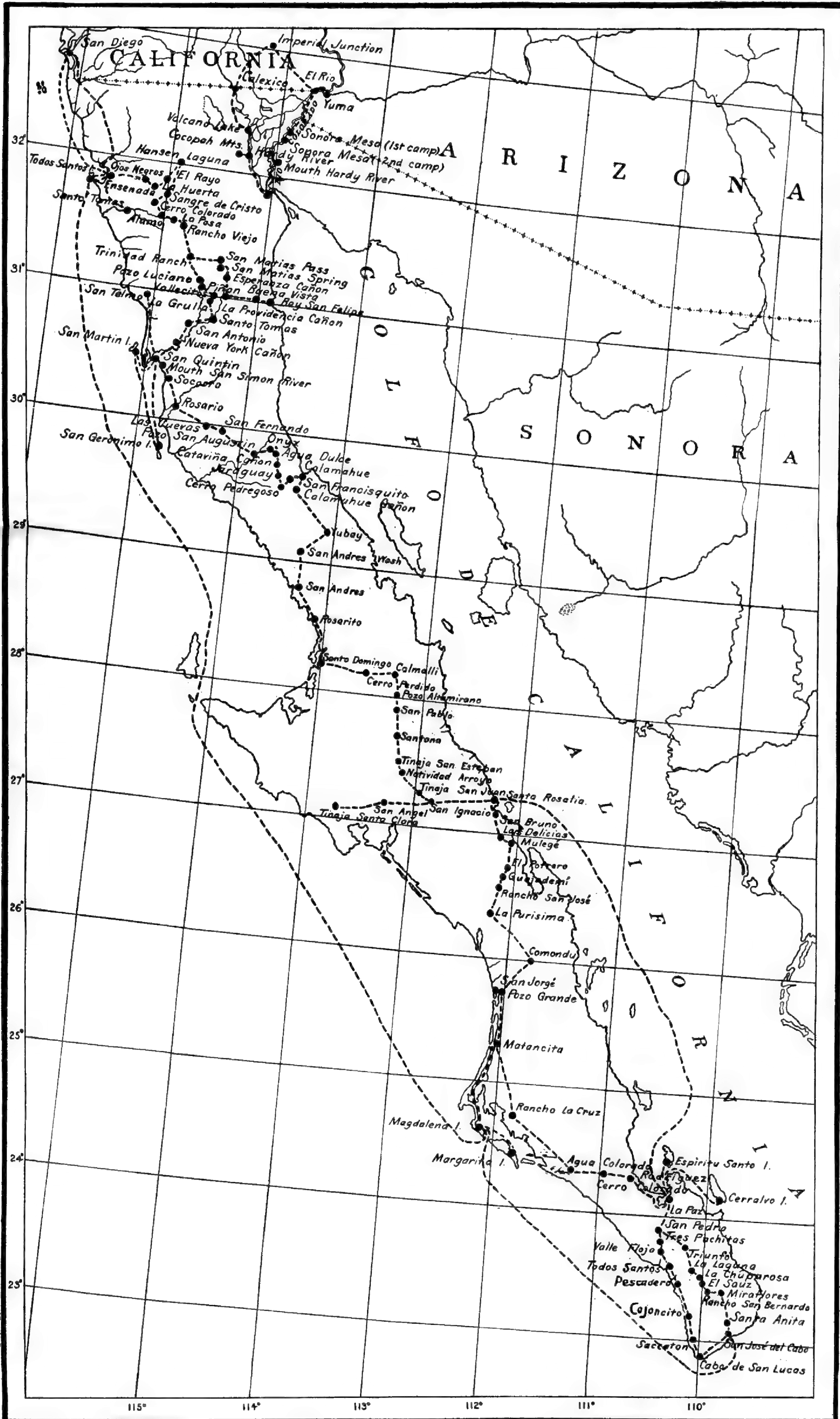
Plants annual, monœcious, of a light green aspect, about 50 cm. high; stem branching, striate, more or less beset with whitish acicular hairs; leaves on petioles 1 cm. or more in length, varying in outline from oval to linear-lanceolate, prominently nerved, sharply serrate or serrulate, the blades sometimes 15 cm. in length, sparingly pilose; peduncles pubescent, sometimes glandular, axillary, about 10 cm. in length; flowers remotely spicate, the staminate uppermost, bracted; bracts ovate, about 1 mm. long; staminate flowers minute; sepals 5, ovate-acute, 2 mm. long; petals obovate, clawed, slightly exceeding the calyx; stamens 10 or less in number, included; pistillate flowers somewhat larger; calyx cleft nearly to the base; lobes unequal, glandular-ciliate; petals minute or none; ovary sessile, 3-locular; styles short, cleft into numerous filiform lobes; mature capsule hispid with glandular hairs, 1 cm. or less in diameter; seeds subglobose (1 in each cell), about 3 mm. in diameter, minutely alveolate, of a light brown color.

The only North American specimens seen are from Gueydan, Louisiana.

EXPLANATION OF PLATE 103.—Reproduction of Martyn's plate 38, as cited.

<sup>1</sup> Hist. Pl. Rar. 38. pl. 38. The title page of Martyn's work bears the date of 1728, the time when the first fascicle was published.

<sup>2</sup> Urban, Symb. Antill. 4: 344. 1903.



MAP OF LOWER CALIFORNIA, SHOWING THE ROUTE OF THE EXPEDITION.

# PLANT RECORDS OF AN EXPEDITION TO LOWER CALIFORNIA.

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By EDWARD A. GOLDMAN.

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## INTRODUCTION.

The list which is here published is based on a collection of plants made by Mr. E. W. Nelson and the author in the course of general exploration in the service of the Bureau of Biological Survey of the United States Department of Agriculture. The expedition upon which the collection was obtained occupied the period from April, 1905, to February, 1906, during which the entire length of Lower California was traversed. Lack of time and of transportation facilities limited our collection to the more conspicuous and important species, mainly trees and shrubs. Herbarium specimens gathered by others and published records have been used to some extent, but no effort has been made to complete the list of Peninsular species, which would necessarily be very long, owing to diversified conditions of climate and topography. The larger and economically more important native species are included as far as possible, the entries being accompanied by data of collection and distribution.

Although botanical collecting in Lower California began with the visit of H. M. S. *Sulphur* in 1839, comparatively little was known of the flora of the Peninsula until Dr. Edward Palmer visited the coast in 1887. T. S. Brandegee, landing at Magdalena Bay two years later, took up the work and prosecuted it at intervals in the field and in the herbarium during more than 13 years, greatly advancing our knowledge of the Peninsula flora, especially of the interior. The investigations of the various collectors have been largely restricted to particular areas which, owing to accessibility, have been repeatedly revisited, while much of the mountainous interior, especially of the central section, remains entirely unknown. The work of Brandegee was centered in the Cape District from Magdalena Bay southward, including the Victoria Mountains, but he made an overland journey from Magdalena Bay to San Quintín and visited the high mountains of the northern part of the Peninsula. The other principal collectors—R. B. Hinds, of H. M. S. *Sulphur*; L. J. Xantus, Dr. J. A. Veatch,

Dr. Edward Palmer, Lieut. C. F. Pond, and Dr. J. N. Rose—have confined their attention mainly to the coasts. Several important mountain ranges along the backbone of the Peninsula—the Sierra de Calamahué, Sierra de Santa Lucía, Sierra de San Francisco, and the Sierra de la Giganta—remain unexplored, and they doubtless bear on their upper slopes many new and interesting plants. New light on distribution is also to be expected, as a number of species now known only from near the summits of the Victoria Mountains will probably be found to range farther north in the Sierra de la Giganta.

Lower California was not included in the botanical treatment of Mexico in the *Biologia Centrali-Americana* and has been given no place in any general flora of North America, except the as yet incomplete North American Flora. The most important papers dealing with the flora of the Peninsula are those published by Brandegee, mainly in the Proceedings of the California Academy of Sciences and *Zoe*; by Bentham in the Botany of the Voyage of the *Sulphur*; and, as scattered articles, by Rose, Gray, Watson, Greene, and Hitchcock and Chase.

The flora of the Peninsula is readily separable into two main divisions: One, identical with that of southern California, which entering from the north occupies the northwest coast and the Sierra del Pinal and San Pedro Mártir mountain regions, comprising species which disappear rapidly to the southward, a few reappearing on the summits of the high mountains in the Cape District south of La Paz; the other, a more austral flora, derived from or related to that of the adjacent mainland coast of Mexico, occupying the entire southern part of the Peninsula except the summits of the higher mountains and extending northward in a narrowing strip east of the San Pedro Mártir Mountains. Brandegee<sup>1</sup> states that the greatest change in the flora takes place in about latitude 28°. While a rough division may be made in the vicinity of this parallel, many austral species reach much farther northward along the coast of the Gulf of California.

The region as a whole is of unusual interest, owing in part to its configuration and to the inclusion within its borders of these widely differing floral areas. The higher mountains are crowned by familiar appearing forests of oak and pine. In the more arid desert sections a number of species in adapting themselves to their environment have developed into monstrous forms which so prevail as to give the landscape an aspect of unreality. Several remarkable genera seem to be peculiar to the Peninsula and numerous species belonging to genera ranging widely in tropical America are here rather narrowly restricted in range.

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<sup>1</sup> Southern Extension of California Flora. *Zoe* 4: 199–210. 1893.

The subjoined list includes 3 species described in the present paper and 19 already described from material collected by this expedition:

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<b>Agave nelsoni</b> Trel. Rep. Mo. Bot. Gard. <b>22</b> : 61. <i>pl.</i> 65-67. 1911. Type from San Fernando.....	318
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For aid in the determination of species, I am especially indebted to Mr. T. S. Brandegee, the well-known authority on the botany of the region, his special field of study. Others who have given the

benefit of their knowledge of special groups are Dr. J. N. Rose, Mrs. Katherine Brandegee, Mr. Frederick V. Coville, Dr. William Trelease, Mr. George R. Shaw, Mr. Paul C. Standley, Mr. O. F. Cook, Mr. Carleton R. Ball, Dr. E. L. Greene, and Miss Alice Eastwood.

### ANNOTATED LIST OF SPECIES.

#### ROCCELLACEAE. Orchilla Family.

*Rocella* sp.

ORCHILLA.

The native name of this lichen is "orchilla." It was formerly the source of a large and profitable industry in the vicinity of Magdalena Bay, on the west coast of the Peninsula. It was shipped to England, where from the raw material fast dyes of several colors were extracted. When cheaper aniline dyes came into general use, however, the business became unprofitable. A recent demand for vegetable dyes may result in a revival of the industry. The plant seems to be confined mainly to a narrow strip of shore line, extending from near Magdalena Bay north for about 150 miles. Orchilla grows in thick drooping, mosslike fringes along the branches of desert shrubs and trees near the coast.

#### PINACEAE. Pine Family.

*Abies concolor* (Gord.) Parry.

WHITE FIR.

Occurs rather sparingly on the cooler slopes above 2,250 meters in the San Pedro Mártir Mountains. Collected at Vallecitos, July 15.

*Cupressus guadalupensis* S. Wats. (?)

GUADALUPE CYPRESS.

A single cypress tree was found by us in a notch at about 2,700 meters altitude on the crest of the San Pedro Mártir Mountains several miles east of Vallecitos, July 15, and from it a branch bearing ripe cones was collected. From near the spot, which was reached on horseback, we had a splendid view of Santa Catalina Peak, the highest of the San Pedro Mártir Mountains, across a canyon to the southeast, and at our feet the east slope of the range broke away abruptly to the desert over 2,100 meters below.

In the absence of specimens for comparison we assume ours to be the same as a species collected in the San Pedro Mártir Mountains by Townsend and Anthony, regarded by Dr. C. S. Sargent as somewhat different from the type of *guadalupensis*, but not separable from it.<sup>1</sup> It seems very unlike *C. goveniana*, a widely ranging species, which approaches the Lower California boundary, and may prove to differ from *guadalupensis*, which grows abundantly at lower elevations on the more humid, fog-enshrouded slopes of Guadalupe Island.

*Juniperus californica* Carr.

CALIFORNIA JUNIPER. CEDRO.

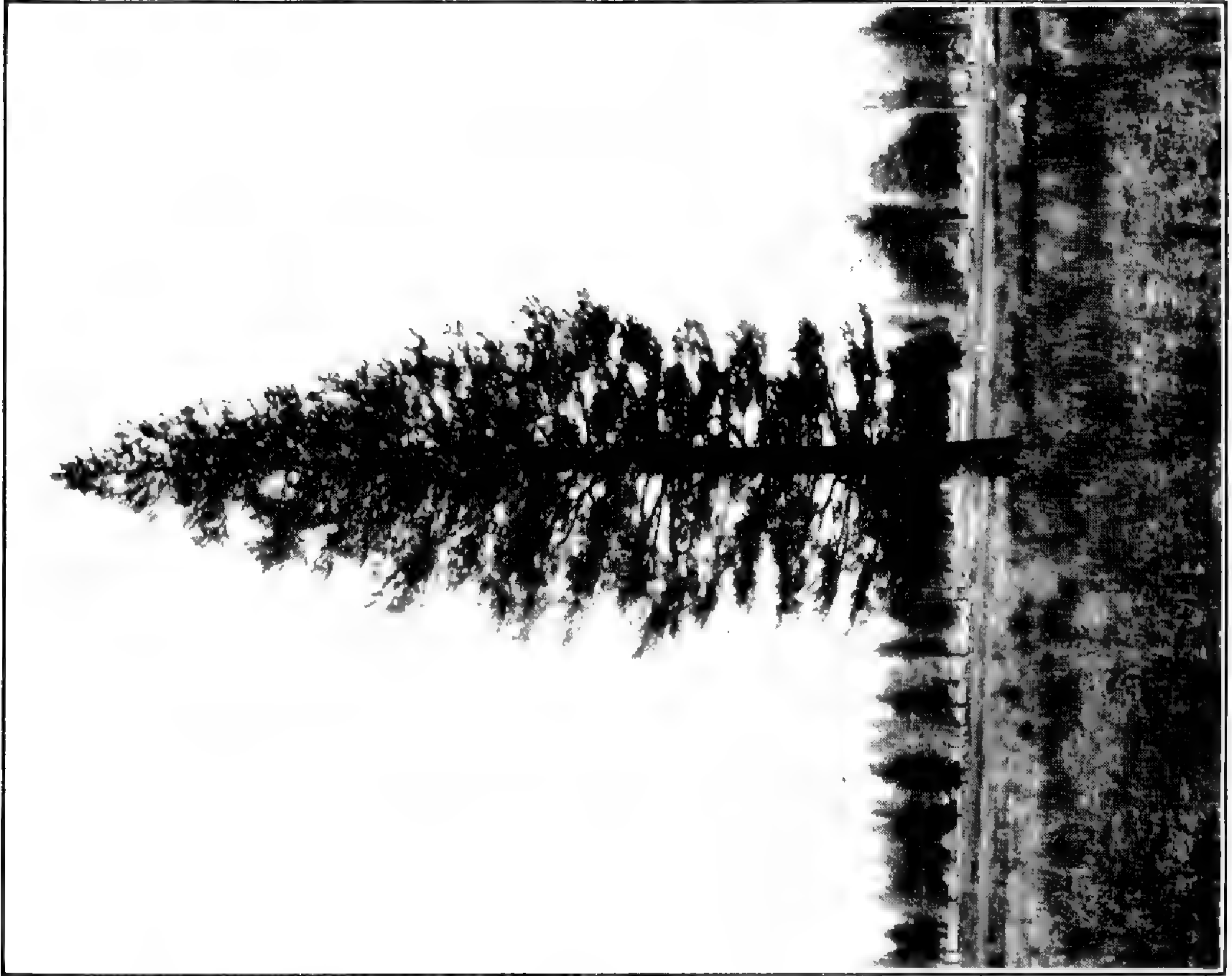
Abundant over many slopes along our route, beginning at about 450 meters altitude a few miles east of Ensenada, thence up through San Rafael Valley to the summit of the Sierra del Pinal. It was also noted near El Alamo and in Trinidad Valley, and farther south at 990 meters along the road from Rancho Santo Tomás to San Antonio, on the west slope of the San Pedro Mártir Mountains. A specimen in fruit was collected east of Ensenada, May 31. Brandegee records the species as far south on the peninsula as Agua Dulce.

Specimens in the U. S. National Herbarium taken on Cedros Island by Dr. Edward Palmer and by A. W. Anthony, determined as *Juniperus cedrosiana* Kellogg,

<sup>1</sup> Proc. Calif. Acad. II. 2: 216. 1889.



A. *LIBOCEDRUS DECURRENS* TORR., SAN PEDRO MÁRTIR MOUNTAINS.



B. *PINUS CONTORTA* DOUGL., SAN PEDRO MÁRTIR MOUNTAINS.





A. *PINUS JEFFREYI* OREG. COM., SAN PEDRO MÁRTIR MOUNTAINS.



B. *PINUS LAMBERTIANA* DOUGL. AND *P. JEFFREYI*, SAN PEDRO MÁRTIR MOUNTAINS.

appear like herbarium specimens of *J. californica*. Dr. J. A. Veatch, the collector of the type material of *J. cedrosiana*, says:<sup>1</sup> "This juniper grows rather abundantly in some localities on Cerros [Cedros] Island. It is found most abundant about the middle of the island, on the eastern side, in deep ravines, usually at an elevation of 600 or 700 feet above the sea."

It is worthy of note that in the remarks accompanying the original description of *J. cedrosiana* mention is made of specimens previously collected by Doctor Veatch in the hills along the west side of the San Joaquin Valley in California and supposed to represent the same species. This supposition seems confirmed by later investigations. The name "Cedros" usually applied to the island seems to be derived from the Spanish word "cedro," commonly used by the Mexicans as the name for trees of this group.

**Libocedrus decurrens Torr.**

INCENSE CEDAR. PLATE 104, A.

Moderately common, mainly on the cooler slopes at 2,100 to 2,400 meters altitude near La Grulla and Vallecitos in the San Pedro Mártir Mountains. A specimen with immature fruit was taken at La Grulla, July 20. It also occurs sparingly on the Sierra del Pinal.

**Pinus jeffreyi Oreg. Com.**

JEFFREY YELLOW PINE. PLATE 105, A, B.

Pines of the *ponderosa* type grow as a more or less continuous forest in the Transition Zone along the western side of the Pinal and San Pedro Mártir Mountains, extending from varying elevations between 1,200 and 1,800 meters (this lower limit depending on moisture and slope exposure), up to the summit of the range. In spite of poor soil these pines grow in places to large size and are by far the most important forest trees of the region. Some timber has been sawed in the Sierra del Pinal, but the rugged character of the San Pedro Mártir Mountains makes lumbering operations difficult. Having the somewhat uncertain status of *jeffreyi* in mind, we were anxious to discover whether more than one pine of the *ponderosa* type occurs in these mountains. cursory examination in the field seemed to show a wide range of variation irrespective of altitude and we came to no satisfactory conclusion, possibly because we were unaware of some of the distinguishing characteristics of the two forms. We found trees with large and with small cones standing in close proximity and by this character alone easily separable. But other trees were seen with cones so nearly intermediate in size that we abandoned this character as unreliable. A study of these pines may demonstrate the occurrence of two forms, as in southern California. Our specimens collected at Vallecitos were referred to *jeffreyi* by George R. Shaw.

**Pinus lambertiana Dougl.**

SUGAR PINE. PLATE 105, B.

The sugar pine, like the lodgepole pine, is known from Mexico only in the San Pedro Mártir Mountains. It was noted by us in the upper part of the Transition Zone, mainly on northern exposures above 2,250 meters, near La Grulla and Vallecitos, and thence upward to near the summit of the range. It occurs rather sparingly and is associated here with the yellow pine and white fir. A specimen taken at Vallecitos was determined for us by Mr. Shaw.

**Pinus coulteri Lambert.**

COULTER PINE.

This pine occurs mixed with the Jeffrey yellow pine on the top of the Sierra del Pinal. It is not known from the San Pedro Mártir Mountains.

**Pinus cembroides Zucc.**

MEXICAN PINYON.

The pinyons, or nut pines, are restricted in Lower California to the higher mountains in the northern and extreme southern parts of the Peninsula. According to

<sup>1</sup> Hesperian 4: 4. 1860.

the determinations of Mr. Shaw, typical *P. cembroides* is widely distributed on the Mexican mainland, but is known on the Peninsula only from the Sierra de la Laguna,<sup>1</sup> which it therefore must have reached from the opposite side of the Gulf of California. In these mountains we found it growing abundantly in the Upper Sonoran Zone above about 1,500 meters elevation, usually taking the form of a much branched, widely spreading tree 9 to 18 meters in height and 30 to 60 cm. in diameter at base. A specimen was taken at La Laguna, near the summit of the mountains, January 26. The species had previously been collected by Brandegee in the same vicinity.

*Pinus edulis* Engelm.

PINYON.

A nut pine collected by us at 1,800 meters altitude near Rancho Santo Tomás, on the west slope of the San Pedro Mártir mountains has been referred by Mr. Shaw to *edulis*.

*Pinus quadrifolia* Parl.

PARRY PINYON.

This is the abundant species of pinyon on the western and northern slopes of the San Pedro Mártir mountains and extends southward along the Rosarito Divide to the cliffs about Matomi, the extreme southern limit of the conifers in this range. On the northwestern basal slopes of the San Pedro Mártir mountains and outlying foothills considerable forests of these pinyons occur. This is the main nut pine of the Indians, one of whose old camp sites we found at Piñón.

The distribution of the pinyons, or nut pines, in northern Lower California is imperfectly known. Whether two or more forms occur together or have separate and well-defined ranges was not determined by us. The pinyon taken at Hanson Laguna has been referred by Mr. Shaw to *P. parryana*. None were seen in the coast region near Ensenada, but on the Sierra del Pinal they form a scattered growth over the western slopes above about 1,620 meters altitude and down to 1,350 meters on the east slope. A few were also seen on the rocky, rolling plains 15 miles east of El Alamo and at San Matías Spring. Pinyons were noted at a number of localities along the western side of the San Pedro Mártir mountains, where they apparently extend rather sparingly in a horizontal belt, reaching from about 990 to 1,500 meters (depending upon the slope exposure) and up to about 1,950 meters along the open ridges. They extend through San Matías Pass and along the north side of Windy Canyon; on the east slope of the mountains a few were noted as low as 900 meters altitude. From this low elevation on the east side a few scattering individuals range up to 2,700 meters on the warm, dry slopes facing the Gulf of California and unaffected by the cooler, more humid climate of the west slope.

*Pinus monophylla* Torr. & Frem.

SINGLE-LEAF PINYON.

Edmund Heller reported this from the east slope of the Sierra del Pinal, east of Laguna Hanson, below 1,350 meters. Further work will probably show that it has a much more extended range in this region.

*Pinus contorta* Dougl.

LONGPOLE PINE. PLATE 104, B.

Not known to occur in Mexico except on the upper slopes of the San Pedro Mártir mountains. It grows on the western side above about 2,400 meters altitude and is one of the few forest trees representing the Canadian Zone in these mountains. At Vallecitos, where specimens were taken, we found it the most common pine bordering open-mountain meadows. On the rough slopes it is associated with the yellow pine. The tree attains a height here of 22 to 30 meters or more, with straight stem

<sup>1</sup> Sierra de la Laguna is the name of the high northern section of the Victoria Mountains.

and rather long, narrow, tapering crown. This is the pine which has commonly passed under the name *murrayana*, but late authors, such as Sudworth<sup>1</sup> and Shaw<sup>2</sup> apply the name *contorta*.

### GNETACEAE. Joint-fir Family.

#### *Ephedra californica* S. Wats.

Abundant near the Pacific coast at Ensenada, in San Rafael and Trinidad valleys, and up along sandy arroyos on the warmer slopes to about 1,560 meters on the west side of the Pinal and San Pedro Mártir mountains. Over parts of the bottoms of San Rafael and Trinidad valleys it is the principal shrub. Specimens were obtained in flower at Ensenada, February 28, in fruit at La Huerta, June 2, and lacking flowers or fruit in Trinidad Valley, July 4. This species appears to occupy the Pacific slope of the San Pedro Mártir mountain region, while *E. trifurca* extends southward in the delta of the Colorado River.

#### *Ephedra trifurca* Torr.

Noted near Volcano Lake, along the basal slopes of the Cocopah mountains, and at other localities on the Colorado Desert. Plants of the genus were seen along much of our route through the desert as far south in the Peninsula as Rosarito, but as no specimens were obtained south of the San Pedro Mártir mountain region the specific identity of the southern plants is uncertain. It seems probable, however, that *trifurca* extends for a considerable distance southward along the Gulf of California, leaving the mountain slopes, especially on the Pacific side, occupied by *E. californica*.

### POACEAE. Grass Family.

#### *Conchrus palmeri* Vasey.

HUITSAPOL GORDO.

The "huitsapol gordo," as it is known, at least in the vicinity of Matancita, is a burgrass growing abundantly on sandy deserts nearly throughout the Peninsula. The large, well armed burs of this species place it in the long list of desert plants to be avoided. Specimens with fully grown and ripening burs were taken at San Felipe on the Gulf of California, June 20, and with partly grown burs along the road from Santo Domingo to Matancita near the Pacific coast, November 15.

### PHOENICACEAE. Palm Family.

#### *Cocus nucifera* L.

COCONUT PALM.

The coconut palm has been introduced in a few places in the Cape District from La Paz southward. Small groves occur at La Paz, Cape San Lucas, and San José del Cabo.

#### *Erythea brandegeei* Purpus.

BRANDEGEE PALM.

This is the tall species growing abundantly, especially in the canyons, on the middle and upper slopes of the Sierra de la Laguna, south of La Paz, where it is often associated with *Populus monticola*. Brandegee states that the leaves generally fall away, leaving hard, smooth trunks which may reach a height of 37 meters, though less than 60 cm. in diameter at the base, and which, lacking the stiffness of other species of the genus, wave with the wind.

<sup>1</sup> For. Trees Pac. Slope 49. 1908.

<sup>2</sup> Publ. Arn. Arb. 1:29. 1909.

**Glaucothea armata** (S. Wats.) Cook.

BLUE PALM. PLATES 106, 107, A.

Brandege states that this species is abundant in northern Lower California, growing in canyons or along the sandy bottoms of dry streams in the foothills on both eastern and western slopes of the mountains. He records it from "San Esteban and northward." A blue-leaved palm collected at Yubay may be referable to *armata*. The palms of Lower California are very imperfectly known.

**Phoenix dactylifera** L.

DATE PALM. PLATE 107, B.

The common date palm, introduced many years ago in southern Lower California, is thriving in many places. About the towns of San Ignacio, Comandú, and San José del Cabo there are extensive groves, which produce good crops of the fruit without any care. Smaller groves grow in the moist, saline soil about some long-abandoned water holes at San Angel, in the southern part of the Vizcaino Desert, about 40 miles west of San Ignacio. At this place, in their desert setting of shifting sand dunes, the palms suggest an oasis of the Sahara.

**Washingtonia filifera** Wendl.

The palms commonly referred to the genus *Washingtonia* (or *Neowashingtonia*) are very imperfectly known. One or more species are represented at isolated localities extending in a chain, mainly along the eastern side of the Peninsula, from near the international boundary to the Cape. Several names are based on plants raised from seed of uncertain origin. According to Brandege many palms of this species now cultivated in California probably came from seed collected along the western edge of the Colorado Desert, and in Cantillas Canyon, a locality in Lower California, just below the boundary near Campo. Mr. O. F. Cook, who has devoted much study to American palms in general, suggests that *W. filifera* may have been carried by some of the early travelers from the Cape District of the Peninsula. Mr. S. B. Parish in "A contribution toward a knowledge of the genus *Washingtonia*"<sup>1</sup> arrives at no definite conclusion.

**Washingtonia gracilis** Parish.

This form was described from cultivated trees growing in San Bernardino and Riverside, California. Parish states that it is probably indigenous in northern Lower California. The characters he gives to distinguish it from *W. filifera* and its varieties are the more slender trunk and smaller, less deeply divided leaves, without filaments and on shorter petioles. In the northeastern part of the Peninsula the palms are of rather slender growth, as shown by photographs by Edmund Heller taken in Agua Caliente Canyon and by my own photographs and specimens from farther south, and if not *W. filifera* they may represent this species. In this region they grow mainly along the rocky sides of watercourses.

**Washingtonia sonorae** S. Wats.

SONORA PALM.

Under this name Brandege records the large palm which grows along the coast in parts of the Cape District from La Paz southward. On account of an apparent preference for the low elevations in the vicinity of the seashore he regards it as a more suitable species than *W. filifera* for cultivation near the coast of California. *Washingtonia sonorae* was described from specimens collected near Guaymas by Palmer, and Watson assigned to this species specimens taken by the same collector at La Paz, Lower California. Brandege suggests that the species may extend northward along the Gulf of California to the region about the mouth of the Colorado River. This seems very doubtful, as we found no palms of any kind at the localities visited on the coast near the upper end of the Gulf.

<sup>1</sup> Bot. Gaz. 44: 408-434. 1907.



GLAUCOTHEA ARMATA (S. WATS.) COOK, JARAGUÁY.



A. *GLAUCOTHEA ARMATA* (S. WATS.) COOK, CATAVIÑA CANYON.

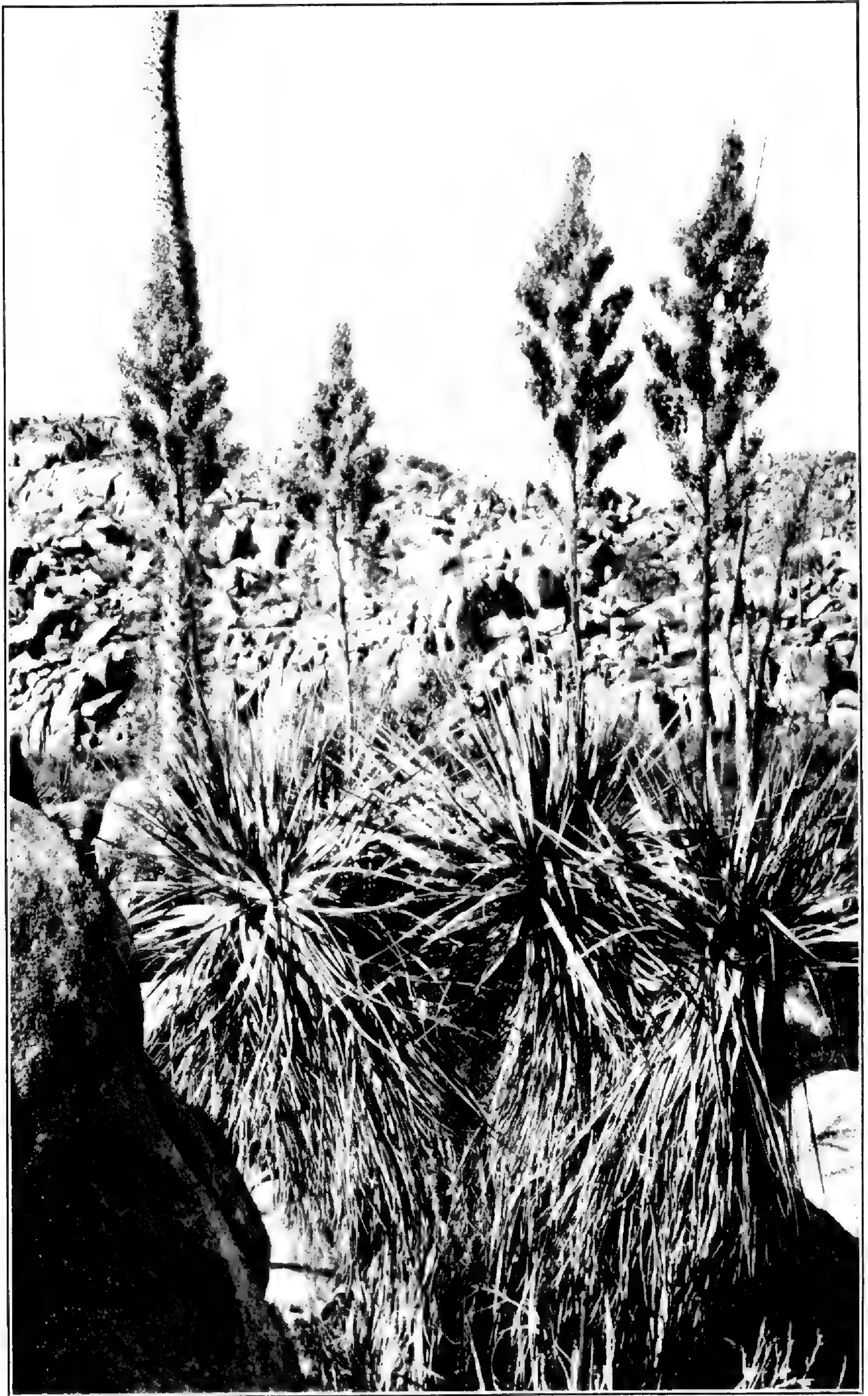


B. *PHOENIX DACTYLIFERA* L., SAN ANGEL.

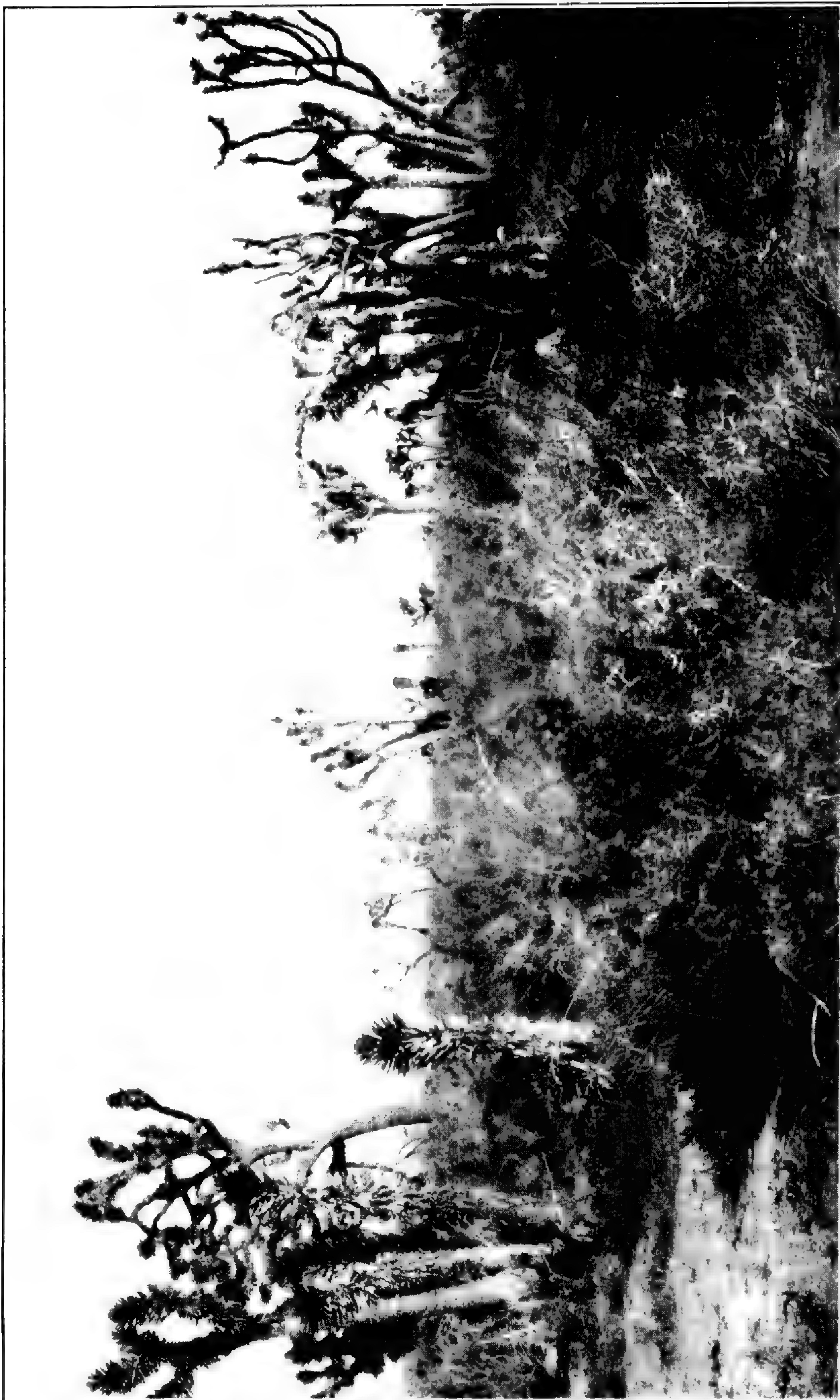


NO-LINA BELDINGI T. S. BRANDEG., SIERRA DE LA LAGUNA.





*NOLINA BIGELOVII* S. WATS., YUBAY.



YUCCA VALIDA T. S. BRANDEG., SANTA ROSALIA BAY.

**BROMELIACEAE. Pineapple Family.****Hechtia montana** T. S. Brandeg.

First noted by us at about 450 meters altitude on a mountain 5 or 6 miles southwest of El Potrero, where a fruiting specimen was taken October 31. It was afterwards seen at intervals along our route and was most abundant in places on the basal slopes of the Victoria Mountains in the Cape District south of La Paz.

**DRACAENACEAE. Yucca Family.****Hesperoyucca whipplei** (Torr.) Baker.

WHIPPLE YUCCA.

This *Yucca* is common on open slopes above about 1,440 meters altitude in the Sierra del Pinal. A few were found in flower and a specimen taken June 7, at about 1,680 meters on the west slope just below the summit of one of the higher peaks near Laguna Hanson.

Fruiting specimens of *Hesperoyucca* from Jaraguáy, 58 miles southeast of San Fernando, are doubtfully referred to this species by Trelease. In a letter he states that the leaves are broader than usual, with watered-silk marking, and that the specimens extend the known range of the genus southward from the northern part of the Peninsula. As they represent a species 2.5 to 3.5 meters high growing abundantly in an extremely arid, Lower Sonoran desert region (the character of country avoided by *whipplei* farther north), their identity with the present species would seem well questioned. A *Hesperoyucca* occurs also on the desert near San Fernando.

**Nolina beldingi** T. S. Brandeg.

BEARGRASS. PLATE 108.

Abundant in many places in the oak forest from about 1,300 meters altitude to the summit of the Sierra de la Laguna.<sup>1</sup> It is a large, conspicuous, branching species, attaining a height of 7.5 meters. At the time of our visit most of the ripe seeds had fallen, but a specimen retaining a few was taken at La Laguna, January 27.

**Nolina palmeri** S. Wats.

BEARGRASS.

The genus *Nolina* was noted in only a few places along our route. *Nolina palmeri* was abundant at about 900 meters in the canyon leading from San Matías Spring down into San Matías Pass, and above 840 meters along the open bottom and sides of Windy Canyon on the east slope of the San Pedro Mártir Mountains. It grew to a height of 3 to 3.5 meters. A specimen in flower was taken near San Matías Pass, June 28. Trelease<sup>2</sup> gives the type locality of this species as Tantillas Mountains and assigns it a range overlapping those of *N. bigelovii* and *N. beldingi deserticola*.

**Nolina bigelovii** S. Wats.

BEARGRASS. PLATE 109.

This species was noted at about 540 meters elevation on a rocky mesa near Jaraguáy, 58 miles southeast of San Fernando, where it was collected in fruit September 9. Only a few plants were seen there growing among large boulders. The leaves are about 120 cm. long and the flower stalk 1.8 to 3 meters high.

**Yucca valida** T. S. Brandeg.

TREE YUCCA. PLATE 110.

*Yuccas* were abundant at intervals along much of our route throughout the Peninsula, except in the high mountains, but too few specimens were collected to throw much light on the number or distribution of species. Specimens taken at 600 meters near Yubay and at about the same elevation on the southern slope of the Victoria Mountains have been referred to this species by Trelease. The localities represented

<sup>1</sup> See footnote, p. 314.

<sup>2</sup> The Desert Group Nolineae. Proc. Amer. Phil. Soc. 50: 420. 1911.

give *Y. valida* a range in the Peninsula from near Cape San Lucas northward to about latitude 29° 30', and it probably reaches still farther. It is a tree species, growing in the vicinity of Yubay and southward to a height of 6 to 7.5 meters, in places forming a real forest. At Yubay the fruit was ripening September 18. Brandegee, who discovered and described the species, says: "This *Yucca* is certainly distinct from *Y. baccata*<sup>1</sup> and does not seem referable to any of its Mexican varieties. It does not begin to bloom until about the middle of May, when *Y. baccata* to the north of it has already nearly mature fruit. It was observed from San Jorge to San Borgia [San Borja], and near Patrocínio formed forests miles in extent; the trees in general appearance strikingly like *Y. brevifolia*, though the trunks were much less covered with old reflexed leaves."

### AMARYLLIDACEAE. Amaryllis Family.

#### *Agave nelsoni* Trel.<sup>2</sup>

PLATE 111, D.

This *Agave*, remarkable for the shortness and breadth of its leaves, was first seen and collected in flower at San Fernando, September 4. It was noted as abundant along the road from Pozo San Agustín to Onyx and a species supposed to be the same was seen in a number of places along the backbone of the Peninsula southward to near Yubay. The leaves in this species are 25 to 30 cm. in length and overlap for about half of this distance. The leaf margins are often nearly smooth, or the thorns inconspicuous and falling off almost at a touch. The flower stem is 3 to 7.5 meters in height. Under the name *shawii* Brandegee records this species as very abundant between Rosario and San Quintín.

#### *Agave pringlei* Orcutt.

This *Agave* belongs to the pinyon and lower part of the yellow pine forest on the slopes of the Sierra del Pinal and San Pedro Mártir mountains. It is a small species with short and rather narrow leaves, the flowers in dense clusters on 10 or 12 short stalks near the top of the main stem.

#### *Agave cerulata* Trel.<sup>2</sup>

The type specimens of this *Agave* were collected in flower at about 240 meters altitude at Calmallí, and a species we took to be the same was abundant on rocky, rolling plains, and rocky slopes of hills from Calmallí south to San Ignacio. The leaves are not numerous; the flower stem averages 3 to 3.5 meters in height.

#### *Agave consociata* Trel.

We found this *Agave* rather common in places at about 1,110 meters altitude on the Alamo Plain, where it was collected June 11. The leaves were 30 to 50 in number and the flower stalks 1.8 to 3.5 meters high. The type was collected by Parish at San Felipe, California. The species seems to range southward from the basal slopes of the mountains of the southeastern part of that State to the desert mountains of northern Lower California. Trel. records specimens collected by Mearns near the international boundary in Nachoguero Valley and by MacDougal in the Cocopah Mountains.

#### *Agave promontorii* Trel.<sup>2</sup>

PLATE 111, B.

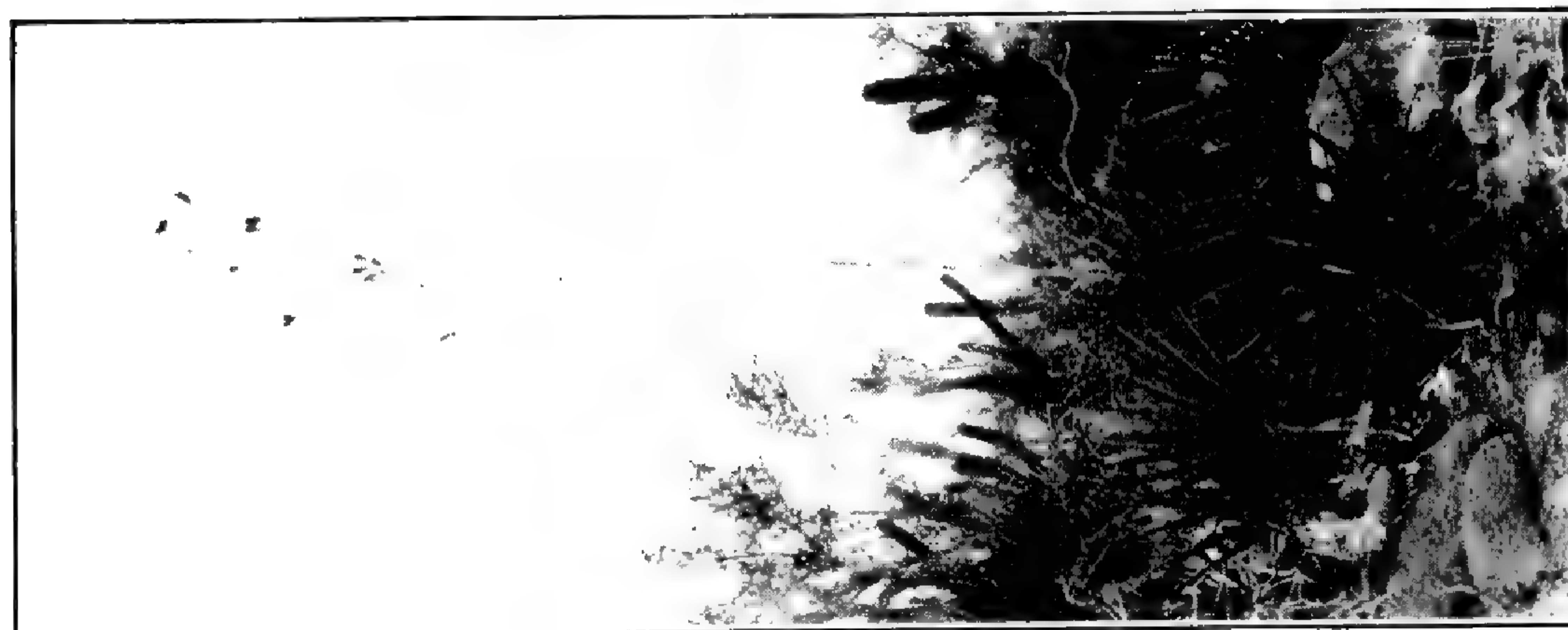
This large *Agave*, recently described, was found growing rather sparingly at 720 to 1,500 meters altitude on the warmer slopes of the Victoria Mountains, in the Cape Dis-

<sup>1</sup> The plant here referred to as *Yucca baccata* is of some other species.

<sup>2</sup> See p. 311.



D



C



B



A

FOUR SPECIES OF AGAVE: A, *A. GOLDMANIANA* TREL., SAN ANDRÉS; B, *A. PROMONTORII* TREL., SIERRA DE LA VICTORIA; C, *A. VEXANS* TREL., EL POTRERO; D, *A. NELSONI* TREL., SAN FERNANDO.

trict south of La Paz. A flowering specimen was collected along the road from San Bernardo to El Saúz, January 21. The broad leaves are about a meter in length and closely beset with stout pines. The flower stalks vary from 3.5 to 7 meters in height.

**Agave aurea** T. S. Brandeg.

We first noticed and collected this handsome Agave on the lava-capped mesa a few miles north of Comandú, where it at once attracted our attention by its large size and showy flowers. The leaves, 25 to 30 in number, are 90 to 120 cm. in length, and the flower stems range from 1.8 to 3 meters in height. It is an abundant species at 180 to 360 meters altitude in the vicinity of Comandú, but was not noted elsewhere. It is unevenly distributed, growing in patches usually a few acres in extent, where the soil is thickest or where the loose lava boulders are least numerous on the surface. At Comandú we were told that some years previously a company had been organized with a view to extracting the fiber on a commercial scale, but that the venture failed before thorough tests had been made. It seemed to us that unless the plant grows in greater abundance elsewhere than here the field for such an enterprise would be small.

**Agave vexans** Trel.<sup>1</sup>

PLATE 111, C.

Five or six miles southwest of El Potrero this recently described species grew sparingly on a steep mountain side leading up from about 300 meters altitude to 720 meters on the summit of a ridge forming here the backbone of the Peninsula. It is distinguished from the other species noted in the general region by its small size and by the slenderness of the leaves. The fruit stalks stand 1.2 to 1.8 meters high. On October 31, when our specimen was taken, the ripe seeds were falling from the capsules at every jar.

**Agave goldmaniana** Trel.<sup>1</sup>

PLATE 111, A.

This large and conspicuous species is abundant in many places along the Pacific slope of the Peninsula from near San Telmo southward to Santo Domingo. The flower stalks reach a height of 4.5 to 6 meters. The leaves, for several feet upward from the base of the stem, form a mass which appears to become top-heavy, causing the plants to assume a somewhat reclining position unlike any other Agave we had ever seen. In some sections these plants formed forests over considerable areas. The species was described from specimens with ripe fruit collected by us near Yubay, September 18.

**SALICACEAE. Willow Family.**

**Populus tremuloides** Michx.

QUAKING ASPEN.

Quaking aspens were found sparingly, mainly along north slopes in canyons above 2,100 meters altitude in the vicinity of La Grulla and Vallecitos, in the San Pedro Mártir mountains. The species belongs to the Canadian Zone, but reaches downward along cold streams well into the Transition Zone.

**Populus monticola** T. S. Brandeg.

HUIRIGO.

The cottonwood, locally known as "huirigo," is common along canyons at about 660 to 1,650 meters in the Sierra de la Laguna. It is a handsome species, growing 15 to 22 meters high and 60 to 90 cm. in diameter, the bark often smooth and white, much like that of an aspen. In the lower part of its vertical range it is associated with the tall slender palm, *Erythea brandegeei*. A specimen with leaves was collected along the road from Rancho San Bernardo to El Saúz. On the sugar plantation of

<sup>1</sup> See p. 311.

San José del Cabo loaves of raw sugar, called "panocha," are made by pouring hot sirup in molds cut in slabs of huirigo timber. This well marked species of *Populus* was described by Brandegee from the Sierra de la Laguna and is not known to occur elsewhere.

***Populus fremontii* S. Wats.**

FREMONT COTTONWOOD. ALAMO.

Rather common along arroyos at 1,350 to 1,500 meters along the boundary between the Upper Sonoran and Transition zones, near El Piñón on the northwest slope of the San Pedro Mártir mountains. *Populus trichocarpa* also was found along one stream in the vicinity; but the two species were not associated in the same situations. At San José del Cabo, where it may have been introduced, we found *P. fremontii* a common species. It grows here near sea level in the vicinity of the town and is known locally as "álamo." A specimen collected January 6 was in flower. Brandegee records the species as introduced at La Purísima and Comandú, but perhaps indigenous at San Enrique.

***Populus macdougalii* Rose.**

ALAMO. MACDOUGAL COTTONWOOD.

This species has recently been recognized and described<sup>1</sup> as distinct from the delta region of the Colorado River. The trees grow most abundantly in belts along the complicated series of ever shifting river channels. When we descended the river on the crest of the spring flood in 1905, the soft alluvial banks were being very rapidly undermined in places, involving the destruction of the cottonwood timber along the water. We often noted first a slight quivering of the topmost branches of tall trees, which then toppled and fell into the stream, one after another, and were swept away. Dense new growths of small cottonwoods, mixed with willows, spring up in old river channels which have filled and become blocked with silt.

***Populus trichocarpa* Torr. & Gray.**

BLACK COTTONWOOD.

At about 1,350 meters altitude, close along the course of a stream about 10 miles southwest of El Piñón, on the west side of the San Pedro Mártir mountains, we found this species abundant. It was not noted elsewhere. It forms here a rather small, but relatively tall, very straight tree with a long tapering spire. Compared with some specimens of *trichocarpa* from farther north the stems of this form seem more slender and the leaves smaller and more pointed. We have seen no other record of this species from Lower California.

***Salix lasiolepis* Benth.**

AHUEJOTE.

This willow was noted by us only along the banks of a small stream at 1,650 meters at La Laguna, near the summit of the Sierra de la Laguna. It appears to belong to the Upper Sonoran Zone, growing here as a tree 7.5 to 9 meters in height. The new leaves and flowers were coming out January 27, as shown by our specimen. The species is recorded by Brandegee from Rosario.

***Salix exigua* Nutt.**

SANDBAR WILLOW.

The only record obtained of this little willow was at Arroyo de León, on the northwest slope of the San Pedro Mártir Mountains. Here, at an elevation of about 900 meters, a few individuals were growing in a wet meadow along a small stream as small shrubs 1.8 to 2.5 meters high. A flowering specimen was taken July 4.

***Salix bonplandiana* Kunth.**

SAÚZ. BONPLAND WILLOW.

This willow is moderately abundant along streams in the Cape District south of La Paz at elevations varying from near sea level up to at least 450 meters on the south-

<sup>1</sup> Smiths. Misc. Coll. 61<sup>12</sup>: 1. 1913.

ern slopes of the Victoria Mountains. It forms a tree 6 to 9 meters in height. Flowering specimens were taken along the road from El Sacatón to Cape San Lucas, December 29, and between Miraflores and Rancho San Bernardo, January 20. Brandege records the species from La Purísima and La Paz.

*Salix taxifolia* H. B. K.

This handsome willow, with small, silvery gray leaves, was found sparingly in small marshy spots along a stream at about 1,050 meters along the road from Rancho San Bernardo to El Saúz on the southern slope of the Victoria Mountains in the Cape District. It grows to a height of 10 meters. The new leaves and abundant flowers were coming out January 21.

**FAGACEAE. Beech Family.**

*Quercus brandegei* Goldman, sp. nov.

BRANDEGEE OAK.

Tree 12 to 20 meters high; branches widely spreading, slender, and somewhat drooping toward ends; leaves persistent through winter, the blades 40 to 65 mm. long, 13 to 18 mm. broad, elliptical, normally acute at apex and cuneate at base, but sometimes slightly rounded at one or both ends, usually entire, but occasionally with 1 to 6 short, irregularly distributed, spiny teeth, short-petioled, glabrous above, scurfy or slightly roughened beneath; fruits single or several on peduncles 14 to 34 mm. long; acorns fusiform, 30 to 37 mm. long, 9 to 10 mm. in diameter, attenuate toward the apex, inclosed in a cup for one-fourth or less of their total length; cups deeply turbinate, 11 to 13 mm. high, the scales small, acute, grayish-tomentose, becoming brownish and appressed at tips.

Type in the U. S. National Herbarium, no. 565544, collected at Rancho El Paraíso, 18 miles southwest of El Triunfo, at northwest base of the Victoria Mountains, Lower California, altitude about 540 meters, January 30, 1906, by E. W. Nelson and E. A. Goldman (no. 7475).

This oak evidently belongs to the *Q. virginiana* group and seems most like Small's *Q. fusiformis* from Texas. The leaves are very similar, but the acorns present an extreme development of the tendency toward elongation and attenuation shown in *fusiformis*. After leaving the San Pedro Mártir Mountains we saw no oaks until we entered the Victoria Mountains in the Cape District, where three species are apparently isolated from their congeners to the north by several hundred miles of intervening desert. *Q. brandegei* was first noted at about 150 to 450 meters near Miraflores and later at about 540 meters near Rancho El Paraíso at the northwest base of the Victoria Mountains on our way to El Triunfo. It is a handsome species, growing scattered along alluvial valley bottoms, the slender, drooping branches in places gracefully overhanging the arroyos and roads. At the time of our visit most of the acorns had very recently fallen, many of the empty cups still remaining in place. The ground under some trees was fairly covered with shell fragments left where small rodents had been at work. The species is named for Mr. T. S. Brandege, who collected flowering specimens at Miraflores, March 21, 1892.

*Quercus idonea* Goldman, sp. nov.

ENCINO ROBLE.

Tree 8 to 10 meters high, the branches rather stout, moderately spreading, forming a symmetrical rounded top; leaves persistent through winter, the blades 85 to 115 mm. long, 40 to 50 mm. in greatest width, oblong, acute or slightly obtuse or somewhat rounded at base, entire or irregularly sinuous and spinescent, with rather short tomentose petioles, deep green and shining above, beneath duller and paler, with scattered stellate hairs; fruit sessile or with short peduncles; acorns ovoid, rather narrow at base, acute at apex, 20 to 25 mm. long, 8 to 10 mm. in diameter, inclosed



in cups for about one-third their total length; involucre deep cup-shaped, 9 to 11 mm. high, the scales hoary-tomentose, roughened or tuberculate on outer surface.

Type in the U. S. National Herbarium, no. 565500, collected near Rancho San Bernardo, 13 miles west of Miraflores on the eastern slope of Victoria Mountains, Lower California, altitude about 600 meters, January 20, 1906, by E. W. Nelson and E. A. Goldman (no. 7423).

This oak is similar to *Quercus glaucoides* Mart. & Gal., from Oaxaca, but the acorns are more elongate, the cup scales thicker, more tuberculate, and less acuminate at the tips; the leaves have longer, more densely tomentose petioles (leaves nearly sessile and smooth in *glaucoides*), and their lower surfaces are stellate-hairy (glabrous in *glaucoides*).

On the lower slopes of the Victoria Mountains, mainly on the east side, this oak grows abundantly and is generally distributed at about 600 to 900 meters altitude. It is overlapped by the "encino negro" (*Q. devia*), which gradually becomes the dominant species, especially on north slopes, and replaces it entirely in the Upper Sonoran Zone above about 1,500 meters on the south side of the Sierra de la Laguna. At the time of our visit the ripe acorns had recently fallen in abundance, but a few still remained in the cups.

**Quercus devia** Goldman, sp. nov.

ENCINO NEGRO.

Tree 20 meters high, the branches mainly upright and tending to form a cone-shaped top; leaves persistent through winter, the blades 60 to 100 mm. long, 15 to 31 mm. broad, elliptical, acute or cuspidate at apex, usually rounded or cordate at base, entire for one-third to one-half their length, becoming sinuate-dentate, with slender, rigid spinose points along terminal portion, short-petioled, thinly pubescent with scattered short stellate hairs and bearing longer tufts of stellate pubescence on midrib near base and in angle between midrib and revolute margin; acorns small, 15 to 17 mm. long, 7.6 to 8.4 mm. in diameter, rather narrow and rounded at base, tapering and acute at apex, set in shallow cups for less than one-fourth their length; cups saucer-shaped, about 4.5 mm. high, the scales thin, acute, grayish-tomentose, margined with reddish brown.

Type in the U. S. National Herbarium, no. 565525, collected near La Chuparosa, a spring at about 1,500 meters altitude in the Sierra de la Laguna, Lower California, January 23, 1906, by E. W. Nelson and E. A. Goldman (no. 7454).

The leaves of this species superficially resemble those of *Quercus acutifolia* Née, but are shorter petioled, the blades more rounded and wedge-shaped at the base, with pubescence less generally distributed over the lower surface. The fruit somewhat resembles that of *Q. phellos*, but the acorns are larger, more slender, and less expanded near the base, and the leaves are so widely different that the two are evidently not closely allied. *Q. devia* ranges upward from about 1,050 meters on the south slope of the mountains to the summits at about 1,800 meters, where it is one of the few species that characterize the Upper Sonoran Zone. It is associated with *Q. idonea* below about 1,500 meters, but replaces the latter entirely above this elevation. Its native name is "encino negro."

**Quercus agrifolia** Née.

CALIFORNIA LIVE OAK.

The California live oak ranges southward into the Peninsula through the Upper Sonoran foothill region between the Pacific coast and the western slopes of the high mountains. It was noted mainly along arroyos and canyons in a number of localities from near Ensenada northward to the Valley of Guadalupe along the road to Tijuana and eastward to La Huerta at the western base of the Sierra del Pinal. It was abundant also along small arroyos at about 1,110 meters altitude near El Alamo and between La Posa and Rancho Viejo. The largest trees were seen along the river at San Antonio, where at about 900 meters elevation a permanent stream emerges from the west slope of the San Pedro Mártir Mountains. Oaks supposed to be of this species were noted

by us at higher levels near El Rayo and Sangre de Cristo in the Pinal Mountains and near Rancho Santo Tomás in the San Pedro Mártir Mountains, but they may have been *Q. wislizeni*.

**Quercus chrysolepis** Liebm.

CANYON LIVE OAK.

The canyon live oak is common in the Transition Zone over the higher parts of the Sierra del Pinal and San Pedro Mártir mountains, reaching down along the western side to about 1,200 to 1,500 meters, the variation depending on the slope exposure. Specimens bearing well-developed acorns were obtained by us, however, along a water course as low as about 1,050 meters altitude in the San Pedro Mártir Mountains, on the road from Rancho Santo Tomás to San Antonio, July 28. In the Pinal Mountains we found *Q. chrysolepis* common among the great boulders on the summits at between 1,500 and 1,800 meters elevation near Hanson Laguna. Specimens in the U. S. National Herbarium from Cedros Island seem referable to this species. They were collected by A. W. Anthony, July–October, 1896.

**Quercus palmeri** Engelm.

PALMER OAK.

Noted in a number of places at 900 to 1,500 meters elevation, along the western basal slopes of the Sierra del Pinal and San Pedro Mártir mountains. It grows usually as a stout shrub or small tree, 1.8 to 4.5 meters high, forming patches a few yards in extent. The foliage is very stiff and prickly, making it uncomfortable to force one's way through thickets containing it. It was collected by us at about 900 meters elevation near Arroyo de León, on the northwest slope of the San Pedro Mártir Mountains. This oak was originally described by Engelmann as a variety of *chrysolepis* and later raised by him to specific rank. It seems quite different from *chrysolepis* and, moreover, ranges in the Upper Sonoran Zone on warmer slopes and at lower elevations than the latter species in the same general region.

**Quercus dumosa** Nutt.

CALIFORNIA SCRUB OAK.

This species enters Lower California on the Pacific coast, ranging southward through the foothill region to near San Quintín. It is a low growing species, not usually over 3.5 to 4.5 meters high, forming thickets on hillsides and along the bottoms of arroyos in the Upper Sonoran Zone. It was collected by us 40 miles south of Tijuana, on the road to Ensenada. A specimen in the U. S. National Herbarium, taken at San Quintín by J. D. B. Stillman, November 18, 1862, seems referable to this species.

**Quercus tomentella** Engelm.

GUADALUPE ISLAND OAK.

Described from Guadalupe Island and represented in the U. S. National Herbarium by specimens collected there by A. W. Anthony, July–October, 1896, and March–June, 1897, by Dr. F. Franceschi in 1893, and by Dr. J. N. Rose in 1911. It has also been recorded from the islands off the coast of southern California. The species seems to be assignable to the Upper Sonoran Zone.

**ULMACEAE. Elm Family.**

**Celtis reticulata** Torr.

HACKBERRY.

A small hackberry, apparently *C. reticulata*, which ranges widely in the southwestern United States, was noted by us in only a few places at about 720 meters altitude near the road from Miraflores to San Bernardo on the southern slope of the Victoria Mountains in the Cape District. It grows here as a mere shrub, 3 to 4.5 meters high. Reported by Brandegee from San Julio Canyon and as a small shrub growing about the Sierra San Lázaro, not far from where we found it.

The lower elevation of its range and its difference in floral area suggest the possibility that with additional material the Lower California plant may prove not to be true *C. reticulata*.

**MORACEAE. Mulberry Family.****Ficus palmeri** S. Wats.

WILD FIG. SALATE.

Wild fig trees were first met with at Yubay, where a very few stunted trees were growing about large boulders near the water hole. No others were seen until we again entered the hill country along the backbone of the Peninsula between Pozo Altamirano and San Pablo and in the vicinity of Tinaja de Santana. This fig was also found in the hills at El Potrero, 25 miles southwest of Mulegé, and more abundantly in the Cape District south of La Paz, where it is known to the people as "salate." The species appears to be at home on the warm slopes of rocky canyons in the hill country, growing usually as a small tree 4.5 to 7.5 meters high, but sometimes reaching a height of 10 meters. It was not observed on the plains along the Pacific coast. Specimens in fruit were taken as follows: Yubay, September 18; El Potrero, October 21; between El Cajón and El Sacatón, December 28. Concerning this species Brandege says: "*Ficus palmeri* is found from San Ignacio to the Cape, especially among rocks and upon the face of cliffs. The trunk is very white, and on the perpendicular rocks flattens out at the base and assumes various fantastic forms, some of them, even when the trees are small, becoming 4 feet wide while only 2 or 3 inches thick, and finally branching out in all directions seeking crevices for a foothold. In good soil, in the bottom of canyons or about springs, it is a fine, well-shaped, large tree and affords an agreeable shade from the hot sun. The small figs are edible, but I think no one eats many of them, and certainly would not eat any without a good appetite. The trunk never grows tall enough to be made into boats or canoes and all the 'dugouts' so common about Magdalena Bay, San José, and La Paz are fashioned from the fig trees of Mazatlán on the mainland. When the small figs are ripe the tree is full of animal life; numerous insects are buzzing around, attracted by the sweet exudations of the fruit, and hummingbirds are continually flying through the branches. Sometimes in canyons this fig bears numerous aerial rootlets, but generally the trunk is smooth and light colored."<sup>1</sup>

**LORANTHACEAE. Mistletoe Family.****Loranthus sonorae** S. Wats.

INJERTO.

This parasite was described from material collected by Palmer near Guaymas, Sonora, where it was "growing on *Bursera microphylla*." It was taken in flower by us and noted as common on this same species (now known as *Elaphrium microphyllum*) 5 miles southwest of El Potrero, October 31. Seen at intervals throughout the southern part of the Peninsula.

**OLACACEAE. Ximenia Family.****Schoepfia californica** T. S. Brandeg.

First noted near Santo Domingo and then seen occasionally along our route over the Coastal Plain to Matancita, growing as a shrub or small tree 4.5 to 6 meters high. Its grayish foliage and general habit at a little distance somewhat suggest an olive tree. A flowering specimen was collected on the road a few miles north of Matancita, November 15. A species which we took to be this was noted on Cerralvo Island. Recorded by Brandege at San Gregorio, Comandú, and in the Cape District.

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<sup>1</sup> Zoe 2: 149, 150. 1891.

**POLYGONACEAE. Buckwheat Family.*****Antigonon leptopus* Hook. & Arn.**

This beautiful plant was first seen about 5 miles southwest of El Potrero as we climbed the steep slope of the backbone of the Peninsula on our way from Mulegé to La Purísima. It was noted at intervals thereafter and was abundant at all the lower levels throughout the Cape District south of La Paz, from the sand dunes along the beach up to 600 meters or more on the southern slopes of the Victoria Mountains. It grows as a vine 3 to 4.5 meters in length, spreading along the ground and climbing in masses over other vegetation. The flowers seem to be always coming out, the large dark-red sepals fading gradually as the seeds mature. Flowering specimens were taken at El Potrero, October 31, and along the road from Tres Pachitas to Valle Flojo, December 25. Brandegee records it as occurring at Comandú and La Purísima and common at low and middle elevations in the Cape District.

***Eriogonum fasciculatum* Benth.**

The genus *Eriogonum* well represents the Californian flora in the northern part of the Peninsula, but comparatively few species reach far south of the San Pedro Mártir Mountain region. *Eriogonum fasciculatum*, apparently a somewhat variable species, is one of the most abundant. It was a common shrub from near the Pacific coast up to about 2,100 meters altitude on southwest slopes on the west side of the San Pedro Mártir Mountains and was noted along Windy Canyon on the east side down to 750 meters. South of the mountains it was seen at intervals along our route as far as Agua Dulce, 30 miles southeast of San Fernando, where a flowering specimen was taken at 660 meters altitude, September 9. Another specimen, also in flower, had been collected east of Ensenada, May 31. Brandegee, on his overland journey, found this shrub at Pozo Alemán.

***Eriogonum elongatum* Benth.**

Noted as abundant and generally distributed in the desert region along the middle of the Peninsula from near Onyx to Yubay. It is a handsome plant, growing 60 to 120 cm. high, but is rather inconspicuous owing to the blending of its silvery-gray color with that of the bleached sand. At the time of our visit it was flowering mainly along dry arroyos or in the vicinity of water. A specimen was taken at Jaraguáy, about 58 miles southeast of San Fernando, September 9. Brandegee records the species from San Julio Canyon.

***Eriogonum orcuttianum* S. Wats.**

This large species was noted by us while skirting the east base of the San Pedro Mártir Mountains from the mouth of Windy Canyon southeast of San Matías Pass to La Providencia Canyon. It occurred in a few places in the gravelly deltas at the mouths of canyons, where flood waters spread over the neighboring desert. It grows here as a stout bush 90 to 120 cm. high. A flowering specimen was taken at the mouth of Esperanza Canyon, June 27. The species is recorded by Brandegee from Paraíso.

***Eriogonum parishii* S. Wats.**

Near La Grulla and Vallecitos on the upper slopes of the San Pedro Mártir Mountains we found this *Eriogonum* common in the loose, decomposed granite soil on dry, open hillsides.

**Eriogonum polifolium** Benth.

Noted in abundance at elevations ranging from about 780 meters in Trinidad Valley up to about 2,100 meters on open, brush-covered, southerly slopes along the west side of the San Pedro Mártir Mountains. It grows as a shrub 60 to 90 cm. in height. Specimens in flower were taken at Arroyo de León, near Trinidad Valley, July 4.

**Eriogonum trichopodum** Torr.

In the sandy and gravelly desert region near Agua Dulce, 30 miles southeast of San Fernando, this *Eriogonum* was one of the characteristic species. It grows to a height of 60 to 90 cm., but the slender, hairlike branchlets render it almost invisible at a short distance. It was associated here with *E. fasciculatum* and, like that species, was not observed farther south. A flowering specimen was taken at Agua Dulce, September 9.

**CHENOPODIACEAE. Goosefoot Family.****Atriplex canescens** (Pursh) Nutt.

CHAMISO.

Various species of *Atriplex* are commonly called "chamiso" in Lower California. In the San Pedro Mártir Mountain region *A. canescens* ranges widely in both the Upper and Lower Sonoran zones, and extends southward to an undetermined limit. It is the principal shrub at about 810 meters over Lower Sonoran parts of the bottom of Trinidad Valley, whence it reaches eastward through San Matías Pass and in less abundance upward over open Upper Sonoran mountain slopes to at least 1,500 meters altitude. One or more forms of the *A. canescens* type are among the most abundant desert shrubs, ranging at low elevations nearly throughout the Peninsula. Thickets in which *Atriplex*, *Covillea*, *Simmondsia*, and *Prosopis* bushes are dominant afford cover and food for small desert mammals. The seeds of all these bushes are eaten by mammals, as shown by the fragments of seed capsules left about the entrances to burrows or under rocks where they have been carried and left by the animals. Specimens of *A. canescens* were collected in Trinidad Valley and San Matías Pass.

**Atriplex linearis** S. Wats.

CHAMISO.

A specimen referred to this species by Mrs. K. Brandegee was taken at Tinaja de San Esteban, 25 miles north of San Ignacio, where it grew as a shrub 1.2 to 2.5 meters in height. The species, much resembling *A. canescens*, was originally described from Guaymas. Mr. Brandegee records it from San Jorge and La Paz.

**Atriplex barclayana** (Benth.) Dietr.

CHAMISO.

Along the route from Calmallí to San Ignacio this species was seen in abundance. It forms thickets in soft soil along arroyos, avoiding stony hillsides. It grows as a shrub 90 to 120 cm. high, with somewhat drooping habit. A specimen was collected at Tinaja de San Esteban, 25 miles north of San Ignacio. Brandegee records it from Magdalena Island.

**AMARANTHACEAE. Amaranth Family.****Celosia floribunda** A. Gray.

This species was abundant in the valley at Comandú, growing as a shrub 1.2 to 1.8 meters high. A flowering specimen was collected November 6. Brandegee likewise records this species from Comandú, as also from San José del Cabo and Todos Santos in the Cape District, and says it seems to reach its greatest development along the streams north of Todos Santos, sometimes forming small trees.

**Dicraurus alternifolius** (S. Wats.) Uline & Bray.

First met with and a flowering specimen taken at about 600 meters altitude 5 or 6 miles southwest of El Potrero, on a steep mountain side toward the crest of the Peninsula, October 31. It was noted in a few places farther south along our route from La Purísima to Comandú but was nowhere very abundant. It grows as a shrub 3 to 3.5 meters in height.

**AIZOACEAE. Carpetweed Family.****Mesembryanthemum crystallinum** L.

ICE PLANT.

At least one species of ice plant was noted on the beach at Ensenada and San Quintín and near the Pacific coast as far south as the vicinity of San Andrés and Rosarito. It was one of the most abundant plants on the Coronados Islands and on Todos Santos, San Martín, and San Gerónimo islands, growing often as the exclusive species, the masses densest where most exposed to the ocean fogs.

**ALLIONIACEAE. Four-o'clock Family.****Abronia gracilis** Benth.

SAND VERBENA.

A little herb, discovered at Magdalena Bay, on the voyage of the *Sulphur*. We found it one of the most abundant species along the sandy coast from San Jorge south to the Llano de Yrais. It grows prostrate, the branches spreading 10 to 25 cm. over the sand, and is one of the few species which gain a foothold in and along the edges of dune areas and tend to check the constant drifting. Specimens in flower were taken a few miles north of Matancita, November 15.

**Hesperonia californica** (A. Gray) Standley.

A common little shrub in the hill country along our route from San Pablo to San Ignacio. It grows to a height of 90 to 120 cm. A specimen in flower was taken at about 360 meters altitude, near Tinaja de San Esteban, 25 miles north of San Ignacio.

**Quamoclidion triflorum** (Benth.) Standley.

First noticed along our route from Cerro Colorado to Rodríguez northwest of La Paz, but seen more abundantly in the hills along the basal slopes of the mountains in the Cape District south of La Paz. It grows as a shrub, varying from 1 to 2.5 meters in height. Specimens were collected in flower between Cerro Colorado and Rodríguez, December 16, and at 720 meters altitude, near the Rancho San Bernardo in the Victoria Mountains, January 20.

**PHYTOLACCACEAE. Pokeweed Family.****Phaulothamnus spinescens** A. Gray.

Noted only at about 600 meters altitude on a northeast mountain slope 5 or 6 miles southwest of El Potrero on the road from Mulegé to La Purísima, where a fruiting specimen was taken October 31. It was growing as a shrub 1.8 to 2.5 meters high.

**Stegnosperma halimifolium** Benth.

This shrub was first noted at Calamahué. From this point south to Cape San Lucas it was very abundant along much of our route, especially in fertile soil along arroyos, ranging upward from near sea level to about 720 meters in the hills along the backbone of the Peninsula and on Espíritu Santo Island. This species, like *Calliandra californica* and a number of others of the region, may be found flowering and fruiting at almost any time of year. It is a handsome shrub 1.8 to 3.5 meters

high. Specimens in flower and fruit were collected as follows: Calamahué, September 15; El Potrero (about 5 miles southwest), October 31; road from Cerro Colorado to Rodríguez, December 16; San José del Cabo, January 6; Espíritu Santo Island, February 7.

### RANUNCULACEAE. Crowfoot Family.

*Thalictrum peninsulare* (T. S. Brandeg.) Rose.

Common in the oak forest on cool, moist, northerly slopes above about 1,500 meters altitude on the Sierra de la Laguna. This familiar-appearing plant was associated with a number of others whose habitat is above the Lower Sonoran Zone and which are therefore isolated here on the mountain tops. A specimen with leaves only was taken at about 1,650 meters near La Laguna, January 29. This was the first time we had observed the genus *Thalictrum* since leaving the San Pedro Mártir Mountains. Brandege records this plant as common at middle elevations in the mountains south of La Paz.

### BERBERIDACEAE. Barberry Family.

*Berberis fremontii* Torr.

This species was found rather sparingly in the Upper Sonoran Zone at the lower end of Trinidad Valley and in open arroyos up to about 1,500 meters altitude near El Piñón on the northwest slope of the San Pedro Mártir Mountains. It grows here as a shrub 1.8 to 3 meters high. A specimen with leaves only was collected in Trinidad Valley, June 16 and one with fruit near El Piñón, July 7. Brandege records it growing in great rounded patches 3 meters high at San Sebastián and Rancho Viejo.

### CAPPARIDACEAE. Caper Family.

*Atamisquaea emarginata* Miers.

On the shore of the bay near La Paz we found this species flowering February 3. It was also seen occasionally along the route to Cape San Lucas growing as a shrub 1.8 to 3.5 meters high. It was collected by Palmer at Mulegé in 1887 and by Brandege at San Gregorio in 1889. The species has also been recorded from the opposite side of the Gulf of California at Guaymas and near Hermosillo, Sonora, by Brandege, who refers to it as "that disagreeable bush."<sup>1</sup>

*Forchammeria watsoni* Rose.

PALO SAN JUAN.

The "palo San Juan," as this species is called by the people, occurs rather sparingly in the Cape District near San José del Cabo and on Espíritu Santo Island, as also on the coast of Sonora. It is a thick-trunked tree 4.5 to 7.5 meters in height, spreading abruptly to form an umbrella-shaped top. On Espíritu Santo Island a few individuals were growing on steep rocky slopes 30 to 60 meters above sea level. A fruiting specimen was taken February 7.

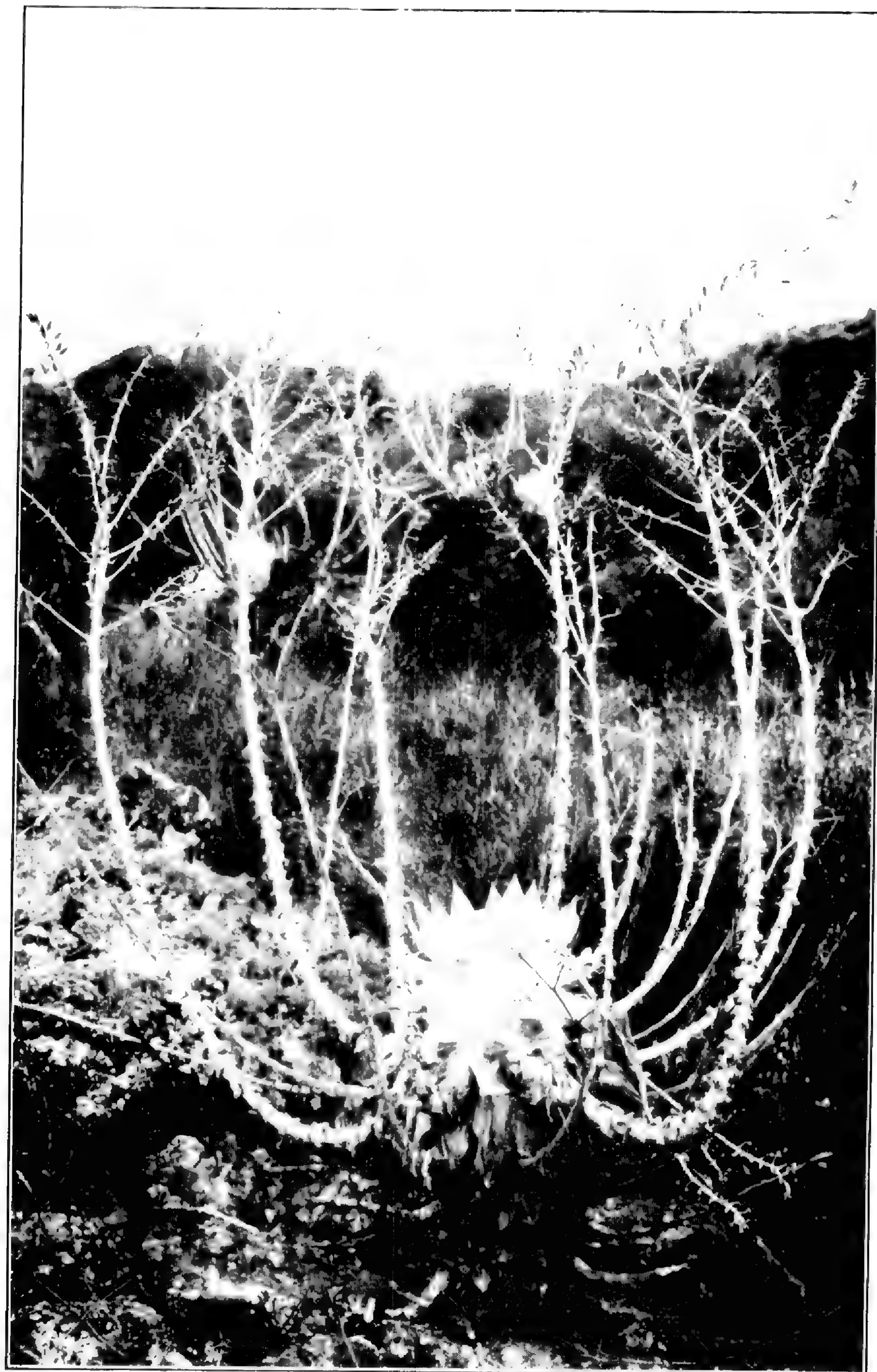
*Isomeris arborea* Nutt.

Abundant in sandy places near Ensenada and on the coastal plains from near San Telmo southward at least as far as the San Simón River. Specimens in fruit and flowers were collected at Ensenada, May 20, and near San Quintín, August 2.

*Wislizenia palmeri* A. Gray.

An abundant species along arroyos or in the vicinity of water at San Francisquito and Calamahué, growing as a shrub 1.2 to 1.8 meters high. Specimens in flower and fruit were taken at Calamahué, September 15. The species belongs in the Lower Sonoran Zone.

<sup>1</sup> Zoe 3: 344. 1893.



DUDLEYA ANTHONYI ROSE, SAN MARTÍN ISLAND.



**CRASSULACEAE. Orpine Family.****Dudleya anthonyi** Rose.

PLATE 112.

Found growing abundantly on the rocks along the shores of San Martín Island, where the type was collected by A. W. Anthony, July–October, 1896. The large size and light color of the leaves render the plants conspicuous in contrast with the dark-colored rock.

**HYDRANGEACEAE. Hydrangea Family.****Philadelphium pumilus** Rydb.

A rather common species in the Transition Zone at Vallecitos in the San Pedro Mártir Mountains. Here, at 2,400 meters altitude, it grows as a shrub 1.2 to 1.8 meters high on dry rocky slopes bordering open meadows. A species here assumed to be the same was recorded by Brandegee from these same mountains under the name *P. serpyllifolius*,<sup>1</sup> as also by Hall from the San Jacinto Mountains in southern California.<sup>2</sup> This name belongs to a different species found in western Texas and New Mexico. One of Hall's specimens subsequently became the type of *P. pumilus*. Our material, taken in flower July 15 at Vallecitos, agrees well with Rydberg's description, and it therefore seems probable that the species has a more or less continuous range in the Transition Zone from the mountains of southern California southward to the San Pedro Mártir Range.

**GROSSULARIACEAE. Gooseberry Family.****Grossularia quercetorum** (Greene) Coville & Britton.

GOOSEBERRY.

Found growing rather sparingly at 810 meters on the nearly open plain in the bottom of San Rafael Valley, a few miles west of La Huerta, where specimens were collected June 2. It was also noted in Trinidad Valley, in San Matías Pass, and at 1,080 meters elevation in ascending the dry northwestern slopes of the San Pedro Mártir Mountains, along the road from Trinidad Valley to Pozo Luciano. It grows as a shrub 1 to 1.5 meters high in the lower part of the Upper Sonoran Zone.

**Ribes indecorum** Eastw.

CURRANT.

From the type locality near San Diego this currant ranges southward into Lower California. It was first noted by us at 840 meters elevation, growing on north slopes only, near La Huerta at the western base of the Sierra del Pinal. It grows as a shrub 1.8 to 2.5 meters high. Specimens were collected June 2, when the plants were well laden with young fruit. A currant which we took to be this species was seen at 900 meters near San Antonio, at the west base of the San Pedro Mártir Mountains.

**Ribes brandegei** Eastw.

CURRANT.

Known only from the upper slopes of the Sierra de la Laguna, where, like a number of other Upper Sonoran species, it is isolated from its congeners by a wide desert interval. It occurs rather sparingly, mainly along water courses, from an elevation of about 1,380 meters to near the summit in the vicinity of La Laguna. It is a slender species, reaching a height of about 2.5 meters. A flowering specimen was collected January 26.

<sup>1</sup> Zoe 4: 205. 1893.<sup>2</sup> A Botanical Survey of San Jacinto Mountain. Univ. Calif. Pub. Bot. 1: 83. 1902.

**PLATANACEAE. Sycamore Family.****Platanus racemosa** Nutt.

CALIFORNIA SYCAMORE.

Noted by us at Ensenada and on the west slope of the San Pedro Mártir Mountains. It grew along a watercourse at 1,080 meters elevation below Rancho Santo Tomás and was common along the river at 900 meters near San Antonio. Brandegee records it from the slopes of the San Pedro Mártir Mountains.

**ROSACEAE. Rose Family.****Adenostoma fasciculatum** Hook. & Arn.

CHAMISO.

Perhaps the most abundant shrub in the Upper Sonoran Zone on the western slopes of the Sierra del Pinal and San Pedro Mártir mountains. East of Ensenada on open southwest slopes it was noted at altitudes ranging from about 300 meters up to about 1,800 meters, and in places probably reaches still higher. It is absent from the bottoms of San Rafael and Trinidad valleys, which are largely Lower Sonoran in character, but grows on adjacent hill slopes. Brandegee records the species as far south as Rosario. A flowering specimen was collected east of Ensenada, May 31. The name "chamiso" is also commonly applied to the various species of *Atriplex* growing in the Peninsula.

**Adenostoma sparsifolium** Torr.

PALO AMARILLO.

The Mexican name for this shrub is "palo amarillo," the name given to *Esenbeckia flava* in the southern part of the Peninsula. It ranges irregularly over the western slopes of the Sierra del Pinal and San Pedro Mártir mountains. Near San Antonio it was observed as low as 1,020 meters and from this level upward in favorable situations on warm slopes to 1,740 meters near Rancho Santo Tomás. On open slopes about Laguna Hanson, near the top of the Pinal Mountains, it is one of the most characteristic species. It grows in thickets almost to the exclusion of other shrubs on some hillsides with a surface of loose, decomposed granite, and where the formation changes abruptly to harder rock it may disappear almost entirely and be replaced by a thick growth of manzanita and *Adenostoma fasciculatum*. Specimens were taken along the road from Ojos Negros to Alamo and between Rancho Santo Tomás and San Antonio.

**Cercocarpus rotundifolius** Rydb.

MOUNTAIN MAHOGANY.

This mountain mahogany was common along small canyons from about 1,440 meters elevation on the west side of the Sierra del Pinal to about 1,680 meters near the summit of the range in the vicinity of Laguna Hanson. It grows as a shrub 3.5 to 5.5 meters high and, combined with *Adenostoma fasciculatum* and other species, forms dense thickets on some slopes. A specimen with the flowers dropping and the hairy fruits just appearing was collected at Laguna Hanson, June 2. The species was not noted by us in the San Pedro Mártir Mountains, but may occur there.

**Heteromeles arbutifolia** Roemer.

CALIFORNIA HOLLY.

Common only locally, usually along streams or near springs, from near the Pacific coast up to about 1,200 meters elevation on the west side of the Sierra del Pinal and San Pedro Mártir mountains. A specimen still retaining fruit was taken about 10 miles east of Ensenada, May 31, and others in flower at Arroyo de León and San Antonio, July 4 and July 28. South of the high mountains of the northern part of the Peninsula the California holly was not seen until we entered the Sierra de la Laguna, in the Cape District, where the same or a related species occurs on the upper slopes at from

1,200 to 1,680 meters. It is associated here in the Upper Sonoran Zone with a number of other plants which are isolated by hundreds of miles of desert from their congeners to the northward. It is rather common, especially along streams or about springs, growing as a shrub 3 to 6 meters high. A specimen in fruit was collected at about 1,350 meters near El Saúz on the trail from Miraflores to La Laguna. Brandegee records it from the Cape District as follows: Sierra de la Laguna, flowering in January; Sierra de San Francisquito, fruit in October.

**Rosa californica** Schlecht. & Cham.

CALIFORNIA ROSE.

Common in or along the borders of wet meadows in the Transition Zone along the western side of the San Pedro Mártir Mountains. Specimens in flower were taken at La Grulla, July 20.

**Rosa minutifolia** Engelm.

SMALL-LEAVED ROSE.

Abundant in the lower part of the Upper Sonoran Zone, near San Quintín, where it is found along dry, stony arroyos among the lower hills and up over gravelly mesas to at least 300 meters altitude. It was also noted along the road from San Quintín north as far as San Telmo. It is a peculiar little species, 1 to 1.5 meters high, in places forming dense thickets, from which almost all other shrubs are excluded. Although the regular flowering season had passed, a few plants were still blooming when our collection was made near San Quintín, August 2. Of this rose and its limited known distribution Brandegee says: "Abundant near the coast from north of Ensenada to below El Rosario. It extends into the interior a dozen or more miles from the Pacific slope. In some localities most of the bushes produce white flowers."<sup>1</sup>

**Rubus** sp.

An unidentified *Rubus* is rather common in the oak forest on the upper slopes of the Sierra de la Laguna. It was collected in flower at 1,650 meters, in the Upper Sonoran Zone, January 27.

**Sericotheca dumosa** (Nutt.) Rydb.

In the upper part of the Transition Zone in the San Pedro Mártir Mountains this shrub is fairly abundant. It forms clumps in the pine forest where other undergrowth is scanty and is often associated with other shrubs on more open slopes, especially among rocks near the tops of hills. A flowering specimen was collected at 2,400 meters altitude near Vallecitos, July 15.

### AMYGDALACEAE. Almond Family.

**Emplectocladus fasciculatus** Torr.

This small almond, forming a shrub 1.8 to 2.5 meters high, was found near the western end of Trinidad Valley. It occurs here on rather dry slopes at about 780 meters altitude, where the greater part of the vegetation is assignable to the Upper Sonoran Zone. The species has been recorded from southern California eastward to Utah, but apparently has not been taken before in Lower California. The genus to which it belongs is credited with representing the nearest approach in the American flora to the old genus *Amygdalus*, the almond of the Old World. A specimen bearing immature fruit was collected June 16.

**Prunus ilicifolia** (Nutt.) Walp.

HOLLY-LEAVED CHERRY. ISLÁY.

In Lower California this cherry is well known locally as "isláy." It is abundant in places in the Upper Sonoran Zone, from near the coast at Ensenada up to the tops of the Sierra del Pinal and at least as high as 1,500 meters on the west slope of the San Pedro Mártir Mountains. It grows here as a shrub 1.8 to 3.5 meters high. The large, well-flavored fruit is gathered to some extent by the people at La Huerta and

<sup>1</sup> Zoe 4: 205. 1893.

other localities. Specimens in flower were taken east of Ensenada, May 31, and at La Huerta, June 2, and with green fruit along the road from Rancho Santo Tomás to San Antonio, July 28.

### MIMOSACEAE. Mimosa Family.

**Acacia filicioides** (Cav.) Trel.

TIMBE.

Specimens in flower and immature fruit were taken at Tinaja de Santana (altitude 1,020 meters), 35 miles north of San Ignacio, October 4. The species was found growing as a shrub 1.8 to 2.5 meters high, on stony hill slopes. Brandegee records it from San José del Cabo and Todos Santos.

**Acacia flexicaulis** Benth.

MEXICAN EBONY.

First noted and a specimen in fruit collected between Agua Colorada and Cerro Colorado, northwest of La Paz, December 15. From this vicinity southward to Cape San Lucas it was one of the characteristic species at the lower elevations, growing as a thorny shrub 1.8 to 2.5 meters high, with short, broad, thickened pods.

**Acacia greggii** A. Gray.

CAT'S-CLAW.

This Lower Sonoran species was common on the desert near the east base of the San Pedro Mártir Mountains; on the western side of the Peninsula it was first seen near Las Cuevas, northwest of San Fernando, and thence it was noted at intervals along our route southward to near San Pablo south of Calmallí. Its general range thus seems to include the northern half of the Peninsula, exclusive of the high mountains and the northwest coast region. Specimens in flower and immature fruit were taken at La Providencia Canyon, June 26, and in ripening fruit at Jaraguáy, about 58 miles southeast of San Fernando, September 9. This *Acacia* is usually a shrub 1.2 to 4.5 meters high, but sometimes becomes a tree with a height of 6 meters. Dense clumps are often formed, the shade and thorny protection of which afford favorite hiding places for jack rabbits and other mammals.

**Albizzia occidentalis** T. S. Brandeg.

PALO ESCOPETA.

The "palo escopeta," so called by the people of the Cape District, is one of the characteristic species, growing as a forest tree 6 to 9 meters high, from the west coast near El Pescadero up the basal slope of the Victoria Mountains in the vicinity of Miraflores. A specimen with large, flat, ripening pods was taken on the road from El Pescadero to El Cajón, December 27.

**Calliandra californica** Benth.

Widely distributed in the Peninsula. Flowering specimens were collected at San Fernando, September 4; on Margarita Island, November 29; and between Santa Anita and Miraflores, January 19. It was an abundant species along much of our route, especially in the foothills of the mountains in the Cape District south of La Paz. It forms a shrub 1 to 2 meters high and seems to prefer rather sterile, stony hillsides. The species is recorded by Brandegee from San José del Cabo and from Magdalena and Margarita islands northward to San Borja.

**Lysiloma microphylla** Benth.

This tree is associated with *Albizzia occidentalis* in many places along the western and southern slopes of the Victoria Mountains in the Cape District. It grows to a



LYSILOMA CANDIDA T. S. BRANDEG., 40 MILES WEST OF SANTA ROSALÍA.

height of 6 to 9 meters. A specimen with immature pods was taken on the road from Tres Pachitas to Valle Flojo, December 25. This species is recorded by Brandegee from mountains near San José del Cabo and Todos Santos.

**Lysiloma candida** T. S. Brandeg.

PALO BLANCO. PLATE 113.

This tree, well known to the people as "palo blanco," ranges in suitable localities throughout the Peninsula south of about latitude  $27^{\circ} 30'$ . It was first met with by us when we descended from the high mesa on which Tinaja de Santana is situated into a deep canyon on the road to San Ignacio. A few trees only were seen near the bottom, but later the same day we crossed another canyon in which it grew in a fairly heavy belt along each side of the water course, being here the most prominent species. From this point southward to the Cape the palo blanco was noted in the hill country at frequent intervals. In the northern part of its range the tree grows only in a narrow belt along dry washes in canyon bottoms, where it is often the largest and most abundant species. It was not seen on the plains along the west coast, but in crossing the backbone of the Peninsula from Cerro Colorado to Rodríguez and in the Cape District south of La Paz we found it much more generally distributed over the rocky hill slopes than farther north.

The palo blanco is, economically, one of the most important trees of the Peninsula. One of the leading industries of the Cape District is the gathering of the bark, which is used locally for tanning, from San Ignacio southward, and is shipped in considerable quantities, especially from the port of San José del Cabo. The trees grow from 15 to 30 cm. in diameter and from their whitish bark present a striking appearance. The bark is taken off in strips and packed in sacks for transportation on the backs of burros to the coast.

Specimens of the tree were collected by us near Tinaja de San Esteban, 25 miles north of San Ignacio, October 5, and 20 miles east of San Ignacio, October 19. At both localities the ripe pods were falling from the trees. In ripening the stout marginal threads split away and often adhere to the branch for some time after the pod bearing the seeds has fallen. A specimen in the U. S. National Herbarium was collected by Palmer on Carmen Island, November 1-7, 1890.

**Mimosa purpurascens** Robinson.

Specimens in flower and ripening fruit were taken on the road from Agua Colorada to Cerro Colorado, December 15. It grows as a shrub 2 to 3.5 meters high. Not noted in abundance.

**Mimosa xanti** A. Gray.

CELOSA.

This mimosa, locally known as "celosa," is abundant throughout much of the lower country in the Cape District south of La Paz, where it helps to make up many of the denser thickets. It grows as a shrub 1.2 to 3.5 meters in height. The strong recurved thorns seem always ready to tear the flesh or clothing, whence the name "celosa," meaning in the Spanish language "jealous." Specimens with flowers and ripe pods were taken along the road from El Cajón to El Sacatón, December 28, at Santa Anita and Cape San Lucas January 3-11, and at San José del Cabo, February 22. Brandegee records it as very abundant at San José del Cabo, Todos Santos, and on the Victoria Mountains.

**Pithecolobium dulce** Benth.

GUAMUCHIL. GUAMUCHLI.

This species, a tree of wide distribution on the mainland of Mexico, is abundant at San José del Cabo and was noted along the road between Santa Anita and Miraflores. Brandegee records it from Todos Santos, La Paz, and San José del Cabo. It ranges much farther north on the coastal plains in Sonora. The white pulp surrounding the seeds is eaten by the people.

***Pithecolobium tortum* Mart.?**

This species was collected in fruit on the road from Santa Anita to Miraflores, January 19. It was rather common, growing as a tree 4.5 to 6 meters high. Brandegees refers our specimen provisionally to *P. tortum* Mart., the name he used with reservation for the species recorded in his Flora of the Cape Region as growing at low elevations at San José del Cabo and Todos Santos. This was described as a handsome small tree with horizontal dark-green leaves.

***Prosopis glandulosa* Torr.**

MESQUITE.

One of the most abundant and generally distributed plants in Lower California. It spreads over nearly the whole of the Peninsula, ascending from the desert bordering the shores of the Gulf of California through San Matías Pass into Trinidad Valley, San Rafael Valley, and other valleys west of the higher mountains and occurring up to 1,350 meters on southwest slopes. It is absent, however, on the upper slopes of the Sierra del Pinal, the San Pedro Mártir Mountains, and the high mountains of the Cape District. It varies in size from a small shrub to a tree 4.5 to 9 meters in height. Usually it grows more abundantly and to a larger size in the alluvial soil in arroyos, in some places to the exclusion of other trees, but it may also overspread desert plains and rocky hills. Economically it is one of the important plants of the Peninsula. The pods, leaves, and even twigs furnish valuable forage for stock, and the pods are eaten by many of the native mammals. A specimen in fruit was collected on the road from Santo Domingo to Matancita, November 15.

***Prosopis odorata* Torr. & Frém.**

SCREWPOD MESQUITE.

This species occurs rather sparingly on low-lying areas in the delta of the Colorado River.

***Prosopis palmeri* S. Wats.**

PALMER MESQUITE.

First noticed by us while crossing the rugged backbone of the Peninsula near Guajaderní, on our way from Mulegé to La Purísima. It was more abundant, however, along much of our route from Matancita to La Paz, occurring as the principal species on the more fertile soil in some of the arroyos between 30 and 150 meters altitude. Brandegees records the species as abundant on the high, rocky mesas near La Purísima and Comandú. It forms a tree 4.5 to 7.5 meters high, with the trunk thickened from the ground up to about 3 meters, where a great number of small, spreading branches are given off. The bark is rough and splits off in long strips. Specimens bearing flowers and ripe fruit were taken between Agua Colorada and Cerro Colorado, December 15.

***Vachellia farnesiana* (L.) Wight & Arn.**

HUISACHE. VINORAMA.

The "huisache," as it is commonly called, is widely dispersed in tropical and subtropical Mexico and ranges well into the Lower Sonoran Zone. Its irregular distribution in Lower California may be due to its not being native, having supposedly been introduced and cultivated about some of the missions. This would explain its absence from large areas apparently well suited to its growth. A few trees were noted by us along the road from Onyx to Agua Dulce, but the species was more abundant from San Ignacio southward to San Jorge. South of San Jorge it was not again seen until we entered the Cape District south of La Paz, where it was abundant in many localities, especially in the vicinity of towns. At Miraflores it has received the local name "vinorama." It was collected in flower between Tres Pachitas and Valle Flojo, December 25. Brandegees records the species from San José del Cabo.

## CASSIACEAE. Senna Family.

**Cassia confinis** Greene.

This *Cassia* was noted at Tinaja de San Esteban, 25 miles north of San Ignacio, and thence southward at intervals to near La Paz, and on Espiritu Santo Island. It grows as a shrub 1 to 2 meters in height. Like many other plants of the region, it produces flowers and fruit irregularly during a considerable part of, if not the entire, year. Specimens in flower and fruit were taken at Tinaja de San Esteban, October 5, and on Espiritu Santo Island, February 7.

**Cassia occidentalis** L.

PALO DE ZORILLA.

The "palo de zorilla," as it is known to the people, is common at the lower elevations south of La Paz. Along the basal slopes of the Victoria Mountains it forms a good-sized tree, 7.5 to 9 meters high. A specimen with the long, slender seed pods fully ripe was taken between Tres Pachitas and Valle Flojo, December 25. Not noted by us north of La Paz. Brandege records the species from San José del Cabo and San Bartolomé. He remarks that the name "palo de zorilla" (skunk tree) seems wholly inappropriate, as the tree possesses nothing to suggest such a name.

**Cassia articulata** Rose.

The type of this recently published species was collected by C. A. Purpus near San José del Cabo in 1901. A specimen with ripe seed pods was taken by us at about 600 meters elevation between Miraflores and Rancho San Bernardo in the Victoria Mountains. Only a few shrubs 1.8 to 2 meters high were seen. These two records give the species a very limited known range in the extreme southern end of the Peninsula.

**Cassia purpusi** T. S. Brandeg.

This species was based on material collected by C. A. Purpus near Calmallí in 1898, and by us (in flower and fruit) at Rosarito, 18 miles southeast of San Andrés, September 25, 1905. Its known range is thus limited to a small area in the central section of the Peninsula. At Rosarito it was found growing in a moist place along an arroyo. The plant is a handsome shrub.

**Cassia goldmani** Rose.<sup>1</sup>

While on our way from Mulegé across the mountains to La Purísima this previously unknown species was found in a few places between 450 and 720 meters altitude on the steep eastern slope leading up to the backbone of the Peninsula, 5 or 6 miles southwest of El Potrero. It forms a large shrub or small tree 3.5 to 5.5 meters high and is associated with such southern species as *Esenbeckia flava*, *Antigonon leptopus*, and *Erythrina purpusi*. The specimens, with ripening pods, were collected October 31.

**Cercidium torreyanum** (S. Wats.) Sarg.

PALO VERDE.

No trees were so nearly omnipresent along our route throughout the greater part of the Peninsula as those of the genus *Cercidium*. They abound in nearly every part except the higher slopes of the Sierra del Pinal and San Pedro Mártir mountains, the Victoria Mountains, and the northwest coast region. But the number of species and the boundaries of their respective ranges are not definitely known. *Cercidium torreyanum* is assumed to range from southeastern California southward through the desert region between the Gulf and the high mountains to an undetermined southern limit. On the east slope of the San Pedro Mártir Mountains it ascends along the open bot-

<sup>1</sup> See p. 311.



tom of Windy Canyon to 1,080 meters altitude near San Matías Pass. It is associated with many Lower Sonoran plants and seems to belong in the list of species characteristic of this zone, but it represents a genus mainly tropical in distribution. In northeastern Lower California it grows 4.5 to 7.5 meters high. Like other species of the genus it is commonly called "palo verde," a name derived from the smooth, greenish bark.

**Cercidium peninsulare** Rose.

PALO VERDE. PALO DE PÚA. PLATE 114.

The type of this species was taken by the present writer on the open plain near La Paz April 16, 1899, then in flower. It is abundant throughout the Cape District south of La Paz except on the upper slopes of the mountains and reaches northward to an undetermined limit, its range overlapping or so continuous with that of *torreyanum* that we did not distinguish between them. The species was collected by Dr. J. N. Rose in the spring of 1911 at various places in the Cape District and on Carmen and Cerralvo islands. Where forage for stock is scarce, especially in the extremely arid central desert region, the branches of palo verde trees are lopped and the tips and leaves are eaten by mules with apparent relish. Although generally known as "palo verde," this tree is also called locally "palo de púa." It is generally distributed over rocky hills and sandy deserts, but is usually more abundant along dry washes. During the dry season and droughts the trees are nearly or quite bare, but leaves appear in a remarkably short time after even a single local shower. In places the appearance of the palo verde trees showed a sharp line of demarcation between the area recently visited by rain and that over which drought still prevailed. The abundance of this species in the Cape District and its association with so many tropical plants seem to place it with the tropical element, to which most members of the genus *Cercidium* belong.

**Haematoxylon boreale** S. Wats.

BRASIL. PALO DE BRASIL. LOGWOOD.

The "Brasil," or "palo de Brasil," as it is called by the people, was common at the lower elevations along our route in the Cape District south of La Paz. It grows as a scrubby tree 4.5 to 7.5 meters in height. The trunks of the older trees may be very thick at the base, but are usually hollow and have deeply fluted bark. We did not find the species used as a dyewood. Specimens with ripe seed pods were taken between Tres Pachitas and Valle Flojo, December 25, 1905, and in flower between San Pedro and La Paz, February 1, 1906. Brandegee records the species from La Paz, Todos Santos, and San José del Cabo.

**Hoffmanseggia microphylla** Torr.

At San Felipe this species is quite common in sandy places along the Gulf shore. It grows as a shrub 1 to 1.5 meters high. At the time of our visit, June 20, it was nearly leafless, but bearing flowers and fruit. Recorded by Brandegee from Calamahué.

**Parkinsonia aculeata** L.

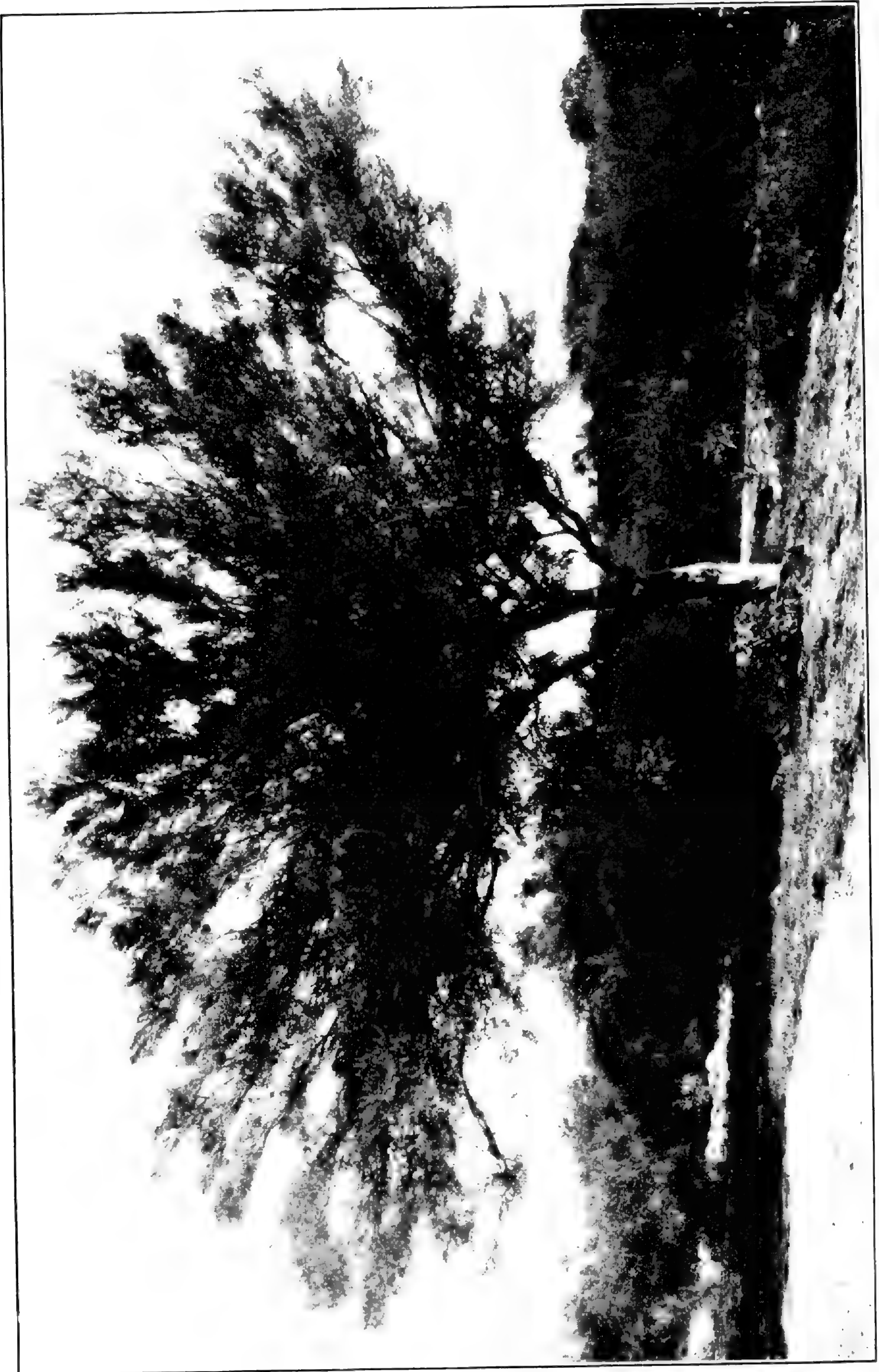
RETAMA.

This species has a wide range in Mexico, extending southward from near the southern border of the United States within the limits of the Lower Sonoran Zone. It occupies the greater part of Lower California, but is absent on the high mountains and in the northwest coast region. Specimens were collected at Agua Dulce, 30 miles southeast of San Fernando, in September, 1905. The species was noted by Brandegee from San Gregorio to Calamahué and San Fernando. It was also collected at La Paz by Doctor Rose in June, 1897.

**Parkinsonia microphylla** Torr.

RETAMA.

The range assigned this species by Sudworth comprises adjoining portions of the desert region in southern California, southern Arizona, northeastern Lower Califor-



CERCIDIUM PENINSULARE ROSE, SANTA ANITA.

nia, and Sonora. It was recorded by Brandegee at Calamahué. Palmer collected specimens at Santa Rosalía in March, 1890, and Doctor Rose at Agua Verde and at the head of Concepción Bay in April, 1911. It seems to be less widely dispersed than its congener, *P. aculeata*, like which it belongs to the Lower Sonoran Zone.

**Poinciana placida** (T. S. Brandeg.) Rose.

A few of these bushes, 3 to 3.5 meters high and bearing handsome orange and reddish flowers, were found in a stony place near the shore of Espiritu Santo Island, February 7.

**Poinciana californica** (A. Gray) Rose.

About the middle of November this plant was practically leafless, but bearing deep, dark red flowers near the tips of the slender twigs, while other branches still held ripe seed pods. It was seen in a few places on the sandy Coastal Plain from San Jorge to Matancita, growing as a shrub 2 to 3 meters high. Specimens were collected a few miles north of Matancita, November 15.

**Tamarindus indica** L.

TAMARINDO. TAMARIND.

The tamarind, which is so widely distributed in cultivation in tropical Mexico, was seen at San José del Cabo, where Brandegee has already recorded it as common. The tart pulp surrounding the seeds is used to make a refreshing drink.

### FABACEAE. Pea Family.

**Brongniartia peninsularis** Rose.<sup>1</sup>

The type of this species was collected by us at about 450 meters while we were ascending the backbone of the Peninsula, about 5 miles southwest of El Potrero and about 30 miles southwest of Mulegé, October 31. It was growing on the rocky mountain side as a shrub 2 to 3 meters high. Not noted elsewhere.

**Erythrina purpusi** T. S. Brandeg.

CORAL BEAN.

We first noted and collected this species along the road 5 miles southwest of El Potrero, between Mulegé and La Purísima. It was described by Brandegee and recorded by him as common at low elevations in the Cape District. It was also seen between Guajaderní and Agua Grande and at several localities near the west coast between Todos Santos and Cape San Lucas. It belongs to the tropical or subtropical element of the flora of the region.

**Olneya tesota** A. Gray. MEXICAN IRONWOOD. UÑA DE GATO. PALO DE HIERRO.

Few plants reaching tree size have so wide a range and are at the same time so abundant in Lower California as the ironwood. It was noted from the basal slopes of the desert mountains near the delta of the Colorado southward to La Paz and on Cerralvo Island. It was not observed in the Cape District south of La Paz nor along the west coast north of the Santa Clara Mountains, but may reach farther in suitable situations. It grows 6 to 7.5 meters in height. Although it may occur on gravelly plains, it is more at home along rocky arroyos and on the slopes of desert mountains, situations so frequent in the Peninsula. It belongs to the Lower Sonoran Zone, occurring on both sides of the Gulf of California. A specimen was taken at Tinaja de San Esteban, 25 miles north of San Ignacio. Brandegee records it from Comandú to Calamahué. He also mentioned its native name, "uña de gato," which is also applied to several other thorny species.

**Parosela spinosa** (A. Gray) Heller.

INDIGO BUSH.

First met with by us at San Felipe on the Gulf of California. Here we found a few scattered groups of these desert plants in sandy arroyos near the beach, growing

<sup>1</sup> See p. 311.

as trees (instead of bushes) and becoming 4.5 to 6 meters high. Specimens were collected in flower on June 20, the trees presenting a showy appearance, the deep dark blue flowers affording a pleasing contrast. When not in flower the gray foliage blends with the desert surroundings and the plants are inconspicuous. The species was afterwards noted along the trail from Agua Dulce to Jaraguáy and between Calamahué and Yubay. Brandegee found it growing as a small tree or bush in the sand of dry stream beds at Calamahué. It has also been recorded from Sonora and the lower Colorado Valley north of the United States boundary, and thus seems assignable to the Lower Sonoran Zone.

### GERANIACEAE. Cranesbill Family.

*Erodium texanum* A. Gray.

ALFILERILLA.

This, or one or more allied species, grows abundantly in many places, especially on sandy or gravelly mesas in the northern half of the Peninsula. At the time of our visit the rains of the preceding season had matured a crop which added materially to the scanty forage available for our pack and saddle animals. The species presents wide variation in size and form, evidently due to local environmental conditions. On very dry gravelly slopes tiny upright plants 2 inches or less in height mature seed, while along moist sandy arroyos, perhaps only a few feet away, vigorous individuals may spread like a mat for several feet over the ground. Watson records this species from Dr. Palmer's collection at Los Angeles Bay on the Gulf coast.

### ZYGOPHYLLACEAE. Caltrop Family.

*Covillea glutinosa* (Engelm.) Rydb.

CREOSOTE BUSH.

This is one of the most abundant and widely ranging shrubs in the Peninsula. It extends southward from the Colorado Desert along the east side of the Sierra del Pinal and the San Pedro Mártir mountains, reaching upward through San Matías Pass into Trinidad Valley, while south of the mountains it is abundant from near Rosario over the greater part of the Peninsula as far as La Paz. Brandegee records the species as far as Todos Santos on the west coast. It was not noted in the Cape District south of these points and is absent from the high mountains and the north-west coast region. Along the adjacent coast of the Mexican mainland it seems to reach its extreme southern limit a few miles south of Guaymas, but on the tablelands of the interior it ranges to the southern part of the State of San Luis Potosí. It is one of the species which serve best to characterize the Lower Sonoran Zone.

### RUTACEAE. Rue Family.

*Cneoridium dumosum* Hook. f.

This shrub was common at altitudes between 900 and 1,200 meters in the Upper Sonoran Zone on the west slope of the San Pedro Mártir Mountains. A specimen still retaining a few ripe fruits was taken above San Antonio, July 28.

*Esenbeckia flava* T. S. Brandeg.

PALO AMARILLO.

First seen along our route 5 or 6 miles southwest of El Potrero, where it was taken in fruit at about 600 meters altitude on a steep mountain side, October 31. It was not noted again until we entered the hills between Agua Colorada and Cerro Colorado on our way from Matancita to La Paz. From this point southward to Cape San Lucas it was rather common at the lower elevations in the hill country. It is a small tree 6 to 9 meters in height and is well known to the people in the Cape District as "palo amarillo," a name applied farther north to *Adenostoma sparsifolium*.

Brandegge, who described and named this species,<sup>1</sup> outlined its range as extending northward on the western coast to some distance above Todos Santos and on the eastern as far as La Paz. In the same paper he states that the name "palo amarillo" is due to the color of the wood and that the tree is often used for poles in the construction of houses. He found the flowers of a sickish-sweet odor, appearing in August, the fruit falling in December.

**Xanthoxylon pterota** H. B. K.

This thorny shrub was rather common in places along the southern slope of the Victoria Mountains. It grows 4.5 to 5.5 meters high. A specimen with ripe fruit was taken at about 750 meters, between San Bernardo and El Saúz, January 21.

**BURSERACEAE. Torchwood Family.**

**Elaphrium macdougalii** Rose.

The copal trees of the genus *Elaphrium* are widely dispersed in tropical America and are found nearly throughout Lower California, except in the extreme northern part, the San Pedro Mártir Mountains, and the northwest coast region. Collectively the species form a very important part of the flora of the Peninsula. The present species ranges in the Lower Sonoran desert strip between the Gulf of California and the eastern base of the San Pedro Mártir Mountains and has been reported from the coast of Sonora. Growing as a tree 6 to 7.5 meters in height, it is especially abundant on the plain along the eastern basal slopes of the Borrego and Consag mountains, near San Felipe Bay, where specimens were taken June 26. *Elaphrium microphyllum* occurs in much smaller numbers in the same locality.

**Elaphrium rhoifolium** (Benth.) Rose.

Although this species is not known to reach so far north as *E. microphyllum*, it is probably as widely dispersed in the Peninsula, since north of San Ignacio it spreads over much of the Pacific slope from which *E. microphyllum* is absent. It is one of the characteristic species of the Cape District and ranges thence northward to the southern slopes of the San Pedro Mártir Mountains. On the Pacific slope it was first seen on a rocky hill near San Fernando, where specimens with young fruit and flowers were taken September 4. At Calamahué young leaves, flowers, and fruit were appearing September 15. Specimens with fully developed fruit were taken at El Potrero, October 14, and between La Purísima and Comandú, November 5. It is also an abundant species on Magdalena Island.

**Elaphrium cerasifolium** (T. S. Brandeg.) Rose. CHERRY-LEAVED COPAL.

This *Elaphrium* is known only from the Cape District south of La Paz, where it was not abundant. A small tree 6 or 7.5 meters in height was noticed on the slope of the deep wash at El Cajón, from which a specimen in fruit was taken December 28. The type came from San José del Cabo.

**Elaphrium epinnatum** Rose.<sup>2</sup>

This species, recently described from our material, was found only at Cape San Lucas, where the type was collected December 30, 1905. It grows as a tree about 7.5 meters in height.

**Elaphrium filicifolium** (T. S. Brandeg.) Rose.

Brandegge records this species as common throughout the Cape District south of La Paz. It is the only species of the genus known to occur in the Peninsula which we did not collect.

<sup>1</sup> Zoe 1: 378. 1891.

<sup>2</sup> See p. 311.

**Elaphrium odoratum** (T. S. Brandeg.) Rose. TOROTE. PLATE 115.

The name "torote" is shared by this tree and *E. microphyllum* and may be applied to others. *Elaphrium odoratum* was first noted along our route at El Potrero, 25 miles southwest of Mulegé. It was abundant and generally distributed at the lower elevations along with *E. rhoifolium* and *E. microphyllum* from this point southward to Cape San Lucas. The bark is yellow and, as in some of the other species, peels off in large, thin, papery flakes. Fruiting specimens were taken at El Potrero, October 31; between La Purísima and Comandú, November 5, and at San Pedro, 18 miles south of La Paz, December 23.

**Elaphrium microphyllum** (A. Gray) Rose. TOROTE.

This "torote" ranges from southern Arizona southward along both coasts of the Gulf of California. It was first noted by us at San Felipe and was found in small numbers along with *E. macdougalii* on the plain bordering the basal slopes of the Borrego Mountains. It was again observed at San Francisquito, but was much more abundant from Santa Rosalía southward to Cape San Lucas, spreading across to the west coast at least as far north as San Jorge. On Magdalena, Espíritu Santo, and Cerralvo islands it is one of the most abundant trees. In the Cape District it is associated with *E. rhoifolium*, *E. odoratum*, and others, and very generally distributed from the coast to 750 or 900 meters altitude on the slopes of the Victoria Mountains. The trees ordinarily vary from 3 to 9 meters in height, but on Cerralvo Island were unusually stocky and only 1.5 to 3 meters high. Specimens were taken at San Felipe, San Francisquito, and at various localities in the Cape District and on the neighboring islands.

Walter E. Bryant, in a general account of the Cape District south of La Paz, in 1891, says that many tons of the bark of this species are exported for dyeing purposes from the vicinity of Buena Vista. The bark, which is reddish, is cut in small pieces from the trunks and larger limbs of the trees and spread on the ground to dry, and is then shipped in sacks.

**Elaphrium goldmani** Rose.<sup>1</sup>

Soon after leaving Matancita this species was recognized as one not seen in the region previously traversed to the northward. It was abundant on the plains and low mesas as far as the vicinity of Cerro Colorado along our route to La Paz. The species was based on specimens collected by us between Matancita and La Cruz, December 9, 1905.

### MALPIGHIACEAE. Malpighia Family.

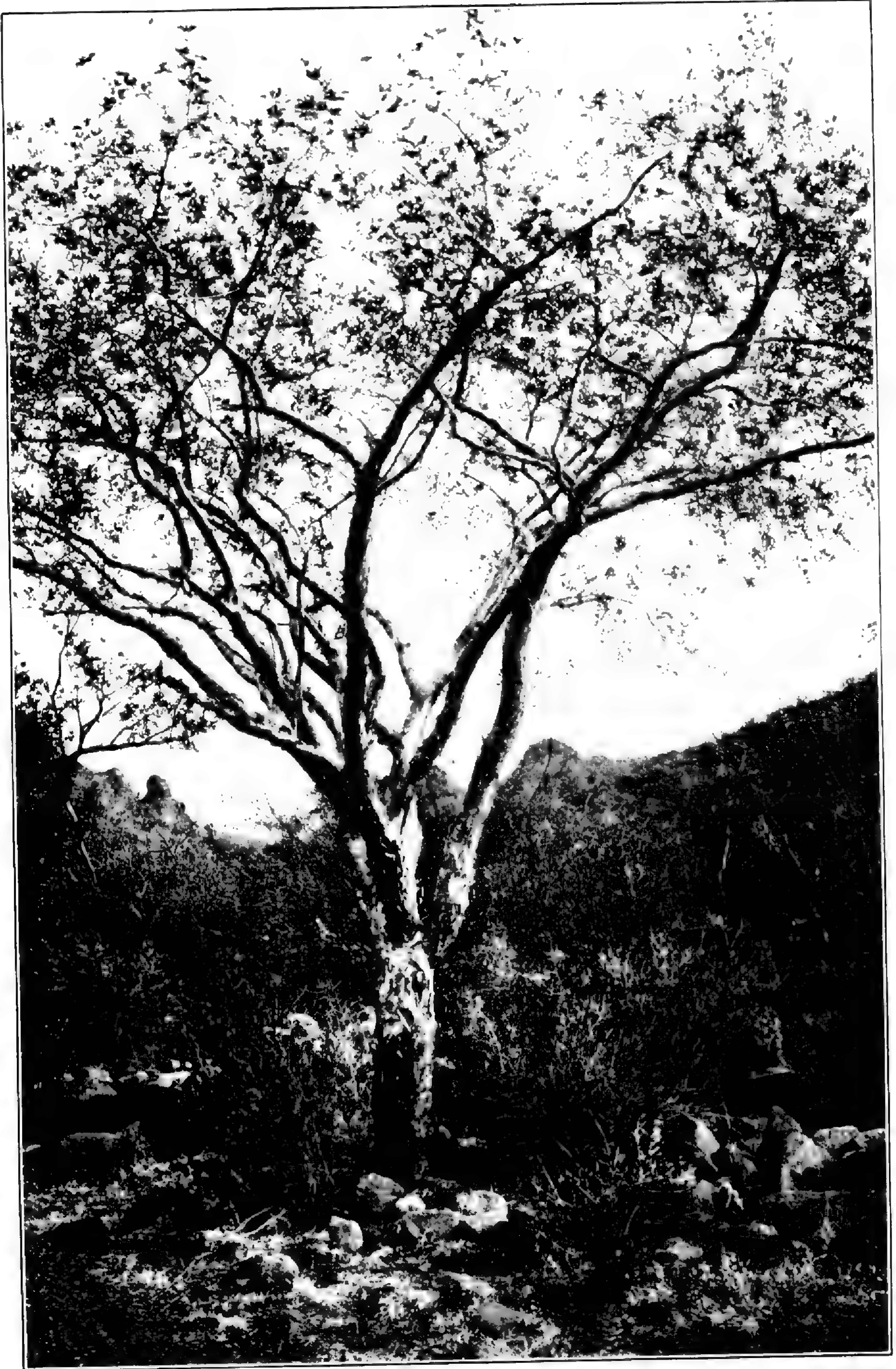
**Janusia gracilis** A. Gray.

In San Matías Pass, at about 900 meters, we found this shrubby little vine common. It grows in sandy soil and climbs over other vegetation. Specimens in fruit and flower were taken June 28. Mr. Brandege informs us that it has not heretofore been reported from Lower California.

**Malpighia diversifolia** T. S. Brandeg.

In the valley at Comandú we found this species common, forming a shrub 2 to 2.5 meters high. A specimen in fruit was collected November 7. It was not again noted by us, but has been recorded by Brandege as common about San José del Cabo, the type locality. He further states that the fruit is called by the people "manzanita" and "without any special reason is sometimes eaten by them." The species forms a part of the subtropical flora of the Peninsula.

<sup>1</sup> See p. 311.



ELAPHRIUM ODORATUM (T. S. BRANDEG.) ROSE, EL POTRERO.

**Mascagnia macroptera** (Moc. & Sessé) Niedenzu.

This species has a wide range in tropical and subtropical portions of Mexico, from the type locality near Monterey, Nuevo León, to southern Sonora and Lower California. It was first noted by us on the Peninsula, about 20 miles east of San Ignacio, where specimens bearing flowers and fruit were collected October 19. From this point southward to near La Paz it was noted along canyons in the hill country. Flowering specimens in the U. S. National Herbarium were collected by Palmer at Mulegé in 1887 and at Santa Agueda, March 4-6, 1890. The species grows as a small shrub, often climbing over other vegetation.

**EUPHORBIACEAE. Spurge Family.****Acalypha californica** Benth.

Flowering specimens of this species were taken at the mouth of La Providencia Canyon, where it opens on the desert at the east base of the San Pedro Mártir Mountains, June 26. It was rather common, growing here as a shrub 0.5 to 1.2 meters high.

**Cnidoscolus palmeri** (S. Wats.) Rose.

Collected at about 450 meters in the hills along the backbone of the Peninsula, about 20 miles east of San Ignacio, where it seemed to be rare. We have no other record of its collection since the type was taken near Guaymas, Sonora, by Palmer. As seen by us, the plant is a shrub about a meter high. Our specimens are in flower and fruit and have the leaves and tender branches armed with stinging hairs, such as characterize some of its congeners, known locally as "mala mujer" in Vera Cruz and other parts of tropical Mexico. The species was originally described under the name *Jatropha palmeri*.

**Croton magdalena** Millsp.

First noted about 5 miles southwest of El Potrero on the way from Mulegé to La Purísima. It was common at Comandú, and a *Croton* which we took to be the same was seen at intervals along the route southward to Cape San Lucas. It grows as a shrub 2 to 3.5 meters high. A specimen in fruit was taken about 5 miles southwest of El Potrero, October 31. Reported by Brandegee from San José del Cabo and in the mountains. Brandegee remarks that some forms are much less pubescent or hirsute than the type from Magdalena Island.

**Croton californicus** Muell. Arg.

In the vicinity of La Paz and at the lower elevations southward to Cape San Lucas this species was noted in abundance as a shrub 1.2 to 1.5 meters high. A flowering specimen was taken at La Paz, February 17. Millspaugh records specimens in fine flower and fruit collected by Brandegee on Magdalena Island, January 23.

**Ditaxis brandegei** (Millsp.) Rose & Standl.

A specimen of this species in flower was taken on the shore of La Paz Bay, near Rodríguez, December 16. A shrub about a meter high. Not noted in abundance. The type was collected by Brandegee at San Gregorio.

**Euphorbia californica** Benth.

From near Tinaja de San Esteban, 25 miles north of San Ignacio, southward this species was noted at intervals, but was more common at the lower elevations in the Cape District south of La Paz. It grows as a shrub 1.2 to 1.5 meters high. A specimen in flower and with young leaves just coming out was taken at Tinaja de San Esteban and one in flower and fruit between El Cajón and El Sacatón, December 28. Brandegee records this species from Todos Santos.



**Euphorbia misera** Benth.

This species was noted by us only in the vicinity of San Francisquito and Calamahué. It grows on dry, rocky hillsides as a shrub or very short-trunked tree 1.2 to 1.8 meters in height and very thick at the base. The trunk and branches are much gnarled or contorted. A specimen with flowers and growing fruit was taken at Calamahué, September 15. The species is based on specimens taken at San Diego and San Quintín during the voyage of the *Sulphur*. It is recorded by Brandegee from San Martín and Natividad islands.

**Euphorbia tomentulosa** S. Wats.

A specimen of this species in flower and fruit was taken at the mouth of La Providencia Canyon at the east base of the San Pedro Mártir Mountains, June 26. It grows here as a shrub 0.5 to 1.2 meters high. Recorded by Brandegee from La Paz.

**Euphorbia xanti** Engelm.

LIGA.

The "liga," as it is called in the Cape District, was abundant on the coastal plain near Matancita and southward along much of our route to Cape San Lucas. It grows as a shrub 1.2 to 3 meters high. After rains fresh shoots thrown out are so tender that they snap off at the basal joints almost at a touch, allowing the poisonous, milky juice to flow freely. This juice often gets on the lips and faces of feeding animals and causes the hair to come off. It sometimes enters their eyes and results in more or less severe inflammation and even blindness. Several of our mules were affected by it. Flowering specimens of the plant were taken between Agua Colorada and Cerro Colorado, December 15, and between El Sacatón and Cape San Lucas, December 29. Brandegee records it from San José del Cabo, Todos Santos, and La Paz.

**Euphorbia eriantha** Benth.

In places along our route through the hill country from La Purísima to Comandú this species was common. A plant which we took to be the same species occurs on the coastal plain at least as far south as Matancita. It grows as a shrub 1.2 to 1.5 meters high. A specimen in flower and growing fruit was taken between La Purísima and Comandú, November 4. Millspaugh records specimens in full fruit collected by Brandegee on Magdalena Island, January 22. Brandegee in his Flora of the Cape Region lists the species from San José del Cabo. This *Euphorbia* doubtless has a wide range, mainly in the Lower Sonoran Zone of the Peninsula. It has been recorded by Parish as far north as Agua Caliente, in southern California.<sup>1</sup>

**Jatropha canescens** Muell. Arg.

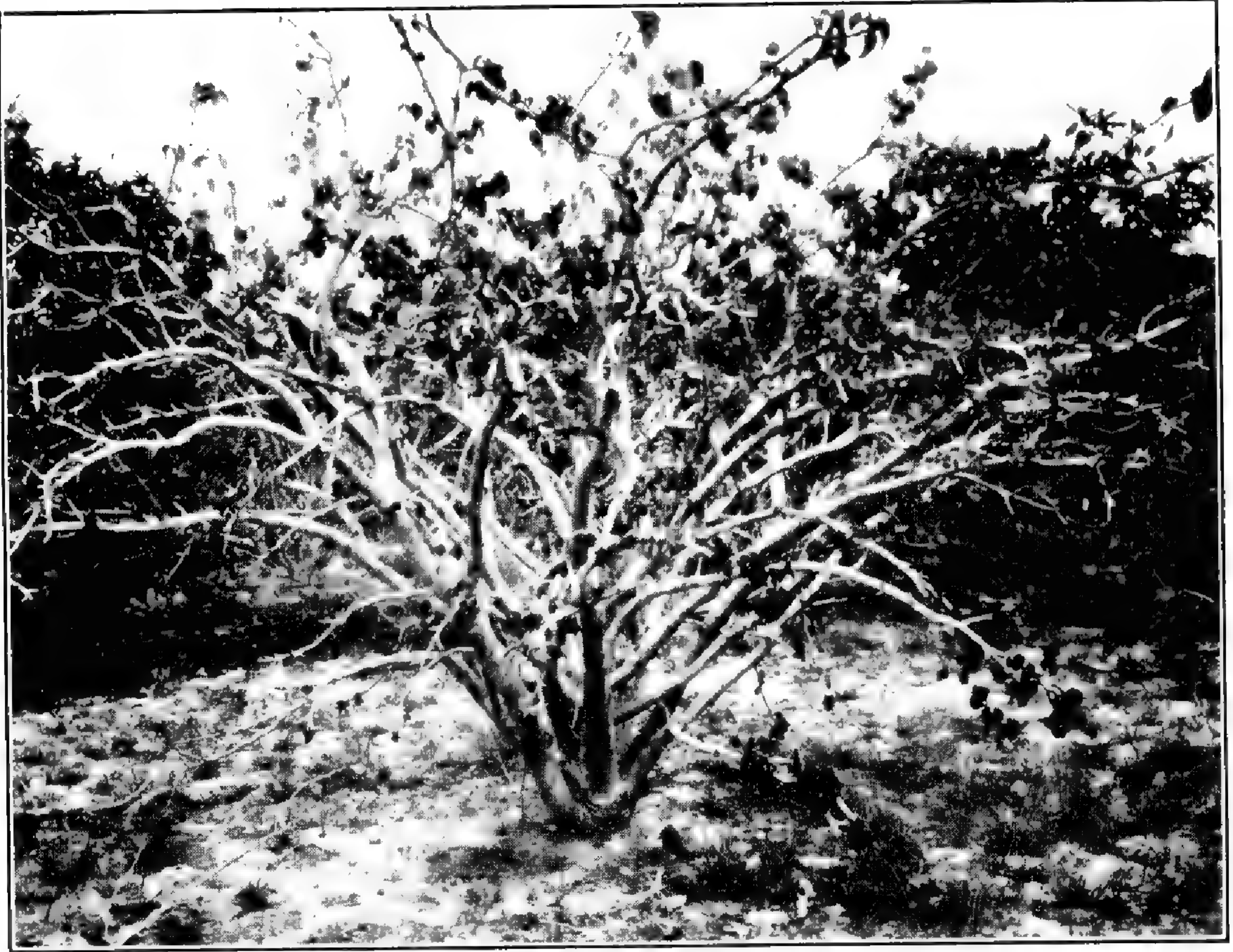
LONBOL. PLATE 116, A.

A widely ranging representative of the flora of the Cape District. It was first seen by us near Santo Domingo, whence it was one of the most abundant and generally distributed species along nearly the whole route to Cape San Lucas, as also on the islands of Magdalena, Margarita, and Espíritu Santo. It forms a large shrub or a small tree 4.5 to 6 meters high. Specimens in flower were taken at Santo Domingo, September 26, and Tinaja de Santana, October 4, and in fruit between Tres Pachitas and Valle Flojo, December 25. This species is also common on the east side of the Gulf of California.

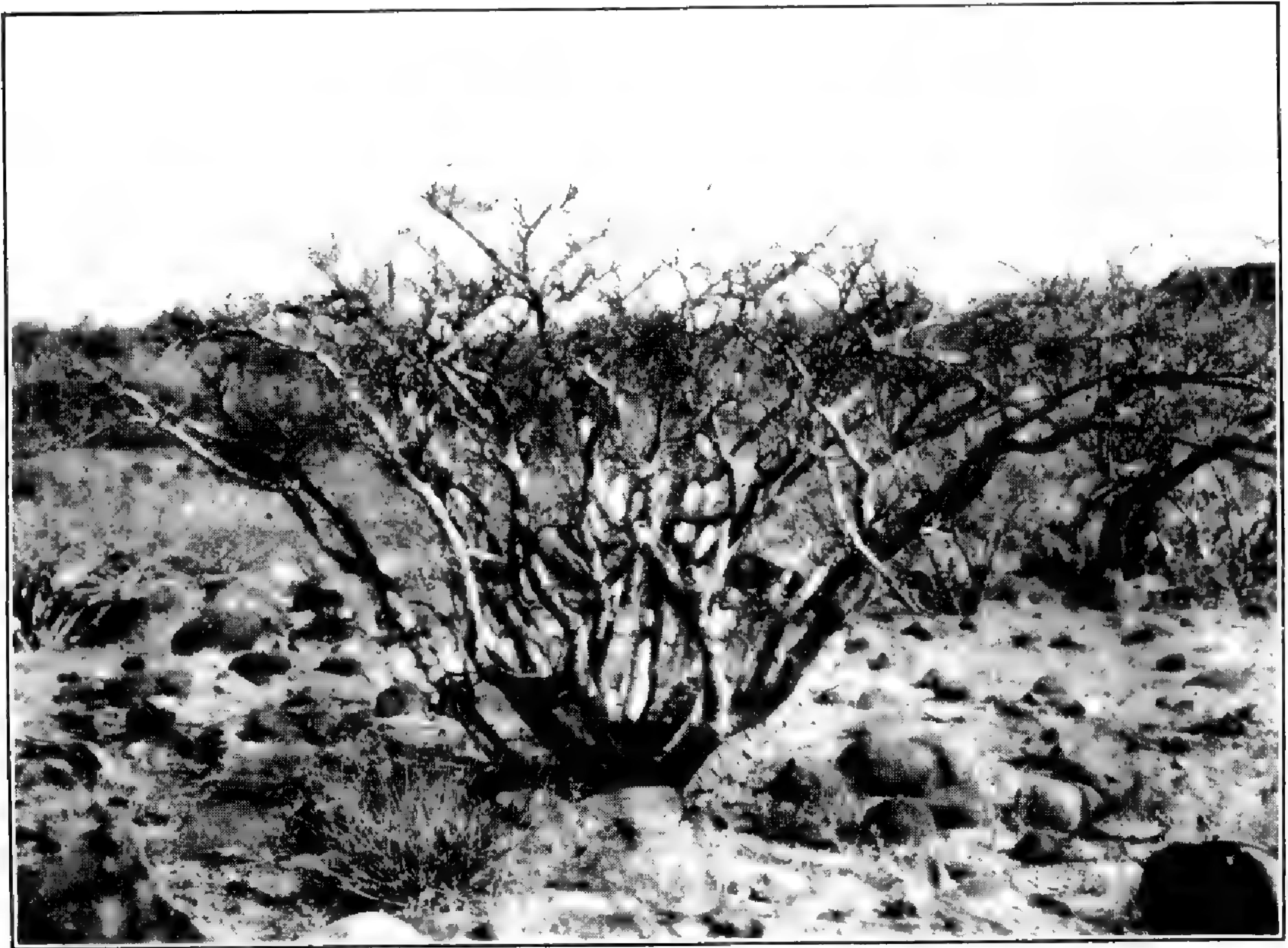
**Jatropha cordata** (Orteg.) Muell. Arg.

This species resembles *J. canescens* in size and general appearance, but differs conspicuously in its smoother leaves, which, as Brandegee says, "glisten in the sunlight as if varnished."<sup>2</sup> Specimens in fruit and flower were collected at about 600 meters altitude, 5 miles southwest of El Potrero on our way across the mountains from Mulegé

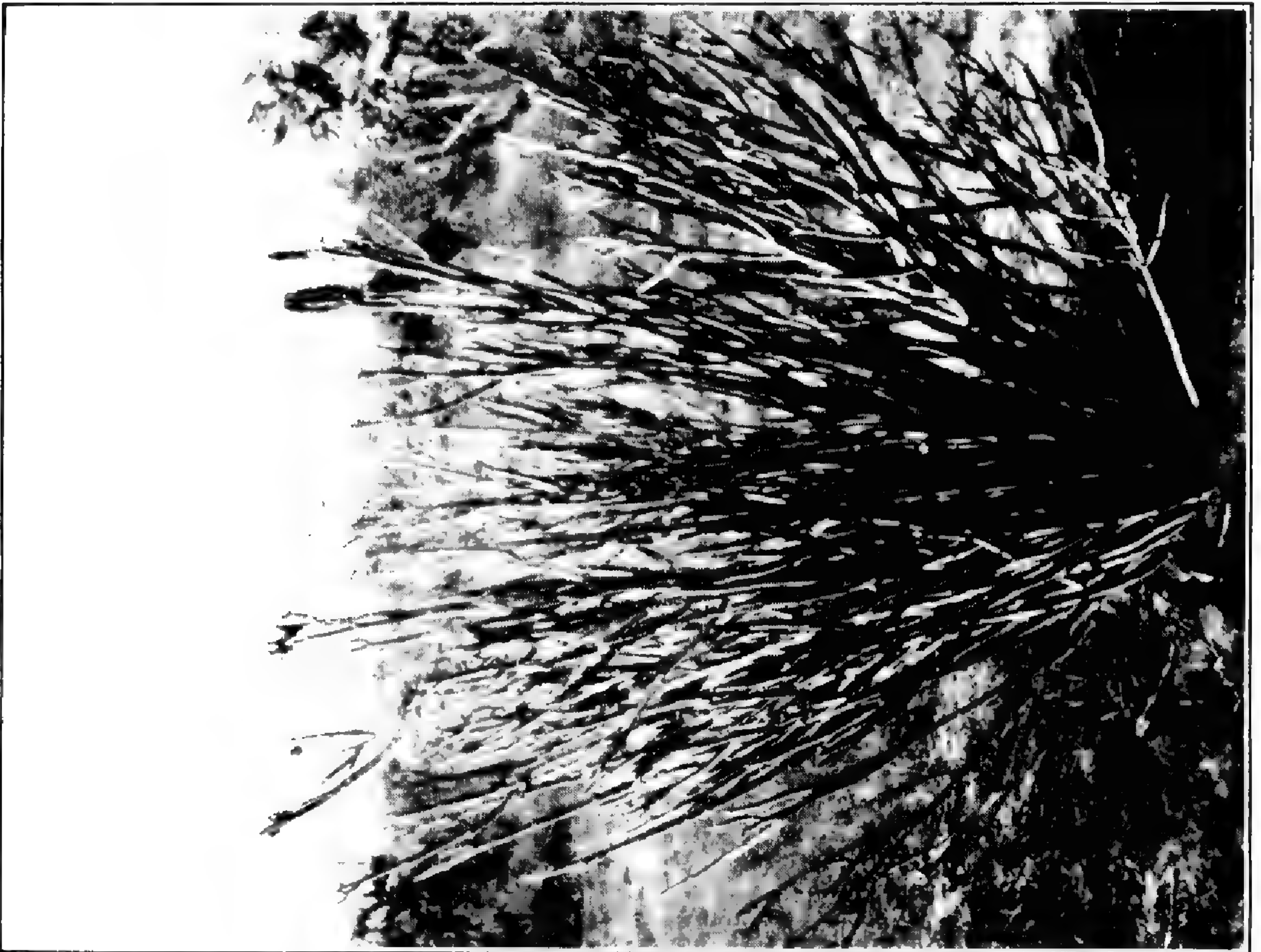
<sup>1</sup> Zoe 4: 166. 1893.<sup>2</sup> Zoe 2: 149. 1891.



A. *JATROPHA CANESCENS* MUELL. ARG., CAPE SAN LUCAS.



B. *JATROPHA SPATHULATA* MUELL. ARG., IN DRY SEASON, SANTA ROSALÍA.



A. PEDILANTHUS MACROCARPUS BENTH., MATANCITA.



B. SEBASTIANIA BILOCULARIS S. WATS., EL PESCADERO.

to La Purísima. In his Flora of the Cape Region Brandegee records it as common at the higher elevations of the interior mountains. It was not seen by us, however, on the higher part of the Victoria Mountains. The species appears to belong in the subtropical area on both sides of the Gulf of California.

**Jatropha spathulata** Muell. Arg.

MATACORA. PLATE 116, B.

One of the widely ranging species which belong to the Cape District and reach well northward. Its distribution corresponds closely to that of *Pedilanthus macrocarpus*. First seen by us near Calamahué and thereafter abundantly nearly all along the route to Cape San Lucas and on the islands of Margarita, Cerralvo, and Espiritu Santo. A very small tree or a shrub, 1.5 to 2.5 meters high. At San Ignacio we were told that the women formerly wove the peeled branches of this species into baskets. The baskets were called "coras" and the name "matacora" appears to be derived therefrom. Specimens of the plant were collected at Calamahué, September 15, and at Tinaja de Santana, 35 miles north of San Ignacio, October 4.

**Manihot chlorosticta** Standl. & Goldm.<sup>1</sup>

Among the many plants of the Cape District that are evidently derived from the tropical flora of the adjacent mainland of Mexico is a Manihot which has recently been described from specimens taken by us, January 6, 1906, at San José del Cabo, where it is rather common. It had been collected before in the same vicinity, but was confused with *M. carthaginensis*, a more southern species with very different leaves and seeds. The species was not seen farther north.

**Pedilanthus macrocarpus** Benth.

CANDELILLA. PLATE 117, A.

One of the most widely ranging and characteristic plants of the Peninsula. Its distribution corresponds closely with that of *Jatropha spathulata* and other species of that genus. It was first seen at Calamahué and was noted as abundant at many localities southward on the mainland to Cape San Lucas and on the islands of Magdalena, Margarita, and Espiritu Santo. Shrub 1 to 1.5 meters high. Rather generally distributed, but most abundant on the coastal plains along the west side of the Peninsula. The thick, milky sap is very sticky and is said to produce a substance similar to rubber, with commercial possibilities. Specimens in flower and fruit were taken at Calamahué, September 15, and along the road from Santo Domingo to Matancita, November 15.

**Sebastiania bilocularis** S. Wats.

HIERBA DE LA FLECHA. PLATE 117, B.

Known to the people throughout the southern part of the Peninsula. It was first noted by us about 20 miles east of San Ignacio, and was abundant thence at intervals southward in the lower hill country to the vicinity of Cape San Lucas. It grows as a tree 3 to 6 meters in height, with spreading branches and rounded top clothed with dense, dark green foliage, in contrast with other desert vegetation. The tree is said to be poisonous and the local name implies an arrow poison. Exposure to the smoke from the burning wood and sleeping in the shade of the tree are said to cause sore eyes. At El Pescadero we were told that the milky juice from the finely chopped branches placed in water is used to kill fish. Specimens in flower were taken about 20 miles east of San Ignacio, October 19, and in flower and fruit between El Pescadero and El Cajón, December 27. Millspaugh records material collected by Brandegee at La Purísima February 12, in excellent floral condition but lacking fruit.

Under his original description Watson gives the type region as consisting of dry water-courses on the hills and mountains of northwestern Sonora. He also states that the plant is described as a tree 3 to 6 meters high with upright slender branches, and is called "yerba de fleche" by the Papago Indians, who say that the Apaches used to poison their arrows with its milky juice.

<sup>1</sup> See p. 311.

**BUXACEAE. Box Family.****Simmondsia californica** Nutt.

JOJOBA.

The "jojoba," as it is known in Mexico, ranges mainly in the Lower Sonoran Zone, reaching southward along the basal slopes of the mountains from San Diego, California, and the Colorado Desert into Sonora and Lower California and becoming less abundant near La Paz and on Carmen and Espíritu Santo islands. A species apparently the same was described by Kellogg from Cedros Island under the name *Simmondsia pabulosa*. Dr. J. A. Veatch, the collector, in notes accompanying the description of Kellogg, says: "Growing in the ravines as well as in the crevices and fissures of nearly perpendicular cliffs. Fruit generally abundant, ripening in July and August, has the taste of a chestnut, with a slight bitterness. The goats and deer of the island are exceedingly fond of both the fruit and leaves and seem to live mostly upon them."

Few shrubs were as abundant or generally distributed along so much of our route. It was first seen in a dry rocky canyon near the eastern base of the Cocopah Mountains. Near the west coast it was found as far north as the Valley of Guadalupe, north of Ensenada, and thence upward along the basal slopes of the Sierra del Pinal and San Pedro Mártir mountains to 840 meters at La Huerta and 900 meters near San Antonio. Along the open bottom of Windy Canyon on the east slope of the San Pedro Mártir Mountains it was noted as high as 1,140 meters. It is associated with *Covillea glutinosa* throughout much of its range and, like it, extends from the desert east of the high mountains through San Matías Pass into Trinidad Valley on the west slope; but it reaches its greatest abundance near the center of its range between San Fernando and San Ignacio, in the extremely arid central section of the Peninsula. It grows as a shrub 1.2 to 2.5 meters high. The evergreen leaves are thickened and leathery; the flowers and fruit seem to be produced irregularly throughout the year. Specimens in fruit or flower, or both, were obtained as follows: Ensenada, February 28; La Huerta, June 2; Trinidad Valley, June 16; Jaraguáy, September 9; Agua Colorada to Cerro Colorado, December 15; Espíritu Santo Island, February 7.

**ANACARDIACEAE. Cashew Family.****Pachycormus discolor** (Benth.) Coville.

COPALQUÍN. PLATE 118, A, B.

This species, like *Idria columnaris*, represents a monotypic genus confined to Lower California. The two are associated in the extremely arid central section of the Peninsula and by their abundance, large size, and striking appearance. They, together with other strange desert forms, make that region seem a wonderland of plant monstrosities. The impression that we were traversing an unreal world was especially strong during our night journeys, when the contorted trunks of the copalquín assumed still more fantastic shapes in the moonlight.

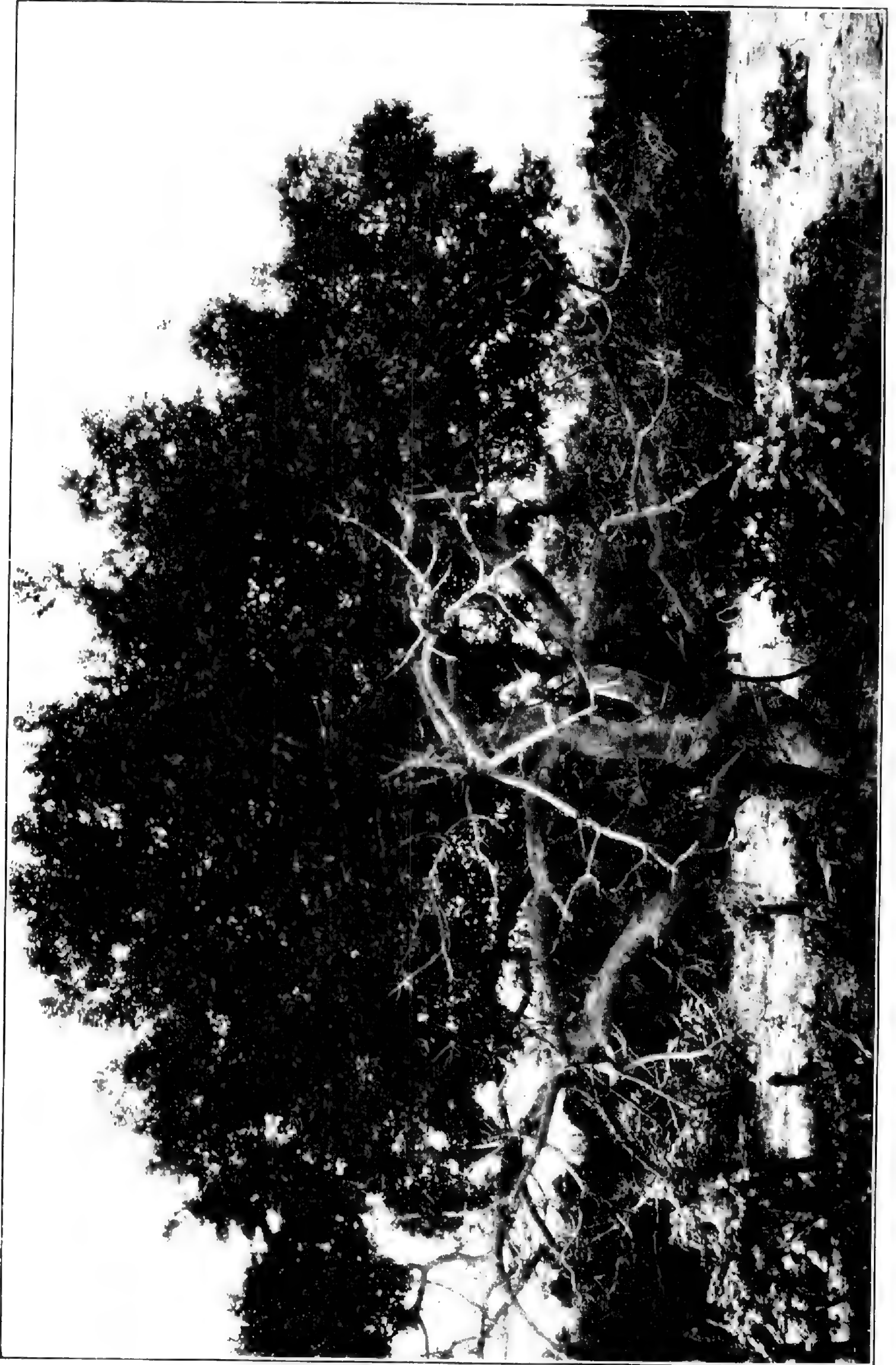
The species was first seen by us near Agua Dulce, a few miles south of Onyx, and was very abundant in suitable situations along the route southward to Magdalena Bay, where it was first discovered during the voyage of the *Sulphur*. It was found to be at home on the stony slopes of desert mountains at all elevations up to about 600 meters, usually disappearing as we ascended the higher, lava-covered mesas and rugged ridges along the backbone of the Peninsula, and was less abundant on sandy plains. It grows as a short-trunked tree, varying from 1.8 to 4.5 meters, very crooked, and tapering rapidly from the ground upward. The species apparently reaches its greatest development on the basal slope of the Santa Clara Mountains, near the coast west of San Ignacio, where a number of trees with a basal trunk diameter of a meter were seen. During the dry season most of the trees are leafless, but they may produce flowers. Specimens in flower were obtained at Jaraguáy, Septem-



A. *PACHYCORMUS DISCOLOR* (BENTH.) COVILLE, IN DRY SEASON, SAN ANDRÉS.



B. SAME SPECIES, SHOWING LARGER GROWTH, SANTA CLARA MOUNTAINS.



TAPIIRA EDULIS T. S. BRANDEG., CAPE SAN LUCAS.

ber 9, at San Andrés, September 21, on Margarita Island, November 29. On Cedros Island these trees were seen in 1859 by Doctor Veatch, who published some interesting notes concerning them, accompanying the description of a supposed new species by Kellogg.<sup>1</sup> He found the main trunks of full-grown trees averaging 60 cm. in diameter with the height of the trunk often less than that. A few exceptionally tall trees reached a height of 1.8 meters. He further says: "The trunk divides into several ponderous branches that shoot off horizontally and are bent and contracted into grotesque resemblances of the flexed limbs of a corpulent human being. These huge branches often terminate suddenly in a few short twigs covered with a profusion of red flowers, reminding one of the proboscis of an elephant holding a nosegay. The resemblance is heightened by the peculiar brown skinlike epidermis that forms the outer bark, which splits and peels off annually, accommodating the increase of growth. This epidermis, when removed, exposes the smooth greenish-colored surface of the spongy inner bark, which is from 1 to 2 inches in thickness. When this bark is cut through, a milky juice exudes that soon hardens into a compact mass of gum and resin. The quantity furnished from a single cut is considerable.

"The branches of the larger trees often shoot out to a horizontal distance of 20 feet from the trunk, thus covering an area of 40 feet in diameter. Smaller subordinate limbs spring upward from the upper side of the large boughs, and in this way give a neat oval appearance to the outline of the tree. When loaded with its bright red flowers, the effect is strikingly beautiful, particularly where hundreds of the trees stand near each other, intertwining their boughs, and forbidding ingress to the mysterious space they cover and protect. The leaves are minute and fall off before the blossoms are fairly developed. The young tree looks a good deal like a huge radish protruding from the ground. On the mountain sides, from a little above seashore to an elevation of 1,500 feet, these trees grow scatteringly, singly, and in small clumps, but in the narrow vales of the ravines they sometimes form groves of several acres in extent, presenting the impenetrable and compact form above described. From June till August seems to be their blooming season."

Brandegge says the species also occurs on Natividad Island.

#### *Schmaltzia ribifolia* Greene.<sup>2</sup>

The type of this species was taken by us at 1,140 meters elevation in San Matías Pass at the north end of the San Pedro Mártir Mountains. It is rather common here, growing as a shrub 1.8 to 2.5 meters high and bearing ripe fruit June 28.

#### *Tapirira edulis* T. S. Brandeg.

CIRUELA. PLATE 119.

The "ciruela," as it is called in Lower California, is quite unlike the species of *Spondias* with which we became familiar under the same local name on the Isthmus of Tehuantepec and along the west coast of the Mexican mainland. The trees are somewhat similar in general appearance, but the fruit and leaves of this *Tapirira* are velvety and the fruit tasted by us was by no means so agreeable in flavor. The fruit, however, is eaten by the people of the Cape District and Brandegge says: "The ripe fruit is usually very pleasant to the taste, although on some trees it is always bitter. On a hot afternoon, far from water, it is always delightful to find the shade of one of these trees and eat the juicy ripe fruit with which the ground under them, in September, is in most cases plentifully sprinkled."

The ciruela was first seen by us in the hills between Agua Colorada and Cerro Colorado, northwest of La Paz. It was abundant at the lower elevations along much of our route throughout the Cape District south of La Paz and is a representative here of the tropical flora of Mexico. J. E. McLellan, in a field report dated August, 1895, mentions the "pits" of ciruela fruit as the chief food at that season of the antelope

<sup>1</sup> *Hesperian* 4: 49-50. 1860.

<sup>2</sup> See p. 311.



squirrel (*Ammospermophilus*) inhabiting Espiritu Santo Island. The ciruela grows as a tree 7.5 to 9 meters in height, with a trunk diameter of 15 to 30 cm. A specimen in fruit was taken between Agua Colorada and Cerro Colorado, December 15.

### CELASTRACEAE. Staff-tree Family.

**Maytenus phyllanthoides** Benth.

Along the shore of the bay a few miles north of La Paz we found this species abundant. It grows as a tree 4.5 to 7.5 meters high in low, swampy places, which may be submerged at high tide. A specimen was collected here February 3. The species was discovered at Magdalena Bay on the voyage of the *Sulphur*. It was noted by Brandegee on the coast at Todos Santos, San Jorge, La Paz, and San José del Cabo, and on Margarita Island.

Watson records the species from the collection made by Palmer at Mulegé in 1887.

### STAPHYLEACEAE. Bladder-nut Family.

**Viscainoa geniculata** (Kellogg) Greene.

A Lower Sonoran desert shrub which, like *Simmondsia californica*, ranges widely in the Peninsula, but reaches its greatest abundance in the extremely arid central section from the vicinity of San Fernando south to San Ignacio. It was first met with at 1,140 meters altitude near San Matías Pass, where it was taken in flower June 17. It was not again noted until we were nearing Jaraguáy, 58 miles southeast of San Fernando, when it suddenly became abundant on an open gravelly mesa and was seen along most of the route thence to San Ignacio. Beyond San Ignacio it was noted at intervals as far as Cerro Colorado, northwest of La Paz. The species has also been recorded from Sonora. Like *Simmondsia californica* it shows a preference for the desert region along the gulf side of the Peninsula, reaching across to the Pacific coast mainly in the central part of its range. It grows 1.5 to 3.5 meters high and is commonly associated with such species as *Simmondsia californica*, *Covillea glutinosa*, *Idria columnaris*, and *Prosopis glandulosa*. Besides a flowering specimen in San Matías Pass, one was taken in fruit at Jaraguáy, September 9.

### AESCULACEAE. Buckeye Family.

**Aesculus parryi** A. Gray.

PARRY BUCKEYE.

Found common on steep hill slopes facing the coast near Ensenada and up to about 780 meters altitude near Ojos Negros in San Rafael Valley. It was also noted at intervals along the route from San Telmo southward to a point in the hills between Rosario and Las Cuevas, but beyond this it was not seen, the country becoming pure Lower Sonoran in character. The plant is a shrub 1.2 to 2.5 meters high and appears to belong in the Upper Sonoran Zone. Specimens in flower were taken at Ensenada, May 20. Recorded by Brandegee from Rosario.

### SAPINDACEAE. Soapberry Family.

**Dodonaea viscosa** L.

SWITCH SORREL.

With this species we had already become familiar over wide tropical and subtropical areas in western Mexico. Although ranging so widely, it was not found in great abundance in the Peninsula. It was first noted at Yubay and then along the route from Pozo Altamirano to San Pablo. Farther south it was not seen again until we entered the foothills of the Victoria Mountains, south of La Paz, where it was more common. The species grows as a slender shrub 3 to 6 meters high, reaching

up on the slopes of the Victoria Mountains to between 900 and 1,200 meters. Specimens were obtained as follows: Yubay, September 18 (flowers); San Bernardo to El Saúz, January 21; La Laguna to El Paraíso, January 29 (fruit). Recorded by Brandegee from Jesús María and San Pablo and in the Cape District.

### RHAMNACEAE. Buckthorn Family.

#### *Adolphia infesta* Meisn.

This well-armed and widely ranging species is common in places along dry arroyos at about 600 meters, on the west side of the San Pedro Mártir Mountains. It grows as a shrub 1.5 to 2.5 meters high and appears to belong to the Upper Sonoran Zone. A flowering specimen was taken near San Antonio, August 1.

#### *Ceanothus goldmanii* Rose.<sup>1</sup>

Along the west slope of the Sierra del Pinal and San Pedro Mártir mountains this abundant species is associated in the Upper Sonoran Zone with *C. submontanus*. It was noted at elevations ranging from 840 meters on north slopes near La Huerta up to about 1,680 meters on the upper slopes of the Pinal Mountains and from 1,290 meters between Pozo Luciano and El Piñón on open southwest slopes to about 1,950 meters above Rancho Santo Tomás in the San Pedro Mártir Mountains. It was most abundant on warm slopes at about 1,500 meters, growing as a stout shrub 1.8 to 3.5 meters in height and forming dense thickets. When one of the shrubs dies the branches have a peculiar habit of interlocking or knitting together at the tips, forming a spire. The type, in flower and fruit, was taken at La Huerta, June 2, and a specimen with empty seed capsules at El Piñón, July 5. The species passed as *C. rigidus* Nutt., until recently described as new.

#### *Ceanothus divaricatus* Nutt.

In the Transition Zone near La Grulla and along the road from La Grulla to Rancho Santo Tomás, in our descent of the San Pedro Mártir Mountains, this shrub was noted in a number of places, sometimes associated with *Arctostaphylos pringlei*. It grows 1.8 to 3.5 meters high. A specimen with ripening fruit was collected at La Grulla, July 20. The species is common in the same zone in the mountains of southern California.

#### *Ceanothus submontanus* Rose.<sup>1</sup>

This recently described shrub, closely resembling *C. cuneatus*, ranges with *C. goldmanii* in the Upper Sonoran Zone on the western slopes of the Sierra del Pinal and San Pedro Mártir mountains, but was less abundant than that species and not observed at so high elevations. It was noted at elevations ranging from 840 meters on north slopes near La Huerta up to about 1,650 meters near the summit of the Pinal Mountains and from 1,200 to 1,500 meters near El Piñón in the San Pedro Mártir Mountains. It grows 1 to 3 meters in height. The type, in fruit, was taken at Alamo, June 11, and a specimen with empty seed capsules at El Piñón, July 5.

#### *Ceanothus palmeri* Trel.

A specimen with empty seed capsules was taken near El Piñón, on the northwest slope of the San Pedro Mártir Mountains, July 5. It was noted between 1,350 and 1,500 meters on brush-covered hillsides, where *C. submontanus* and *C. goldmanii* grew more abundantly, with other vegetation of the Upper Sonoran Zone.

#### *Colubrina glabra* S. Wats.

Specimens of this shrub in flower and fruit were taken at 360 meters near Tinaja de San Esteban, 25 miles north of San Ignacio, October 5, and between 360 and 600

<sup>1</sup> See p. 311.

meters, 20 miles east of San Ignacio, October 19. It grows as a shrub 1.8 to 3.5 meters high and appears to belong to the subtropical flora. Recorded by Brandegee from Magdalena Island, San Julio Canyon, and San José del Cabo.

**Karwinskia humboldtiana** Zucc.

A specimen in fruit, taken about 5 miles southwest of El Potrero, October 31, has been referred to this species by Mr. Brandegee. Another, also in fruit, which may represent another species, but is provisionally included in this, was collected between Cerro Colorado and Rodríguez, December 16. Brandegee records the species from La Paz, Todos Santos, and San José del Cabo. *Karwinskia humboldtiana* is apparently a very variable and widely ranging species, or possibly more than one species is passing under this name. As recognized at present, it ranges in the warmer areas from southern Texas and Lower California to southern Mexico or Guatemala. In southern Lower California it is associated with many tropical species. It grows here as a shrub 2.5 to 3.5 meters high.

**Rhamnus californica** Eschw.

CALIFORNIA BUCKTHORN.

Specimens referred to this species by Mrs. Brandegee were taken in the San Pedro Mártir Mountains. The species is common at the upper levels and was flowering at 1,500 meters on northwest slopes near El Piñón, July 7, while it bore both flowers and partly grown fruit at 2,100 meters near La Grulla, July 20.

**Rhamnus crocea** Nutt.

EVERGREEN BUCKTHORN.

The evergreen buckthorn is abundant in the Upper Sonoran Zone along the western side of the Sierra del Pinal and San Pedro Mártir mountains, especially on open slopes, at about 1,350 meters altitude. Specimens were collected as follows: Laguna Hanson (1,680 meters), in flower, June 2; between Rancho Santo Tomás and San Antonio (1,350 meters), in about full grown but still green fruit, July 28; near San Antonio (750 meters), in ripe fruit, August 1.

**MALVACEAE. Mallow Family.**

**Abutilon californicum** Benth.

This shrub was discovered at Magdalena Bay on the voyage of the *Sulphur*. We collected it in flower and ripe fruit at Tinaja de San Esteban, 25 miles north of San Ignacio, October 5. It appears to belong to the subtropical flora of the Peninsula. Brandegee records it from Magdalena and Margarita islands, from the adjacent mainland, and from San José del Cabo.

**Abutilon palmeri** A. Gray.

A handsome shrub, 1.8 to 3.5 meters high. A specimen was taken in flower and fruit along the road from Agua Colorada to Cerro Colorado, December 15. Brandegee records this species from La Paz and Todos Santos, and specimens referred here were collected by him on Margarita Island.

**Gossypium herbaceum** L.

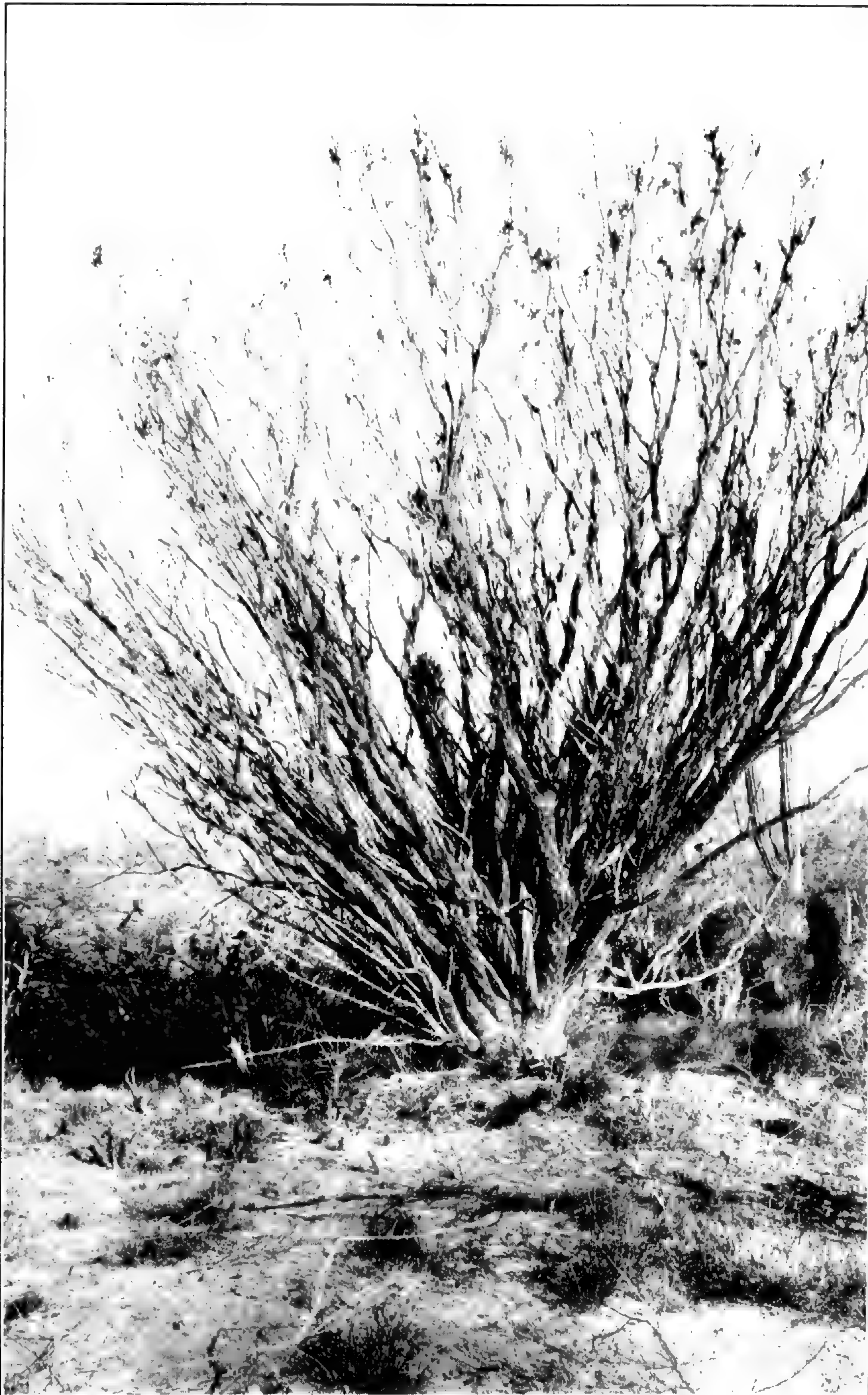
COTTON.

Cotton was formerly cultivated at San José del Cabo, La Purísima, Comandú, and as far north as San Fernando, but has been neglected in more recent years. A few plants were growing in old fields and gardens. Brandegee records the species as escaped from cultivation at San José del Cabo.

**Gossypium davidsonii** Kellogg.

DAVIDSON COTTON.

Wild cotton, referred to this species by Brandegee, was seen several times in the hills between Cerro Colorado and the Cañón de los Reyes in crossing the Peninsula



*FOQUIERIA PENINSULARIS* NASH, SAN ANDRÉS.

from Matancita to La Paz, but was more common at low elevations south of La Paz. Specimens with ripe bolls were collected between Cerro Colorado and Rodríguez, December 16, and with ripe bolls and flowers between Tres Pachitas and Valle Flojo, December 25. It is a shrub 1.2 to 2.5 meters high of no known economic value. Recorded by Brandege from Magdalena Island, San Gregorio, and San José del Cabo.

*Gossypium harknessii* T. S. Brandeg. HARKNESS COTTON.

This wild cotton, forming dense patches 1.2 to 1.8 meters high, is very abundant on the basal slopes of hills on Margarita Island, where it was discovered by Brandege. Specimens with flowers and maturing bolls were collected November 29.

*Hibiscus coulteri* Harv.

The handsome flowers of this species were seen in a few fertile spots along the road through the lava beds from La Purísima to Comandú. It is a shrub 1.8 to 2.5 meters high. Specimens were taken in flower November 5. Brandege records the species from San José del Cabo and La Paz.

### STERCULIACEAE.

*Fremontodendron californicum* (Torr.) Coville. FREMONTIA.

We observed this handsome shrub or small tree only in the Upper Sonoran Zone at San Matías Spring, where the extreme northern end of the San Pedro Mártir Mountains slopes down into San Matías Pass. Flowering specimens were taken June 28.

*Melochia tomentosa* L.

The range of this tropical shrub includes the southern half of the Peninsula. It was rather common in places, mainly near water among the hills in the interior. It was taken in flower and immature fruit at Tinaja de San Esteban, 25 miles north of San Ignacio, October 5. Brandege records the species as common everywhere in the Cape District south of La Paz, except in the mountains.

### FOUQUIERIACEAE. Ocotillo Family.

*Fouquieria splendens* Engelm. OCOTILLO.

Among the most abundant shrubs in the Peninsula are this and the following species of *Fouquieria*. The "ocotillo," as *F. splendens* is locally called, ranges in the Lower Sonoran Zone from southeastern California southward along the east side of the high mountains, spreading across the Peninsula south of the San Pedro Mártir Mountains, and finally meeting and, for a short distance only, overlapping the range of *F. peninsularis* in the vicinity of Rosarito. It is rather partial to gravelly or rocky hillsides and ascends the eastern basal slopes of the San Pedro Mártir Mountains to 1,140 meters in San Matías Pass. Near the west coast it was first seen between Rosario and Las Cuevas. It was taken in flower at San Fernando, September 4.

*Fouquieria peninsularis* Nash. PALO DE ADÁN. PLATE 120.

The "palo de Adán," as this species is called by the people of the Cape District, was first noted near San Andrés. Here it occurs along with *F. splendens*, from which, however, it differs very noticeably in habit. That species ramifies from near the ground into comparatively few stout, straight stems. *Fouquieria peninsularis* is usually not so tall, the stems are more numerous and much more ramified, and the small branches are more slender and crooked. It usually has a well-formed but short trunk. Southward from the vicinity of Rosarito, beyond which *F. splendens* was not noted,

the palo de Adán was one of the most abundant shrubs except on the upper slopes of the mountains. It was also seen on Magdalena and Cerralvo islands. It is more generally distributed than *splendens*, which prefers gravelly or rocky places, while the present species spreads from such areas out over sandy deserts. Like many other shrubs of this region, it is nearly or quite leafless during the dry season, but the full foliage appears in remarkably short time after the first rains. A deer killed on the desert west of San Ignacio about the middle of October had its stomach entirely filled with newly grown leaves of palo de Adán. Specimens were taken at various places from San Andrés to near Cape San Lucas between September 21 and January 19, showing that flowers and fruit are produced irregularly during much of the year. The range of this species and its association with so many southern plant forms seem to place it in the subtropical section of the flora. In his Flora of the Cape Region Brandegee records this species under the name "*Fouquieria spinosa*" as occurring throughout the whole region excepting the high mountains.

*Idria columnaris* Kellogg.

CIBIO. PLATES 121, 122, A, B.

Near Las Cuevas, a few miles southeast of San Fernando, we abruptly entered the range of the extraordinary tree known locally as "cirio." It became at once a dominant species, giving to the entire landscape, by its strange configurations, an aspect very unlike anything we had ever seen. It is generally distributed over rocky hills and sandy flats, but is most numerous on the lower ground, where it commonly forms a scattered forest, the taller trees reaching a height of about 18 meters. In many places, especially along the high rocky backbone of the Peninsula, its range was interrupted, but it would reappear a few miles farther on. It was found to be distributed along our route from near San Fernando to near the Tinaja de Santana, about halfway between Calmallí and San Ignacio, and its general range thus includes one of the most arid sections of the Peninsula. The younger trees are stocky and quite symmetrical, but the older ones are apt to become top-heavy and in overhanging assume many fantastic shapes. A flowering specimen was obtained at Jaraguáy, about 58 miles southeast of San Fernando, September 9. The following notes on this species by Doctor Veatch accompanied the original description by Kellogg:

"I found the *Idria columnaris* growing rather abundantly on the margin of the Bay of Sebastian Viscanio, at a point east of Cedros Island, on the coast of Lower California. It was observed mostly on the sandy and gravelly flats formed by the expansion of hill ravines in their approach to the shore. Near the same locality was also found the kindred genus *Fouquieria*, whose bright scarlet blossoms contrasted strongly and pleasantly with the pale yellowish inflorescence of the *Idria*."

Many of the larger trees are hollow. Bees introduced into Lower California have thrived in a wild state and frequently occupy the hollow trunks of the cirio.

### KOEBERLINIACEAE. Junco Family.

*Koeberlinia spinosa* Zucc.

ALLTHORN.

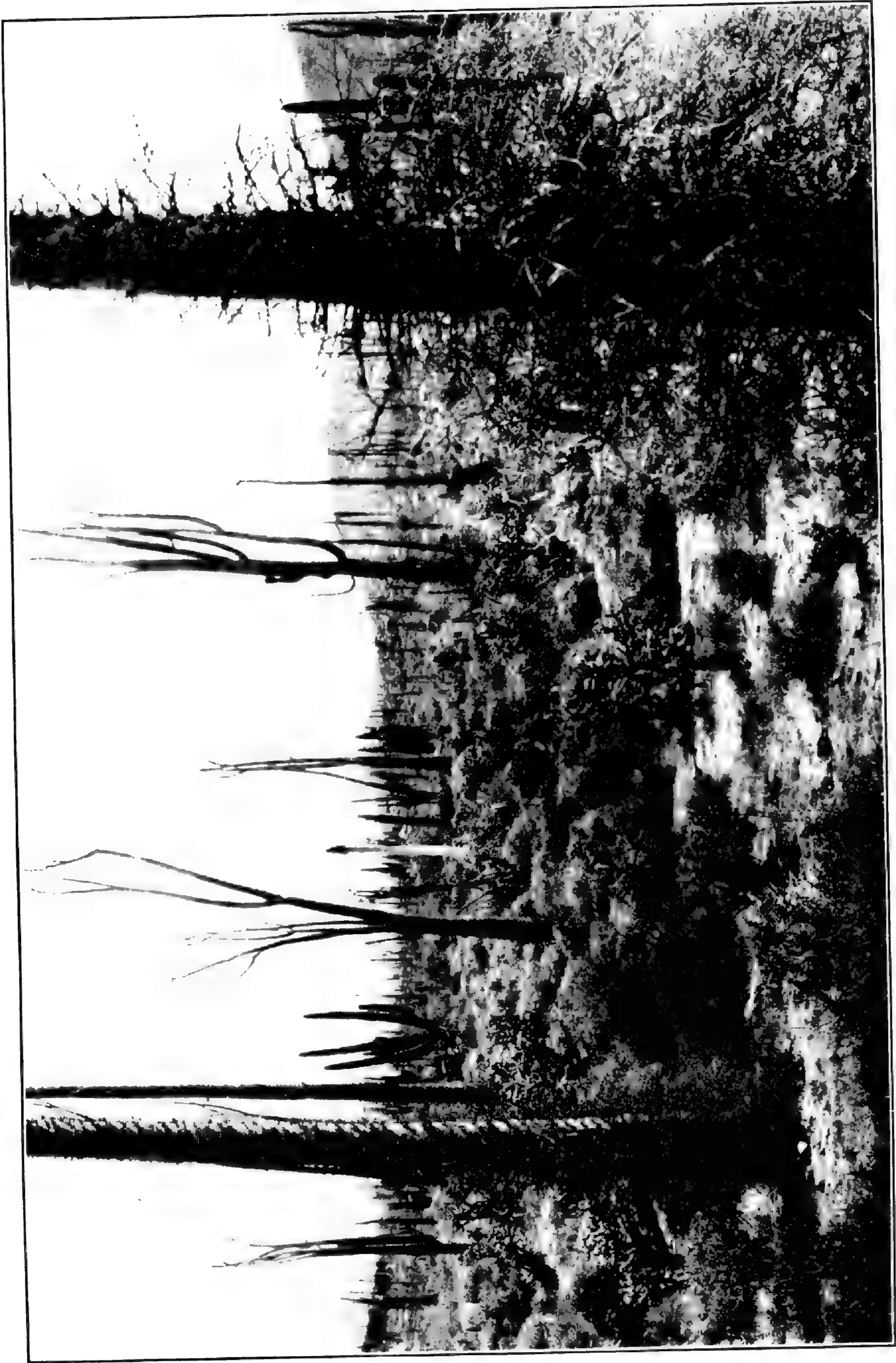
A common Lower Sonoran species of the southwestern United States. Recorded by Brandegee at San Jorge.

### TURNERACEAE. Turnera Family.

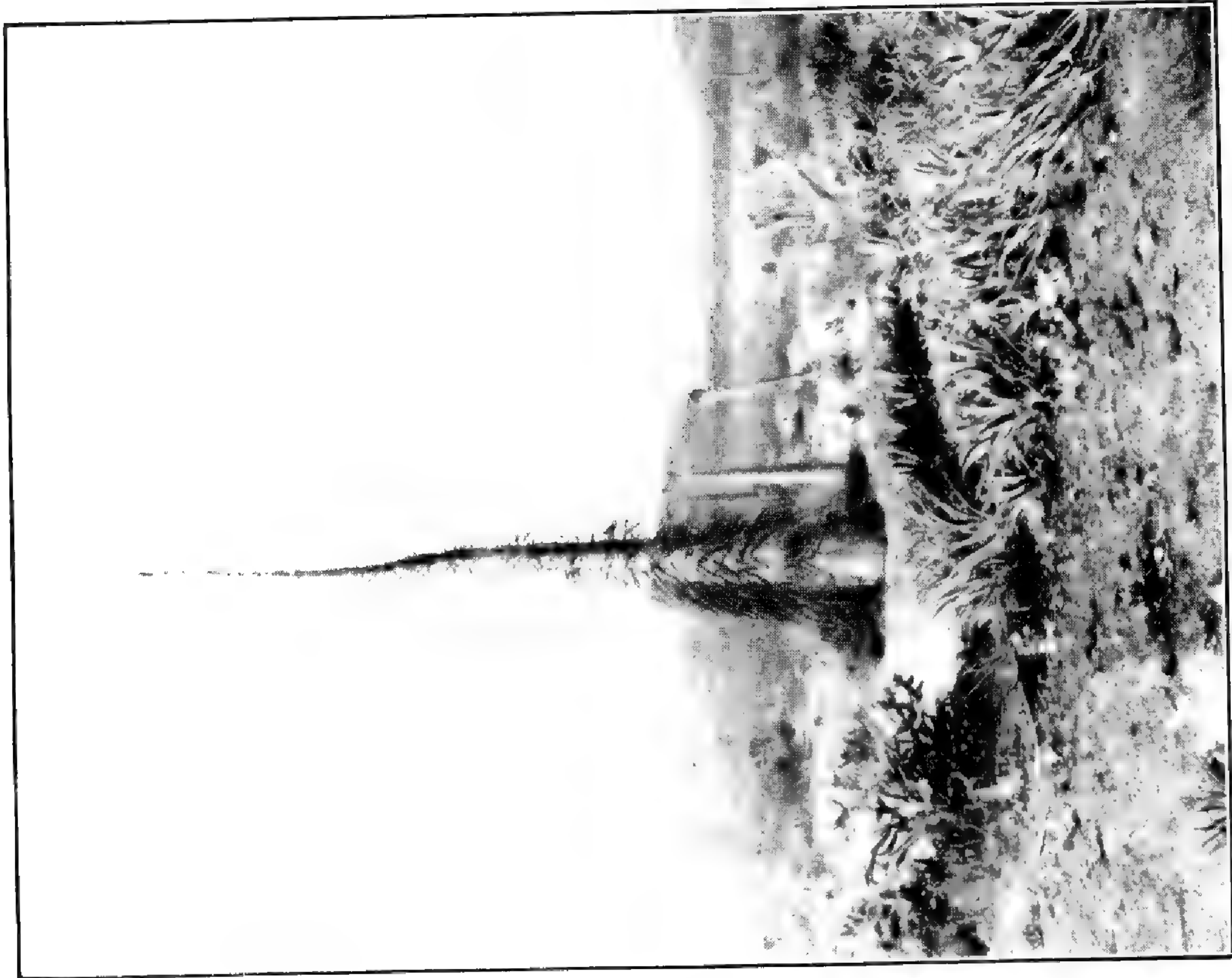
*Turnera humifusa* (Presl) Endl.

DAMIANA.

A small shrub found in the Cape District south of La Paz, as also along the west coast of Mexico, in both regions called "damiana." It is common, with a height of 30 to 60 cm. along the basal slopes of the Victoria Mountains up to 1,050 meters. It is used as tea and in flavoring a liquor called "pazanita." A flowering specimen was taken between San Bernardo and El Saúz, in the Victoria Mountains, January 21. Brandegee records it as common at low elevations in the Cape District.



IDRIA COLUMNARIS KELLOGG, SAN FERNANDO.

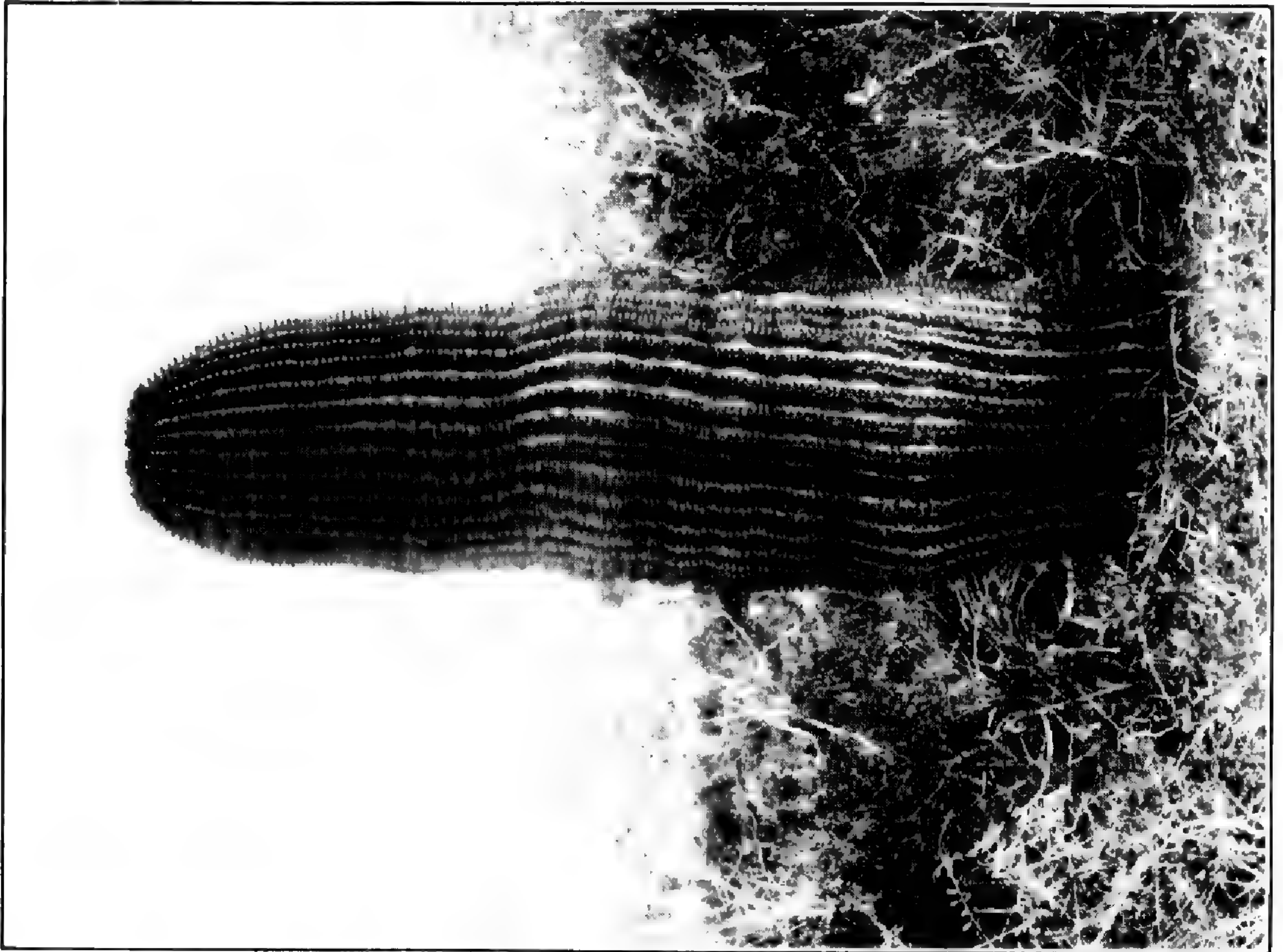


B. THE SAME SPECIES (FULL GROWN), CALMALLI.



A. IDRIA COLUMNARIS KELLOGG (YOUNG PLANT, IN FLOWER), AGUA DULCE.





B. *ECHINOCACTUS DIGUETI* WEB., CERRALVO ISLAND.



A. *ECHINOCACTUS FALCONERI* ORCUTT, SAN JOSÉ DEL CABO.

### CACTACEAE. Cactus Family.

#### *Bergerocactus emoryi* (Engelm.) Britt. & Rose.

Patches of this serpentine cactus were seen on the shores of the Bay of San Quintín and along the beach south of Socorro on the road to Rosario. The range of the species is doubtless more or less continuous along the coast northward to the type locality at the international boundary and may include some of the islands. The stems vary in length from less than 20 to 150 or 175 cm. In some of the larger patches the stems grow more or less upright to a height of a meter or more and then turn downward and trail along the ground.

#### *Echinocactus falconeri* Orcutt.

PLATE 123, A.

The genus *Echinocactus* is represented in the desert regions nearly throughout the Peninsula, but the number of species and their respective ranges have not been fully determined. The present seems to be the most abundant and generally distributed species from at least as far north as latitude 28° to Cape San Lucas. It also has an extended range along the coast on the east side of the Gulf of California. As usual in the group to which it belongs, this species prefers stony places, especially the rock-covered slopes along the backbone of the Peninsula. It grows commonly 0.5 to 1.2 meters high. Specimens were collected at Calmallí, San José del Cabo, and along the road from El Sacatón to Cape San Lucas.

#### *Echinocactus rectispinus* (Engelm.) Rose.

This *Echinocactus* was collected by us at 1,020 meters altitude near Tinaja de Santana, 35 miles north of San Ignacio, October 4. It was growing to a height of 1 to 1.5 meters among the rocks on a lava-covered mesa. A species which we took to be the same was abundant nearly all the way from the Santa Clara Mountains across the Peninsula to Santa Rosalía and northward at least to Calmallí. The type came from the vicinity of Mulegé, where it was collected by Gabb in 1867. Specimens referred to this cactus by Rose were collected by him at the head of Concepción Bay, April 5, 1911. The species probably has an extended range in the Peninsula similar to that of *E. falconeri*.

#### *Echinocactus fordii* Orcutt.

Rose refers to this species specimens collected by him on San Bartolomé Bay, March 13, 1911.

#### *Echinocactus chrysacanthus* Orcutt.

Specimens referred to this species by Rose were collected by him on Cedros Island, March 10, 1911.

#### *Echinocactus orcuttii* Engelm.?

A species found growing abundantly in San Matías Pass, at the north end of the San Pedro Mártir Mountains, was photographed but not collected. It is probably *orcuttii*, which was based on material collected by Orcutt in Palm Valley, in the drainage of the Tijuana River.

#### *Echinocactus digueti* Web.

VIZNAGA. PLATE 123, B.

While in the vicinity of the Cape we were told of the giant "viznaga" of Cerralvo Island, and on our visit found this species quite common. It grows mainly, or is more abundant, along the rocky lower slopes of this mountainous island, often within a few feet of the water. One of the larger plants, which was chosen to be photographed and from which specimens were taken, measured 2.3 meters in height and 2 meters

in circumference, as measured by a tape line drawn as closely to the trunk as the projecting spines would permit. The usual height, however, is 1 to 2 meters.

This Echinocactus was originally discovered by Leon Diguet on Santa Catalina Island, in the Gulf of California, about 100 miles north of La Paz. It was re-collected by Rose at the type locality and on Carmen Island in April, 1911. The species is not known to occur on the mainland.

**Echinocereus brandegei** (Coult.) Schum.

PLATE 124.

Discovered at Campo Alemán by Brandege, April 24, 1889. It was first noticed by us and collected at about 300 meters altitude in the bottom of the canyon at San Pablo. From this point southward to Matancita it was seen in a number of places along our route. Unlike the species of Echinocactus, it prefers the softer soil in the bottoms of canyons along the backbone of the Peninsula or on the plains near the west coast. It was noted as far west as the Santa Clara Mountains, but was more abundant on the coastal plain between San Jorge and Matancita, where it was collected in flower November 14. It grows in thick bunches usually not more than 0.5 to 1.5 meters in diameter, the stems 15 cm. in length, some upright and others reclining.

**Lemaireocereus thurberi** (Engelm.) Britt. & Rose.

PITAHAYA DULCE. ORGAN PIPE CACTUS. PLATE 125, A.

The "pitahaya dulce," so called in Lower California, was originally described from "a rocky canyon near the mountain pass of Bacuachi, a small town on the road to Arispe, in Sonora." It was first seen on our route near Pozo Altamirano and afterwards from this point southward to Cape San Lucas we found it fairly common, except on very sandy areas. Its range in the Peninsula thus includes the southern half, from near latitude 28°. It occurs also on Cerralvo Island. The species grows among the rocks on the lava-covered mesas along the backbone of the Peninsula and on the plains near the Pacific coast. The fruit is gathered in quantities by the people, but seemed to us less palatable than that of the next.

**Lemaireocereus gummosus** (Engelm.) Britt. & Rose.

PITAHAYA AGRIA. PLATE 126, A.

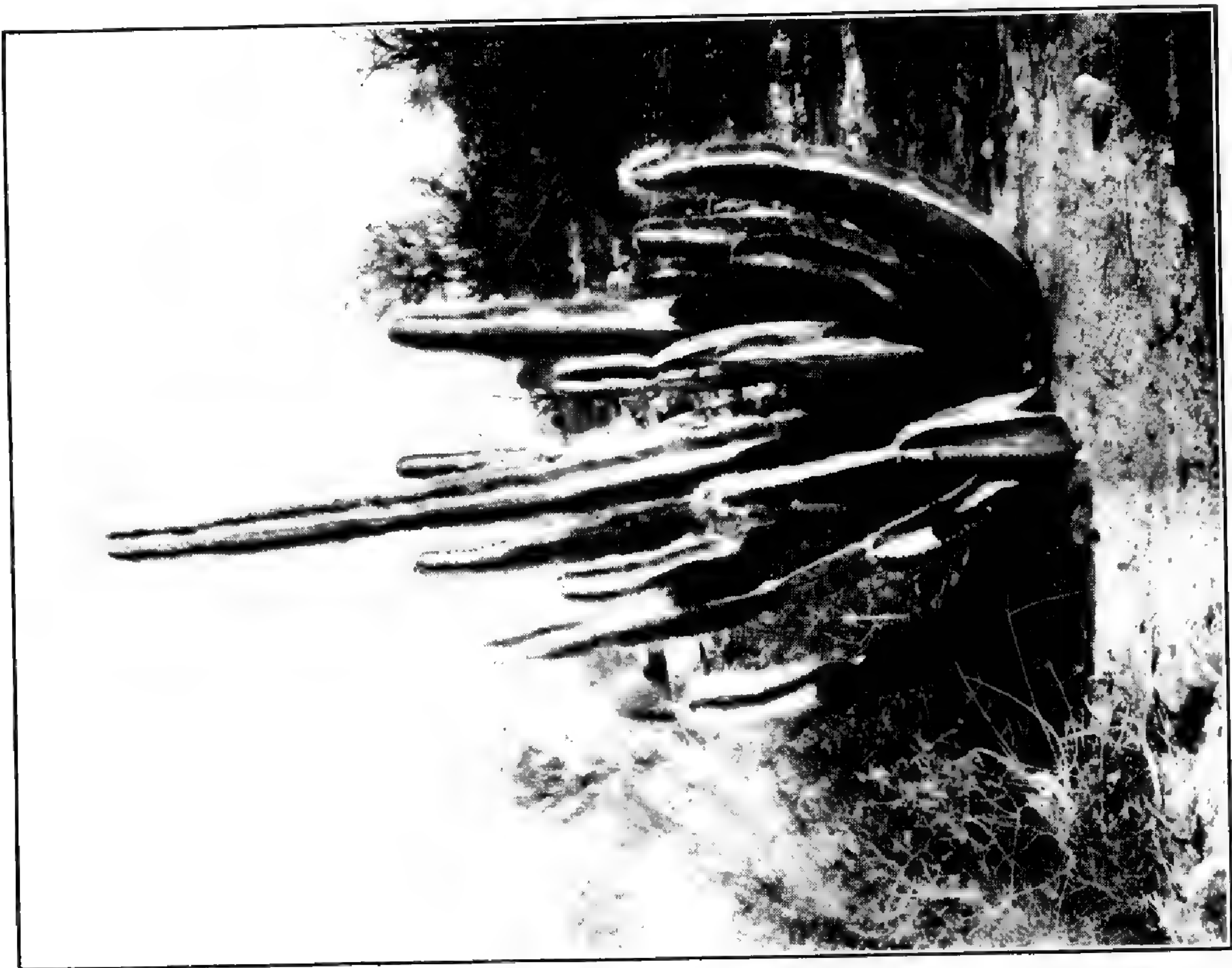
Well known throughout its range by the name given. It was first noted and collected by us in the vicinity of Yubay and was one of the most abundant and generally distributed cactuses along our route from this point southward to Cape San Lucas. It is also common on Magdalena, Margarita, Espíritu Santo, and Cerralvo islands. Brandege recorded the species from San Martín and Cedros islands, and more recently Dr. Rose has collected it on the islands of Catalina and Santa Cruz in the Gulf of California. The plants grow 1.5 to 2 meters high, with numerous branches. The large fruit is slightly tart and very agreeable to the taste. It is much prized by the natives and to us seemed much superior to that of *L. thurberi*, which is sweeter and more insipid.

**Lemaireocereus eruca** (T. S. Brandeg.) Britt. & Rose. CHIRINOLA. PLATE 127.

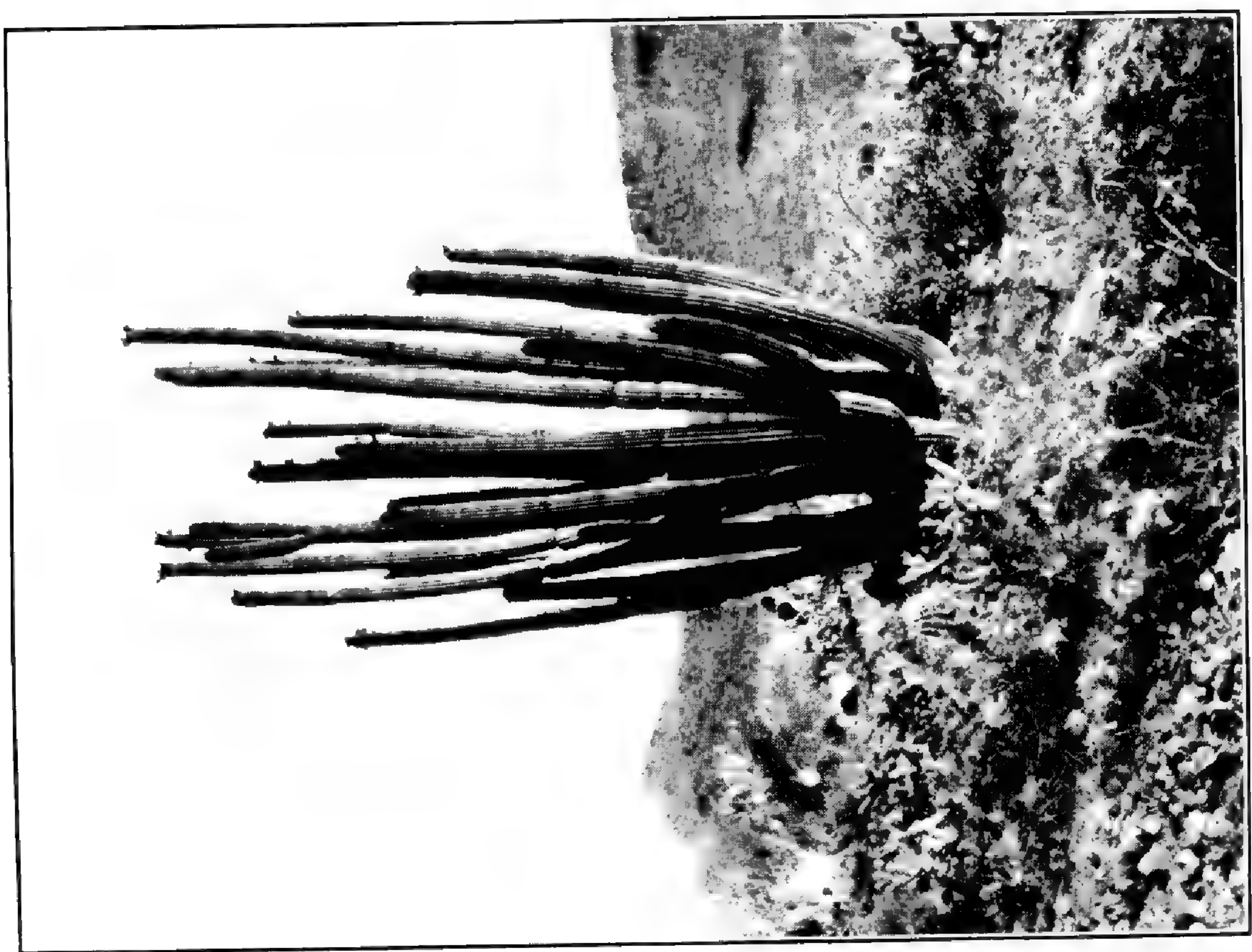
We first saw this remarkable cactus on the coastal plain near Santo Domingo, about 30 miles north of Matancita and here made a collection. From this point southward it was noted at intervals on the plains as far as the Llano de Yrais and on the lower and more sandy parts of Magdalena Island. The stems grow 1 to 3 meters in length and are nearly prostrate, and from this habit and their long whitish recurved spines have aptly been likened to huge caterpillars. The growing ends of the branches stand up from the ground, but progressive growth leaves the main body lying prostrate. The stems become rooted along the lower sides and gradually die behind, resulting in a slow progression of the living portion along the ground. Multiplication of individuals frequently results from the decay of connecting parts. In some places



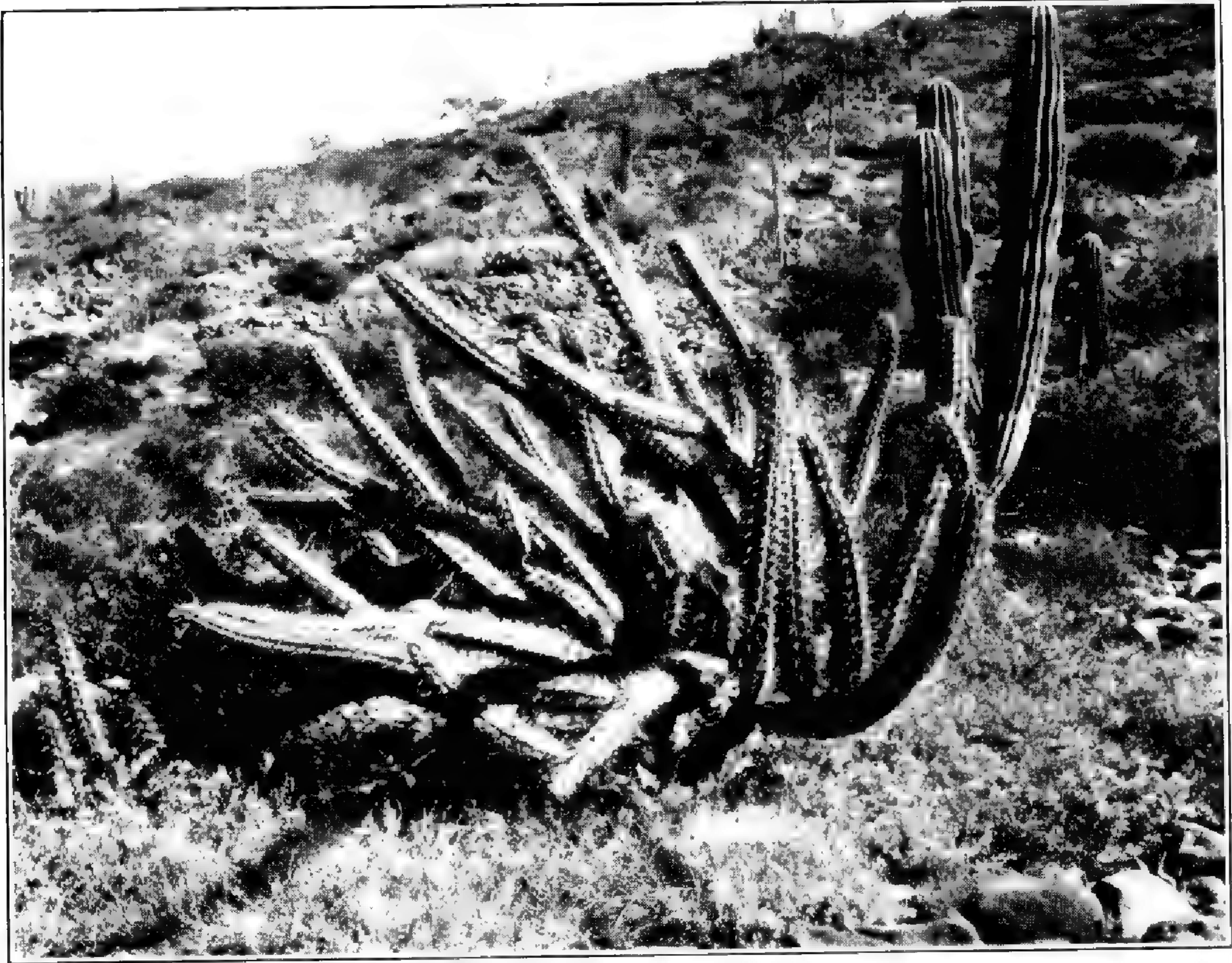
ECHINOCEREUS BRANDEGEI (COULT.) SCHUM., MATANCITA.



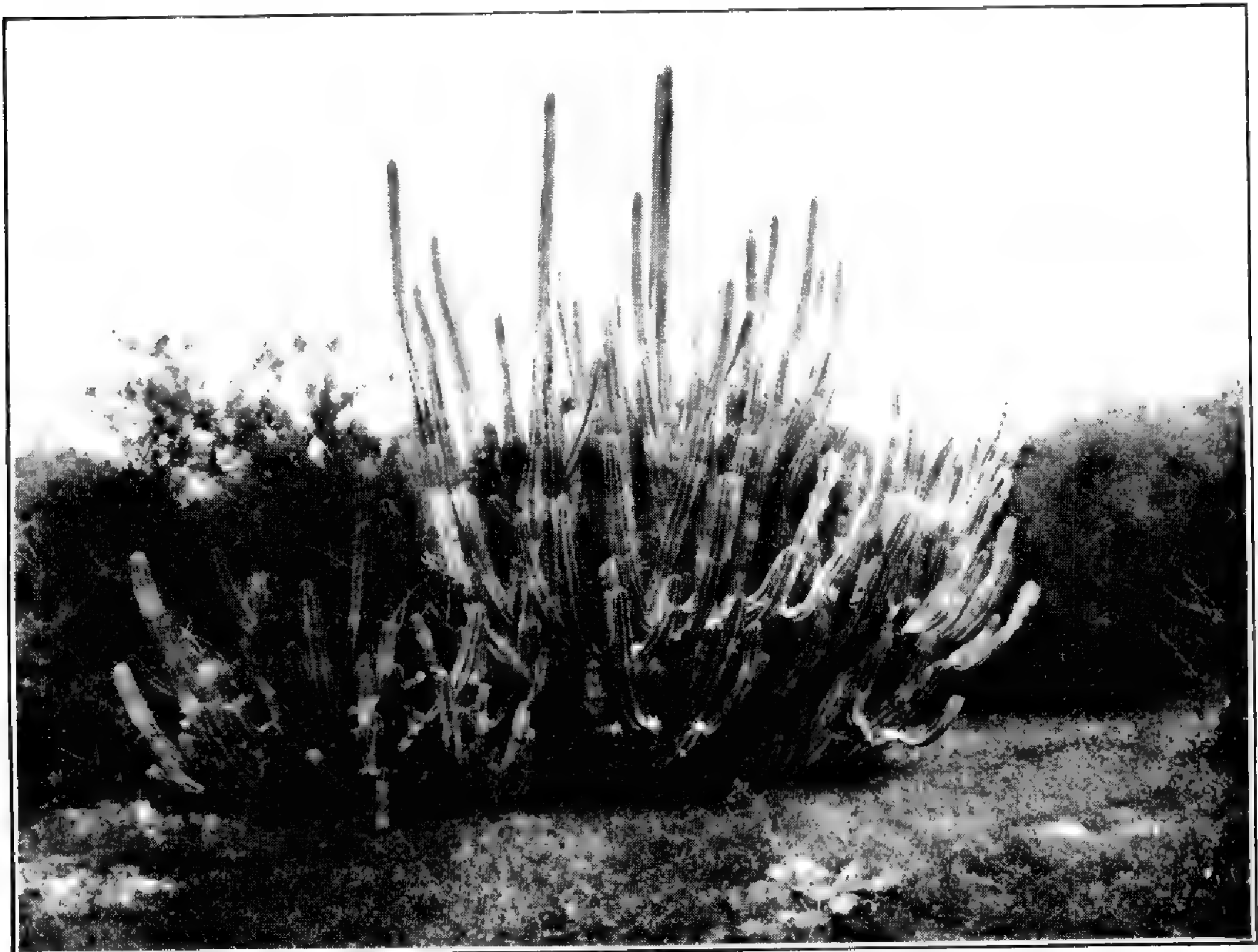
B. *LOPHOCEREUS SCHOTTII* (ENGELM.) BRITT. & ROSE, SAN FRANCISQUITO.



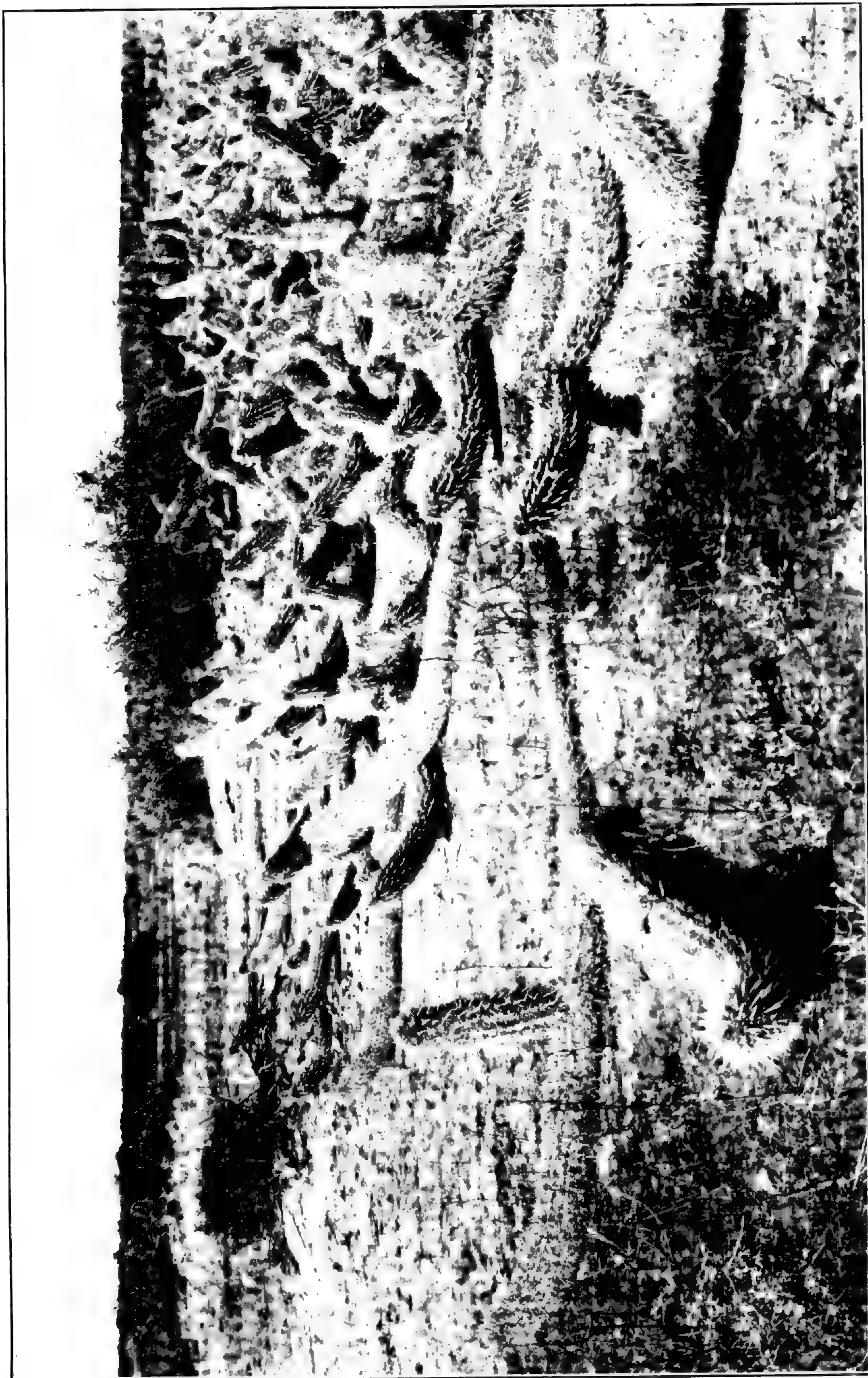
A. *LEMAIREOCEREUS THURBERI* (ENGELM.) BRITT. & ROSE, TINAJA DE SANTANA.



A. *LEMAIREOCEREUS GUMMOSUS* (ENGELM.) BRITT. & ROSE, ESPERITU SANTO ISLAND.



B. *LOPHOCEREUS AUSTRALIS* (K. BRANDEG.) BRITT. & ROSE, CAPE SAN LUCAS.



LEMAIREOCEREUS ERUCA (T. S. BRANDEG.) BRITT. & ROSE, SANTO DOMINGO.

disconnected plants forming a hollow circle can be traced by the remains of dead trunks to a common center. The plants show a preference for soft parts of the coastal plain and grow usually in groups, often topping a slight eminence formed of wind-drifted material. These cactuses serving as a sand binder and preventing erosion tend to favor further accumulations. The desert foxes (*Vulpes macrotis devlus*) of the region find congenial burrowing places among the procumbent trunks.

**Lophocereus sargentianus** (Orcutt) Britt. & Rose.

Species of the genus *Lophocereus* range nearly throughout the desert regions of Lower California from the Cape northward to San Quintín on the Pacific coast and to the arid region near the upper end of the Gulf of California. The genus is also represented in southern Arizona and Sonora. The distribution of the species, however, is imperfectly known. The present species was not distinguished from *L. schottii* by us in the field and may have been confused with it. We failed to note *L. sargentianus* at San Quintín, the type locality, but a *Lophocereus* seen in several places on the sandy plains between San Fernando and Pozo San Agustín may have been this species.

**Lophocereus australis** (K. Brandeg.) Britt. & Rose.

PLATE 126, B.

First noted by us along the road from San Pedro to Tres Pachitas, south of La Paz. From this point to the Cape and eastward to San José del Cabo it is quite common at low elevations wherever the soil is soft. It was noted by us north of La Paz. It has been credited by Britton and Rose to southwestern Sonora. Specimens were collected at Cape San Lucas, where the plant was growing in dense patches. It differs from *schottii*, which it seems to replace here, in its taller, more slender, and much more numerous stems. The ridges are 6 to 8 in number along the basal parts of stems, becoming irregularly more numerous toward the long-spined fruiting tips.

**Lophocereus schottii** (Engelm.) Britt. & Rose.

GARAMBULLO. PLATE 125, B.

Originally described from Sonora and probably extending throughout the greater part of Lower California. It was first seen and collected by us near the mouth of Esperanza Canyon, at the east base of the San Pedro Mártir Mountains and was common over the desert to San Felipe on the Gulf of California. A species assumed to be the same was seen at San Francisquito and noted many times along our route southward to La Paz. From near La Paz to Cape San Lucas it is replaced by *L. australis*. *Lophocereus schottii* grows 1.8 to 3.5 meters high in alluvial valleys and canyon bottoms along the backbone of the Peninsula and on sandy plains. The spines are of two kinds, slender ones massed on the ends of the branches and extending downward from 30 to 125 or 150 cm. and shorter and stouter ones ranged along the ridges, into which the former change rather abruptly. The ridges are commonly 5 in number, but vary from 4 to 6. The large flowers appear along the line of demarcation between the two sets of spines. In the vicinity of La Purísima the species was in flower November 4. It is commonly known in the Peninsula as "garambullo," a name applied also to *Myrtillocactus geometrizans* in the southern part of the plateau region of Mexico.

**Mamillaria roseana** T. S. Brandeg.

A specimen referred by Rose to this handsome species was collected at about 360 meters elevation 20 miles east of San Ignacio. Brandege gives its range as the lower elevations throughout the Cape District south of La Paz and northward to Calmallí. He further says:<sup>1</sup> "This cactus is one of the most showy of Lower California. Palmer collected it at La Paz, and it is no. 139 of the list from that place in Contributions

<sup>1</sup> Zoe 2: 19. 1891.



from the U. S. National Herbarium, no. 3,<sup>1</sup> catalogued by Rose, for whom it is appropriately named. The stems pendent from rocks at Comandú are sometimes 6 feet long."

**Myrtillocactus cochal** (Orcutt) Britt. & Rose.

Originally described from Todos Santos Bay; first seen by us in the hills along the road from Pozo Altamirano to San Pablo, October 3. It was at this time in flower, and the resemblance to *M. geometrizans*, the garambullo,<sup>2</sup> with which we became familiar in the plateau region of Mexico, was noted at once. The flowers are small, whitish, and inconspicuous. This was one of the rarer cactuses along our route from this point southward to the Cape. It was afterwards seen near Tinaja de Santana, in the hills about 20 miles east of San Ignacio, along the road from Agua Grande to Paso Hondo, a few miles north of Comandú, and near San José del Cabo. Brandege records the species from San Martín Island.

**Opuntia pycnantha** Engelm.

Four species of flat-jointed *Opuntia* are known to occur in Lower California. The type of *O. pycnantha* came from Magdalena Bay, but little is yet known of the distribution of the species. It was collected by Brandege on Magdalena Island in March, 1889, and by Rose at Santa María Bay in March, 1911. Short, closely set, yellowish spines distinguish this form from its insular representative, the subspecies *margaritana*.

**Opuntia pycnantha margaritana** Coulter.

Margarita Island is the type locality of this form, which was described by Coulter in 1896. It was again collected there by Rose in March, 1911. It differs from *O. pycnantha* of the mainland in its reddish instead of yellowish spines.

**Opuntia tapona** Engelm.

TUNA TAPONA.

A species bearing edible fruit, described from material collected by William M. Gabb near Loreto while on his overland journey in 1867. Specimens recently collected by Rose indicate that its range extends thence to San José del Cabo. Rose also obtained this species on Pichilique Island and on Espíritu Santo Island, where we had also collected it in 1906.

**Opuntia comonduensis** (Coulter) Britt. & Rose.

The known range of this species extends on the mainland from Comandú, the type locality, southward to San José del Cabo, where the plant was collected by Rose in March, 1911. He also obtained specimens on Carmen Island in April, 1911.

**Opuntia** sp.

PLATE 129, B.

A species with short pinkish thorns grows abundantly along with *O. cholla* or a form of this in the vicinity of Agua Dulce and as far southward as Comandú.

**Opuntia cholla** Engelm.

CHOLLA. PLATE 128, A.

One or more species of the *O. cholla* type are among the most abundant and generally distributed cactuses throughout the desert region from Cape San Lucas north to the basal slopes of the San Pedro Mártir mountains. This type of cactus does not occur or is not abundant on the desert near the delta of the Colorado nor in the northwest coastal region.

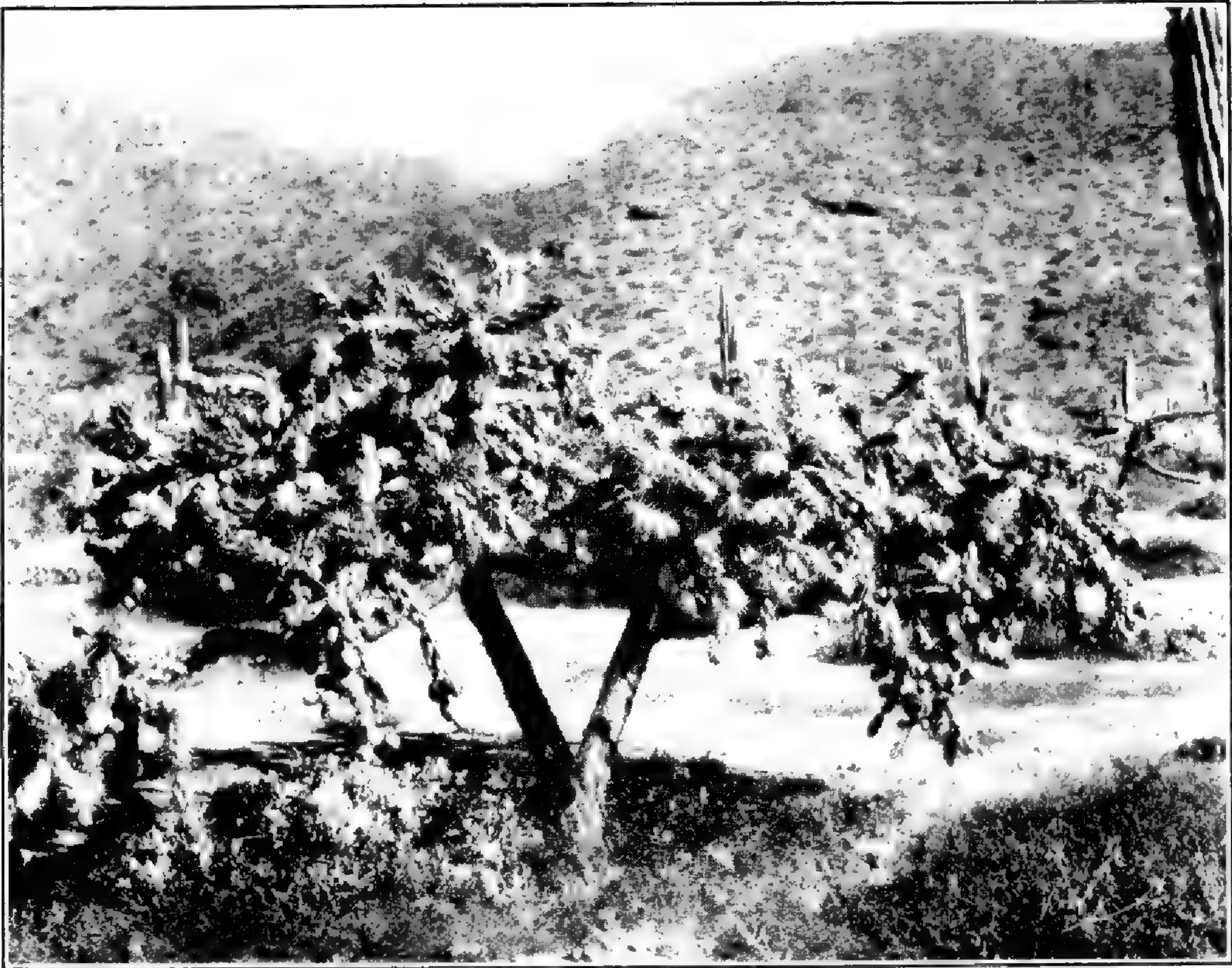
**Opuntia bigelovii** Engelm.

PLATE 128, B.

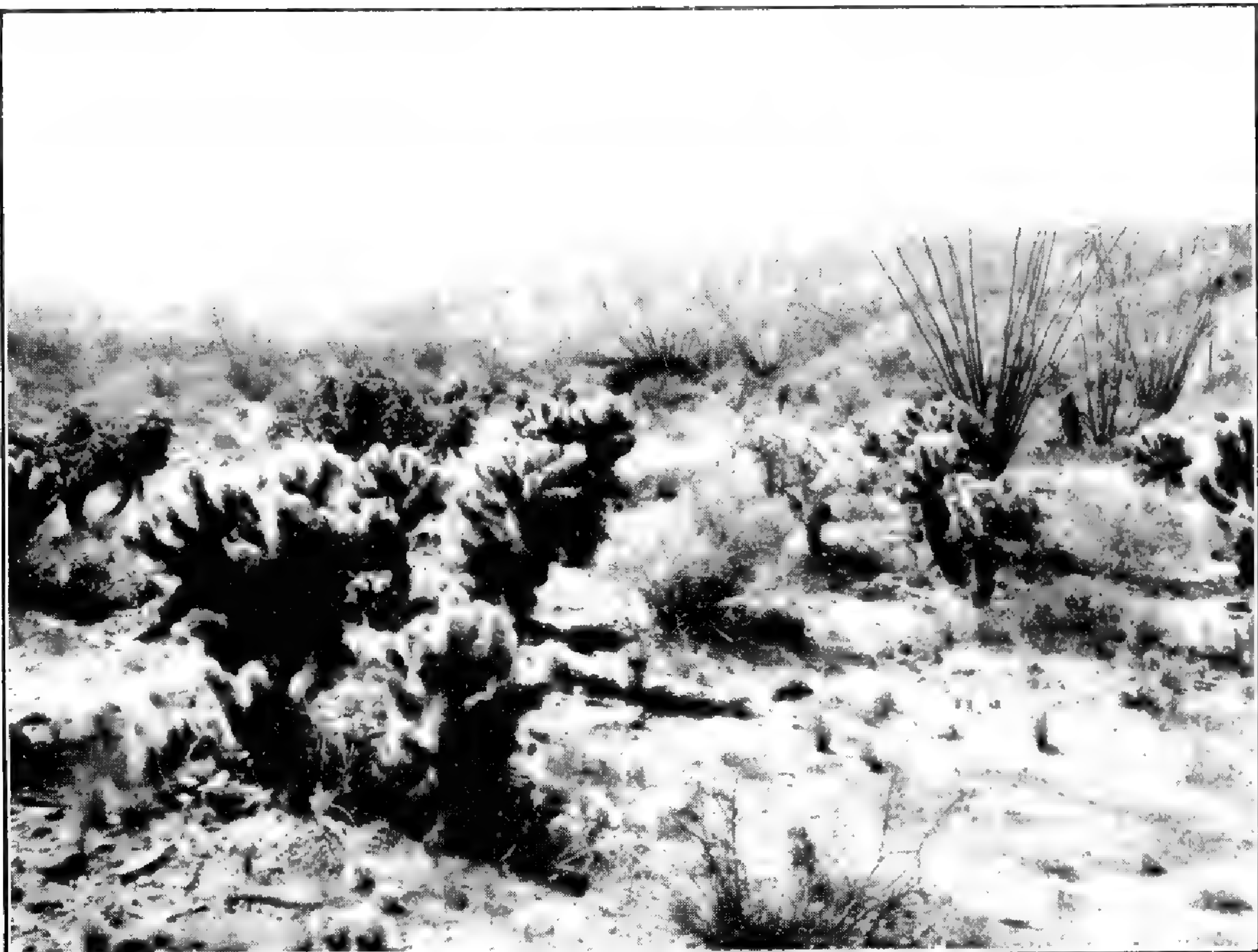
This species, distinguishable at once from *O. cholla* by joints much more thickly beset with whitish spines, was seen in a few places near the Gulf coast from the Cocopah mountains south to Calamahué. It is abundant on the coastal plain near San Felipe Bay.

<sup>1</sup> 1: 70. 1890.

<sup>2</sup> See under *Lophocereus schottii*, p. 353.



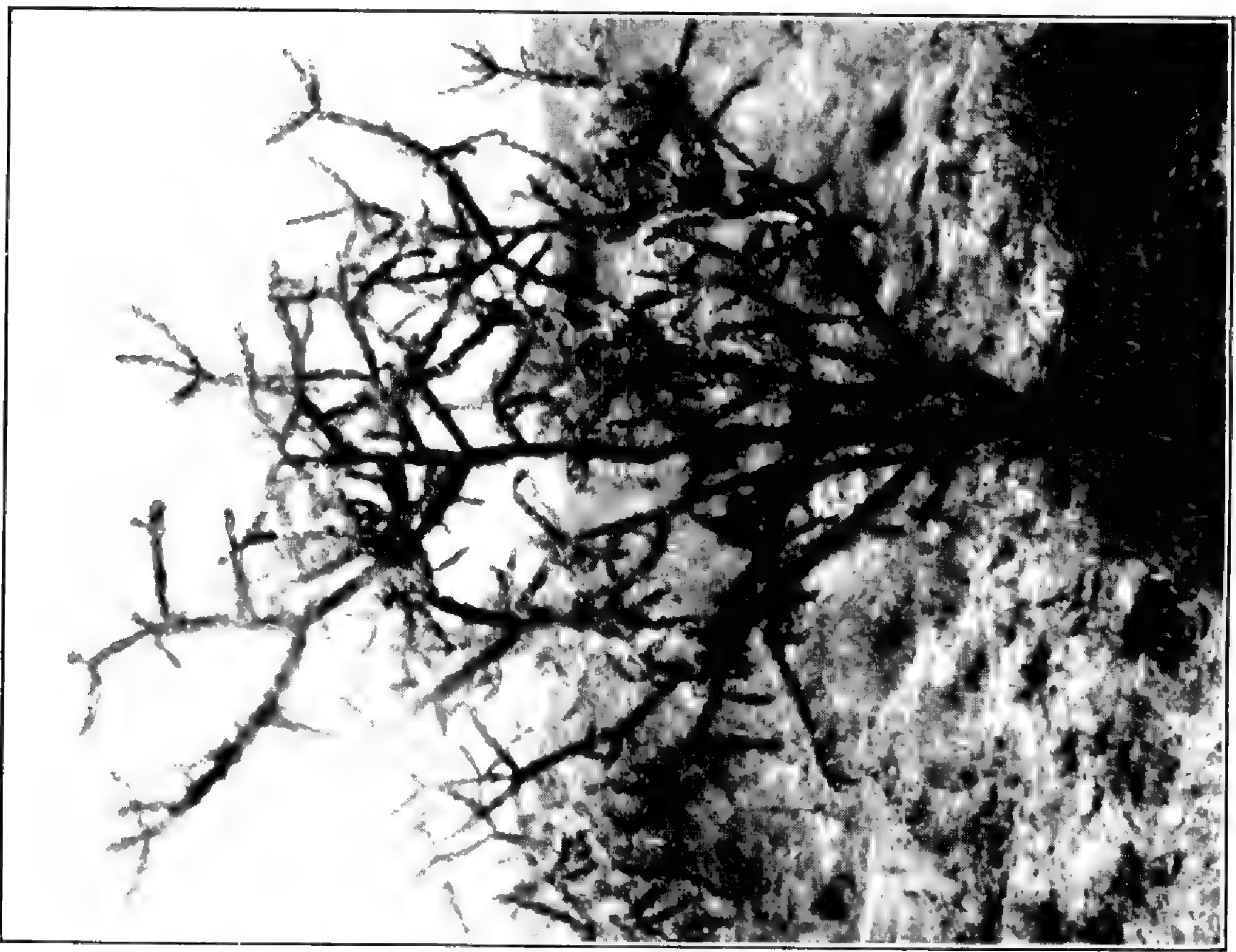
A. *OPUNTIA CHOLLA* ENGELM., ESPÍRITU SANTO ISLAND.



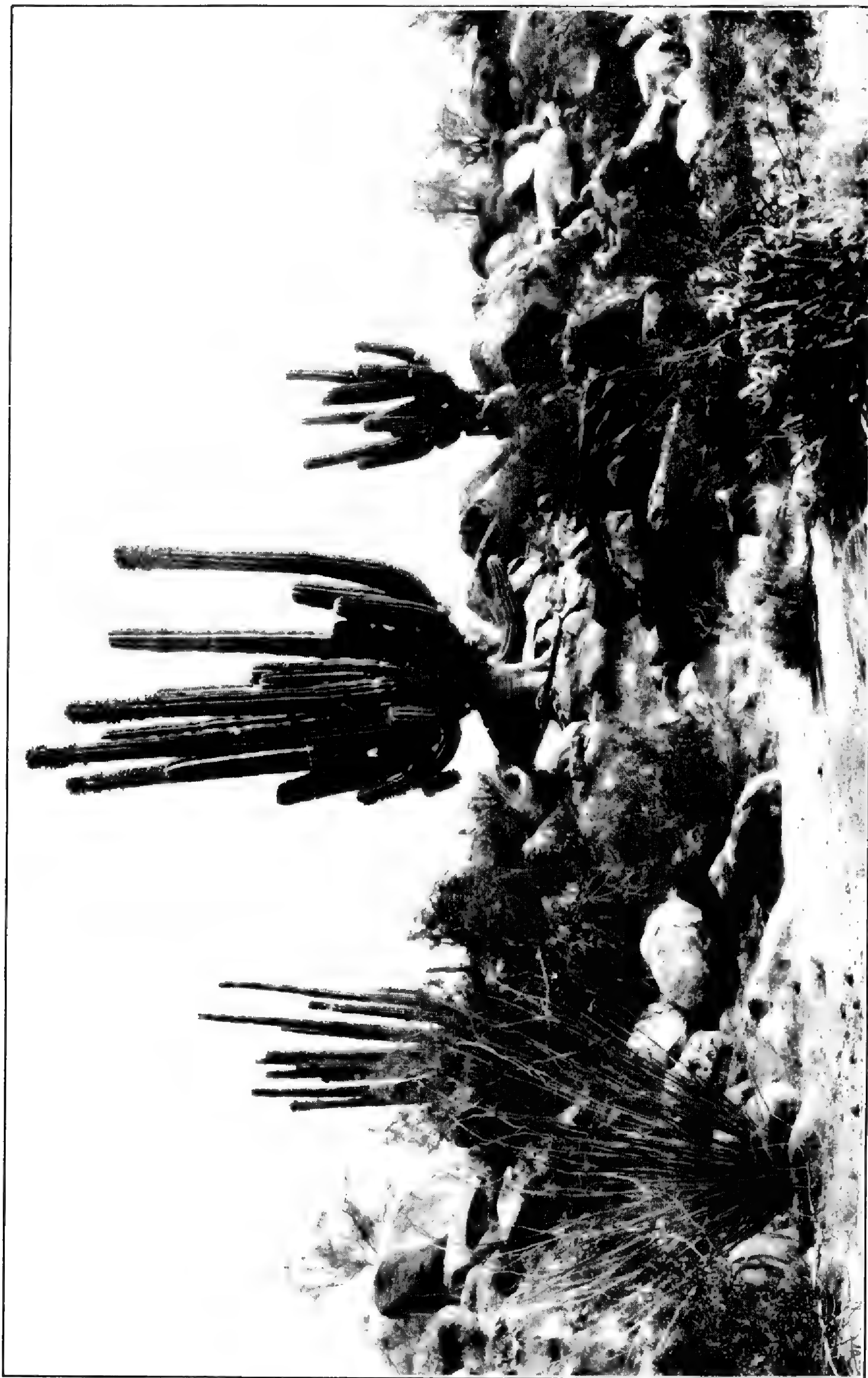
B. *OPUNTIA BIGELOVII* ENGELM., SAN FELIPE BAY.



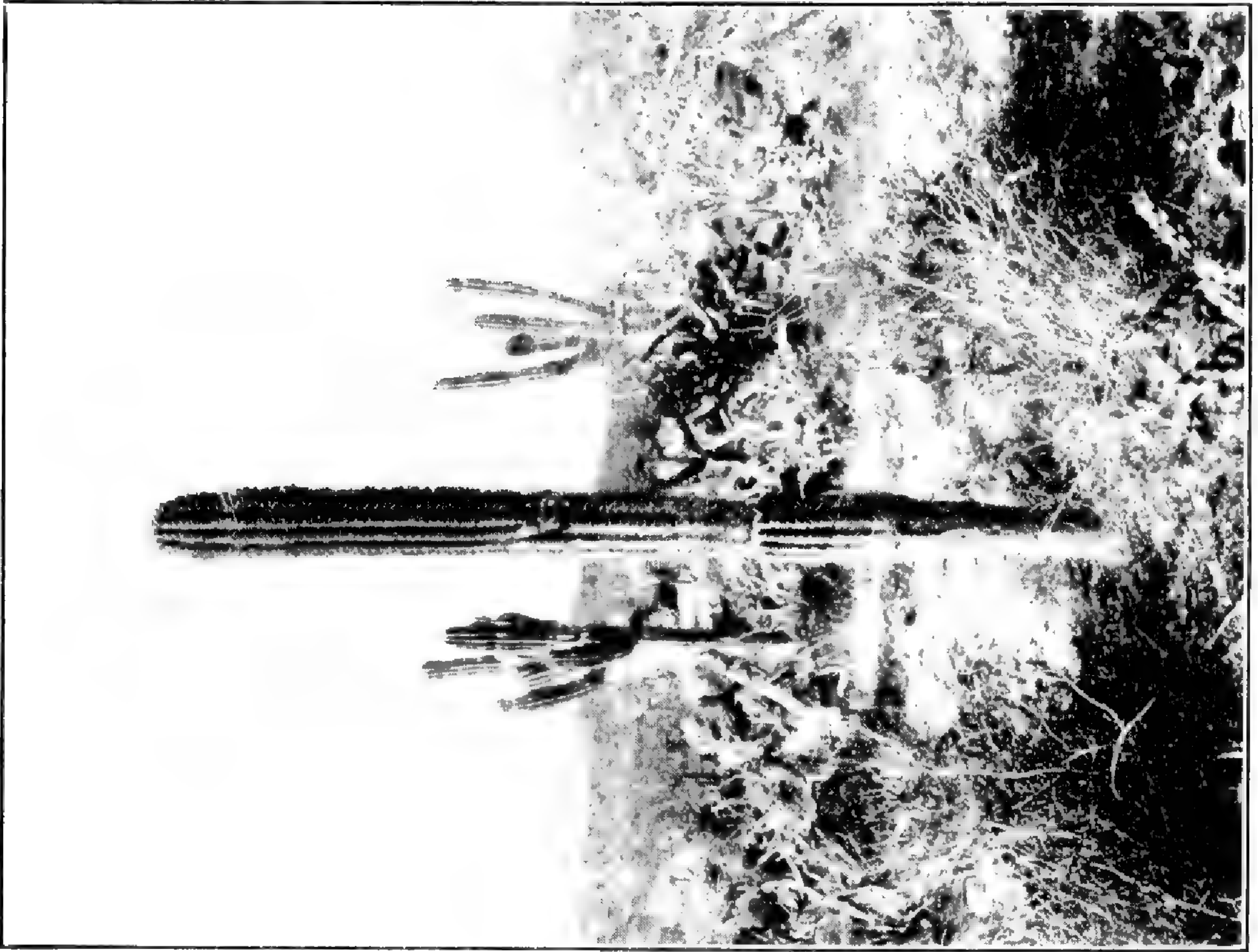
B. OPUNTIA SP., AGUA DULCE.



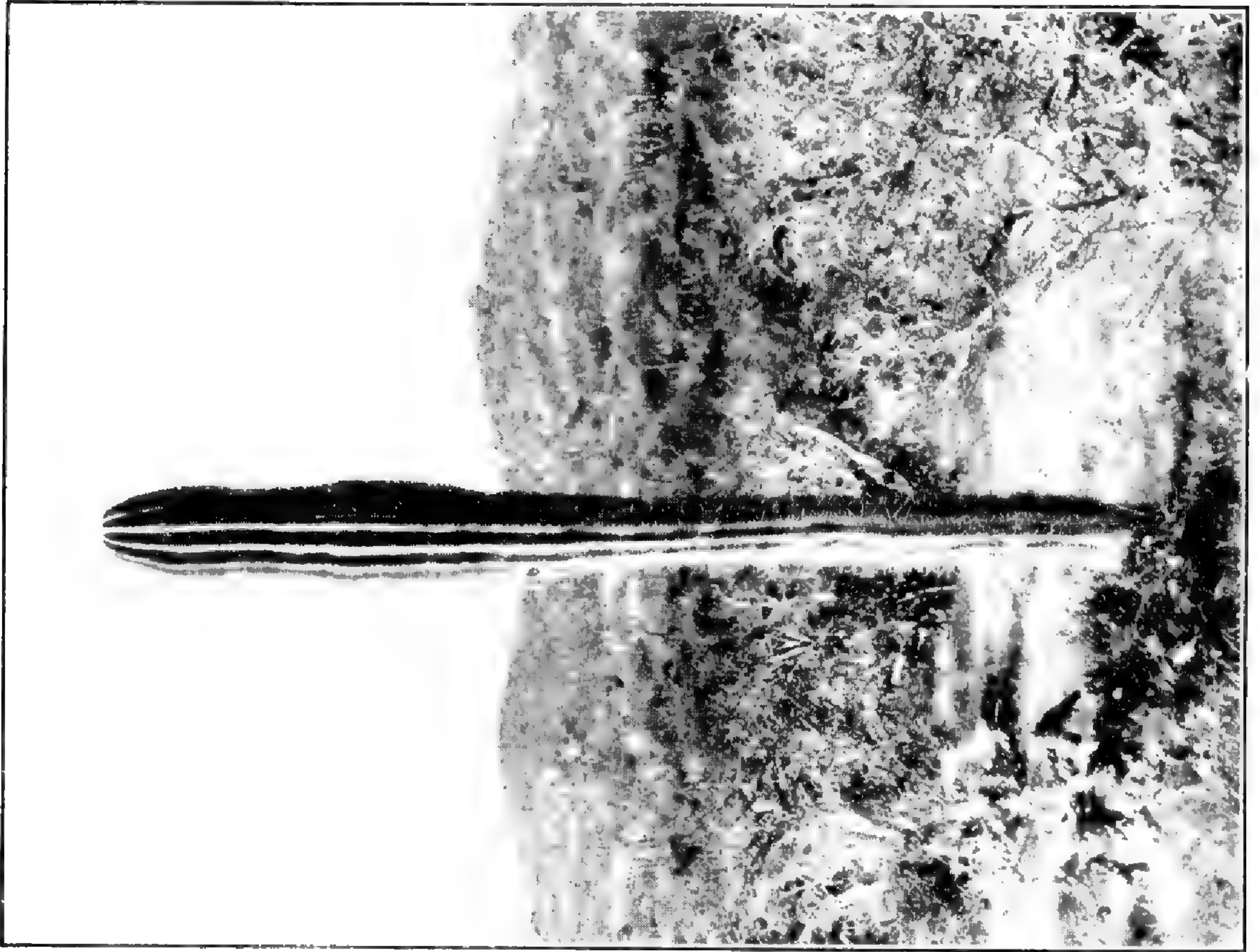
A. OPUNTIA CLAVELLINA ENGELM., SAN ANDRÉS.



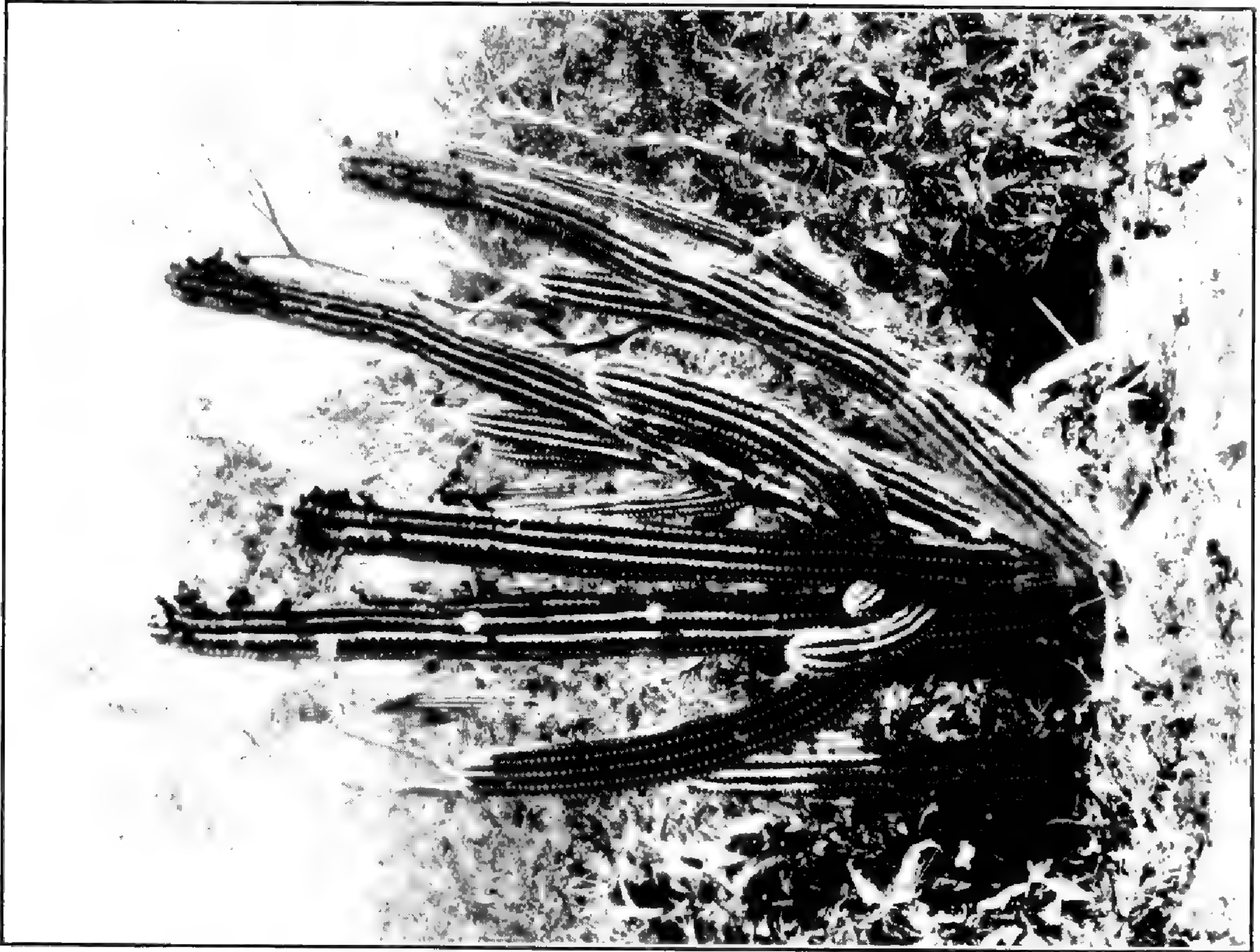
PACHYCEREUS PRINGLEI (S. WATS.) BRITT. & ROSE, EAST BASE OF SAN PEDRO MÁRTIR MOUNTAINS.



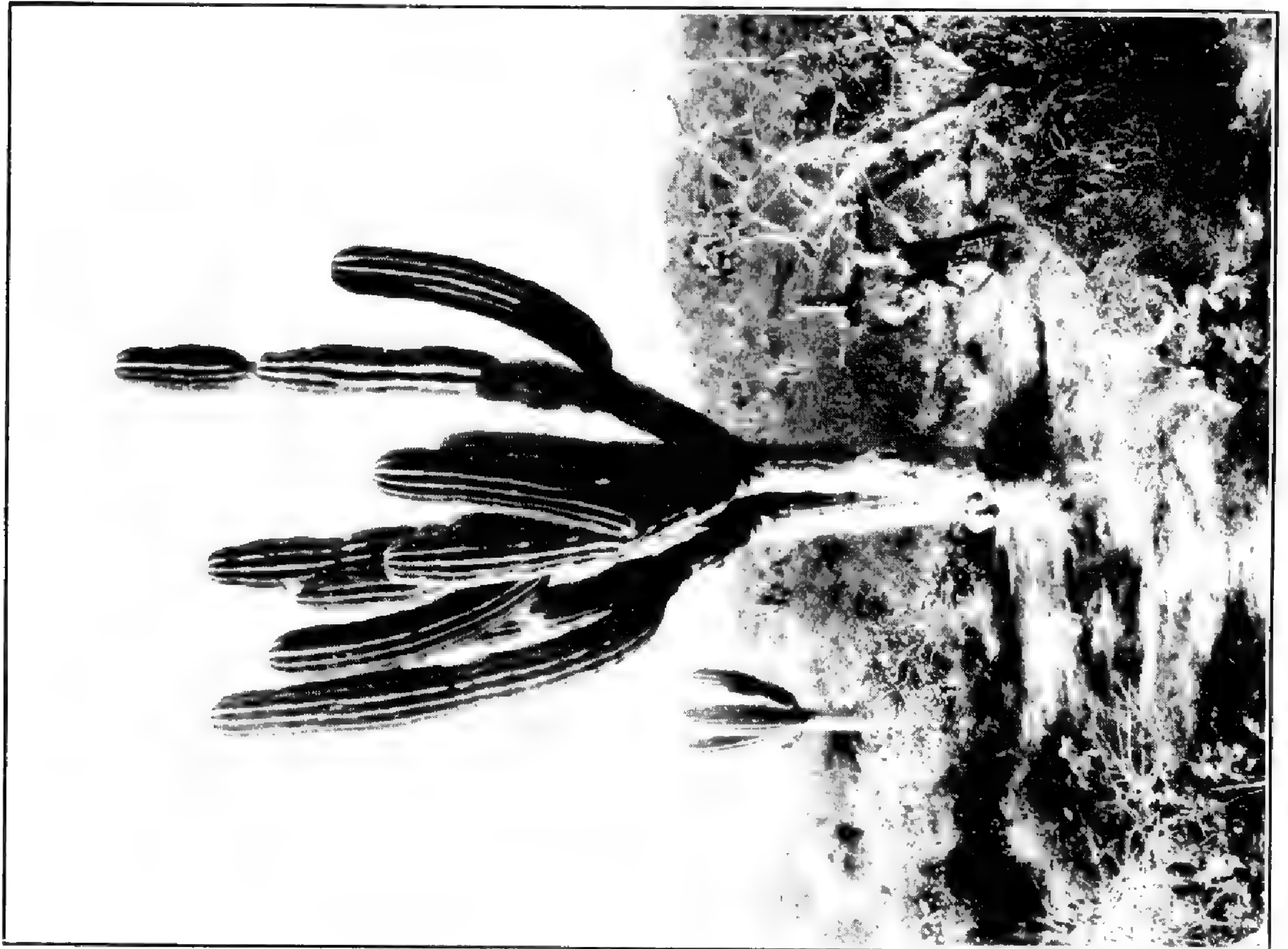
B. PACHYCEREUS TITAN (ENGELM.) BRITT. & ROSE (YOUNG PLANT),  
SAN JOSÉ DEL CABO. (PLANTS OF P. CALVUS IN BACKGROUND.)



A. PACHYCEREUS CALVUS (ENGELM.) BRITT. & ROSE (YOUNG PLANT),  
SAN JOSÉ DEL CABO.



B. *PACHYCEREUS PECTEN-ABORIGINUM* (ENGELM.) BRITT. & ROSE,  
CAPE SAN LUCAS.



A. *PACHYCEREUS CALVUS* (ENGELM.) BRITT. & ROSE, SAN JOSÉ DEL  
CABO.

**Opuntia clavellina** Engelm.

NEEDLE CACTUS. PLATE 129, A.

A cholla cactus which Rose associates with this species was photographed about 5 miles north of San Andrés, between that point and Punta Prieta Ranch, while we were on our way across the Peninsula from Yubay, September 30, 1905. The species was again seen in a few places on the coastal plain between San Andrés and Rosarito. It was more strongly armed than any species previously seen along our route, and owing to the difficulty of carrying such spiny material we neglected to collect specimens during the two days' travel in which it was encountered, fully expecting to find it at some of our camps, where it could be more easily handled. But we looked in vain for the species at San Andrés, Rosarito, and farther southward, and it therefore seems to be one of the rarer cactuses of the region. It is remarkable for the unusual length of the spines. The type came from La Purísima.

**Pachycereus pringlei** (S. Wats.) Britt. & Rose.

CARDÓN. PLATE 130.

Five giant cactuses of the genus *Pachycereus* are credited by Britton and Rose to Lower California, but their ranges are imperfectly known, partly owing to our inability clearly to distinguish some of them in the field. One or more of them occur in nearly every part of the Peninsula except the higher mountains, the northwest coast region, and the Colorado Desert. *P. pringlei* ranges in Sonora, and from the east base of the San Pedro Mártir Mountains southward along the middle of the Peninsula, probably to beyond Calmallí. Some of the largest cactuses we saw on the Peninsula were near Calmallí, where one had a basal diameter of about a meter. These seemed to be of the *pringlei* type, rather than like *calvus*, with which we later became familiar.

**Pachycereus calvus** (Engelm.) Britt. & Rose.

CARDÓN. CARDÓN PELÓN. PLATES 131, A; 132, A.

In the Cape District this species is called "cardón pelón" to distinguish it from *P. pecten-aboriginum*, the "cardón barbón" or "cardón hecho," which occurs with it. Farther north it is known simply as "cardón," a name applied by the people to giant cactuses in general. *Pachycereus calvus*, so far as known, is restricted to Lower California. Its range extends northward from the Cape, probably to about latitude 28°. Its northern limit was undetermined, owing to our failure to distinguish it in that region from *pringlei*. Of the 5 giant cactuses of the genus *Pachycereus* in Lower California, this species is by far the most abundant and generally distributed. In places, especially valleys and canyon bottoms along the backbone of the Peninsula, it forms veritable forests, and it is this species that makes up the greater part of the cactus forest along the road from La Paz to El Triunfo, described by Brandegee<sup>1</sup> and also observed by us. *Pachycereus calvus* has the same general form as *pringlei*, the younger plants having the stem slender near the base and expanding toward the tops, but it is a lower-growing plant, the stems becoming conspicuously bald on top as the name indicates.

**Pachycereus titan** (Engelm.) Britt. & Rose.

PLATE 131, B.

The status of this species is not very clear. The type material was taken by Gabb somewhere in the region "from Cape San Lucas to San Quintín." It may be a tall species confused by us in the field with *P. pecten-aboriginum*, in which case it probably does not range much north of La Paz.

**Pachycereus pecten-aboriginum** (Engelm.) Britt. & Rose.

CARDÓN BARBÓN. CARDÓN HECHO. PLATE 132, B.

The popular names given are applied to this species in Lower California to distinguish it from *P. calvus*. It is there restricted to the Cape District from near La Paz southward. The species was described from Hacienda San Miguel, near Batopilas,

<sup>1</sup> Zoe 1: 26-27. 1890.

Chihuahua, and occurs also in the hot canyons cutting the west side of the Sierra Madre in adjoining parts of southern Sonora. The species is much less abundant, even within its restricted range in the Peninsula, than *P. calvus*. It differs from *calvus* conspicuously in the stems, being more cylindrical, less contracted near the base, and less expanded toward the tops. It varies in height from 4.5 to 7.5 meters or more. Unlike *calvus*, which is more generally distributed, it is found mainly along arroyos, or on the lower more sandy land. Palmer, who collected the type material, stated that the Indians grind the seed to mix with their meal, and use the bristly covering of the fruit as a hair brush. Specimens were collected by us in fruit on the road from San Pedro to Tres Pachitas, December 24, and in flower near Cape San Lucas, December 29.

***Pachycereus orcutti* (K. Brandeg.) Britt. & Rose.**

Described from a plant obtained by Mr. C. R. Orcutt near Rosario in May, 1886. A few giant cactuses noted by us at 900 meters elevation on warm southwest slopes of the San Pedro Mártir Mountains between Santo Tomás and San Antonio were probably of this species and approach the northern limit of the range of the genus on the western slope. A few others were seen along the road from Socorro to Rosario, very near the type locality. No specimens of this little known species were collected by us, its close resemblance to *P. pringlei* in the field leading us to assume that the two were the same. Giant cactuses of several species range in the area from near Rosario to Cape San Lucas, and the southern limit of *orcutti* has not been determined.

***Pereskiopsis brandegei* (Schum.) Britt. & Rose.**

ALCAJER.

The "alcajer," as this peculiar cactus is locally called, was first noted by us near Mantancita and was seen a few times at low elevations between this point and the type locality, Cape San Lucas, and on Espiritu Santo Island. No fruit or flowers were seen until January 30, when a fine plant in fruit was found on the road near El Triunfo. This plant had a somewhat sinuous basal stem, perhaps an inch in diameter, which extended from the ground into the lower branches of a small tree and there subdivided into 6 main branches, which ramified through the top of the tree. The tips of the branches are rather heavy and show a tendency to hang downward. The height of the plant was that of the tree, about 6 meters. The fruit is said to be edible, but very sour. Allied species occur in Sinaloa and other parts of Mexico and in Guatemala.

***Wilcoxia striata* (T. S. Brandeg.) Britt. & Rose.**

JARRAMATRACA. RACAMATRACA.

Under various local names this slender little cactus is well known to the people in southern Lower California. It occurs also in Sonora. We first noticed it on the Vizcaino Desert, near the eastern base of the Santa Clara Mountains, where our men called it "jarramatraca." It was noted in a number of places on the plains near the Pacific coast from this point southward to San José del Cabo, the type locality. At Matancita it was called "racamatraca," and here, during our visit in the middle of November, many of the plants were bearing bright red and fully ripe fruit. The fruit is large for so small a species. North of La Paz this cactus was seen only on the coastal plains, but near the Cape it grows also at the lower elevations on the basal slope of hills. The plants are inconspicuous, the slender stems usually rising from the ground near the base of some shrub and finding partial support upon the branches. Three or four tubers resembling sweet potatoes radiate from the base of each plant 3 or 4 inches below the surface of the ground. In one instance these tubers were examined a few days after a rain, when the soil surrounding them had already become thoroughly dry. Their tenderness made removal difficult without breakage. On being bruised or broken water stored in them flowed very freely. Near San Ignacio we were told that the tubers are sometimes crushed and a cloth saturated with the juice applied to the chest for lung troubles.



Specimens lacking both fruit and flowers were collected near the Santa Clara Mountains, October 14. Fruiting specimens were taken a few miles north of Matancita, November 15, and between El Pescadero and El Cajón, December 27. Material in the U. S. National Herbarium was obtained by Palmer on Carmen Island, November 1-7, 1890. Brandegee, in describing the species, recorded it from Magdalena Island, Margarita Island, and northward to beyond San Ignacio.

### RHIZOPHORACEAE. Mangrove Family.

*Rhizophora mangle* L. MANGROVE. MANGLE.

The mangrove is abundant along parts of the coast of the Cape District and the adjacent islands. It was first seen by us on the east coast between Santa Rosalía and San Bruno, and on the west coast near Matancita. Mangrove lagoons of the familiar type seen along the coasts of southern Mexico occur on the shores of the bays of Magdalena and La Paz and on the islands of Magdalena, Margarita, and Espíritu Santo. Brandegee records the species as covering large areas of shallow water along the lagoons as far north as San Jorge. It is known to the people as "mangle." A specimen in flower was collected at La Paz, February 17.

### COMBRETACEAE. Combretum Family.

*Conocarpus erecta* L.

This tree, widely distributed along the coasts of tropical America, was taken in fruit on the west coast of the Cape District near El Pescadero, December 26. It grows 4.5 to 7.5 meters high with local habitat much like that of *Maytenus phyllanthoides*, but it also thrives on saline soil beyond the reach of the tide. In some low places it forms dense shady groves from which other trees are largely excluded.

### ONAGRACEAE. Evening Primrose Family.

*Burragea fruticulosa* (Benth.) Donn. Sm. & Rose.

This species is the type of a new genus recently described by Capt. John Donnell Smith and Dr. J. N. Rose. It is made a new genus on account of its very remarkable fruit, which is buried in the tissues of the flowering branches. It is a low bushy shrub, 30 to 60 cm. high, and grows on the slopes bordering the bay shore of Magdalena Island, where it was collected in flower November 24. Brandegee records it as a small spreading or decumbent bush 2 or 3 feet high, seen only on Magdalena and Margarita islands.

A second species, *Burragea frutescens* (Curran) Donn. Sm. & Rose, was collected by Rose on the ocean side of Magdalena Island in 1911. This when in flower is one of the most handsome shrubs in Lower California, being covered with a mass of pink.

*Xylonagra arborea* (Kellogg) Donn. Sm. & Rose.

*Xylonagra*, based on *Hauya arborea* (Kellogg) Curran, was recently described by Capt. John Donnell Smith and Dr. J. N. Rose. It is not only very different from true *Hauya* in habit and flowers, but also grows in very different floral zones. Geographically *Hauya* is restricted to Mexico and Guatemala.

This handsome shrub was discovered by Veatch on Cedros Island, growing in open, sterile, rocky, and clayey soils, at an elevation of from 180 to 600 meters. It was described and figured as an *Oenothera* by Kellogg in 1860.<sup>1</sup> The flowering season is irregular or considerably prolonged, perhaps depending on the occurrence of rain.

<sup>1</sup> *Hesperian* 4: 1, 2. 1860.

Like some other shrubs of the region, it may produce flowers and fruit at a time when the plants are nearly or quite leafless. Specimens in the National Herbarium from Cedros Island were taken by A. W. Anthony, July–October, 1896, and March–June, 1897. On the adjacent coast of the Peninsula it was collected at San Bartolomé Bay by Lieut. Charles F. Pond, U. S. N., April 27, 1889, and by Anthony again at Santa Rosalía Bay, July–October, 1896. Specimens from the mountainous interior at San Pablo were referred to this species by Brandegee, although they appeared to differ in some respects.<sup>1</sup> We found this species in a few places along the sandy coast near San Andres. It grew 60 to 120 cm. high, and at the time of our visit (September 21) was entirely leafless but bearing fruit and handsome flowers. The latter are dark red and conspicuous. Specimens were taken.

*Zauschneria californica* Presl.

CALIFORNIA FUCHSIA.

Noted in a number of places along the west side of the San Pedro Mártir Mountains. The species is recorded by Brandegee from Santa María, east of San Fernando. It is here a shrubby plant 1.2 to 1.5 meters high growing on gravelly slopes bordering small valleys in overlapping portions of the Upper and Lower Sonoran zones. A specimen in flower and fruit was taken at 1,020 meters altitude near Rancho San Antonio, August 1.

### ARALIACEAE. Ginseng Family.

*Aralia scopulorum* T. S. Brandeg.

A fruiting specimen was taken at Tinaja de Santana, 35 miles north of San Ignacio, October 4. The plant was a shrub 4.5 meters high, growing near a spring in the hills at 1,020 meters. Brandegee found the species common on the rocks of Comandú Canyon, where the type material, including flowers and young fruit, were collected in March.

### CORNACEAE. Dogwood Family.

*Garrya veatchii palmeri* Eastw.

QUININE BUSH.

This was noted in a few places between 1,350 and 2,100 meters elevation, in the Upper Sonoran Zone, along the western slopes of the Sierra del Pinal and San Pedro Mártir mountains. It grows 1.5 to 2 meters high on dry hillsides where species of *Adenostoma* and *Arctostaphylos* are dominant shrubs. A fruiting specimen was taken at 2,100 meters near the Rancho Santo Tomás, in the San Pedro Mártir Mountains, July 26. Since our specimens seem referable to *palmeri* it seems probable that typical *G. veatchii* may be confined to Cedros Island, where the type was collected by Veatch about 1858 or 1859.

*Garrya salicifolia* Eastw.

QUININE BUSH.

A large *Garrya*, with willow-like leaves, inhabits the Sierra de la Laguna. It is one of a number of Upper Sonoran shrubs which are separated from their congeners to the northward by the long desert section of the Peninsula. It was common in places near our camp at La Laguna, along with *Heteromeles* and other shrubs, growing to a height of 3.5 to 5.5 meters. A fruiting specimen was taken January 27.

### ERICACEAE. Heath Family.

*Arbutus peninsularis* Rose & Goldm.<sup>2</sup>

This madroño, recently described, was listed by Brandegee in his Flora of the Cape Region as *A. menziesii*, the well-known madroño of California, which probably ex-

<sup>1</sup> Proc. Calif. Acad. II. 2: 157. 1889.

<sup>2</sup> See p. 311.

tends into northern Lower California. It differs from *A. menziesii* in having the leaves tomentose and green beneath instead of glabrous and glaucous and in its more crowded inflorescence and larger calyx lobes. The type was collected by us near La Chuparosa, on the upper slope of the Sierra de la Laguna, January 23, 1906.

The species is rather abundant and generally distributed along with the oaks in the Upper Sonoran Zone from about 1,200 meters elevation to the summit of the Sierra de la Laguna. It occurs disconnectedly here on the mountain tops, like numerous other species whose congeners are absent in the wide desert interval to the northward.

**Arctostaphylos sp.**

A specimen of an undetermined and perhaps undescribed manzanita bearing ripe fruit was taken at about 1,500 meters altitude along the trail on the west slope of the San Pedro Mártir Mountains between Rancho Santo Tomás and San Antonio, July 28. The species is less abundant than *A. glauca*, with which it occurs. In habit of growth it is similar to *glauca*, reaching a height of 1.8 to 3 meters.

**Arctostaphylos bicolor (Nutt.) A. Gray.**

MANZANITA.

Common in places along the steep Upper Sonoran slopes of the hills fronting the coast near Ensenada and eastward to about 780 meters altitude near Ojos Negros. Beyond this the open plain in San Rafael Valley, largely Lower Sonoran in character, is unsuitable for its growth. It was collected in fruit about 15 miles east of Ensenada, May 31. Brandegee records the species from Rancho Viejo.

**Arctostaphylos pringlei Parry.**

MANZANITA.

Abundant in the Transition Zone on the upper slopes of the Sierra del Pinal and San Pedro Mártir mountains. It is associated with *A. glauca* and the two form dense thickets between 2,100 and 2,250 meters altitude near La Grulla. It was taken in flower at Laguna Hanson, June 7, and in ripe fruit at La Grulla, July 20. Brandegee states that this manzanita blooms later and is more viscous, with redder bracts and flowers, than the other species of the general region.

**Arctostaphylos glauca Lindl.**

MANZANITA.

The most abundant manzanita in the Peninsula. It ranges upward, mainly in the Upper Sonoran Zone, from about 840 meters near La Huerta and Trinidad Valley to near the summit of the Sierra del Pinal and on the warmer slopes to above 2,100 meters altitude in the San Pedro Mártir Mountains. It forms thickets which at the higher levels are largely mixed with *A. pringlei*. Fruiting specimens were collected at La Huerta, June 2; El Piñón, July 5; La Grulla, July 20.

**Arctostaphylos oppositifolia Parry.**

MANZANITA.

This tall, slender-leaved species, so unlike the other manzanitas, is common in places on the Upper Sonoran slopes along the west side of the San Pedro Mártir Mountains. Specimens in fruit were taken at the 1,500 meter level in descending from Rancho Santo Tomás to San Antonio, and at 1,020 meters on a ridge a few miles west of San Antonio, on the trail to San Quintín. It is a larger species than the other manzanitas of the Peninsula, commonly reaching a height of 4.5 meters.

**EBENACEAE. Ebony Family.**

**Brayodendron texanum (Scheele) Small.**

ZAPOTILLO. GUAYPARIN.

A persimmon tree about 2 meters high, probably of the species listed by Brandegee under this name, but perhaps representing a distinct species, was first noted among the sand dunes at Cape San Lucas, where a specimen was collected. The species

was later found in a similar situation at San José del Cabo and in rocky places on Cerralvo Island. At San José del Cabo the fruit was ripening January 8. Brandege lists the species as a small tree not uncommon along the base of the mountains, in the Cape District south of La Paz. The fruit he describes as about an inch in diameter, black when ripe, and very pleasant to the taste. He gives "guayparín" as a native name, but it was pointed out to us as "zapotillo."

### OLEACEAE. Olive Family.

*Fraxinus attenuata* Jones.

FRESNO. ASH.

Noted as common in the Upper Sonoran Zone along canyons in the hills near Ensenada and eastward as far as Ojos Negros in San Rafael Valley. It is a shrub or small tree 3 to 4.5 meters high. Specimens with ripe fruit were taken at Ensenada, May 20, and at the same locality, in flower and still retaining old fruit, February 28. The species was recorded by its describer from Valley of Palms, Lower California, and Catalina Mountains, Arizona.

### APOCYNACEAE. Dogbane Family.

*Plumiera mexicana* Lodd.

CACALOXÓCHITL.

A specimen in fruit, taken between Valle Flojo and El Pescadero, is somewhat doubtfully referred to this species. It represents a genus widely distributed in tropical America and in the Old World. This species was seen in a few places at low elevation south of La Paz. It forms a tree 6 to 9 meters high. According to Brandege, who also recorded specimens, it is known locally as "cacaloxóchitl," an old Aztec word and the same term which is applied to it in Central America.<sup>1</sup>

*Vallesia dichotoma* Ruiz & Pav.

This representative of the tropical flora of the Peninsula was first seen in the hills about 20 miles east of San Ignacio, where a flowering specimen was taken October 19. It was more abundant at low elevations south of La Paz, as a small tree 3 to 4.5 meters high. Brandege records it from San Gregorio and refers to it material collected by Palmer at Mulegé. The flowers are small and nearly hidden in the dense foliage. The species occurs also in about the same latitude along the coast of Sonora and Sinaloa.

### ASCLEPIADACEAE. Milkweed Family.

*Rothrockia cordifolia* A. Gray.

TALAYOTE.

Vines of this type were common and in many places conspicuous climbers over other vegetation along our route in the hill country from Comandú southward. Flowering specimens were taken at Comandú, November 6, and between Tres Pachitas and Valle Flojo, December 25. Brandege records it as a common plant of the Cape District.

### CONVOLVULACEAE. Morning-glory Family.

*Ipomoea pes-caprae* (L.) Sweet.

GOAT'S-FOOT MORNING-GLORY.

This morning-glory, so widely distributed on tropical shores, is a very common beach plant in suitable places along the coasts of the Cape District south of La Paz. It spreads in rank profusion over the sand dunes, the prostrate branches reaching a length of 6 to 12 meters. A flowering specimen was taken between Cape San Lucas and San José del Cabo, January 4. Brandege records the species on the ocean beach at Todos Santos, San José del Cabo, and La Paz.

<sup>1</sup> Zoe 2: 151. 1891.

**Jacquemontia abutiloides** Benth.

The beautiful flowers of this shrubby vine were first seen by us near Tinaja de Santana, 25 miles north of San Ignacio, October 5, and a specimen was here taken. It was common in the vicinity and was observed at intervals southward to Cape San Lucas. The species was published in the Botany of the Voyage of the *Sulphur* from material collected at Magdalena Bay and represents in the Peninsula a group of wide distribution in tropical America. In his field notes Brandegee says: "For producing quantity of color, *Jacquemontia abutiloides* far excels any of its near relatives, the *Ipomoeas*. It is usually low but sometimes spreads out over bushes a length of 10 feet, and when in full bloom seems to bear more flowers than leaves; it is then a mass of blue."<sup>1</sup>

**HYDROPHYLLACEAE. Waterleaf Family.****Eriodictyon angustifolium** Nutt.

Abundant in the Upper Sonoran Zone on chaparral-covered slopes from about 840 meters near Ojos Negros and in Trinidad Valley up to about 1,500 meters altitude near El Piñón on the western slope of the San Pedro Mártir Mountains. Flowering specimens were taken between Ojos Negros and Alamo, June 10, and at Arroyo de León on the way from Trinidad Valley to El Piñón, July 4.

**Eriodictyon sessilifolium** Greene.

This shrub, 1.2 to 2.5 meters high, was common in places along the sandy coast of San Quintín. It was taken in flower August 2. In a paper on the southern extension of the California flora Brandegee says of this species: "*Eriodictyon sessilifolium* Greene is common in many places in the northern Peninsula. Mr. Greene was mistaken in crediting it to Alta California, for Mr. J. M. Hutchings, the earliest recorded collector, states that the label quoted by Mr. Greene (Bull. Cal. Acad., I, 201) is an error and that the specimen was collected between Ensenada and Tia Juana."<sup>2</sup>

**BORAGINACEAE. Borage Family.****Cordia watsoni** Rose.

This very handsome species was first noted by us along sandy arroyos near Tinaja de San Esteban and extended thence for a few miles southward toward San Ignacio. It was also seen at intervals along the road from San Ignacio to Santa Rosalía, but was nowhere abundant. It grows as a shrub 1.8 to 2.5 meters high. Specimens bearing the large conspicuous white flowers were collected October 5. *Cordia watsoni* was based on material collected at Guaymas by Palmer.

**Bourreria sonora** S. Wats.

This species was found rather sparingly in a few places at low elevations in the Cape District south of La Paz, and on Espíritu Santo Island. It grows on rocky hillsides as a large shrub or small, scrubby tree 3 to 6 meters high, with dense, stiff dark-green foliage. Specimens in fruit were collected along the route from El Sacatón to Cape San Lucas, December 29, and on Espíritu Santo Island, February 7. Brandegee records the species from San José del Cabo and La Paz.

**VERBENACEAE. Vervain Family.****Duranta plumieri** Jacq.

This species, which is widely dispersed in tropical and subtropical America, includes in its range the Cape District south of La Paz. It is rather common along the basal

<sup>1</sup> Zoe 2: 148. 1891.<sup>2</sup> Zoe 4: 208. 1893.

slopes of the Victoria Mountains as a thorny shrub 3 to 3.5 meters high. A fruiting specimen was taken at 720 meters near Rancho San Bernardo, January 20. Brandegee found this species in the same vicinity and states that it is common at middle elevations on the west side of the mountains, sometimes forming impenetrable thickets.

**Lantana camara L.**

A flowering specimen of this *Lantana* was taken at 1,050 meters between Rancho San Bernardo and El Saúz in the Victoria Mountains, January 21. It was common in the vicinity. This is another of the tropical or subtropical American species with a range extending to southern Lower California.

**Lantana involucrata L.**

This widely dispersed tropical and subtropical shrub is abundant in the Cape District south of La Paz, where it has an altitudinal range from near sea level to about 1,200 meters on the southern slopes of the Victoria Mountains. Flowering and fruiting specimens were taken between El Cajón and El Sacatón, December 28; between San Bernardo and El Saúz, January 21; and between El Paraíso and El Triunfo, January 30.

**Lippia barbata T. S. Brandeg.**

The specimens on which Mr. Brandegee based this species were brought by a native of Comandú from La Giganta, a high mountain in the vicinity. A flowering specimen was taken by us on the road from Laguna to El Paraíso in the Cape District south of La Paz, January 29. The plant was a shrub 1.8 to 3.5 meters high, occurring at about 510 meters altitude on the north side of the mountains.

**Lippia formosa T. S. Brandeg.**

A flowering specimen of this species was taken between San Pedro and Tres Pachitas in crossing the Peninsula south of La Paz, December 24. It was noted in several places in the same vicinity, growing 1.8 to 2.5 meters high along with other shrubby vegetation in the midst of a forest of *Pachycereus calvus*, one of the giant cactuses of the region. Brandegee describes it as a common bush with rather showy flowers, growing on the hills about Todos Santos.

**Lippia palmeri S. Wats.**

Not uncommon in rocky places among the hills 20 miles east of San Ignacio, where it was taken in flower October 19. It was also collected in flower along the road from Agua Colorada to Cerro Colorado northwest of La Paz, December 15. Brandegee records it from Miraflores in the Cape District south of La Paz. *Lippia palmeri* was described from specimens taken at Guaymas and therefore includes in its range subtropical areas on both sides of the Gulf of California. It is a small bush 0.5 to 1.8 meters high.

### MENTHACEAE. Mint Family.

**Mesosphaerum insulare Standl. & Goldm.<sup>1</sup>**

On Espíritu Santo Island this shrub was observed to be common along the basal slopes of the rugged hills which form the high interior of the island, where it was collected February 7, 1906. It is one of the plants recently described from material obtained by our expedition.

**Mesosphaerum emoryi (Torr.) Kuntze.**

This Lower Sonoran shrub of Arizona and California seems to enter the Peninsula through the desert region east of the Sierra del Pinal and the San Pedro Mártir Moun-

<sup>1</sup> See p. 311.

tains and may extend far southward. It was rather common in the rocky and gravelly deposit where La Providencia Canyon opens on the desert at the east base of the high mountains and was taken in flower there June 26. A specimen in the U. S. National Herbarium, also in flower, was collected at Santa Rosalía Bay by A. W. Anthony, July-October, 1896. *Mesosphaerum emoryi* is a northern representative of a group mainly tropical in distribution.

***Mesosphaerum laniflorum* (Benth.) Kuntze.**

This species is abundant at the lower elevations in the Cape District from La Paz southward. It was published in the Botany of the Voyage of the *Sulphur* from material taken at Cape San Lucas. Flowering specimens in the U. S. National Herbarium were collected at the type locality by Xantus, between August, 1859, and January, 1860; at La Paz by Palmer, January 20-February 5, 1890; at Todos Santos by Brandegee, January 29, 1890; and at Las Animas by Purpus in 1901.

***Mesosphaerum palmeri* (S. Wats.) Goldman.**

The range of this shrub includes the coast of southern Sonora and the Cape District of the Peninsula. It is common in the subtropical belt on the lower slopes of the Victoria Mountains. Flowering specimens were taken between Miraflores and Rancho San Bernardo, January 20, and at 750 meters altitude between La Laguna and El Paraíso, January 29.

***Monardella linoides* A. Gray.**

This little undershrub, perhaps representing the subspecies *stricta* of Parish, was common in the open pine forest at 2,400 meters altitude in the Transition Zone of the San Pedro Mártir Mountains. It was taken in flower at Vallecitos, July 15.

***Monardella macrantha* A. Gray.**

A very small shrub or woody herb growing abundantly in the open pine forest at 2,400 meters altitude in the upper part of the Transition Zone in the San Pedro Mártir Mountains. The large, handsome flowers were quite conspicuous near Vallecitos, where specimens were taken July 15.

***Ramona incana pachystachya* (A. Gray) Heller.**

In many parts of the open pine forest in the San Pedro Mártir Mountains this sage was the most common shrub. It was noted from about 1,500 meters on north slopes near El Piñón up to near the summit of the range, but was most abundant in the upper part of the Transition Zone. Flowering specimens were taken at El Piñón, July 7, and at Rancho Santo Tomás, July 26.

***Ramona polystachya* (Benth.) Greene.**

This sage was rather common along the basal slopes of hills bordering Trinidad Valley, where it was taken in flower, at about 780 meters, June 16. The species appears to belong to the Upper Sonoran Zone.

***Salvia californica* T. S. Brandeg.**

This *Salvia* was described from Calmallí, where Brandegee collected it while on his overland journey from Magdalena Bay to San Quintín. We found it abundant at about 300 meters along canyons in the hills near San Pablo, not far to the southward of Calmallí. It is a shrub about a meter high, associated here with both Lower Sonoran and tropical or subtropical species. Flowering specimens were taken October 3.

***Salvia similis* T. S. Brandeg.**

A common shrub growing 1.8 to 3 meters high along small streams and in shaded canyons in the Upper Sonoran Zone on the upper slopes of the Sierra de la Laguna. It was taken in flower at 1,350 meters on the road from Rancho San Bernardo to El Saúz, January 21. This species is restricted, so far as known, to these mountains.

**SOLANACEAE. Nightshade Family.****Lycium richii** A. Gray.

FRUTILLA.

Species of the genus *Lycium*, growing as shrubs 1.8 to 2.5 meters high, form an important element in the desert flora nearly throughout the Peninsula and on many of the islands, but they are not well known, and most of our specimens are still undetermined. The berries are eaten by small desert rodents and by some of the birds. At San Felipe Bay the holes of *Citellus tereticaudus* were numerous under shelter of a dense thicket made up almost entirely of *Lycium* bushes (perhaps *L. torreyi*), and the animals were carrying the ripening berries in their cheek pouches. In these species the fruiting season is much prolonged, and it is not unusual to find flowers with fruit at all stages of development on the plant at the same time. Specimens referred by Brandegee to *L. richii* were collected in flower and fruit at Comandú, November 7, and in fruit along the road between Tres Pachitas and Valle Flojo, December 25. Brandegee records *L. richii* from La Paz. The native name "frutilla" is applied indiscriminately to several species.

**Solanum hindsianum** Benth.

This species was common in many places along the route from San Francisquito southward to San Ignacio and thence eastward to Santa Rosalía. It is well distributed, but more abundant in soft soil along arroyos, growing as a shrub 1.5 to 3 meters high. Some plants are entirely thornless, while others have a few thorns distributed irregularly along the branches. Flowering specimens were collected at San Francisquito, September 11, and at Tinaja de San Esteban, 25 miles north of San Ignacio, October 5.

**SCROPHULARIACEAE. Figwort Family.****Diplacus arachnoideus** Greene.

Found rather common on the same hill slopes with *Diplacus puniceus* in the Upper Sonoran Zone along the road from near sea level at Ensenada to about 900 meters near Ojos Negros. It grows here as a shrub 1 to 1.5 meters high, with large, handsome flowers. A specimen was taken east of Ensenada, May 31.

**Diplacus puniceus** Nutt.

Noted as rather common along with *D. arachnoideus* and other chaparral on steep Upper Sonoran hill slopes from near sea level at Ensenada to about 900 meters near Ojos Negros, in San Rafael Valley. It is a handsome shrub growing 0.5 to 1.2 meters high. A flowering specimen was collected a few miles east of Ensenada on the road to Ojos Negros, May 31.

**Galvesia juncea** (Benth.) A. Gray.

Originally discovered on the voyage of the *Sulphur* from San Diego to Magdalena Bay. Specimens in flower and fruit were obtained by us at the mouth of the San Simón River, a few miles south of San Quintín, August 29. The species grows here as a shrub 1.8 to 2.5 meters high. Specimens in the U. S. National Herbarium were collected on Cedros Island by Lieut. Charles F. Pond, Dr. Edward Palmer, and A. W. Anthony, and on San Quintín Bay by Palmer.

**Pentstemon antirrhinoides** Benth.

Of the several species of *Pentstemon* noted by us this was the largest and most conspicuous. It was a rather common shrub growing 1 to 1.5 meters high and associated with *Adenostoma* and *Arctostaphylos* on dry Upper Sonoran hill slopes along our route from near sea level at Ensenada to about 1,500 meters near El Piñón on the western side of the Sierra del Pinal and San Pedro Mártir mountains. Flowering specimens were taken east of Ensenada, May 31, and at El Piñón, July 5.



**Pentstemon centranthifolius** Benth.

A common species growing 1 to 1.2 meters high, at about 810 meters altitude, along the sloping borders of Trinidad Valley, where it was collected in flower July 4.

**Pentstemon palmeri** A. Gray.

This widely ranging species of the southwestern United States was collected at 1,140 meters altitude in San Matías Pass, June 17. Brandege records it from Agua Dulce and San Luis.

**Pentstemon linarioides** A. Gray.

Common from 1,500 meters altitude near El Piñón upward in the Transition Zone to at least 2,400 meters near Vallecitos on the west slope of the San Pedro Mártir Mountains. It grows here as a shrub 30 to 45 cm. high, and was usually seen in the open pine forest on dry, rocky hillsides. A flowering specimen was taken near El Piñón, July 7.

**BIGNONIACEAE. Bignonia Family.****Chilopsis linearis** (Cav.) Sweet.

DESERT WILLOW.

Seen in the vicinity of San Matías Pass, where, like *Covillea glutinosa* and *Simmondsia californica*, it forms a part of the Lower Sonoran flora which extends through the pass from the desert side into Trinidad Valley. It was rather common along dry arroyos near San Matías Spring and was scattered over the south slopes of the ridge on the north side of Trinidad Valley. Specimens were collected in flower June 17 and in fruit and flower June 28.

**Crescentia cujete** L.

JÍCARA.

A jícara tree, probably introduced from the Mexican mainland, was noted by us at San José del Cabo. Brandege says: "*Crescentia alata*, a queer looking garden tree, is planted for the gourdlike fruit, which is credited with medicinal properties. This fruit is about 4 inches in diameter and when used is filled with 'mescal' through a hole made at one end, then persons imagining themselves affected with chest diseases drink out the liquor from time to time expecting to become cured."

**MARTYNIACEAE. Martynia Family.****Martynia altheaefolia** Benth.

ESPUELA DEL DIABLO.

This species was published in the Botany of the Voyage of the *Sulphur*, from Magdalena Bay. We found it abundant on the coast plain from San Jorge to Llano de Yrais, and along the sandy shores at Cape San Lucas and San José del Cabo. The local name of this queer plant is derived from the spreading, hooked arms of the dry fruit, which seem always ready to clasp everything within reach. Five or six of these fruits sometimes become entangled and roll together before the wind over the plain. Specimens in flower and nearly ripe fruit were taken a few miles north of Matancita, November 15.

The species probably ranges in suitable situations nearly throughout the Lower Sonoran Zone in Lower California. It has been recorded by Parish as far north as Vallecito, in southern California.<sup>1</sup>

**ACANTHACEAE. Acanthus Family.****Beloperone purpusi** T. S. Brandeg.

At the time of our visit this was a common flowering species in places along the basal slopes of the Victoria Mountains. The plant is a shrub about a meter high. A specimen was taken between Santa Anita and Miraflores, January 19.

<sup>1</sup>Zoe 4: 165. 1893.

**Beloperone californica** Benth.

This handsome species was taken in flower on Cerralvo Island, February 12. It was common there as a shrub 1.2 to 1.8 meters high. It was originally described from material taken at Cape San Lucas on the voyage of the *Sulphur*. Brandegee says its red blossoms may be seen at most localities south of Magdalena Bay.

**Justicia insolita** T. S. Brandeg.

A flowering specimen of this species was taken at an altitude between 360 and 600 meters in the hills 20 miles east of San Ignacio, October 19. A few shrubs 1.2 to 1.8 meters high were seen. The species was originally described from material collected at San Gregorio by Brandegee on his overland journey from Magdalena Bay to San Quintín. He records it also from Todos Santos and La Paz in the Cape District.

**Justicia palmeri** Rose.

This species was common along the basal slopes of the Victoria Mountains. It grows as a shrub 1.2 to 1.8 meters high. A flowering specimen was taken on the road from San Pedro to Tres Pachitas, December 24. Brandegee records it from La Paz and San José del Cabo.

**Ruellia** sp.

An undetermined *Ruellia* was noted near San Pablo and was seen at intervals from that point southward to near Cape San Lucas, mainly on the warmer slopes of canyons in the hill country along the backbone of the Peninsula. It is a shrub about a meter high with purple flowers, and with a peculiar fragrance which I had learned to associate with a similar plant of the arid Tropical Zone in western Mexico. Specimens were collected at Tinaja de San Esteban, 25 miles north of San Ignacio.

**RUBIACEAE. Madder Family.****Chiococca racemosa** Jacq.

A specimen of this shrub in fruit was taken at about 750 meters on the road between San Bernardo and El Saúz in the Victoria Mountains. It was a rather common species on the mountain side, growing 1.8 to 3.5 meters high. The species has a very wide range in tropical America and evidently belongs to the tropical element of the flora of the Peninsula. Brandegee records it from the foothills of the Sierra San Francisquito.

**CAPRIFOLIACEAE. Honeysuckle Family.****Lonicera interrupta** Benth.

Common in the Upper Sonoran Zone on the west slope of the Sierra del Pinal and San Pedro Mártir mountains, from near the coast at Ensenada to at least 1,560 meters near El Rayo and above San Antonio. Collected in flower in a canyon a few miles east of Ensenada, May 31.

**Sambucus glauca** Nutt.

BLUE ELDERBERRY.

Elders, provisionally referred to this species, were noted in a number of places along the road from Ensenada northward to the international boundary at Tijuana and from sea level upward through the Upper Sonoran Zone to above 1,500 meters. The only specimens were taken May 20, at Ensenada, where the species was then flowering. Brandegee records *S. glauca* as "not common on San Pedro Mártir."



*IBERVILLEA SONORAE* (S. WATS.) GREENE, CERRALVO ISLAND.

***Symphoricarpos parishii* Rydb.**

A common shrub 1 to 1.5 meters high, confined mainly to the limited Canadian Zone areas on northerly slopes in the San Pedro Mártir Mountains, but descending along cold streams to at least 2,400 meters in the upper part of the Transition Zone. Taken in flower at Vallecitos, July 15.

**CUCURBITACEAE. Gourd Family.*****Ibervillea sonorae* (S. Wats.) Greene.**

PLATE 133.

This remarkable species has a wide range in the lower part of the Lower Sonoran or Subtropical zone on both sides of the Gulf of California. It is a desert plant, growing in sandy places as a slender vine 1 to 1.5 meters long from an enormously enlarged woody, base, which may or may not project above the surface of the ground. It was first noted by us at Pozo Altamirano, 30 miles south of Calmallí, October 3, specimens in fruit and flower being then taken. It is common on the low sandy plains throughout the southern part of the Peninsula and on Cerralvo Island, where the largest individual seen had a basal diameter of over 60 cm. The average diameter, however, is perhaps not more than 15 cm. As the bulbous basal part projects but little, if at all, above the surface, these plants are usually inconspicuous, especially during the long dry season when growth is interrupted and the slender terminal parts wither back to the persistent base.

**AMBROSIACEAE. Ragweed Family.*****Hymenoclea monogyra* Torr. & Gray.**

ROMERILLO.

The "romerillo," as it is locally known, occurs in suitable situations nearly throughout the Peninsula. From a center of abundance in the Lower Sonoran Zone it ranges along the Pacific coast, in the vicinity of Ensenada, a short distance into the Upper Sonoran Zone and both in the Cape District and along the coast of Sinaloa enters the subtropical belt. It is limited locally to sandy bottoms along stream beds, in many places forming thickets in the deep sand, from which most other shrubs are excluded. It was taken in flower or fruit at Rosarito, September 25; El Potrero, 25 miles southwest of Mulegé, October 31; San Pedro, 18 miles south of La Paz, December 23. Brandege records the species in the Cape District from San José del Cabo to La Paz.

**ASTERACEAE. Aster Family.*****Alvordia fruticosa* T. S. Brandeg.**

Known only from the Cape District. This species is common at low elevations, growing as a much branched shrub 3 to 4.5 meters in height. It was taken in flower on the road between El Cajón and El Sacatón, December 28.

***Artemisia californica* Less.**

CALIFORNIA SAGEBRUSH.

Recorded by Brandege from "Las Huevitas, [Las Cuevas?], near Rosario." This point is probably near the southern limit of its range in Lower California. It was noted at a number of places on the west slope in the San Pedro Mártir Mountain region. The species belongs to the Upper Sonoran Zone.

***Artemisia tridentata* Nutt.**

SAGEBRUSH.

This species was found sparingly in the Upper Sonoran Zone at about 750 meters near the western rim of San Rafael Valley, about 20 miles east of Ensenada. A specimen with leaves only was taken May 31.

**Baccharis sarothroides** A. Gray.

This species ranges mainly in the Lower Sonoran Zone from southern California southward on both sides of the Gulf of California. Specimens were taken by us on wet soil at San Fernando, September 4. Recorded by Brandegee from the Sierra San Lázaro in the Cape District south of La Paz and from San Gregorio.

**Baccharis glutinosa** Pers.

This species or a plant referred to it ranges from California south in wet places at low elevations throughout Lower California and is widely dispersed on the Mexican mainland from the Sonoran to the Tropical zones. It was taken by us at Rosarito and San José del Cabo. Recorded by Brandegee from San Gregorio and Comandú.

**Baccharis viminea** DC.

This species ranges southward from California throughout the greater part of the Peninsula. It was taken by us along a small stream in the hills between La Purísima and Comandú and has been recorded by Brandegee from San José del Cabo.

**Bebbia atriplicifolia** (A. Gray) Greene.

This shrub seems to be known only from the southern part of the Peninsula, where it is associated with many subtropical species. It grows 1 to 3 meters high in sandy soil. Flowering specimens were taken by us in the vicinity of the type locality near Cape San Lucas, January 4, and at Santo Domingo, September 26. Brandegee records this species from San Gregorio and Comandú and agrees with Dr. Gray that it is probably the same as *B. juncea* of Magdalena Island.

**Chrysoma diffusa** (Benth.) Greene.

This shrub was described in the Botany of the Voyage of the *Sulphur*, from Magdalena Bay. It appears to belong in the subtropical areas on both sides of the Gulf of California. A few miles north of Matancita, and therefore near the type locality, we found it common on the coast plain and flowering November 15. At Cape San Lucas it was still flowering December 30.

**Chrysoma palmeri** (A. Gray) Greene.

This species ranges southward from southern California in the Lower Sonoran Zone. Flowering specimens were taken on the sandy coast at Santo Domingo, September 26. The species forms a round-topped bush 0.5 to 1.2 meters high.

**Coleosanthus atractyloides** (A. Gray) Kuntze.

This species, widely distributed in the southwestern United States, was taken in the Upper Sonoran Zone near Alamo, where it was flowering June 11.

**Coreocarpus involutus** Greene.

In the original description of this species, from material taken at San Bartolomé Bay by Lieut. Pond in March, 1889, it is represented to be an annual, 15 cm. high. Doctor Greene has referred to this species a shrub 1.2 to 1.5 meters high, collected by us on the coastal plain between Matancita and La Cruz. In the light of this additional material, *C. involutus* is evidently a much larger plant than was at first supposed. It appears to belong to the subtropical flora of the Peninsula. It was bearing flowers and fruit December 9.

**Encelia farinosa** A. Gray.

INCIENSO. WHITE BRITTLE BUSH.

This handsome and widely dispersed shrub seems to belong mainly to the Lower Sonoran Zone, but reaches in places into the Upper Sonoran and in the Cape District

enters the subtropical area. It is abundant at low elevations nearly throughout the Peninsula, but favors dry hillsides, growing to a height of 1 to 2.5 meters, with a rounded top. The long, naked flower stems project above the dome of dense foliage and become dry and brittle after the seeds have ripened. Flowering specimens were collected by us at San Pablo, October 3, and between Tres Pachitas and Valle Flojo, December 25. According to Brandegee<sup>1</sup> the local name of the plant in the southern part of the Peninsula is "inciense," derived from a resinous exudation which is collected and burned as an incense in the churches. Hornaday<sup>2</sup> mentioned its occurrence in Sonora, where he formally named it "white brittle bush."

**Eupatorium peninsulare** T. S. Brandeg.

This shrub is common along the lower slopes of the mountains from near Mulegé throughout the southern part of the Peninsula. It appears to belong with the subtropical flora of the region. A flowering specimen was taken about 5 miles southwest of El Potrero, October 31.

**Franseria bryanti** Curran.

STAR THORN.

First seen between San Andrés and Rosarito, near the west coast. It was noted at intervals along the route southward to the Llano de Yrais, growing 0.5 to 1 meter high. On dry, stony hills between San Ignacio and Santa Rosalía it was one of the more abundant plants. Flowering specimens were collected at 360 meters near Tinaja de San Esteban, 25 miles north of San Ignacio, October 5. The species was described from material collected by Bryant at Magdalena Bay. It is conspicuous from the armament of long whitish thorns which stand out from the branches and radiate in clusters near the tops. From these thorn clusters the plant was given the name "star thorn" in my field notes.

**Franseria carduacea** Greene.<sup>3</sup>

This species was based on material collected by us at 1,020 meters altitude near Tinaja de Santana, 35 miles north of San Ignacio. It is common as a shrub 2.5 to 3.5 meters high.

**Isocoma venata** (H. B. K.) Greene.

This species, or one of its forms, is abundant in the vicinity of the mouth of the San Simón River, near San Quintín. It grows here as a shrub 1.2 to 1.8 meters in height. Flowering specimens were taken August 29.

**Lepidospartum squamatum** A. Gray.

A common shrub, 1.5 to 2 meters high, along the sandy wash at Calamahué. This species ranges in the Lower Sonoran Zone from southern California southward. At Calamahué the flowers were fading September 15.

**Palafoxia arenaria** T. S. Brandeg.

This species is known only from the southern part of the Peninsula. It was described from material taken between the lagoon and the ocean near Boca de Las Animas, near San Jorge. Along the shore of the bay near La Paz, where we collected the species in flower February 17, it seemed to prefer sandy situations, as suggested in the original description.

**Peucephyllum schottii** A. Gray.

This shrub ranges in the Lower Sonoran Zone in Sonora and northeastern Lower California. It was common along the broad wash at Calamahué, growing 1.8 to 3.5 meters high, with a dense bushy top. The ripe seeds were falling September 15.

<sup>1</sup> Zoe 1: 83. 1890.

<sup>2</sup> Camp-Fires on Desert and Lava, pp. 182-183. 1908.

<sup>3</sup> See p. 311.

**Pluchea sericea** (Nutt.) Coville.

ARROWWEED.

A very abundant Lower Sonoran species in the delta of the Colorado, noted along the gulf coast at San Felipe and Calamahué. On the Pacific coast it was seen sparingly in moist places at intervals from near Ensenada to a short distance south of San Andrés. It was taken in flower at San Felipe, on the gulf coast, June 20, and at the mouth of San Simón River, a few miles south of San Quintín, August 29. On the low lands in the delta of the Colorado extensive areas are covered with a dense pure growth of arrowweed.

**Porophyllum gracile** Benth.

YERBA DEL VENADO.

The "yerba del venado," as it is known in the Cape District, is one of the numerous species discovered at Magdalena Bay on the voyage of the *Sulphur*. It is common in places and generally distributed mainly in the Lower Sonoran Zone, from the southwestern United States southward nearly throughout Lower California. Flowering specimens were taken by us at Pozo Altamirano, October 3; near Matancita, November 15; at Cape San Lucas, December 30; and between San Bernardo and El Saúz, January 21. Brandege records the species from Magdalena Island, San Jorge, Todos Santos, and San José del Cabo. It has been taken by other collectors at various localities, including Cedros Island. It grows 30 to 100 cm. high and is said to have several economic uses. The local name is derived from the supposed fondness of deer for the plant, which is said also to be a favorite forage with cattle. Tea made of the leaves and flowers has astringent properties and is therefore believed to be useful in certain intestinal troubles.

**Porophyllum confertum** Greene.<sup>1</sup>

The type of this recently described species was collected by us on Cerralvo Island, where it was flowering February 12. It is a shrub or woody herb, 1.2 to 1.8 meters high.

**Senecio goldmanii** Greene.<sup>1</sup>

This species was based on specimens collected by us at about 105 meters elevation near Rosarito, where the plant was flowering September 25. The plant is a shrub about a meter high.

**Tagetes lacera** T. S. Brandeg.

A specimen of this species was taken in flower at 1,650 meters on the upper slope of the Sierra de Laguna, January 27. It is a shrub or woody herb, 1 to 1.5 meters high, apparently confined to the Upper Sonoran Zone in these mountains, where it is associated with oaks, the pinyon, and *Nolina beldingi*.

**Tumionella monactis** (A. Gray) Greene.

The zonal position of this shrub seems to be mainly the overlapping area between the Upper and Lower Sonoran zones from southern California south into northern Lower California. It was abundant at 1,110 meters on the plain near Alamo, there in flower June 11.

**Viguiera tomentosa** A. Gray.

This shrub seems to be known only from southern Lower California, where it was recorded by Brandege as ranging from the coast up to the summits of the highest mountains. We found it flowering along the road from El Cajón to El Sacatón, December 28. It grows 3 to 3.5 meters high.

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<sup>1</sup> See p. 311.

**Viguiera deltoidea** A. Gray.

Typical *V. deltoidea* seems to be restricted to the southern or south-central part of the Peninsula, passing farther north into *V. parishii*. A form from the Sierra El Taste in the Cape District south of La Paz has been described by Brandegee under the subspecific name *tastensis*. The species is a common shrub 1.5 to 3 meters or more in height and is rather generally distributed, but most abundant on stony mesas and along dry arroyos. It was collected in flower at San Andrés, September 21, and at Rosarito, September 25. Brandegee records the species from Todos Santos, La Paz, and San José del Cabo. It is associated with many subtropical species.

**Viguiera chenopodina** Greene.<sup>1</sup>

The type of this recently published species was collected by us between Santo Domingo and Matancita, November 14. It grows on the coastal plain as a shrub 1.8 to 3 meters high.

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<sup>1</sup>See p. 311.



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