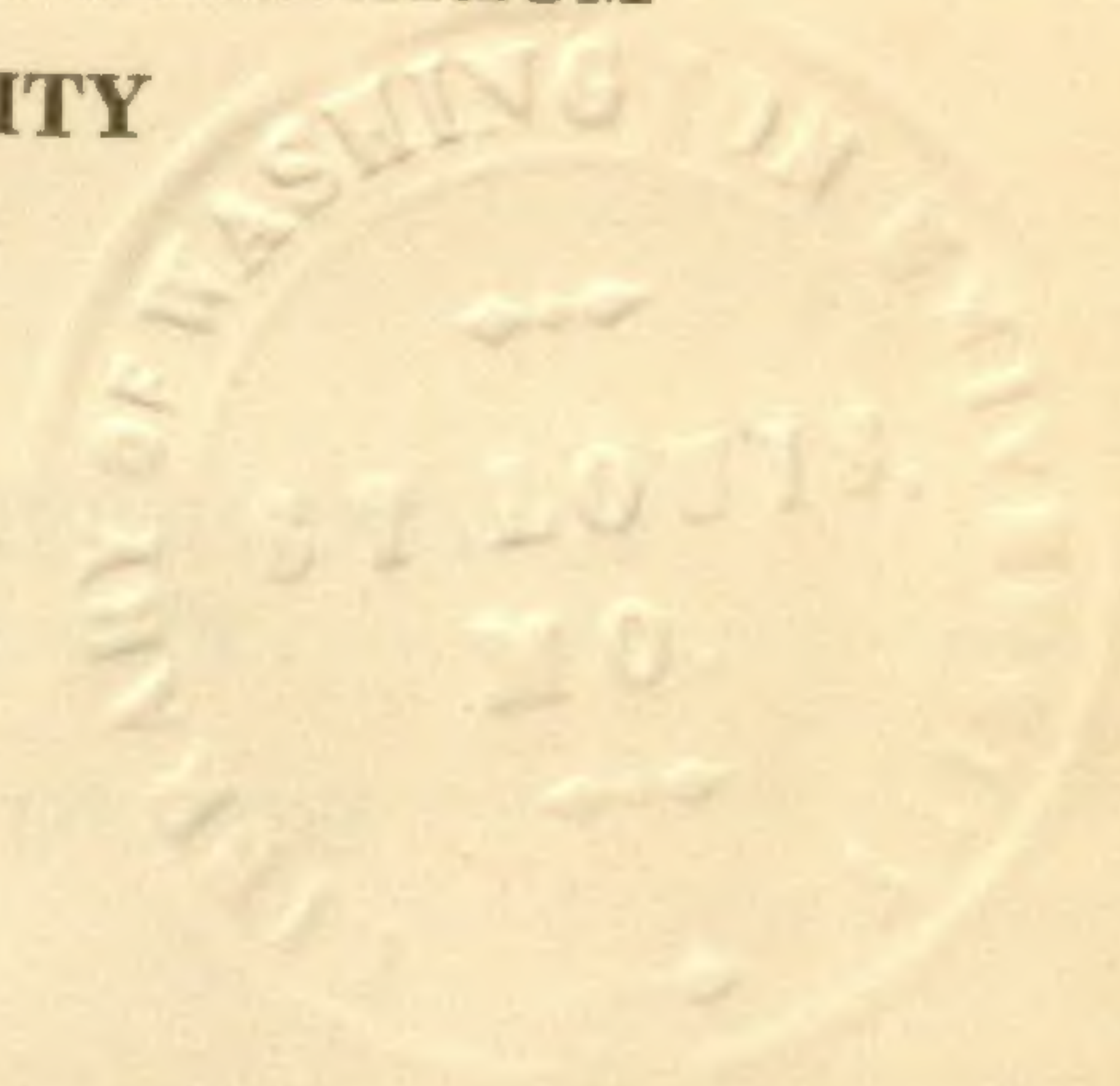


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THE FLORA OF THE ELIZABETH ISLANDS,  
MASSACHUSETTS

By JOHN M. FOGG, JR.

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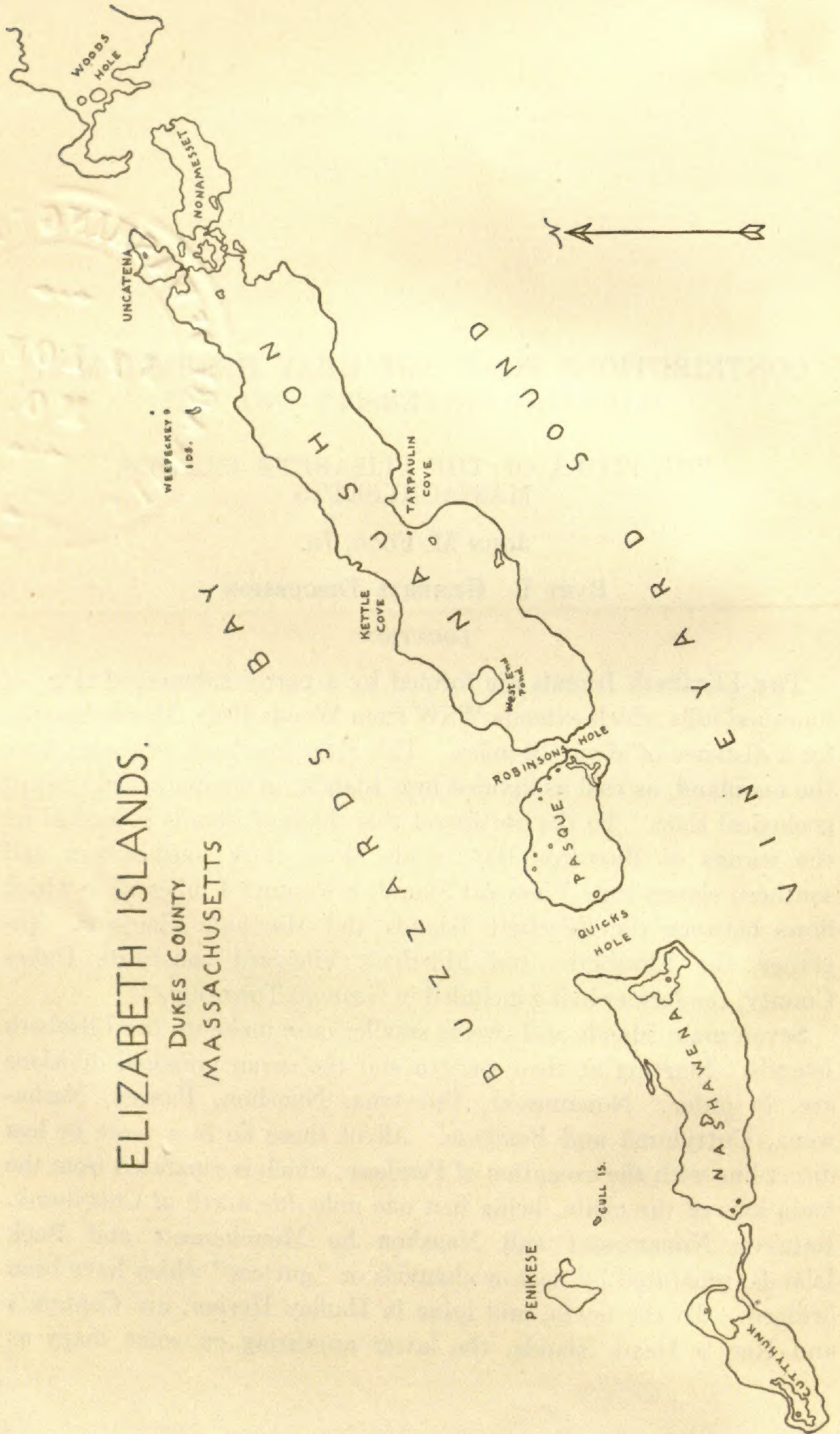
PART I. GENERAL DISCUSSION

LOCATION

THE Elizabeth Islands are formed by a partly submerged ridge of morainal hills which extends WSW from Woods Hole, Massachusetts, for a distance of about 16 miles. This ridge has been separated from the mainland, as well as divided into islands, in comparatively recent geological time. To the northwest this chain of islands is washed by the waters of Buzzards Bay, while along their southeastern and southern shores runs Vineyard Sound, a channel 4 miles wide which flows between the Elizabeth Islands and Martha's Vineyard. Together, the Elizabeths and Martha's Vineyard constitute Dukes County, the former being included in Gosnold Township.

Seven main islands and twelve smaller ones make up the Elizabeth Islands. Starting at their eastern end the seven principal divisions are, in order: Nonamesset, Uncatena, Naushon, Pasque, Nashawena, Cuttyhunk and Penikese. All of these lie in a more or less direct line with the exception of Penikese, which is separated from the main axis of the chain, being just one mile due north of Cuttyhunk. Between Nonamesset and Naushon lie Monohansett and Buck Islands, separated by narrow channels or "gutters" which have been bridged. To the north, and lying in Hadley Harbor, are Captain's and Ram's Head Islands, the latter appearing on some maps as

ELIZABETH ISLANDS.  
 DUKES COUNTY  
 MASSACHUSETTS



Puritan Island. To the south of the gutters lie East Buck and West Buck Islands, although here again confusion exists, as West Buck occasionally appears on maps as "Monohansett." The three Weepecket Islands extend northward from the eastern end of Naushon and now constitute a bird sanctuary. With the mention of Gull Island, a small strip of sand lying east of Penikese, and Pine Island, immediately to the northeast of Nonamesset, the subject of the minor islands may be dismissed, for the remaining islets are too small to have received formal names.

#### HISTORICAL INTEREST OF THE ELIZABETH ISLANDS

A unique historical interest attaches to the Elizabeth Islands through the fact that upon the outermost of the chain was made the first attempt to establish an English settlement in North America. On the 4th of June (Old Style, May 25th), 1602, Captain Bartholomew Gosnold, after having named Cape Cod and Dover Cliff (now Gay Head), fixed upon the island of Cuttyhunk as the site of a future settlement and, in honor of his sovereign queen, called it Elizabeth's Isle, which name has since been applied to the entire group. Here, upon a tiny islet in a large pond at the west end, the crew of Gosnold's ship, the "Concord," constructed a rude fort, and here they lived for a period of three weeks. This settlement, short-lived though it was, thus antedates the founding of Jamestown by five years and that of Plymouth by eighteen years, a fact which was commemorated by the erection and dedication of a monument to Gosnold on Cuttyhunk upon the occasion of the tercentenary of the original landfall.<sup>1</sup>

Cuttyhunk is the only member of the Elizabeth Islands which has been able to boast a permanent population. The little town of Gosnold, named after its illustrious founder, has long existed as a fishing village at the east end of the island and today has about one hundred inhabitants. During the whaling days schooners bound for New Bedford were accustomed to stop at Cuttyhunk to pick up their pilots.

Another claim to fame on the part of one of the Elizabeth Islands may be made for Penikese, the smallest and most desolate member of the chain. Here, in the summer of 1873, Louis Agassiz founded his school which, through the generosity of the New York merchant who

<sup>1</sup> For further details concerning the history of Gosnold on Cuttyhunk and the exercises which marked the dedication of the monument in 1903, see the *Old Dartmouth Historical Sketches*, nos. 1 and 4. New Bedford, Mass. (1903).

donated the island and funds for the construction of a laboratory, became known as the Anderson School of Natural History. To this summer school, the first of its kind in the country, came students from all over the United States and the roll included names which later became known as belonging to some of the foremost figures in American biology. Following Agassiz's death in December, 1873, the school was continued for one summer by his son Alexander, but thereafter was abandoned and the island reverted to the State of Massachusetts, later to be used as a leper colony, from which function it was released only in 1921.

The island of Naushon has for several generations been the property of the Forbes family, various members of which have summer homes at the east end, near Hadley Harbor. To the Forbeses also belong Nonamesset, Uncatena and Nashawena and it is only through the generosity and hospitality of the owners that it has been possible to carry on the botanical exploration which forms the basis for the present survey.

#### PREVIOUS BOTANICAL WORK ON THE ELIZABETH ISLANDS

Mention has been made above of Gosnold's visit to the Elizabeth Islands in 1602. With Gosnold on that expedition were Gilbert Archer and John Brereton, "gentlemen and historians." The former has left us a very readable and illuminating account of the voyage.

One of the chief objects which Gosnold had in visiting the New World was to collect and carry home to England a cargo of native Sassafras which was then much in demand because of its supposed medicinal value. According to Archer, Elizabeth's Isle (Cuttyhunk) was in 1602 overgrown with wood, a fact not without interest in view of the present treeless nature of this and of several other islands of the chain. Not only did Gosnold's party find there the Sassafras which they sought, but mention is also made of cedar, oak, beech and ash. The very islet upon which the fort was built is spoken of as cedar-covered. Hills Hope (Penikese) was likewise overgrown with cedar, and Naushon which was also visited is referred to as being forested, a character which this island, almost alone of the Elizabeths, has retained in large measure down to the present day.

References to the plant life of the Elizabeth Islands seem to be lacking for a period of more than 250 years, but we may well suppose that during that interval extensive deforestation was carried on and

the islands divested of their original tree growth. Certain it is that within the memory of no living inhabitant have there been trees on Cuttyhunk or Penikese, except the few which have been planted by the hand of man. It is probable that this statement also holds for Pasque and the greater part of Nonamesset and Uncatena. Nashawena still has considerable areas which are more or less wooded, and Naushton, as already mentioned, has apparently retained much of its original forest.

The first published report, known to the writer, on the flora of any of the Elizabeth Islands dates from the year 1874 and concerns the island of Penikese. Among the students attracted to Agassiz's laboratory in the summer of 1873 was David Starr Jordan, who began his scientific career with a botanical publication. The task assigned to Jordan by Agassiz was an enumeration of the plants growing upon the island and in the waters surrounding it. As the result of this study Jordan published a list<sup>1</sup> of the flora in which he included not only flowering plants but cryptogams as well. So far as the lower forms were concerned, since no attempt was made at microscopic examination, only the most obvious species were included. The list enumerates 83 species of algae, 2 mosses, 1 fern and 113 species of flowering plants. Although the marine algae were preserved and the original set is still in existence, the writer has it on the authority of Dr. Jordan that no collection of specimens of the higher plants was made, and we have therefore only the published names as records. In 1923, on the occasion of the fiftieth anniversary of the founding of the Anderson School, a botanical survey of Penikese was made by the staff and students of the Marine Biological Laboratory at Woods Hole, Massachusetts. The results of this survey were published in *RHODORA* for 1924, and, insofar as they indicate the possible direction of change in the elements of the flora of one of the Elizabeth Islands, will be referred to later.

Since 1873 nearly a score of botanists have visited the Elizabeth Islands and brought back specimens which are in one or more of our eastern herbaria. Since these records have been incorporated into the catalog which forms the second part of this study, a brief chronological account of these collectors is here presented.

Walter and C. E. Faxon, in 1873 and 1875 respectively, collected a few specimens on Nashawena; these sheets are in the Gray Herbarium.

<sup>1</sup> Jordan, D. S. "The Flora of Penikese." *Am. Nat.* viii. 193 (1874).

In 1890 a Miss Weir collected on Naushon a few sheets which are now in the herbarium of the New England Botanical Club.

In August, 1898, Dr. Arthur Hollick made a trip to the islands with a view to studying the geological formations there presented. In the published account of this survey<sup>1</sup> the author makes mention of some of the plants which he found growing on the various members of the chain. The few specimens which he collected are in the New York Botanical Garden herbarium.

In the herbarium of the Marine Biological Laboratory at Woods Hole are several plants collected on Naushon in 1901. Some of these bear the name of S. B. Sipe while the others are merely signed "E. A. S." Inquiry has shown that these initials refer to Miss Elizabeth A. Simons (now Mrs. Eldred Jungerich).

Also from 1901 there dates the largest collection made on any of the Elizabeths, previous to that which forms the basis of the present report. In the Library of the Gray Herbarium there is a manuscript list compiled by Mrs. Alice R. Northrop of the plants of Nashawena. This list contains the names of 335 species of flowering plants and ferns and therefore constitutes a substantial contribution to our knowledge of the flora of this island. Mrs. Northrop spent the summer of 1901 and a part of that of 1903 on Nashawena and was thus admirably situated for making careful botanical observations. Her list includes many surprises: species which are either absent or very locally known from southeastern Massachusetts, some of them constituting, indeed, notable extensions in range. To this class of rarities belong such plants as *Cyperus erythrorhizos*, *Uvularia perfoliata*, *Habenaria bracteata*, *Arethusa bulbosa*, *Rumex verticillatus*, *Coptis groenlandica*, *Ranunculus reptans* and *Hydrocotyle Canbyi*. Unfortunately not a single one of these specialties appears to be corroborated by herbarium material. However, Mrs. Northrop did collect some specimens for permanent record, about one-fifth of the names on her list being represented by sheets in the collections of the New York Botanical Garden. And the fact that a few of her most interesting records, such as *Habenaria blephariglottis*, *Liparis (Leptorchis) Loeselii*, *Tipularia discolor* and *Asclepias verticillata* are substantiated by specimens and that others, such as *Arisaema triphyllum*, *Medeola virginiana*, *Ranunculus delphinifolius*, *Myriophyllum pinnatum*,

<sup>1</sup> Hollick, A. A Reconnaissance of the Elizabeth Islands. Cont. Geol. Dept. Columbia Univ. xi. no. 72 (1901).

*Hydrocotyle Canbyi*, *Cornus florida* and *Trientalis borealis*, have been duplicated by the writer either for Nashawena or other islands of the group, makes it necessary to give definite weight to the plants mentioned on Mrs. Northrop's list.

In the herbarium of the New England Botanical Club is a sheet of *Habenaria orbiculata* collected on Naushon by Lillian MacRae in July, 1904. This is the only specimen bearing the name of this collector seen by the writer.

A. H. Moore also visited the Elizabeth Islands in 1904 and several sheets of his collecting from Naushon and Penikese are in the collections of the New England Botanical Club.

In 1906, J. A. Cushman paid two visits to the islands, collecting on Nonamesset on July 27, and on Naushon, in company with Max Morse, on August 25. Specimens from these trips are in the herbarium of the Boston Society of Natural History.

Naushon and Nashawena were visited by E. F. Williams on July 10, 1911. The few plants collected on this occasion are in the New England Botanical Club herbarium.

In 1911, also, F. W. Pennell made several collecting trips to the Elizabeths, touching chiefly Nonamesset, Naushon, Nashawena and Cuttyhunk. Dr. Pennell's specimens, numbering about fifty, were distributed to the Marine Biological Laboratory and the University of Pennsylvania.

Thirty sheets from Cuttyhunk, collected by S. N. F. Sanford in 1917, are now in the New England Botanical Club.

Scattered collections were made on various islands by W. R. Taylor from 1917 to 1921. These specimens, with the exception of a sheet of *Liparis Loeselii* which is now in the New England Club, are either at the Marine Biological Laboratory or at the University of Pennsylvania.

Dr. H. K. Svenson visited Pasque on September 8, 1926 and collected a few specimens which are now in the herbarium of the New England Botanical Club.

On August 10, 1927, Professor M. L. Fernald and the writer visited Uncatena and Naushon, and the material collected upon that occasion has been distributed to the New England Botanical Club and the University of Pennsylvania.

A few specimens were collected by E. W. Hervey on Cuttyhunk. These bear no date and are now in the New England Botanical Club herbarium.



## COLLECTIONS MADE DURING COURSE OF PRESENT STUDY

By far the largest number of records accumulated to form the basis for the present account of the flora of the Elizabeth Islands represent collections made by the writer over a period of six years. From 1923 to 1928 inclusive, each island was visited many times and hundreds of specimens were collected. This material has been worked over and specimens have been distributed to the following institutions: Gray Herbarium, New England Botanical Club, University of Pennsylvania, Missouri Botanical Garden, Cornell University and Marine Biological Laboratory, Woods Hole, Massachusetts.

In the Fiftieth Anniversary Survey of Penikese already referred to,<sup>1</sup> the writer contributed the list of Spermatophytes collected in 1923. Subsequent visits have resulted in several additions to that list and made possible a more careful analysis of conditions on the island, and, as stated earlier, such evidences of vegetational changes as are thus afforded will be dealt with in a later section.

## TOPOGRAPHY OF THE ELIZABETH ISLANDS

The general topography of the Elizabeth Islands is that of gently undulating morainal hills with a maximum elevation of about 170 feet. All the features characteristic of typical morainal regions are here presented, from the rounded hills and depressions, the latter often occupied by ponds or peaty bogs, to the boulders, some the size of a small house, which are scattered everywhere. Nowhere except along the beaches is there any considerable stretch of flat land: a walk across any of the islands necessitates repeated ascent and descent of the rolling hills.

Along the south sides of the islands, facing Vineyard Sound, the shore tends to be steep and precipitous, often presenting sheer sand and gravel faces nearly a hundred feet high, rising abruptly from a narrow cobble beach. In general the highest land is along this south shore, and the ground slopes away gradually to the opposite side of the islands where there are frequent coves and low brackish swamps or fresh ponds.

The ponds which occur in the hollows in the open, rounded hills are, in some cases, merely small pools which may form desiccated bog-holes or disappear entirely in very dry seasons, or, in other cases, are

<sup>1</sup>The Flora of Penikese, Fifty Years After. Edited by I. F. Lewis. RHODORA, xxvi. 181-195, 211-219, 222-229 (1924).

sufficiently large to have been designated as lakes. The largest of these latter, West End Pond on Naushon, is more than a quarter of a mile in diameter.

The character of the beaches varies from those of the rugged boulder type, liberally bestrewn with huge rounded stones, to those which offer a smooth sandy shelf. The characteristic type lies between these extremes, and we find for the most part a shingle or cobble beach with here and there piles of boulders and flat sandy patches. Dunes of shifting sand are rare and occur extensively only at the east end of Nashawena, and along the north shore of Naushon, west of Kettle Cove.

In those islands which have been deprived of their trees the open barren hills are covered with grasses, or other low growth, while the dry hollows or protected lee slopes harbor dense patches of scrub vegetation, made up mostly of *Myrica caroliniensis* and species of *Gaylussacia* or *Vaccinium*. Occasionally an extensive boggy hollow will be densely wooded, the tops of the trees (*Nyssa sylvatica*, *Quercus velutina*, *Acer rubrum*, etc.) conforming to the height and contour of the surrounding slopes.

The most conspicuous vegetational feature of the islands, aside from the open grassy downs, is the dense growth of rather low beech woods which clothes the greater part of Naushon and smaller areas on some of the other islands. From a distance these woods are seen to fit in closely with the general topography, due, doubtless, to the high wind velocity which would tend to level forest growth to the existing lines of the hills and ridges.

#### CHARACTERISTIC FEATURES OF THE SEPARATE ISLANDS

As the various members of the Elizabeth Islands exhibit some diversity as regards general topographic and vegetational features, and also in the influence which man has exerted upon the latter, a brief description of each of the seven main divisions is here given.

**NONAMESSET.** This island, the easternmost of the chain, is roughly oblong with a length of  $1\frac{1}{4}$  miles and a greatest width of  $\frac{1}{2}$  mile. Its longitudinal axis lies east and west. The eastern three-quarters of Nonamesset is essentially treeless, save for an occasional wooded depression, while the western quarter is heavily clothed with mixed beech and oak woods. The rather sharp line between these two areas, a line which follows, for the most part, an old stone wall, indicates that the

treeless nature of the eastern portion is due to artificial denudation, it probably having been cleared for purposes of agriculture or grazing. Altogether there are about 15 ponds of more or less permanent character on Nonamesset and all but one of these lie in the exposed eastern portion. Munsod Pond, as it appears on the charts, has now become merely an arm of Lackey's Bay and the narrow bar which formerly protected it has been submerged. Nonamesset is connected with Naushon by three bridges which cross the narrow gates or "gutters" separating Monohansett and Buck Islands. The East and West Gutters are open and the rapid current flows through them as through a mill race, but the Middle Gutter is "blind," being closed by the stone wall that forms the bridge.

UNCATENA is a triangular-shaped island about  $\frac{3}{4}$  of a mile long and  $\frac{1}{2}$  a mile wide. It lies to the west of Nonamesset across Hadley Harbor and forms a wedge that juts northward into Buzzards Bay. Uncatena is practically treeless, except for a small natural area in the extreme southern corner, and here again the assumption is that active deforestation has been carried on, for it was from the originally densely wooded nature of Nonamesset and Uncatena that Woods Hole is said to have derived its name. There are about a dozen small fresh water ponds on Uncatena during the course of a moderately rainy summer and a large inland brackish pond drains eastward into Hadley Harbor by a sluice-way which makes of the northeastern part of the island a peninsula. Dry, exposed, undulating grassland characterizes the vegetation of nine-tenths of this island, with an increase of scrubby thicket to the westward. The summer home of Mr. Malcolm Forbes is located on the east side of Uncatena and a large central area is fenced off for grazing. This island connects by a bridge across the Northwest Gutter with Naushon.

NAUSHON is the largest of the Elizabeth Islands. It is  $6\frac{1}{2}$  miles long and averages 1 mile wide, with a width of about  $1\frac{1}{2}$  miles at its widest point. It extends from Hadley Harbor almost due southwest to Robinson's Hole which separates it from Pasque. By far the greater part (perhaps  $\frac{3}{4}$ ) of the surface of Naushon is covered with a dense growth of trees. In some regions, like the area near French Watering Place, these woods present an almost pure stand of beech, in others there is considerable admixture of oak, hickory, hop hornbeam, maple and black gum. Almost the only portions of Naushon which are not wooded are those right along the shore or some of

the higher exposed ridges in the central part of the island. Along the north shore, on one of these treeless stretches, Scotch Broom (*Cytisus scoparius*) was introduced some years ago and has taken hold so vigorously that it now solidly occupies an area of several acres. In similar spots along this same shore, various conifers (notably larch, Scotch pine and several spruces) have been set out as a windbreak and these appear to be no more than holding their own. Naushon has many ponds, nearly all of them fresh. West End Pond, Mary's Lake and French Watering Place are the three largest, in the order named, and there are about a score of smaller ones, depending upon the degree of rainfall. The island is indented by two large coves, Tarpaulin Cove and Kettle Cove, which are nearly across from each other on opposite shores. It has been suggested that it was by the approximation of similar indentations that Nashawena was separated from Pasque in comparatively recent times and that the same process may be going on here in Naushon. The gravel cliffs which in many places form the south shore of the island are high and very precipitous. East of Tarpaulin Cove they are usually barren on their crests, while westward they are frequently wooded right to the very edge. Naushon presents several areas of low brackish marshland, the most extensive being near Job's Neck and at the west end near West End Pond. At the east end of the island are the several residences of members of the Forbes family. Here, also are tracts under cultivation and scattered farmhouses and outhouses.

**PASQUE.** Lying across Robinsons Hole from Naushon is the island of Pasque, or Peskinese, as it was formerly called. Pasque is roughly oval in form, with a long axis, lying east and west, of  $1\frac{1}{2}$  miles, and a short one about 1 mile. It is almost entirely destitute of trees, save for a few protected hollows. The extreme eastern end is low and marshy, and is drained by a sinuous tidal stream. Numerous fresh water ponds are scattered around the rim of the island, for the central part is high and arid. As on the other islands, the depressions among the hills near the shore are often peaty and boggy and several extensive areas of this sort are to be found here. Pasque was formerly the property of a fishing club. As evidences of this are a large frame club-house, a landing wharf, a truck patch and outhouses, including an ice-house on the edge of a small pond; all at the eastern end of the island. The ownership of Pasque has just recently passed into private hands. Between Pasque and Nashawena lies Quicks Hole.

NASHAWENA. The second largest island of the group is Nashawena (formerly Nashuina), or "Little Naushon," with a length of 3 miles and an average width of about a mile. Nashawena contains large wooded areas, chiefly toward the east end, although in the troughs between the long ridges of hills that traverse the island longitudinally trees may be found, except in the western quarter. The shores and the extreme western portion are barren and open, as are likewise the higher hills throughout. Behind the line of dune hills, which forms most of the eastern border of the island, lie two large ponds of fresh water separated by a low swampy area: these are known as "the dune ponds." The easternmost of these ponds is separated from the sound by a low barrier beach, and evidence indicates that inundations of salt water probably occur occasionally during the severe storms of winter. It seems also likely that these two ponds have from time to time been connected as a single body of water. Here again, as on Naushon, the highest land is along the southern side of the island and the slope is to the north. Many of the hollows, especially around the margin of the island, harbor small ponds, and in addition to the dune ponds there are several good sized bodies of water, the largest of which is Choptauk Lake, two-thirds of the way to the west end. There are numerous swampy and boggy areas on Nashawena, most of them occurring in the central parts of the island in the wide depressions between the lines of hills. In many cases these swampy hollows are overgrown by tangles and thickets so dense as to be well nigh impenetrable. It is supposed that, at one time, much of the open land on Nashawena was under cultivation. The old stone farm house, said to have been built in 1725, still stands, although a modern wing has been added to it in recent years. An obscure gravestone bears the date 1736. Today the island belongs to the Forbes family and is used chiefly for the raising of sheep, of which there are thought to be about 700. The caretaker and his wife, Captain and Mrs. Mark Jamison, occupy the new wing of the old farmhouse, and to their kind hospitality the writer owes a very enjoyable and botanically profitable visit to the island in July, 1928.

CUTTYHUNK. West of Nashawena, and separated from it by a very narrow passage, Canapitsit Channel, lies the island which Gosnold in 1602 named Elizabeth's Isle but which has reverted, with some modification, to the old Indian name of Cuttyhunk. Roughly oblong in shape, the main body of Cuttyhunk is some 2 miles long, with a

greatest width of about  $\frac{3}{4}$  of a mile, and lies along a NE-SW axis. From its southeastern corner a narrow sand-spit runs due east for  $\frac{3}{4}$  of a mile toward Nashawena. On this strip is located U. S. Coast Guard Station No. 50. The northeastern quarter of the island is occupied by a large body of salt water known as Cuttyhunk Pond. To the east this is dredged to Cuttyhunk Harbor and thus offers a land-locked refuge to small vessels. West of Cuttyhunk Pond is the little village of Gosnold, spread out upon the sheltered east-facing slope which leads down toward the wharf. All of the central and western portions of the island are open grassy downs, exposed to the full blast of winds from the Atlantic. From the lookout station on the highest hill, near the center of the island, the land slopes gently away to the south and southwest. The low-lying western part of the island is occupied by two bodies of water. One of these is fresh and furnishes the supply of ice for the inhabitants; it has long been known to visiting botanists as Ice-house Pond or Sheep Pond. The other is the pond made known to fame by Gosnold and is variously termed Gosnold Pond or West End Pond. Although originally mentioned as a fresh-water pond, and still referred to as such, this body of water, which is separated from the open sea by a very narrow cobble barrier beach, is certainly frequently inundated. In 1927, *Potamogeton bupleuroides* and *Ruppia maritima*, var. *longipes*, both reliable indicators of a brackish medium, were found growing in it and in 1928 various species of marine algae were collected along its northern shores. Toward the western end of this pond is the tiny island upon which stands the monument to Gosnold already mentioned, an unpretentious structure of rough native stone. Not far from this, but on the extreme western edge of the main island, stands the Cuttyhunk lighthouse. Several smaller ponds and numerous boggy hollows, some of them rather extensive, are scattered over the western and southern portion of the island, but these tend to disappear late in summer when the rainfall is less abundant.

**PENIKESE.** The smallest of the main divisions of the Elizabeth Islands lies a mile to the north of Cuttyhunk. Known also to Gosnold as a cedar covered isle, and called by him Hills Hope, this island likewise goes today by its Indian name and is, if possible, even more barren and treeless than Cuttyhunk. Penikese is about  $\frac{2}{3}$  of a mile long and  $\frac{1}{2}$  a mile wide, with a broadly spatulate peninsula running eastward for  $\frac{1}{4}$  mile from its northern end. Its contour resembles

that of the other islands, the highest point, however, being only about 70 feet. Its few trees are mostly the result of an attempt at a planting made around the building which, in the days of the leper colony, served as the home of the resident physician, although several scrub willows grow in one of the hollows around the margin of a small pond on the east side. Of the former luxuriant forest growth Dr. Jordan, writing in 1874, says, "there is now no trace left save the rotten roots of a solitary beech stump and a few branches of red cedar and red maple (?) found buried in the muck of a small swamp." The status of the ponds on Penikese appears to be even more precarious than of those on the other islands. In favorable seasons six small ponds, two of them brackish, may be found; during a dry summer the number has been known to be reduced to half. Penikese, then, is dominated by open, grassy downs with the exception of the narrow cobbly strip which connects the two portions of the island. That part of the open hillsides forming the northern slope of the island has been taken over by the terns (common and roseate), thousands of which here find their breeding ground. In fact, now that the island has reverted to its wilder state, these birds show a tendency to usurp it altogether. It is extremely difficult to walk across any of the grassland areas during the nesting season without stepping upon the eggs or the young birds. The handsome stone residence building, on the east side near the landing, has been partly demolished, leaving only a portion of the structure to house the caretaker who is still stationed there. The frame cottages on the west side of the island, formerly occupied by the unfortunate lepers, were destroyed in 1927, a single concrete structure being all that remains. This, and the tiny graveyard at the extreme north end of the island, bear mute testimony to the use to which Penikese was put from 1905 to 1921. The remains of an old wooden reservoir cap the highest hill on the island, while, set in a large boulder near by, is a bronze tablet placed there in 1923 to commemorate the fiftieth anniversary of the founding of the Anderson School of Natural History by Jean Louis Rodolphe Agassiz in 1873.

*(To be continued)*

THE FLORA OF THE ELIZABETH ISLANDS,  
MASSACHUSETTS

JOHN M. FOGG, JR.

(Continued from page 132)

HABITATS

Despite their almost uniformly bleak and arid nature, the Elizabeth Islands offer a considerable diversity of habitats and the chief of these, together with a few of the most characteristic plants of each, are here described.

**BEACHES.** These may be of boulders, cobbles or pure white sand. In the first two cases, few plants may be sought for, although on the shingle or cobble beaches *Ammophila breviligulata* sometimes manages to get a foothold in the loose stones. The sandy beaches, however, offer a habitat for certain characteristic species, of which the following may be noted:

<i>Ammophila breviligulata</i>	<i>Lathyrus maritimus</i>
<i>Triplasis purpurea</i>	<i>Euphorbia polygonifolia</i>
<i>Polygonum glaucum</i>	<i>Convolvulus sepium</i> , var. <i>pubescens</i>
<i>Atriplex patula</i> , var. <i>hastata</i>	<i>Solanum nigrum</i>
<i>Salsola Kali</i>	<i>Solidago sempervirens</i>
<i>Arenaria peploides</i> , var. <i>robusta</i>	<i>Xanthium echinatum</i>
<i>Cakile edentula</i>	<i>Sonchus oleraceus</i>

On some of the beaches dead Eel Grass, *Zostera marina*, has been piled up by the waves, forming dense mats often two or three feet thick.

**SALT MARSH.** There are no extensive salt marshes on the islands, but a few restricted areas of this nature do occur, such as those along the southwestern shore of Nonamesset, the eastern side of Uncatena, the northeastern end of Naushon facing Lackeys Bay, the regions on the north shore at the west end of the same island, the southeastern corner of Pasque and the extreme west end of Nashawena. Other similar patches, scattered throughout, are too limited or local to merit enumeration. As typical of these low, brackish marshlands, or the slightly elevated peaty areas bordering them, may be cited:

<i>Typha angustifolia</i>	<i>Cyperus ferax</i>
<i>Andropogon glomeratus</i>	<i>C. strigosus</i>
<i>Echinochloa Walteri</i>	<i>Eleocharis parvula</i>
<i>Spartina alterniflora</i> , var. <i>pilosa</i>	<i>E. uniglumis</i> , var. <i>halophila</i>
<i>S. patens</i>	<i>E. rostellata</i>
<i>Distichlis spicata</i>	<i>Scirpus Olneyi</i>



*S. validus*  
*S. campestris*, var. *paludosus*  
*Carex hormathodes*  
*Juncus bufonius*  
*J. Gerardi*  
*J. articulatus*, var. *obtusatus*  
*Rumex maritimus*, var. *fueginus*

*Salicornia europaea*  
*Suaeda linearis*  
*Spergularia leiosperma*  
*Hibiscus Moscheutos*  
*Ptilimnium capillaceum*  
*Pluchea camphorata*

On the brackish mud flats, like those bordering Cuttyhunk Pond, occur such characteristic things as:

*Puccinellia paupercula*, var.  
*alaskana*  
*Salicornia europaea*  
*S. ambigua*

*Suaeda linearis*  
*Spergularia leiosperma*  
*Plantago oliganthos*

BRACKISH PONDS. Either in the salt marsh areas themselves, or near the shore and separated from the sea only by narrow shingle barriers, occur several brackish ponds, in which may be found such plants as:

*Potamogeton bupleuroides*  
*P. pectinatus*

*Ruppia maritima*, var. *subcapitata*  
*R. maritima*, var. *longipes*

FRESH WATER PONDS. There are at least 65 fresh water ponds of a more or less permanent nature on the Elizabeth Islands. Of these, some are mere pools 20 or 30 yards across in low hollows or kettle-holes, while others, such as West End Pond on Naushon, may have a width of nearly one-third of a mile. With this wide difference in size there goes a corresponding diversity of pond bottoms and the accompanying floras. Some of the ponds have grassy bottoms and merely represent hollows which have become filled with rain water; others have a sandy or cobbly bottom; while the bottoms of still others are formed of a thick grayish clay. As representative of the plants, floating or submerged, of these fresh water ponds may be mentioned:

*Potamogeton Oakesianus*  
*P. pulcher*  
*P. diversifolius*  
*Vallisneria americana*  
*Glyceria acutiflora*  
*Lemna minor*  
*Nymphozanthos variegatus*  
*Nymphaea odorata*  
*Ranunculus delphinifolius*  
*Callitriche heterophylla*  
*C. palustris*

*Elatine minima*  
*Ludvigia palustris*  
*Myriophyllum scabratum*  
*M. humile*  
*M. tenellum*  
*Proserpinaca palustris*  
*Hydrocotyle umbellata*  
*H. Canbyi*  
*H. verticillata*  
*Nymphoides lacunosum*  
*Utricularia geminiscapa*

POND MARGINS. The margins of the fresh water ponds support, in

most cases, a rather characteristic flora, the components of which depend usually upon the nature of the shore.

Around those ponds with a pure sandy border the following plants may be listed as fairly typical:

<i>Cyperus dentatus</i>	<i>Ranunculus Cymbalaria</i>
<i>Scirpus americanus</i>	<i>Potentilla pacifica</i>
<i>Mariscus mariscoides</i>	<i>Samolus floribundus</i>
<i>Juncus pelocarpus</i>	<i>Limosella subulata</i>
<i>J. militaris</i>	<i>Ilysanthes inaequalis</i>
<i>J. marginatus</i>	<i>Coreopsis rosea</i>

Surrounding those ponds, however, which offer a peaty or boggy border, a somewhat different series may be cited as representative:

<i>Thelypteris palustris</i> , var. pubescens	<i>Iris versicolor</i>
<i>Sagittaria latifolia</i>	<i>Habenaria lacera</i>
<i>Sparganium americanum</i>	<i>Drosera rotundifolia</i>
<i>Glyceria obtusa</i>	<i>D. intermedia</i>
<i>G. pallida</i>	<i>Spiraea tomentosa</i>
<i>Eleocharis acicularis</i>	<i>Polygala cruciata</i>
<i>Scirpus cyperinus</i>	<i>Hypericum boreale</i>
<i>Rynchospora alba</i>	<i>H. virginicum</i>
<i>R. capitellata</i>	<i>Viola lanceolata</i>
<i>Carex lurida</i>	<i>Rhexia virginica</i>
<i>Eriocaulon septangulare</i>	<i>Scutellaria epilobiifolia</i>
<i>Xyris caroliniana</i>	<i>Lycopus uniflorus</i>
<i>Juncus canadensis</i>	<i>Gratiola aurea</i>
<i>J. acuminatus</i>	<i>Bidens connata</i>

It is not suggested that the two classes of plants above presented be taken as mutually exclusive. In general, however, these species exhibit a marked preference for the habitat under which they are listed.

**SWAMPS.** Swampy areas occur near some of the larger ponds, notably west of French Watering Place on Naushon and around portions of the dune ponds on Nashawena. In addition, most of the islands boast one or more swampy hollows and Naushon and Nashawena each has several rather extensive swamps in low-lying depressions near the shore. A few of the characteristic plants of this type of habitat may be noted:

<i>Typha latifolia</i>	<i>Juncus effusus</i> , var. <i>costulatus</i>
<i>Spartina Michauxiana</i>	<i>Spiraea tomentosa</i>
<i>Phragmites communis</i>	<i>Rosa palustris</i>
<i>Dulichium arundinaceum</i>	<i>Impatiens biflora</i>
<i>Scirpus validus</i>	<i>Decodon verticillatus</i>
<i>S. cyperinus</i>	<i>Sium suave</i>

*Asclepias incarnata*, var. *pulchra*  
*Lysimachia terrestris*

*Cephalanthus occidentalis*  
*Eupatorium verticillatum*

**Bogs.** In addition to the restricted boggy areas in the moist hollows and those forming pond margins, there are several rather extensive bogs of a permanent character. Chief among these may be mentioned one chain of bogs at the east end of Pasque and another series at the west end of Cuttyhunk. Many of the plants which occur around the peaty borders of the small ponds grow also in these open bogs, but certain other species reach their fullest development only in the more extensive areas. The following is but a partial list of some of the more conspicuous of these bog plants:

*Woodwardia areolata*  
*Thelypteris palustris*, var.  
  *pubescens*  
*Osmunda regalis*, var.  
  *spectabilis*  
*Lycopodium inundatum*, var.  
  *Bigelovii*  
*Panicum longifolium*  
*Glyceria obtusa*  
*Eriophorum virginicum*  
*Rynchospora fusca*  
*Carex cephalantha*  
*C. Howei*  
*C. canescens*, var. *disjuncta*  
*C. virescens*  
*C. limosa*  
*Eriocaulon septangulare*  
*Xyris caroliniana*

*Juncus effusus*, var. *costulatus*  
*Habenaria clavellata*  
*H. lacera*  
*Pogonia ophioglossoides*  
*Calopogon pulchellus*  
*Drosera rotundifolia*  
*D. intermedia*  
*Rubus hispidus*  
*Polygala cruciata*  
*Viola lanceolata*  
*Epilobium palustre*, var. *monticola*  
*Clethra alnifolia*  
*Rhododendron viscosum*  
*Chamaedaphne calyculata*  
*Vaccinium macrocarpon*  
*Bartonia virginica*  
*Menyanthes trifoliata*, var. *minor*

**GRASSLAND.** As already indicated, the larger part of the surface of the Elizabeth Islands is dominated by open, undulating grassland. The following list, incomplete though it is, will convey more adequately than could any description an impression of the character of these bleak grassy downs:

*Dennstaedtia punctilobula*  
*Andropogon scoparius*, var.  
  *frequens*  
*Paspalum pubescens*  
*Panicum virgatum*, var. *spissum*  
*P. depauperatum*  
*P. Lindheimeri*, var. *fasciculatum*  
*P. meridionale*  
*P. oricola*  
*P. sphaerocarpon*  
*Anthoxanthum odoratum*

*Aristida purpurascens*  
*Phleum pratense*  
*Holcus lanatus*  
*Poa pratensis*  
*Festuca rubra*  
*Agropyron repens*  
*Cyperus filiculmis*, var.  
  *macilentus*  
*Carex albolutescens*  
*C. silicea*  
*C. Muhlenbergii*

<i>C. Swanii</i>	<i>Viola fimbriatula</i>
<i>C. varia</i>	<i>Daucus Carota</i>
<i>Juncus tenuis</i>	<i>Trichostema dichotomum</i>
<i>J. Greenei</i>	<i>Linaria canadensis</i>
<i>Sisyrinchium angustifolium</i>	<i>Eupatorium hyssopifolium</i>
<i>Spiranthes gracilis</i>	<i>Chrysopsis falcata</i>
<i>Rumex Acetosella</i>	<i>Solidago suaveolens</i>
<i>Spergularia rubra</i>	<i>S. nemoralis</i>
<i>Stellaria graminea</i>	<i>S. graminifolia</i>
<i>Cerastium vulgatum</i>	<i>S. tenuifolia</i>
<i>Ranunculus acris</i>	<i>Aster patens</i>
<i>Lepidium virginicum</i>	<i>A. linariifolius</i>
<i>Potentilla pumila</i>	<i>Sericocarpus asteroides</i>
<i>P. argentea</i>	<i>Antennaria neglecta</i>
<i>Trifolium arvense</i>	<i>Anaphalis margaritacea</i>
<i>Polygala polygama</i>	<i>Gnaphalium obtusifolium</i>
<i>Euphorbia maculata</i>	<i>Rudbeckia hirta</i>
<i>Hypericum perforatum</i>	<i>Achillea Millefolium</i>
<i>Helianthemum canadense</i>	<i>Chrysanthemum Leucanthemum,</i>
<i>H. dumosum</i>	<i>var. pinnatifidum</i>
<i>H. Bicknellii</i>	<i>Krigia virginica</i>
<i>Hudsonia tomentosa</i>	<i>Leontodon autumnalis</i>
<i>Lechea maritima</i>	<i>Hieracium Gronovii</i>

SCRUB GROWTH. Under the protected lee of the hills, in dry sheltered hollows or bordering the woods, where they form a transition zone between the grassland and the woodland, occur open patches or dense, scrubby thickets of low shrubs, of which the following may be designated as characteristic:

<i>Myrica Gale</i>	<i>Ilex verticillata</i>
<i>M. caroliniensis</i>	<i>Clethra alnifolia</i>
<i>Betula populifolia</i>	<i>Rhododendron viscosum</i>
<i>Pyrus arbutifolia</i>	<i>Leucothoe racemosa</i>
<i>Amelanchier oblongifolia</i>	<i>Lyonia ligustrina</i>
<i>Rubus Andrewsianus</i>	<i>Gaylussacia frondosa</i>
<i>Rosa virginiana</i>	<i>G. baccata</i>
<i>Prunus serotina</i>	<i>Vaccinium corymbosum</i>
<i>P. maritima</i>	<i>V. atrococcum</i>
<i>Rhus copallina</i>	<i>Viburnum dentatum</i>

WOODLAND. In certain areas, especially near the center of Naushton, the native woods are made up of almost pure stands of beech, *Fagus grandifolia*. These trees grow nowhere very tall, averaging, perhaps, 30–40 feet, and their low, flat, leafy crowns meet overhead, forming a thick roof through which a subdued light filters. This climax beech forest may also be seen on a somewhat reduced scale in portions of Nonamesset and Nashawena. Usually, however, the wooded areas, although they may be dominated by beech, contain a

liberal sprinkling of certain other species, most prevalent among which are:

Ostrya virginiana	Sassafras officinale
Quercus alba	Acer rubrum
Q. velutina	Nyssa sylvatica
Hamamelis virginiana	

In addition to these important constituents of the densely forested portions, a few other trees occur scattered here and there, seldom entering conspicuously into the formation of the heavy woods. As such may be named:

Pinus rigida	Prunus serotina
Chamaecyparis thyoides	Rhus Vernix
Juniperus virginiana	Ilex opaca
Carya alba	Cornus florida

Mention has already been made of the efforts which were carried on to introduce certain trees either as a windbreak or for ornamental purposes. Some of these, such as white poplar, ailanthus and catalpa, have taken hold and are spreading, while others apparently just manage to survive. A partial list of these introductions follows:

Pinus sylvestris	Betula pubescens
Larix decidua	B. pendula
Picea Abies	Gleditsia triacanthos
P. glauca	Robinia Pseudo-Acacia
P. pungens	Ailanthus glandulosa
Salix alba	Catalpa bignonioides
Populus alba	

The herbaceous flora which enjoys the protection of the native woodland of the islands is for the most part a rather meagre one. The dry, leaf-covered floor of the pure beech woods is almost uniformly sterile, so far as vascular plants are concerned, although such an habitat presents a rich and varied mycological flora, especially following a heavy rain. In the more open mixed woods, however, several characteristic species inhabit the shaded knolls. As examples may be cited:

Pteridium aquilinum, var. latiusculum	Sanicula canadensis
Thelypteris noveboracensis	Monotropa uniflora
Panicum dichotomum	Epifagus virginiana
Carex cephalophora	Galium pilosum

Certain of the low depressions or hollows in the woodland areas are swampy and, in addition to high-bush blueberries (*Vaccinium corymbosum* and *V. atrococcum*), may harbor such plants as:

<i>Sparganium eurycarpum</i>	<i>Juncus effusus</i> , var. <i>solutus</i>
<i>S. americanum</i>	<i>Decodon verticillatus</i>
<i>Sagittaria latifolia</i>	<i>Siam suave</i>
<i>Glyceria striata</i>	<i>Lycopus uniflorus</i>
<i>Carex lupulina</i>	<i>Erechtites hieracifolia</i>

Other similar depressions are moss-covered and boggy and in such situations may be found:

<i>Carex Howei</i>	<i>Oakesia sessilifolia</i>
<i>C. canescens</i> , var. <i>disjuncta</i>	<i>Maianthemum canadense</i>
<i>C. brunnescens</i> , var. <i>sphaerostachya</i>	<i>Medeola virginiana</i>
<i>Arisaema triphyllum</i>	<i>Trientalis borealis</i>

#### CHANGES IN THE FLORA OF THE ELIZABETH ISLANDS

Here it is proposed to indicate the possible direction and nature of the changes in the flora of these islands. It has seemed advisable to put on record certain facts which illustrate what has already taken place in this respect and to point out others which may be of interest to the future student of the islands in interpreting further changes.

The original wooded nature of all of the Elizabeth Islands has previously been alluded to, as has also the fact that the present treeless condition of some members of the chain is apparently the direct result of cutting by man. Right here the question may very well be asked, "Why have the islands thus denuded never regained their forest growth?" In attempting to solve this problem two chief factors must be taken into account and their relative importance weighed.

In the first place, sheep have been raised more or less extensively on the islands from time to time and the effects of these browsing animals in cropping off the young vegetation must not be lost sight of. Despite the numbers and activities of the sheep, however, they have not succeeded in keeping down completely the herbaceous growth in those areas which they inhabit. Even on Nashawena, where their numbers are greatest, the open grassy downs where they graze boast a large number of species of grasses as well as other plants and one has no difficulty in collecting perfect and unmutilated specimens of any plant which he desires. While evidences of grazing are certainly not absent, the region in general does not present the devastated appearance which so often results where sheep have been allowed to run wild; and the fact that so many herbaceous and shrubby plants are able to make a showing, especially in the protected hollows, would seem to indicate

that it can scarcely have been the sheep alone which kept back the developing growth so severely that the trees were unable to regain their foothold.

The second factor which deserves serious consideration is a geologic one. In an important paper on coastal subsidence in 1893,<sup>1</sup> Dr. Arthur Hollick called attention to the fact, already well established, that the era of elevation which was active along the eastern borders of the North American continent in late Tertiary times resulted in an uplifted coastal plain, the eastern limits of which probably coincided with the present 100-fathom contour (about 100 miles from shore). This elevation is supposed to have reached its maximum shortly after the advent of the Ice Age. Then, either previous to, or subsequent to the period of greatest ice accumulation, an era of depression set in. The rate of subsidence has been roughly calculated and Hollick supposes that 6000 years ago the area included within the present 20-fathom line would have been dry land.

That is, not only would the Elizabeth Islands, together with Long Island, Block Island, Martha's Vineyard and Nantucket, have formed a portion of a continuous land surface, but they would have been some miles inland from the actual coast line. The nearest approach of the 20-fathom line to Cuttyhunk is at a point almost due south, where it is now about 20 miles (32 kilometers) out from the shore. To the southeast this distance increases to about 90 miles (146 kilometers) as the submerged contour swings out to sea to conform roughly to the outlines of Nantucket.

The part which this post-Pleistocene land shelf may have played in the migration of plants to the Elizabeth Islands will be a matter for consideration in the section of the Origin of the Flora which follows. The point requiring present emphasis is this: if all the islands were heavily wooded at a time when perhaps their inland location afforded them some protection, it seems highly probable that later, when they assumed their present position, the severe maritime conditions then prevailing would be such as to discourage nature's attempts at reforestation, once the original woodland were removed. This would suggest that those islands which have never been disturbed, such as Naushon, have merely retained an original forest growth, the possession of which they owe to conditions previously more advantageous

<sup>1</sup> Hollick, A. Plant Distribution as a Factor in the Interpretation of Geological Phenomena, with Special Reference to Long Island and Vicinity. Trans. New York Acad. Sci. xii. 189-202 (1893).

than obtain at present, while those less fortunate have suffered through their comparatively recent exposure to the unmitigated forces of the Atlantic. That excessively high wind velocity is an effective factor in retarding tree growth is nowhere better shown than on the eastern side of Nantucket with its extensive scrub oak barrens. This is further borne out on the Elizabeths by the fact that in the open, unprotected areas scrub growth forms only in the more or less sheltered hollows and the occasional isolated sapling which does get a start elsewhere remains dwarfed and stunted.

It is true that on Martha's Vineyard the woods along certain sections of the north shore have been cut for their timber more than once, and that new growth has been quickly made. But this slope enjoys the protection of the high line of morainal hills, averaging 200–300 feet, which shelter it from the winds of the open sea. No such protection exists on the Elizabeth Islands and the lack of it, rather than the presence of sheep, appears to be the determining factor in the failure of natural reforestation. In the light of these facts, it would seem futile to hope that the devastated areas can ever regain their former wooded luxuriance.

Another phase of vegetational change which it seems worth while putting on record is the behavior of certain introduced species on the Elizabeth Islands.

Reference has already been made to the planting of Scotch Broom, *Cytisus scoparius*, on Naushon. It is interesting to note that, in the account of his reconnaissance made between August 10 and 16, 1898, Dr. Hollick says of this species that it was "planted over extensive areas" on Naushon but that it "did not appear to be in a very thriving condition."<sup>1</sup> Today *Cytisus* occupies solidly an area of many acres along the north shore of the island, near Kettle Cove. On the 10th of August, 1927, Professor Fernald and the writer visited this locality and had the unique experience of wandering through this exotic plantation. The plants grow very close together, and are often 6–8 feet tall, and the tendency in attempting to traverse the area is to lose completely one's sense of direction. Unless checked in some way, *Cytisus* bids fair to encroach even further upon the surrounding region and to usurp in time a much larger area than that which it now dominates. Although introduced also on Pasque and Nashawena, Scotch Broom has nowhere else made the showing that it has upon Naushon.

<sup>1</sup> Hollick, A. Cont. Geol. Dept. Columbia Univ. xi. no. 72. 391 (1901).



Another leguminous plant that has been successful in establishing itself is the Woad-waxen, *Genista tinctoria*. This species was introduced at the extreme east end of Naushon, near Hadley Harbor. It now occupies almost solidly a large field in this vicinity and occurs scattered elsewhere over the open hillsides here as well as on Uncatena.

At several places the Tree of Heaven, *Ailanthus glandulosa*, has become thoroughly naturalized and appears to be spreading rapidly. This is especially true on Naushon, north of Tarpaulin Cove, where, in at least one protected hollow, this tree has formed an extensive and almost impenetrable thicket.

There remains to be considered in this connection such light as is thrown on the nature of vegetational changes by an examination of David Starr Jordan's account of the flora of Penikese as he found it in 1873.<sup>1</sup> The author states it as his hope that his list may have an interest for future botanists, especially "as showing which plants survive a prolonged struggle for existence against grass and sheep." And as this is the first published list of the flora of any of the Elizabeth Islands, it forms our chief basis for a study of those changes which may have occurred over a considerable period of years.

In the paper entitled "The Flora of Penikese, Fifty Years After," which has already been mentioned, Dr. I. F. Lewis summarizes the numerical differences between Jordan's list and that compiled as the result of the survey made in 1923.<sup>2</sup> It is not intended to duplicate that summary here, but subsequent exploration by the present writer has yielded so many additional records, and a closer scrutiny of the terminology employed in the earlier list has resulted in a so much better understanding of the discrepancies involved, that it seems well to consider, as briefly as possible, just how much significance, if any, attaches to the marked difference in the superficial aspects of the two lists.

The list for 1873, compiled by Dr. Jordan, contains 1 fern and 113 flowering plants, whereas the present list includes 3 ferns, 1 gymnosperm (introduced) and 178 flowering plants. Of the 114 species of vascular plants tabulated by Jordan for Penikese, including Gull Island, a considerable number (about 25) have not been found as the result of recent investigations. On the other hand, of the 182 species of vascular plants on the present list an even larger number (probably 100) were not enumerated in the earlier report.

<sup>1</sup> Jordan. l. c. p. 193.

<sup>2</sup> Lewis, I. F. RHODORA, xxvi. 188 (1924).

In comparing these two lists the necessary allowances must be made for the very natural changes in nomenclature which have come about during the intervening 55 years. Dr. Jordan states, in a letter to the writer, that the names he employed were those found in the edition of Gray's Manual then most recent (Ed. 5). With this fact in mind, it then becomes possible to reconcile a few of the disparities in the two lists. In general, these discrepancies fall roughly into three categories which may be briefly described as follows:

In the first place, there are those cases in which a difference of names involves direct synonymy. Thus, the plant listed by Jordan as *Dicksonia punctilobula* Kunze is surely the same as that which we are today calling *Dennstaedtia punctilobula* (Michx.) Moore. Similarly, his *Panicum Crusgalli* L. corresponds to our *Echinochloa Crusgalli* (L.) Beauv., his *Triticum repens* L. to our *Agropyron repens* (L.) Beauv., his *Scirpus pungens* Vahl to our *S. americanus* Pers., his *Maruta Cotula* DC. to our *Anthemis Cotula* L., and so on.

The second class of discrepancies includes cases involving mistaken identity or in which an older species has become recognized as consisting of two or more separate and distinct entities. For example, *Calamagrostis arenaria* Roth of Jordan's list is certainly the plant known today as *Ammophila breviligulata* Fernald. This is not at all a case of direct synonymy, but merely an instance where an American plant, as beautifully pointed out by Fernald, has proved upon study to be entirely distinct from its Old World ally. Again, Jordan's *Spartina stricta* Roth is doubtless our *S. alterniflora* Loisel. var. *pilosa* (Merrill) Fernald, his *Scirpus maritimus* L. our *S. campestris* Britton, var. *paludosus* (A. Nels.) Fernald, his *Sisyrinchium Bermudiana* L. our *S. angustifolium* Mill. *Spergularia salina* Presl, of Jordan's list, appears not to grow on Penikese at the present time, but *S. leiosperma* (Kindb.) F. Schmidt is fairly common and we are presumably warranted in applying a modern interpretation to the older name. Comparable to this are *Cerastium viscosum* L. for which we find only *C. vulgatum* L., *Viola sagittata* Ait., which is represented only by *V. fimbriatula* Sm., *Scutellaria galericulata* L. which is replaced by *S. epilobiifolia* Hamilton, and a host of similar cases. In all such instances, then, we are probably justified in assuming that a plant bearing an unallowable name on the early list is represented today by the name of a recently recognized segregate or a closely related species, rather than that it has actually disappeared from the flora.

Finally, there are several plants on the Jordan list concerning the identity of which, in the complete absence of herbarium material, it is futile even to hazard a guess. *Panicum dichotomum* L., for example, which so far has not been collected, may ultimately be found still growing on the island, or, since that name was applied in a very broad sense in 1873, Dr. Jordan may really have had reference to *P. oricola*, *P. meridionale*, *P. Lindheimeri*, var. *fasciculatum* or to something still different not yet reported from the island. Likewise, *Carex straminea* Schkuhr, a name used loosely before this group had received critical study, may be equivalent to either *C. Longii*, *C. hormathodes* or *C. silicea* or to all three. And again *Polygonum Hydropiper* L., not known from Penikese today, may equal *P. punctatum* Ell., which is ubiquitous, or some other species not yet found. Through the unfortunate lack of preserved vouchers, therefore, all such ambiguous references, when uncorroborated by subsequent collections, must be discredited.

After having made all due allowances, however, for inequalities arising from synonymy, modern revisions and ambiguous records, there still remain slightly more than a score of plants of the 1873 list which recent searches have failed to reveal. Most of these are species which occur on the other islands and their absence from Penikese may be merely an apparent one, to be remedied by further scrutiny. As such may be mentioned: *Poa annua*, *Juncus pelocarpus*, *Atriplex arenaria*, *Salsola Kali*, *Euphorbia polygonifolia*, *E. maculata*, *Hypericum mutilum*, and *Asclepias incarnata*, var. *pulchra*. With the exception of the last two species named, which may have disappeared as the result of gradual drying up of the ponds, there is every reason to expect that these plants will some time be collected on the island. A few others, such as *Ruppia maritima*, *Salicornia europaea* (*S. herbacea*) and *Suaeda maritima*, are plants of brackish situations and their absence is confirmed by independent observations on the tendency of the two saline areas on the island to become overgrown and to lose their brackish character. Even during the six years from 1923 to 1928, South Pond has become distinctly less brackish, both as to the nature of its margin and its algal flora. The same can apparently be said for the ponds on the peninsula, and while these may be merely local and transitory phenomena, they suggest the gradual diminution of brackish areas formerly more extensive, a change worth noting. Three of Jordan's plants which were listed from Gull Island only,

namely, *Rhus Toxicodendron*, *Coelopleurum lucidum* (*Archangelica Gmelini*) and *Limonium carolinianum* (*Statice Limonium*), are not only still missing from Penikese, but have completely disappeared from Gull Island as well. The total absence of Poison Ivy from Penikese, in the face of vigorous and repeated search for it, is one of the queer and not altogether unpleasant surprises of this island. Finally, Jordan lists three plants which are not only unknown from Penikese but, so far, have been collected on none of the other Elizabeth Islands: these are *Puccinellia* (*Glyceria*) *maritima*, *Salix discolor*, and *Iva oraria* (*I. frutescens*). The first of these may well refer to *P. paupercula*, var. *alaskana*, known only from Cuttyhunk, the next might easily have been an introduction which had died out, and *Iva* probably is another of the diminishing salt marsh tribe, a species which it would be interesting to add to the list of Elizabeth Islands plants.

Turning now to the modern list of the flora of the island, we find, after again making the necessary correction for synonymy, errors, etc., that of the 182 species of vascular plants which it includes, at least 96 (53)% can not in any way be identified with anything on the earlier list. This large number of species not seen or listed by Dr. Jordan can conveniently be divided into three groups, as follows: (1) Garden escapes, about 20 species; (2) Cosmopolitan adventives, about 20 species; (3) Native plants, over 50 species.

*Garden escapes.* This includes a few ornamentals which may well have been planted during the days of the leper occupation, some of which have spread, while others have just barely managed to persist; a few have escaped from the cultivated area near the site of the old laboratory building which was destroyed by fire in 1896. A partial list includes:

<i>Lilium tigrinum</i>	<i>Oenothera grandiflora</i>
<i>Asparagus officinalis</i>	<i>Ligustrum vulgare</i>
<i>Gysophila paniculata</i>	<i>Digitalis purpurea</i>
<i>Dianthus barbatus</i>	<i>Lonicera japonica</i>
<i>Rubus laciniatus</i>	<i>Helianthus annuus</i>
<i>Rosa rugosa</i>	<i>Coreopsis lanceolata</i>

Here also, since this is a class of plants the introduction of which would appear to have been premeditated, should be mentioned a few trees which were set out around the dwelling of the resident physician, namely:

Pinus sylvestris  
Salix pentandra  
S. alba

Populus alba  
Acer Pseudo-Platanus  
A. platanoides

*Cosmopolitan adventives.* These are the ever present European introductions which occur more or less commonly in dry sterile soils and cleared ground, especially near the haunts of man. It is rather surprising that so many plants of this class should be lacking from Jordan's list, but they have probably been brought in with fodder, building materials and other supplies. A few of these may be cited:

Avena sativa  
Dactylis glomerata  
Bromus secalinus  
B. hordeaceus  
Carex contigua  
Polygonum Convolvulus  
Stellaria graminea  
Sisymbrium altissimum  
Ranunculus acris

Trifolium pratense  
Hypericum perforatum  
Daucus Carota  
Convolvulus arvensis  
Linaria vulgaris  
Tanacetum vulgare  
Sonchus arvensis  
S. oleraceus  
S. asper

*Native plants.* As noted above, more than one-half (96 species) of the plants on the present list of the flora of Penikese appear to have reached the island since 1873. Of these 96 species, about 40 have received consideration in the two classes just dealt with; their appearance on the island since 1873 may be accounted for in the light of their being introductions, either accidental or intentional. Permitting of no such simple explanation, however, is the occurrence today on the island of more than 50 species of native plants which were not recorded as present in 1873 by Dr. Jordan. A few of these, such as *Ranunculus delphinifolius*, *Potentilla pumila*, *Callitriche heterophylla* and *Ilysanthes inaequalis*, are rather inconspicuous forms and might conceivably have been overlooked in the preparation of the original report. Others are late-blooming members of the Compositae and, as Jordan lists only one Golden-rod, *Solidago sempervirens*, and not a single Aster, it would seem that he had not remained on the island long enough to obtain a fair sample of the flora of late summer and might thus have completely missed *Solidago juncea*, *S. rugosa*, *S. nemoralis*, *S. canadensis*, *S. tenuifolia*, *Aster undulatus*, *A. multiflorus* and *A. vimineus*, all of which appear on the present list. In this group also, might be placed such things as *Gnaphalium obtusifolium*, *Rudbeckia hirta*, and *Bidens connata*, although these plants are generally recognizable by the first of August, as, indeed, are most of the Goldenrods and Asters listed above. Incapable, however, of any such interpretations as

those just offered, is the present existence on Penikese of the following plants, most of them conspicuous, some of them dominant elements of the vegetation:

Athyrium angustum	Smilax rotundifolia
Thelypteris palustris, var. pubescens	Sisyrinchium graminoides
Typha latifolia	Myrica caroliniensis
Panicum virgatum, var. spissum	Rumex maritimus, var. fueginus
Danthonia spicata	Amelanchier oblongifolia
Distichlis spicata	Rubus pergratus
Scirpus validus	Rosa palustris
Carex hormathodes	Prunus serotina
C. silicea	Rhus typhina
Juncus dichotomus	Parthenocissus quinquefolia
J. Greenei	Oenothera biennis
J. effusus, var. costulatus	Ligusticum scoticum
J. acuminatus	Asclepias syriaca
J. articulatus	Galium Claytoni
	Sambucus canadensis

It is difficult to believe that all these plants could have escaped the attention of the compiler of the original list and we are rather forced to the conclusion that they have made their advent to the island since 1873. By just what means they may have made their way to Penikese and just how much significance may be attached to their occurrence there today, are matters for conjecture. Certainly they are not species preëminently adapted for wind dispersal, although *Typha* and *Asclepias* constitute exceptions to this statement, and spores of the two ferns may possibly have been transported by that agency. A few of them, such as *Scirpus validus*, *Juncus acuminatus*, *J. articulatus* and the *Rumex*, which grow in or around ponds, may have been brought in by birds, while a few others have fleshy seeds or fruits and may also have been introduced in this way. On the other hand, the presence of this large block of recent arrivals may be merely illustrative of what takes place on these islands when the practice of raising sheep is discontinued, although it is difficult at first sight to see just why these particular species should have been kept down until recent times when so many others were not only present in 1873 but have survived the "prolonged struggle for existence against grass and sheep."

(To be continued)

# THE FLORA OF THE ELIZABETH ISLANDS, MASSACHUSETTS

JOHN M. FOGG, JR.

*(Continued from page 161)*

## THE ORIGIN OF THE FLORA

Any attempt to unravel the geographic origin of the chief elements comprising the flora of the Elizabeth Islands must not only concern itself with a close scrutiny of the vegetation of the immediately adjacent regions, but must also take into account supplementary evidence from two main sources, namely, the history and nature of the coastal plain and its flora, on the one hand, and the study of the morainal deposits of which most of southeastern Massachusetts is composed, on the other. In fact, so far as concerns the Elizabeth Islands, these two problems are rather inextricably linked and one can scarcely be considered independently of the other.

**THE COASTAL PLAIN.** Perhaps no geographic province in North America has received greater botanical attention over a long period of time than the Atlantic coastal plain. Occupying a narrow strip east or southeast of the Piedmont Plateau, from which it is more or less sharply marked off by the fall line, the coastal plain has been thought of as extending from the Gulf States and Florida northeastward through the Southern and Middle Atlantic States and reaching its northern limit in northeastern New Jersey, near the Hackensack Marshes, with a representation eastward on Staten Island, Long Island, and the immediate coast district of southeastern Massachusetts.

The surface of the coastal plain presents in general a very gentle slope to the southeast, which, in southern New Jersey for instance,

averages 5 to 6 feet per mile and is seldom over 10 to 15 feet. Eastward, beneath the waters of the Atlantic, the coastal plain continues with the same gentle slope to the 100-fathom mark, where, about 100 miles from shore, it suddenly drops off to abysmal depths. In the southern states the elevated portion of the coastal plain widens to about 150 miles, while the submarine portion dwindles, finally, off the east coast of Florida, to disappear almost entirely. Northward the submerged portion increases in width, reaching 500 miles off the coast of Newfoundland, while the subaerial portion diminishes, becoming a mere fringe of islands and the peninsula of Cape Cod, and finally disappears altogether. Throughout, the soils of the coastal plain are of a recent nature, being largely Tertiary and Quaternary, and it appears likely that the present fall line represents roughly the shore line at the end of Cretaceous time.

The flora of the coastal plain has long been recognized as distinctly southern in character, due partly to the nature of its constituent soils (for the most part, sands, clays, gravels, etc.) which have permitted a northeasterly extension of a Carolinian flora, and partly to its climate, for the temperature is appreciably milder than that of the only slightly more elevated continental mass to the westward.

In the state of New Jersey, three-fifths of which lies inside the coastal plain province, Dr. Witmer Stone recorded in 1910<sup>1</sup> the presence of 479 species of austro-riparian affinities, plants ranging from Florida, Georgia or the Carolinas north to southern New Jersey, some of them reaching Long Island, Massachusetts or, as we now know, even farther northward. The recorded number of such species has been materially increased by recent study.

In 1911 there appeared in *RHODORA* a very significant paper by Professor Fernald describing a botanical expedition to Newfoundland and southern Labrador.<sup>2</sup> In part II of this paper, the author discusses the Geographic Origin of the Flora of Newfoundland. Analysis of the constituent floral elements there represented reveals that 274 indigenous plants (35% of the total flora) are southwestern types and that, of these, 60 species (over 7% of the total flora) are Carolinian types, being known from southern New Jersey (or even farther southward), Long Island, southeastern Massachusetts, Nova Scotia and Newfound-

<sup>1</sup> Stone, W. The Plants of Southern New Jersey with Especial Reference to the Flora of the Pine Barrens. Ann. Rept. N. J. Mus. (1910).

<sup>2</sup> Fernald, M. L. A Botanical Expedition to Newfoundland and Southern Labrador. *RHODORA*, xlii. 109-162 (1911).



land, but not found inland or in continental eastern Canada. As typical of this Carolinian subclass are cited: *Schizaea pusilla*, *Ammophila breviligulata*, *Carex hormathodes*, *C. silicea*, *Corema Conradii*, *Hudsonia ericoides*, *Myriophyllum tenellum*, *Utricularia geminiscapa* and others.

In an endeavor to account for the presence in Newfoundland of this coastal plain or Carolinian element, Professor Fernald, after considering the part which may have been played by birds, ocean currents, floating ice and logs, and winds, and concluding that they are all inadequate in explaining this distribution, turns to the question of a post-glacial land bridge. Hollick's paper on this subject has already been referred to, and Professor Fernald, quick to see the phytogeographic significance of these conclusions, quotes at length from Hollick's statements and appends corroborative data from other sources.

Evidence derived from a study of the conditions attending the last, or Wisconsin, glaciation indicates that the amount of water then withdrawn from the ocean may have been sufficient, in conjunction with the tendency to uplift already noted, to leave uncovered a considerable portion of the now submerged continental shelf from the South Atlantic states to Nova Scotia and Newfoundland. Of course, as Professor R. A. Daly has recently pointed out, the apparent upward trend of the coastal shelf, resulting in part from the removal of this vast volume of water from the sea, would have been counteracted by the lowering pressure exerted by the tremendous weight of the ice on the continental mass. Nevertheless, it appears that during the Wisconsin advance, and for some time following it, a very considerable portion of the coastal bench must have been above sea level, forming, with the exception of shallow channels such as that draining the Gulf of Maine or Cabot Strait, a nearly continuous platform for the migration of plants, and animals as well, northeastward from the southern states to Nova Scotia and Newfoundland. This strip of silicious soils probably offered a nearly uniform habitat for the advance of species of austro-riparian affinities and their extension northward may even have occurred at a time when the ice had not fully retreated from the mainland of the continent.

Later, with the melting of the glacial ice and the liberation of vast quantities of water to the ocean, and perhaps through the operation of other factors as well, this continental shelf underwent a period of submergence which resulted in the drowning of this coastal plain flora except in those areas, higher than the rest and often widely separated,

which suffered no such submergence. Hence we have today in the Pine Barrens of New Jersey, on Cape Cod and the adjacent islands, in southwestern Nova Scotia and in certain parts of Newfoundland the relics of this formerly continuous flora. That these plants are nearly all species of sterile or silicious soils indicates that they were admirably adapted for migration northeastward along this post-glacial land bridge and probably explains why they have never subsequently extended their ranges to the better, richer soils immediately inland but continue to exhibit the disrupted distribution so well typified by *Schizaea pusilla* and *Corema Conradii*.<sup>1</sup>

In treating this subject elsewhere, Professor Fernald says, "Of greater interest are the coastal plain species, because they represent in New England, eastern Canada and Newfoundland a relic of the extensive flora which during the late Tertiary migrated northward along the then highly elevated continental shelf and at the drowning of the shelf were left as relics at isolated points. This isolated remnant of the flora derived from the southern coastal plain is represented by about 200 species north of New Jersey, and nearly every excursion to southwestern Rhode Island, Cape Cod, Plymouth County (Massachusetts), Nantucket, southern Nova Scotia, Cape Breton, eastern New Brunswick, Prince Edward Island, the Magdalen Islands or southeastern Newfoundland, adds to the number of thus isolated species known to us or extends our knowledge of those already recognized."<sup>2</sup>

And in 1921, in discussing the results of botanical exploration in Nova Scotia, the same author states that "if there were need of further evidence that, since the Pleistocene glaciation the continental shelf of eastern North America has been high in the air, affording an essentially continuous line of migration across the mouth of the Gulf of Maine to Nova Scotia, thence to Newfoundland, that evidence is now abundantly at hand. A striking feature of this migration northward of the southern coastal plain flora is the fact that several distinctive species or genera, *Schizaea pusilla*, *Lophiola*, *Habenaria flava*, and perhaps *Ceratiola*, reached Nova Scotia without establishing colonies on Long Island, Cape Cod or Nantucket. This would seem to indicate that the uplifted shelf was a region of some complexity or else some subtle qualities in the habitats of these plants."<sup>3</sup>

<sup>1</sup> See Fernald, l. c. Plate 90, opp. p. 140.

<sup>2</sup> Fernald, M. L. The Geographic Affinities of the Vascular Floras of New England, the Maritime Provinces and Newfoundland. Amer. Jour. Bot., v. 224 (1918).

<sup>3</sup> Fernald, M. L. The Gray Herbarium Expedition to Nova Scotia. 1920. RHODORA, xxiii. 168 (1921).

Enough has probably been said to indicate the overwhelming amount of botanical evidence in favor of a post-Pleistocene land connection permitting the northeastward extension of a southern coastal plain flora. It now becomes imperative to inquire what part this connection played in the migration of plants to the area under immediate consideration. However, before discussing the direct bearing of these findings upon the problem as presented by the Elizabeth Islands, it will be found helpful to consider what has already been learned concerning the adjacent areas, especially Nantucket, Martha's Vineyard and Cape Cod.

**NANTUCKET.** Nantucket, from its isolated position to the southeast, might be expected to have caught more of these coastal migrants than the areas to the west and northwest and is therefore considered first. For our modern knowledge of the flora of this island we are indebted to the discerning and painstaking researches of the late Eugene P. Bicknell, whose account of "The Ferns and Flowering Plants of Nantucket" appeared in the Bulletin of the Torrey Botanical Club from 1908 to 1919. The final section of this paper is devoted to a consideration of the origin of Nantucket's flora.<sup>1</sup> Omitting the hybrids, Bicknell finds upon the island 1103 [1108] species of plants of which 362 [31%] are listed as introduced and 746 as native. Of the 746 indigenous species, "over one-half [373 +] . . . may fairly be accounted as prevailingly more southern in their general distribution," while "something over 150 species . . . are at least prevailingly more northern in their general distribution."

Turning first to the plants of southern affinities, we find that over a hundred of them reach their northeastern limit of range in southeastern Massachusetts, others reach Vermont, New Hampshire or Maine, others occur in the Maritime Provinces, while a small group is found in Newfoundland. The author then gives a list of 38 plants which appear not to have been found at any more northern or eastern point than Nantucket. It is of interest to note, in passing, that only 8 of these are known from the Elizabeth Islands. More than 190 of the prevailingly southern plants occur in the Pine Barrens of New Jersey, over 300 are plants of the coastal plain elsewhere in that state, while all of Nantucket's southern-ranging maritime plants, about 40 species, also occur in New Jersey. Thus we have over 530 species [considerably more than 50%] in the Nantucket flora which display this south-

Bicknell, E. P. Bull. Torrey Club, xlv. 423 (1919.).

ern relationship. To account for this large percentage of austral forms Bicknell resorts to Fernald's views on the submerged coastal shelf and sees isolated on Nantucket the remnants of an extensive flora of southern derivation belonging to the New England seaboard of Tertiary time, "a flora lost to our later day with these broad coastal tracts which now lie beneath the sea. Yet not wholly lost. We find it still, much of it, we may believe, in the less disturbed flora of our more southern coastal plain, and we find its remnants persisting as the merest fringe along the withdrawn more northern coast-lines of the present day. And isolated on Nantucket it has been preserved to us in that assemblage of southward ranging plants, now a primary element in the general composition of the flora."<sup>1</sup>

Turning now to the more northern element in the Nantucket flora we find a group of over 150 species of plants. Of this number about 15 are found nowhere at a more southern point, while about 45 are near the southern limit of their coastwise range; others reach south to Long Island and a large number find their southern limit in New Jersey. In this connection it is interesting to note that of the list of 59 species given by Dr. Stone as reaching from the Maritime Provinces south to New Jersey, 18 are unknown from Nantucket. Stone's list, as it appears in his *Flora of Southern New Jersey*,<sup>2</sup> is here given. It should be observed that the terminology has been revised so as to correspond to that employed in the present Catalog of Elizabeth Islands plants. The letter "N" following the name of the plant indicates it is known from Nantucket, "M" from Martha's Vineyard, and "E" from the Elizabeth Islands.

<i>Isoetes Braunii</i> N	<i>Eriophorum tenellum</i> NME
<i>Lycopodium inundatum</i>	<i>E. gracile</i> N
<i>Schizaea pusilla</i>	<i>Carex lanuginosa</i> NE
<i>Potamogeton Oakesianus</i> NME	<i>C. trichocarpa</i>
<i>Scheuchzeria palustris</i> , var.	<i>C. exilis</i>
<i>americana</i>	<i>C. livida</i>
<i>Triglochin maritima</i> NME	<i>C. canescens</i> , var. <i>disjuncta</i> NME
<i>Hierochloa odorata</i> N	<i>C. rostrata</i> , var. <i>utriculata</i> N
<i>Spartina Michauxiana</i> NME	<i>C. limosa</i> E
<i>Phalaris arundinacea</i>	<i>C. silicea</i> NME
<i>Glyceria canadensis</i> NME	<i>Eriocaulon septangulare</i> NME
<i>G. obtusa</i> ME	<i>Juncus articulatus</i> NME
<i>G. grandis</i> N	<i>J. pelocarpus</i> NME
<i>Scirpus subterminalis</i>	<i>Sisyrinchium angustifolium</i> NE
<i>S. campestris</i> , var. <i>paludosus</i> NME	<i>Populus tremuloides</i> NM

<sup>1</sup> Bicknell. l. c. p. 434.

<sup>2</sup> Stone, W. l. c. p. 49.

<i>P. grandidentata</i> NM	<i>Hypericum boreale</i> NME
<i>Salix Bebbiana</i> N	<i>H. ellipticum</i>
<i>S. lucida</i>	<i>H. Ascyron</i>
<i>Suaeda maritima</i> N	<i>Myriophyllum tenellum</i> NME
<i>Chenopodium rubrum</i> N	<i>Arctostaphylos uva-ursi</i> , var.
<i>Arenaria lateriflora</i> NME	<i>coactilis</i> NM
<i>Nymphozanthus variegatus</i> NME	<i>Vaccinium pennsylvanicum</i> NM
<i>Actaea rubra</i> NM	<i>Glaux maritima</i> N
<i>Ranunculus Cymbalaria</i> NME	<i>Menyanthes trifoliata</i> , var.
<i>Polanisia graveolens</i>	<i>minor</i> NE
<i>Rosa virginiana</i> NME	<i>Limosella subulata</i> NME
<i>Dalibarda repens</i>	<i>Utricularia intermedia</i> N
<i>Geum strictum</i>	<i>Plantago oliganthos</i> NME
<i>Lathyrus maritimus</i> NME	<i>Solidago uniligulata</i> N
<i>Geranium Robertianum</i>	<i>Aster nemoralis</i>
<i>Corema Conradii</i> NM	<i>Xanthium commune</i>

As will be noted, of this list of essentially northern forms Nantucket has 41 representatives, Martha's Vineyard 27 and the Elizabeth Islands only 25.

Bicknell gives a list of northern plants which occur on Nantucket but are unknown from the coastal plain of New Jersey, only a few of them passing on to Long Island. The significant feature of this list in the present connection is that, although it contains 44 plants, not more than a half dozen of these are found on the Elizabeth Islands.

Mr. Bicknell endeavors to account for the presence of these northern forms, especially those of a maritime character, on Nantucket and elsewhere to the southwest by supposing that the same marginal land connection which allowed the plants of the southern coastal plain to reach Newfoundland would have permitted a counter extension of northern species to the southwest, perhaps at a later date. The author also points out that no farther away than Cape Cod there are established others of these northern species which have not reached Nantucket and likewise that Cape Cod possesses an extensive coastal plain flora which is not represented on this seaward island only a few miles to the southeast. These last two facts are significant because they apply, even in more marked degree, to the Elizabeth Islands. Not only, as indicated in speaking of the lists of northern species found on Nantucket, are many of these boreal forms lacking from the Elizabeths, but we also fail to find there that large element of southern coastal plain types which is conspicuous on Nantucket and almost dominant in certain regions on the Cape.

MARTHA'S VINEYARD. Unfortunately, far too little is known concerning the flora of Martha's Vineyard to permit of drawing any

conclusions as to the origin of the elements there represented. It is rather surprising that this relatively large and very attractive island should have escaped careful botanical treatment, but such is the case. This is not to say that no botanist has ever visited the Vineyard for the purpose of collecting specimens, for there have been over a score of independent collections made. A little more than a century ago, 1829, William Oakes visited the island and recorded some interesting finds. One of the most important collections made was that of Sydney Harris, who from 1891 to 1904, and again later in 1911 and 1914, collected many sheets, mostly from around Chilmark. The island was visited by C. A. Weatherby in 1900, by Professor Fernald in 1901, by A. H. Moore in 1904, by J. A. Cushman in 1906 and 1911, by E. P. Bicknell in 1909 (and again in 1912 and 1913), by F. W. Pennell in 1911, by Miss Magaret Heatley, (now Mrs. C. E. Moss), beginning in 1916; and all of these brought back material which has been distributed to one or more of the large herbaria of the eastern United States. Perhaps the largest collections made were those of Frank C. Seymour in 1916 and 1917; Seymour's specimens have been sent out by the Gray Herbarium. But, so far, no one has published any coherent account of the flora of the island, and New England botanists in general know less about its vegetation than about that of many a more isolated area.

The writer has undertaken to draw together in a single list all the records based upon specimens available from Martha's Vineyard. In the course of this task a systematic census was taken of the material in the New England Botanical Club and the Boston Society of Natural History. This resulted in the compilation of a list which includes about 700 plants. In an effort to supplement this knowledge two field trips were made to the island, one in August, 1927, and the other, in company with Professor Fernald, in August, 1928. From the information thus derived only one conclusion can be safely drawn, namely that from our present insufficient knowledge of the island, the surface only of which seems to have been touched, it is impossible to speak intelligently of the origin of its flora. One or two general statements, however, can probably be made with a fair degree of assurance.

In the first place, it seems evident that the long line of high hills which flanks the north shore from Menemsha to West Chop supports a flora of a northern or continental nature. Several plants were

found here, in the richer soils of the wooded slope, which are either absent from or far from common in southeastern Massachusetts, and it seems very likely that careful search will disclose many more things of this nature.

A second point which seems entitled to emphasis is, that, in general, the flora of Martha's Vineyard is far from being closely related to that of the southern coastal plain. Further study may serve to disprove this observation, but Professor Fernald and the writer, while exploring the region around Gay Head, were unable to escape the conviction that the flora dealt with was continental rather than coastal in character. Time and again the impression was borne home that the countless southern plants which form the primary element in the flora of the middle part of Cape Cod were conspicuously absent. An exception to this general statement may, perhaps, be constituted by the flora of the eastern part of the island, the region around Edgartown, where, apparently, there is a larger representation of austro-riparian types than may be met with elsewhere on the Vineyard. If these observations be justified, they will be found to fit in rather well with the interpretation of the effects of glacial activities upon the origin of the flora of southeastern Massachusetts.

CAPE COD. In speaking of the flora of Cape Cod it is necessary first to have very clearly in mind the fact that botanically, as well as geologically, this region is far from being a unit, but, rather, may be divided, more or less distinctly, into three separate provinces, which, for the sake of convenience, may be designated the "Upper," "Middle" and "Lower" Capes.

"*Upper*" *Cape*. This includes roughly Sandwich, Bourne, Mashpee, Falmouth and the western half of Barnstable. The line of morainal hills which traverses this province from north to south may be traced southwest from Woods Hole, as it is of this same ridge that the Elizabeth Islands are formed. On the mainland these hills are rather heavily wooded and the superficial aspect of this part of the Cape is that generally associated with an Alleghanian flora with a slight tinge of the Canadian. This impression is borne out by a study of the plants which occur here, many of which are either entirely lacking or only very locally known elsewhere on the Cape. There are well over 150 such plants, constituting a list too lengthy for inclusion here; the following few species may, however, be cited as typical:

Polypodium virginianum  
 Polystichum acrostichoides  
 Thelypteris Phegopteris  
 Osmunda Claytoniana  
 Botrychium virginianum  
 Lycopodium lucidulum  
 L. clavatum  
 Potamogeton Robbinsii  
 Panicum subvillosum  
 P. latifolium  
 Oryzopsis pungens  
 Cinna arundinacea  
 Glyceria grandis  
 G. acutiflora  
 Scirpus debilis  
 Carex tribuloides  
 C. scabrata  
 Juncus secundus  
 Smilax herbacea  
 Trillium cernuum  
 Habenaria dilatata  
 Malaxis unifolia  
 Betula lutea

B. papyrifera  
 Alnus noveboracensis  
 Ranunculus recurvatus  
 Thalictrum revolutum  
 Actaea rubra  
 Aquilegia canadensis  
 Chrysosplenium americanum  
 Potentilla tridentata  
 Rubus allegheniensis  
 Nemopanthus mucronata  
 Celastrus scandens  
 Circaea latifolia  
 Rhododendron canadense  
 Fraxinus americana  
 Scrophularia lanceolata  
 Pedicularis canadensis  
 Triosteum perfoliatum  
 Viburnum acerifolium  
 Lobelia inflata  
 Solidago ulmifolia  
 Aster nemoralis  
 A. acuminatus

Few, if any, of these plants, as will be seen, may be looked upon as species characteristic of a southern coastal plain flora.

“*Middle*” *Cape*. This province embraces the eastern part of Barnstable, all of Yarmouth, Dennis, Brewster, Harwich, and, perhaps, Chatham and Orleans. A ridge of morainal hills extending east and west along the north shore from Sandwich to Dennis, forms the “backbone” of this part of the Cape and is flanked to the south by a broad outwash plain. This area is not without its trees, but in certain parts scrub oaks predominate and the appearance of the vegetation differs strikingly from that of the inner Cape. The most salient botanical feature of this province resides in the plants of the numerous ponds and pond margins, many of which are sandy or peaty and offer an ideal habitat for an extensive flora of an austro-riparian nature. Altogether there are over 200 species which are either peculiar to this part of the Cape or which here find their greatest development, being represented only casually in the other two provinces. A partial list of these plants follows:

Thelypteris simulata  
 Pteridium aquilinum, var. pseudo-  
 caudatum  
 Potamogeton pectinatus  
 Sagittaria Engelmanniana

S. teres  
 Andropogon virginicus  
 Paspalum psammophilum  
 Panicum verrucosum  
 P. Bicknellii



- P. microcarpon*  
*P. annulum*  
*P. mattamuskeetense*  
*P. mattamuskeetense*, var. *Clutei*  
*P. spretum*  
*P. Wrightianum*  
*P. albemarlense*  
*P. auburne*  
*P. Commonsianum*  
*P. polyanthes*  
*P. Ashei*  
*Cenchrus pauciflorus*  
*Spartina cynosuroides*  
*Glyceria laxa*  
*G. Fernaldii*  
*Puccinellia fasciculata*  
*Eleocharis rostellata*  
*Psilocarya scirpoides*  
*Scirpus Smithii*, var. *setosus*  
*S. campestris*, var. *novae-angliae*  
*S. Eriophorum*  
*Fuirena squarrosa*  
*Hemicarpha micrantha*  
*Rynchospora Torreyana*  
*R. capitellata*, var. *discutiens*  
*Carex straminea*  
*C. alata*  
*C. annectens*  
*C. laevivaginata*  
*C. Mitchelliana*  
*Arisaema Stewardsonii*  
*Peltandra virginica*  
*Juncus effusus*, var. *compactus*  
*J. pervetus*  
*J. subcaudatus*  
*J. aristulatus*  
*Luzula campestris*, var. *echinata*  
*Lilium superbum*  
*Lachnanthes tinctoria*  
*Salix sericea*  
*Myrica asplenifolia*  
*Fagus grandifolia*, var. *caroliniana*  
*Quercus stellata*  
*Q. Margareta*  
*Q. prinoides*, var. *rufescens*  
*Comandra umbellata*  
*Polygonum Careyi*  
*P. puritanorum*  
*P. setaceum*  
*Chenopodium leptophyllum*  
*Acnida cannabina*  
*Spergularia canadensis*  
*Crataegus rotundifolia*  
*Rubus tardatus*  
*R. Enslenii*  
*R. multispinus*  
*Lespedeza Brittonii*  
*Amphicarpa Pitcheri*  
*Linum striatum*  
*L. floridanum*, var. *intercursum*  
*Callitriche palustris*  
*Ilex laevigata*  
*Ceanothus americanus*, var. *intermedius*  
*Parthenocissus vitacea*  
*Hypericum dissimulatum*  
*Helianthemum dumosum*  
*H. Bicknellii*  
*H. propinquum*  
*Viola emarginata*  
*V. incognita*, var. *Forbesii*  
*Lythrum hyssopifolium*  
*Rhexia mariana*  
*Epilobium molle*  
*Oenothera linearis*  
*O. longipedicellata*  
*Proserpinaca intermedia*  
*Cicuta bulbifera*  
*Lilaeopsis chinensis*  
*Vaccinium stamineum*  
*Sabatia Kennedyana*  
*S. campanulata*  
*Apocynum medium*  
*Cuscuta pentagona*  
*C. compacta*  
*Stachys hyssopifolia*  
*Lycopus virginicus*  
*Limosella subulata*  
*Aureolaria pedicularia*, var. *caesariensis*  
*Utricularia biflora*  
*U. resupinata*  
*U. subulata*  
*Galium tinctorium*  
*Eupatorium hyssopifolium*  
*Mikania scandens*  
*Chrysopsis falcata*  
*Solidago erecta*  
*S. puberula*  
*S. Elliottii*  
*Sericocarpus linifolius*  
*Antennaria petaloidea*

*A. fallax*  
*Gnaphalium obtusifolium*, var.  
*micradenium*

*Bidens coronata*  
*Prenanthes serpentaria*

As will be seen at a glance, the overwhelming majority of species in this list are plants of prevailingly southern affinities. Many of them are common in the Pine Barrens of New Jersey and a considerable number were not known to occur north of there, or perhaps Long Island, when the last revision was made of Gray's Manual in 1908, but have been added to the Massachusetts flora only as the result of recent investigation. The foregoing list is not in any sense an exhaustive one, nor could it hope to be, for nearly every summer's exploration adds to the already large number of southern coastal plain species which are known to occur on the central part of Cape Cod.

"Lower" Cape. At Orleans the Cape makes a right-angle turn and continues almost due north through Eastham, Wellfleet and Truro to Provincetown, which is at the extreme tip. This "fore-arm" or outer portion of the Cape is characterized by rather high, undulating hills, the axes of which for the most part run east and west. It is thought that the troughs between these hills may have formed the delta of a glacial river which drained into Lake Agassiz, a large body of water impounded by the ice and today represented by Cape Cod Bay. From Truro northward this part of the Cape consists of a wave-built sand spit. A few of the plants peculiar to the Outer Cape, such as *Andropogon scoparius*, var. *polyclados*, *Muhlenbergia mexicana*, *Cyperus filicinus*, var. *microdontus*, *Orontium aquaticum*, *Opuntia vulgaris*, *Aureolaria pedicularia* and *Baccharis halimifolia*, are far-ranging southern species, but the significant feature of the flora of this province is that most of its specialties are forms which display a northern or at least a continental affinity. The following are a few of the plants belonging to this category:

*Potamogeton natans*  
*Elymus arenarius*, var. *villosus*  
*Scirpus atrocinctus*  
*Eriophorum spissum*  
*Carex Muhlenbergii*, var. *enervis*  
*C. limosa*  
*C. oligosperma*  
*C. lasiocarpa*  
*C. Pseudo-Cyperus*  
*C. bullata*  
*Juncus effusus*, var. *Pylaei*  
*J. articulatus*, var. *obtusatus*

*Allium canadense*  
*Liparis Loeselii*  
*Salix lucida*  
*Ranunculus sceleratus*  
*Cardamine parviflora*, var.  
*arenicola*  
*Pyrus melanocarpa*  
*Potentilla tridentata*  
*Rubus idaeus*, var. *strigosus*  
*R. orarius*  
*R. amnicola*  
*R. recurvicaulis*

<i>R. arcuans</i>	<i>Arctostaphylos Uva-ursi</i> , var.
<i>Prunus virginiana</i>	<i>coactilis</i>
<i>P. pennsylvanica</i>	<i>Vaccinium pennsylvanicum</i> , var.
<i>Corema Conradii</i>	<i>myrtilloides</i>
<i>Ilex verticillata</i> , var. <i>fastigiata</i>	<i>V. Oxycoccus</i>
<i>Hudsonia tomentosa</i> , var. <i>inter-</i>	<i>Galium trifidum</i> , var. <i>halophilum</i>
<i>media</i>	<i>Linnaea borealis</i> , var. <i>americana</i>
<i>Circaea alpina</i>	<i>Bidens cernua</i>
<i>Cornus canadensis</i>	<i>Lactuca Morssii</i>
	<i>Hieracium marianum</i>

Most of the species listed above are of a prevailing northern distribution; their affinities are with the widely dispersed Canadian flora to the west and northwest. A few of them are here at, or near, the southern limit of their ranges.

Thus, it will be seen, each of the three natural divisions of Cape Cod possesses a rather distinctive flora: that of the Inner Cape is essentially of a continental Alleghanian-Canadian character; that of the Middle Cape is colored by the presence of a considerable number of Carolinian or even Louisianian types; while that of the Outer Cape is rendered striking by the occurrence of so many species of Canadian, or in some cases even Hudsonian, affinities. An attempt to explain the underlying reasons which account for this differentiation will be made in summing up the evidence for the origin of the flora of the Elizabeth Islands themselves.

**ELIZABETH ISLANDS.** Turning now to the region under immediate consideration, we find that the total number of species, varieties and forms of vascular plants known to occur upon the Elizabeth Islands is 686. Of these, 128 (18½%) are introduced, while 558 (81½%) may safely be classed as indigenous.

*Introductions.* The subject of those species of plants introduced on the Elizabeth Islands was dealt with at such length in the section on Changes in the Flora that it seems scarcely necessary to develop it further here. It need merely be pointed out that by far the larger part of these introductions is comprised of those ubiquitous European and Asiatic adventives which everywhere throughout eastern North America have taken possession of recently cleared ground or disturbed sandy areas, often completely dominating our native flora. The rest of the exotics are either garden escapes, as exemplified in the discussion of the foreign elements in the flora of Penikese, or species, such as the *Cytisus* or the various Spruces, which have been deliberately planted by man for a special purpose. A few plants

native to North America are certainly not of indigenous occurrence on the islands, but have been introduced either accidentally or intentionally. As examples of such may be mentioned *Glaucium flavum* and *Solanum triflorum*, which grow on the beach near Tarpaulin Cove, Naushon, and *Juniperus communis*, var. *depressa*, which appears to have been planted along the north shore at the west end of the same island.

(*To be continued*)

THE FLORA OF THE ELIZABETH ISLANDS,  
MASSACHUSETTS

JOHN M. FOGG, JR.

(Continued from page 180)

*Native plants.* The 558 species of indigenous plants on the Elizabeth Islands fall rather clearly into three fairly well differentiated categories. In the first place, there is the southern element—plants of the southern coastal plain which range north from Florida or the Gulf States to achieve their northern limit in southeastern Massachusetts, some of them passing on to Nova Scotia or Newfoundland; then there is a group of species of northern affinities, many of which have already been mentioned in speaking of Nantucket and Cape Cod, which range south or southwest to Massachusetts or, at most, New Jersey. And, finally, there is a large and very important block of plants which fall into neither of the two preceding classes, but belong rather to a continental upland flora than to that which characterizes the lowlying reaches of most of Cape Cod and the adjacent islands. It will be well to analyze briefly the constituents of these three groupings before proceeding further.

*The Southern Element.* In rather striking contrast to the situation found on Nantucket, where, it will be remembered, over 50% of the indigenous flora is prevailingly more southern in its hue, as well as on the middle part of Cape Cod, where, as has been seen, the native flora is preëminently that of the southern coastal plain, is the

fact that on the Elizabeth Islands this southern element finds expression in something less than 20% of the total indigenous flora.

It is true that there are a few species of plants of the southern coastal plain which, on the Elizabeth Islands are near the very northeastern limit of their distribution. *Paspalum setaceum*, for example, is known in Massachusetts only from the Elizabeths and Nantucket.<sup>1</sup> *Panicum longifolium* is found nowhere east of Pasque Island, at which place it is abundant in the peaty bog hollows,<sup>2</sup> although it is represented in Nova Scotia by var. *tusketense*.<sup>3</sup> *Tipularia discolor* is near the northeastern limit of its range on one of the Elizabeth Islands (Nashawena) and on Martha's Vineyard. *Rumex verticillatus*, long known from Block Island, but otherwise rare in New England, has recently been collected on the Elizabeths. *Hydrocotyle Canbyi* and *H. verticillata*, both known on the basis of old records from Woods Hole (for years their only known station in New England) have, during the course of the present survey, been discovered on the Elizabeth Islands as well. *Solidago minor* ranges from Alabama and Florida to Virginia, then "jumps" to Nantucket, where it was reported by Bicknell, and is now known to occur on Naushon, the largest of the Elizabeths. Thus it will be seen, that these islands, as is true of nearly every other locality along the coast from New Jersey northward, are not totally lacking in records which represent interesting, or even spectacular, northern extensions of plants which are essentially southern in their affinities.

In general, however, the flora of the Elizabeth Islands far from suggests that of the coastal plain. The following enumeration, which includes the seven species just mentioned, constitutes a nearly complete list of the plants known from these islands which are also characteristic species of the coastal strip, ranging from the Gulf States, Florida or Georgia northeastward. Many of them, of course, continue farther north and east, being known from Nova Scotia, New Brunswick or even Newfoundland, but they are, for the most part, plants of a pronounced austro-riparian origin. It would be difficult to make such a list comprehensive, for, in the absence of adequate data concerning the complete ranges of every species, it is not always easy to state categorically whether a plant belongs exclusively to the southern coastal plain, or whether it enjoys an Alleghanian-Carolin-

<sup>1</sup> See Weatherby, RHODORA, xxx. 133 (1928).

<sup>2</sup> See Fogg, RHODORA, xxxi. 39 (1929).

<sup>3</sup> See Fernald, RHODORA, xxiii. 192 (1921).

ian distribution. All of the species listed below, with the exception of those marked with an asterisk, are known also from Cape Cod.

- Woodwardia virginica*  
*Thelypteris simulata*  
*Lycopodium inundatum*, var.  
   *Bigelovii*  
*Chamaecyparis thyoides*  
*Sparganium eurycarpum*  
*Potamogeton Oakesianus*  
*P. pulcher*  
*Andropogon scoparius*, var.  
   *polyclados*  
   *A. virginicus*  
   \**Paspalum setaceum*  
   *P. pubescens*  
*Panicum meridionale*  
*P. albemarlene*  
*P. oricola*  
   \**P. longifolium*  
   *P. Commonsianum*  
*Setaria geniculata*  
*Cenchrus pauciflorus*  
*Stipa avenacea*  
*Aristida purpurascens*  
*Ammophila breviligulata*  
*Spartina alterniflora*, var. *pilosa*  
   \**Diplachne maritima*  
*Cyperus erythrorhizos*  
   *C. ferax*  
   *Eleocharis rostellata*  
   *Fimbristylis autumnalis*  
   *Scirpus Olneyi*  
   *S. robustus*  
   *Rynchospora capitellata*  
   *Carex Longii*  
   *C. straminea*  
   *C. alata*  
   *C. Howei*  
   *C. Mitchelliana*  
   *Xyris caroliniana*  
   *Juncus effusus*, var. *costulatus*  
   *Luzula campestris*, var. *echinata*  
   *Smilax rotundifolia*  
   *Iris prismatica*  
   *Sisyrinchium graminoides*  
   *Pogonia ophioglossoides*  
   *Calopogon pulchellus*  
   \**Tipularia discolor*  
   *Myrica caroliniensis*  
   *Spergularia rubra*
- Boehmeria cylindrica*, var.  
   *Drummondiana*  
   \**Rumex verticillatus*  
   *Polygonum glaucum*  
   *P. punctatum*  
   *Drosera intermedia*  
   *Pyrus arbutifolia*  
   *Rubus Andrewsianus*  
   *Rosa palustris*  
   *Prunus maritima*  
   *Desmodium obtusum*  
   *D. marilandicum*  
   *Lespedeza capitata*  
   *Polygala cruciata*  
   *Euphorbia polygonifolia*  
   *Ilex opaca*  
   *I. glabra*  
   *Hibiscus Moscheutos*  
   *Hypericum virginicum*  
   *Helianthemum canadense*  
   *H. Bicknellii*  
   *Lechea villosa*  
   *L. maritima*  
   *Decodon verticillatus*  
   *Rhexia virginica*  
   *Myriophyllum scabratum*  
   *Proserpinaca palustris*  
   \**Sanicula canadensis*  
   *Hydrocotyle umbellata*  
   *H. Canbyi*  
   *H. verticillata*  
   *Ptilimnium capillaceum*  
   *Clethra alnifolia*  
   *Rhododendron viscosum*, var.  
     *glaucum*  
   *Leucothoe racemosa*  
   *Samolus floribundus*  
   *Bartonia virginica*  
   *B. paniculata*  
   *Nymphoides lacunosum*  
   *Asclepias verticillata*  
   *Teucrium canadense*, var.  
     *littorale*  
   *Ilysanthes inaequalis*  
   *Gratiola aurea*  
   *Agalinis maritima*  
   *Utricularia gibba*  
   \**Plantago virginica*

Eupatorium hyssopifolium  
 Solidago Elliottii  
 \*S. minor  
 S. tenuifolia  
 Aster dumosus  
 A. vimineus

Pluchea camphorata  
 Gnaphalium purpureum  
 Coreopsis rosea  
 Krigia virginica  
 Lactuca hirsuta  
 Hieracium Gronovii

A point requiring particular emphasis is, that many of these species are by no means common on the islands. Indeed, a few of them, such as *Thelypteris simulata*, *Paspalum setaceum*, *Panicum longifolium*, *P. Commonsianum*, *Cenchrus pauciflorus*, *Diplachne maritima*, *Eleocharis rostellata*, *Carex straminea*, *C. alata*, *C. Mitchelliana*, *Luzula campestris*, var. *echinata*, *Tipularia discolor*, *Rumex verticillatus*, *Prunus maritima*, *Ilex glabra*, *Sanicula canadensis*, *Hydrocotyle Canbyi*, *Rhododendron viscosum*, var. *glaucum*, *Triosteum perfoliatum*, *Solidago minor* and *Coreopsis rosea*, are known only from a single locality, while certain others, though less restricted, are nevertheless rare and local. And seldom, if ever, are these coastal plain plants present in sufficient abundance to create the impression, inescapable on Cape Cod, of a southern flora transplanted almost *en masse*.

Pursuing this last idea further, it will be found interesting to contrast with the list just given a list of some of the southern coastal plain plants which are known to occur on Cape Cod (most of them from the Middle Cape), but which have not yet been found on the Elizabeth Islands:

*Pteridium aquilinum*, var.  
*pseudocaudatum*  
*Sagittaria Engelmanniana*  
*S. graminea*  
*S. teres*  
*Paspalum psammophilum*  
*Panicum verrucosum*  
*P. Bicknellii*  
*P. microcarpon*  
*P. annulum*  
*P. mattamuskeetense*  
*P. spretum*  
*P. Wrightianum*  
*P. auburne*  
*P. tsugetorum*  
*P. columbianum*  
*P. polyanthes*  
*P. Ashei*  
*P. scoparium*

*Aristida dichotoma*  
*A. gracilis*  
*Spartina cynosuroides*  
*Tridens flavus*  
*Cyperus filicinus*, var.  
*microdontus*  
*C. Grayii*  
*Eleocharis Robbinsii*  
*E. melanocarpa*  
*Psilocarya scirpoides*  
*Scirpus atrovirens*, var.  
*georgianus*  
*S. Eriophorum*  
*Fuirena squarrosa*  
*Hemicarpha micrantha*  
*Rynchospora macrostachya*  
*R. inundata*  
*R. Torreyana*  
*R. capitellata*, var. *discutiens*



<i>Scleria reticularis</i>	<i>Acer rubrum</i> , var. <i>tridens</i>
<i>Carex annectens</i>	<i>Ceanothus americanus</i> , var.
<i>C. intumescens</i>	<i>intermedius</i>
<i>C. bullata</i> , var. <i>Greenei</i>	<i>Vitis cordifolia</i>
<i>Arisaema Stewardsonii</i>	<i>Hypericum adpressum</i>
<i>Peltandra virginica</i>	<i>Hudsonia ericoides</i>
<i>Orontium aquaticum</i>	<i>Viola emarginata</i>
<i>Xyris Smalliana</i>	<i>V. primulifolia</i>
<i>Juncus subcaudatus</i>	<i>Opuntia vulgaris</i>
<i>J. aristulatus</i>	<i>Rhexia mariana</i>
<i>Lilium superbum</i>	<i>Oenothera linearis</i>
<i>Aletris farinosa</i>	<i>O. longipedicellata</i>
<i>Lachnanthes tinctoria</i>	<i>Proserpinaca pectinata</i>
<i>Myrica asplenifolia</i>	<i>P. intermedia</i>
<i>Quercus stellata</i>	<i>Lilaeopsis chinensis</i>
<i>Q. prinoides</i>	<i>Sabatia campanulata</i>
<i>Q. ilicifolia</i>	<i>Cuscuta compacta</i>
<i>Comandra umbellata</i>	<i>Onosmodium virginianum</i>
<i>Polygonum setaceum</i>	<i>Stachys hyssopifolia</i>
<i>Polygonella articulata</i>	<i>Lycopus sessilifolius</i>
<i>Acnida cannabina</i>	<i>Agalinis purpurea</i>
<i>Drosera filiformis</i>	<i>Aureolaria pedicularia</i> , var.
<i>Cassia Chamaecrista</i>	<i>caesariensis</i>
<i>Crotalaria sagittalis</i>	<i>Utricularia inflata</i>
<i>Lupinus perennis</i>	<i>U. subulata</i>
<i>Tephrosia virginiana</i>	<i>Viburnum pubescens</i>
<i>Desmodium rotundifolium</i>	<i>Eupatorium verbenaefolium</i>
<i>D. marilandicum</i>	<i>Mikania scandens</i>
<i>Lespedeza procumbens</i>	<i>Solidago erecta</i>
<i>L. Stuvei</i>	<i>S. puberula</i>
<i>L. angustifolia</i>	<i>Aster spectabilis</i>
<i>Strophostyles helvola</i>	<i>A. subulatus</i>
<i>Linum floridanum</i> , var.	<i>A. tenuifolius</i>
<i>intercursum</i>	<i>Baccharis halimifolia</i>
<i>Polygala Nuttallii</i>	<i>Bidens coronata</i>
<i>Corema Conradii</i>	<i>Lactuca floridana</i>

Thus it will be seen that, while there occur on the Elizabeth Islands something like 100 species belonging to a wideranging southwestern flora, Cape Cod not only has practically every one of these same plants, but boasts in addition at least an equal number of species of the same class which, so far as is known, are totally lacking from the islands.

It may be worth while to note, in passing, that, while an overwhelmingly large proportion of the more than 200 prevailing southern species which occur on Cape Cod occur likewise on Nantucket (and a considerably smaller proportion on Martha's Vineyard), that island has caught a number of these southern migrants which appear not to have succeeded in reaching the Cape. Several of these may be listed:

Eleocharis tricostata	Ascyron hypericoides
Scleria triglomerata	Lespedeza virginica
Carex Walteriana	Lechea Leggettii
Habenaria ciliaris	Ludvigia alterniflora
Quercus pagodaefolia	Pycnanthemum verticillatum
Polygonum robustius	Schwalbea americana
Amaranthus pumilus	Aster concolor
Ranunculus laxicaulis	

Sufficient evidence has probably been adduced to bear out the contention that the relations of the flora of the Elizabeth Islands to that of the southern coastal plain are anything but prominently marked, and that this southern, or southwestern, element is much more strongly represented in the closely adjacent regions, especially Cape Cod and Nantucket. An attempt to determine the causes which account for this break in distribution will shortly be made.

*The Northern Element.* Although lacking many of the northern types which distinguish the floras of parts of Nantucket and the "Lower" Cape, the Elizabeth Islands are not entirely without their representation of plants whose affinities are prevailingly boreal. In all, about 50 such species, constituting nearly 9% of the total native flora, may be considered as belonging to this class. It is significant to contrast this number with the 150 northern plants (over 20%) listed by Bicknell for Nantucket.

In general, these northern species which occur on the Elizabeth Islands are plants which range from Labrador and Newfoundland south to Massachusetts and New Jersey or, in a few cases, Delaware or Maryland. Many of them range south of New England along the mountains but reach the coastwise southern limit of their distribution in Massachusetts, Long Island or New Jersey. In the list which follows those species marked with an asterisk are to be looked upon as essentially maritime.

*Ruppia maritima, var. subcapitata	Carex hormathodes
*Triglochin maritima	C. silicea
*Agrostis stolonifera, var. compacta	C. canescens, var. disjuncta
Spartina Michauxiana	C. limosa
Glyceria obtusa	C. lanuginosa
G. canadensis	Eriocaulon septangulare
*Puccinellia paupercula, var. alaskana	Juncus pelocarpus
Eleocharis uniglumis	J. militaris
Scirpus campestris, var. paludosus	J. articulatus
Eriophorum tenellum	Sisyrinchium angustifolium
Rynchospora fusca	Liparis Loeselii
	Betula populifolia

*Rumex maritimus, var. fueginus	Hypericum boreale
Arenaria lateriflora	Epilobium palustre, var. monticola
Sagina procumbens	Myriophyllum tenellum
*Ranunculus Cymbalaria	*Ligusticum scoticum
Drosera rotundifolia	*Coelopleurum lucidum
Fragaria virginiana, var. terrae-novae	Menyanthes trifoliata, var. minor
*Potentilla pacifica	Chamaedaphne calyculata
*Lathyrus maritimus	Vaccinium macrocarpon
Rhus glabra, var. borealis	Limosella subulata
Ilex verticillata, var. fastigiata	*Plantago juncooides, var. decipiens
	Anaphalis margaritacea

The Elizabeth Islands, then, appear to have received their share of those far-ranging northern types which probably owe their existence in coastal New England, and southwestward, to the former presence of the broad continental shelf, already referred to, which permitted of their extension to the southwest and then, following its submergence, left them stranded at isolated localities along the coast. This would also explain why these islands possess fewer such plants than Martha's Vineyard (see p. 173) and still fewer than either Nantucket or the outer portion of Cape Cod. For, if these boreal species reached southeastern New England from off the elevated coastal bench to the eastward, then it seems logical to assume that a greater number of them would have found a refuge on Nantucket and the "Lower" Cape and that a smaller proportion would have succeeded in finding their way to the areas inland to the west, especially if, as may well have been the case, the retreat of the glacial ice from the latter region lagged appreciably behind its retreat from Nantucket, Martha's Vineyard and Cape Cod.

*The Continental Element.* It is only when we come to consider the continental element as it appears on the Elizabeth Islands that we find ourselves dealing with the type of vegetation which lends a dominating color to their flora. Probably more than 400 plants (about 70% of the total indigenous flora) from these islands are neither prevailing southern nor northern in their distributional affinities but belong, rather, to a widespread continental flora which might be characterized, somewhat arbitrarily, as Canadian-Alleghanian in nature. This, it will be recognized immediately, is an attribute which the Elizabeths share in common with the upper or inner part of Cape Cod, and, indeed, there is every reason to suppose that the flora of these islands may, until comparatively recent geologic times, have been continuous with that of the line of hills which runs from

Falmouth to Bourne, and even north nearly to Plymouth. This entire ridge represents a terminal moraine which, beyond Cuttyhunk, dips below sea level reappearing, as some geologists believe, to form Block Island and, farther west, a portion of Long Island. The separation of the Elizabeth Islands from the mainland and their division into the seven present members of the chain are, as has already been indicated, relatively modern events. So it is entirely in keeping with the past history of this region that so many of the types which are abundant throughout the Falmouth area should likewise be common on the islands.

The relation of the flora of the Elizabeth Islands to that of the mainland comes out most clearly upon an examination of the forest types. The trees have already been listed (p. 151), but it seems entirely justifiable to repeat in this place that the native woods of the islands are made up not only of beech, *Fagus grandifolia* (surely not a coastal plain type), but also contain *Carya alba*, *Ostrya virginiana*, *Quercus alba*, *Q. velutina*, *Sassafras officinale*, *Hamamelis virginiana*, *Acer rubrum*, *Cornus florida* and *Nyssa sylvatica*. Now these trees, while they may and do occur on the coastal plain, are nevertheless more common and more clearly at home on the richer soils of the Piedmont and the areas inland, often reaching their finest development on wet wooded slopes and the alluvia of river valleys.

Under the trees listed above, on the wetter parts of the forest floor, occur such plants as *Carex lupulina*, *Arisaema triphyllum*, *Oakesia sessilifolia*, *Maianthemum canadense*, *Medeola virginiana* and *Trientalis borealis*. These again are types more commonly associated with an Alleghanian woodland flora. The beech drops, *Epifagus virginiana*, a rare plant in southeastern Massachusetts, occurs everywhere in the wooded parts of Naushon and Nashawena, and many other cases of this sort might be cited.

It would be superfluous to list here all of the species of Canadian-Alleghanian affinities which occur on the Elizabeth Islands. An enumeration of them would include most of the names of native plants in the Catalog that follows which have not been listed above in dealing either with the Southern or Northern Elements. A few of the most typical, however, not including the few trees mentioned above, may be given for the sake of comparison:

*Polypodium virginianum*  
*Asplenium platyneuron*

*Athyrium angustum*  
*Osmunda cinnamomea*

Ophioglossum vulgatum	Amelanchier oblongifolia
Isoetes Engelmanni	Geum canadense
Sparganium americanum	Geranium maculatum
Sagittaria latifolia	Acalypha virginica
Andropogon furcatus	A. digyneia
Glyceria striata	Callitriche heterophylla
G. pallida	Rhus typhina
Elymus virginicus	R. Vernix
Cyperus diandrus	R. Toxicodendron
C. rivularis	Ilex verticillata
Scirpus cyperinus	Impatiens biflora
Eriophorum virginicum	Vitis labrusca
Carex rosea, var. radiata	V. aestivalis
C. cephalophora	Viola papilionacea
C. crinita	V. pallens
C. virescens	Ludvigia palustris
C. communis	Cicuta maculata
C. pennsylvanica, var. separans	Sium suave
C. digitalis	Heracleum lanatum
C. debilis, var. Rudgei	Monotropa uniflora
C. lupulina	M. Hypopithys
Arisaema triphyllum	Epigaea repens
Symplocarpus foetidus	Gaultheria procumbens
Acorus Calamus	Lysimachia quadrifolia
Juncus effusus, var. solutus	L. terrestris
Oakesia sessilifolia	Trientalis borealis
Lilium philadelphicum	Apocynum androsaemifolium
Maianthemum canadense	Verbena hastata
Medeola virginiana	Scutellaria galericulata
Habenaria bracteata	Pycnanthemum muticum
H. clavellata	P. flexuosum
H. orbiculata	Epifagus virginiana
Arethusa bulbosa	Cephalanthus occidentalis
Boehmeria cylindrica	Triosteum perfoliatum
Polygonum scandens	Sambucus canadensis
Phytolacca americana	Lobelia cardinalis
Ranunculus delphinifolius	Solidago juncea
Anemone virginiana	S. canadensis
Coptis groenlandica	Aster divaricatus
Spiraea tomentosa	Cirsium discolor

The great bulk of these plants are species primarily of the interior; they attain their fullest development in the Piedmont and the Uplands and their occurrence on the coastal plain may be regarded, in most cases, as rather casual.

In summing up, it need merely be pointed out that the Elizabeth Islands, while serving, as does every other locality along the Atlantic coast, as a meeting ground for both northern and southern species of plants, exhibit both qualitatively and quantitatively a very strong

relationship with a widely dispersed flora of a continental nature, a fact which seems readily explicable upon the basis of the close connection existing between these islands and the inner, hilly part of Cape Cod, both as regards geologic history and general topography.

Finally, there remains to be considered, as briefly as may be, the subject of the last glacial advance over this region and its possible effects in influencing the present-day distribution of the flora.

*Glacial History.* Probably the greatest student of the geology of southeastern Massachusetts since the days of N. S. Shaler, was the late J. B. Woodworth of Harvard University. Professor Woodworth had prepared, shortly before his death, an exhaustive treatment of the glacial history of the Cape Cod region. This manuscript, unfortunately, still awaits publication and the details which it embodies are not yet available. Happily, however, Woodworth had related his broader conclusions to A. P. Brigham, geologist to Colgate University, and the main arguments are set forth by Brigham in his popular book entitled "Cape Cod and The Old Colony."

According to Woodworth, the advance of the last or Wisconsin ice over southeastern Massachusetts took place not as a solid sheet, but in the form of three tongues or lobes. One of these, the "Buzzards Bay Lobe," came down over the region now occupied by Buzzards Bay and deposited as a frontal moraine much of the material which now forms the line of high hills along the northwest shore of Martha's Vineyard, from Menemsha to West Chop. Then, following an interval which represented a retreat and a second advance of the ice, this lobe laid down, as a secondary moraine, the ridge which made the Elizabeth Islands and the "Upper Cape." The line of the islands, as may be seen from a map, almost exactly parallels the line of the morainal hills on the northwest shore of the Vineyard.

The second lobe, which lay to the east of the "Buzzards Bay Lobe," advanced southward over what is now the middle section of Cape Cod and laid down, as a terminal moraine, the sand, gravel and boulders which form the northeast shore of Martha's Vineyard and the higher, crescent-shaped portion of Nantucket. This Woodworth terms the "Cape Cod Lobe." This lobe then retreated, as did the Buzzards Bay Lobe and, as its secondary moraine, deposited the till which composes the "backbone" of Cape Cod from Sandwich to Brewster and Orleans. Thus, Martha's Vineyard was built by the combined action of two lobes and the central and southern parts of the island

represent an outwash or apron plain derived from two separate moraines. The southern and southeastern parts of Nantucket and almost the entire south shore of the Cape likewise represent outwash plains, both formed from the materials deposited by the Cape Cod Lobe.

Still further to the eastward, the third, or "South Channel Lobe" advanced over the area now submerged and known as Georges Banks. With the deposits of this lobe we are not so much concerned, as they now lie mostly beneath the sea, save for such materials as may have contributed to the building of the outer or lower part of Cape Cod. How far this lobe may have extended eastward over the then elevated continental shelf is apparently not definitely known.

It now becomes pertinent to inquire into the relative ages of these deposits and as to whether any evidence is forthcoming to indicate at what time and in what manner the various lobes retreated. Probably Woodworth's report, when it becomes available, will throw much light on this question. However, the writer has it on the authority of Dr. Wigglesworth of the Boston Society of Natural History, who is conversant with Woodworth's views, and who is himself a student of the geology of Martha's Vineyard, that in all probability the middle or Cape Cod lobe was the first one to retreat. If this was the case, it then means that Nantucket, the eastern part of Martha's Vineyard and the central part of Cape Cod were free of ice at a time when the regions to the east and to the west were still covered by the South Channel and Buzzards Bay lobes respectively. Remembering that the coastal shelf was probably considerably higher at that time than it is today, and that the Vineyard, Nantucket and the Cape may well have been continuous dry land, it at once becomes apparent that there was thus opened up an area which soon became available as a refuge for that migration of southern coastal plain species of plants which probably began as soon as the ice commenced to retreat.

It is necessary to point out here that there is a lack of complete agreement as to the exact period of subsidence of the continental shelf and as to whether this migration might have occurred *previous* to the advent of the Wisconsin ice or whether it could not possibly have taken place until after the glacier had receded.

Douglas Johnson, the eminent student of coastal phenomena, in discussing the date of submergence of the Banks cuesta (i. e., the New England-Acadian portion of the outer coastal shelf) states that

“we should expect the subsidence to be at least post-Miocene and more probably post-Pliocene.”<sup>1</sup> And further, “It seems probable that the date of submergence of the drowned topography must be post-Tertiary.”<sup>2</sup> Johnson, then, is inclined to view the elevation of the continental shelf as pre-glacial rather than post-glacial, a condition which would have necessitated the plant migration having antedated the advent of the Wisconsin ice. And, indeed, Fernald sees no reason why these plants should not have moved northeastward along the exposed shelf before the coming of the Wisconsin glaciation and “have persisted outside the subsequently glaciated area, finally taking possession of their present isolated habitats on the receding of the ice.”<sup>3</sup>

In connection with the present study, however, it matters little whether these species of the southern coastal plain reached the New England area before or after the last glaciation. In either case they must have moved inland from off the broad shelf to the eastward to take the places left vacant for them by the recession of the ice, and if we are justified in assuming that it was the Cape Cod Lobe of the glacier which receded first, then we are in a position to understand why so many of these species are to be found upon Nantucket and the “Middle” Cape, and, to a lesser degree, upon the eastern portion of Martha’s Vineyard and are so generally lacking from the Elizabeth Islands and inner Cape Cod. Even if the western half of the Vineyard, the Elizabeth Islands and the “Upper” Cape were free from ice at the time when this migration was operative, it seems likely that they offered a type of habitat which was less attractive to these coastal plain plants than the low-lying silicious areas of Nantucket and the “Middle” Cape which they must have reached first and where they today abound, seldom exhibiting a tendency to widen their ranges into the neighboring regions. And although, as Fernald suggests, these plants may have persisted upon the outer shelf while the ice still covered the area inland, it is nevertheless probable that the Nantucket-“Middle” Cape region would have been the first to witness their return.

*Conclusion:* In summing up, it may be said that, considered from the viewpoint of broad, geographic origins, the native flora of the

<sup>1</sup> Johnson, D. The New England-Acadian Shoreline. New York. 302 (1925).

<sup>2</sup> Ibid. 312, 313

<sup>3</sup> Fernald, M. L. A Preliminary Statement of Results of Studies on the Northeastward Distribution of the Coastal Plain Flora. Amer. Jour. Sci. 4th Ser. xl. 18 (1915).



Elizabeth Islands is seen to consist of three distinct elements. In the first place, there are those species (less than 20%) which exhibit a relationship with the flora of the southern coastal plain. Their presence upon these islands is to be explained upon the basis of a former land connection with New Jersey and southward which took the form of an elevation of the outer coastal bench, now submerged, and which, either prior to or following the Wisconsin glaciation, permitted of the migration of plants from the southwest to the New England area and even farther north and east. That so many more of these southern plants occur upon Cape Cod and Nantucket than upon the Elizabeth Islands is probably to be explained by the behavior of the glacial lobes which covered this area and which, by their differential recession, seem to have rendered the former areas accessible to occupation by plants at an earlier date. Secondly, there is a small percentage (less than 9%) of plants displaying a boreal affinity, the occurrence of which may be attributed to a counter extension southward along this same uplifted shelf. And the fact that the Elizabeth Islands have received a smaller number of these northern representatives than either Cape Cod or Nantucket is probably to be accounted for on the basis of their inland position and the character of the habitat which they offer, which is, in general, less favorable for these northern plants than the situations which they occupy on the "Lower" Cape. And, finally, there is the overwhelming majority (over 70%) of plants occurring on the Elizabeth Islands which show an essential relationship with the flora of the mainland and which give to the islands the dominating character of a Canadian-Alleghanian region. The prevalence of this continental element is doubtless due to the close geologic and physiographic similarity existing between these islands and the "Upper" Cape. Thus it will be seen that the evidence derived from a study of the geographic origin of the flora of the Elizabeth Islands fits rather well into what is already known concerning the history of the neighboring territory and that these islands take their place botanically as an extension of the adjacent mainland rather than as a link in that chain of outposts of a formerly continuous but now highly disrupted coastal plain flora extending from the South Atlantic States to Newfoundland.

*Acknowledgements.* The writer desires to express his profound and grateful appreciation of the stimulating genius of Professor M. L. Fernald under whose guidance this study has been conducted and without whose inspiration it could never have been completed.

Mr. C. A. Weatherby and Mr. Bayard Long have both rendered invaluable assistance in their willingness to aid in the determination of critical material. To them the writer's deepest thanks are due.

He is also indebted to Professor L. H. Bailey, who has kindly examined several specimens of *Rubus*, to Professor K. M. Wiegand, who has looked over some of the *Amelanchier* material, and to Mrs. Agnes Chase who has given her opinion on a few sheets of *Panicum*.

*(To be continued)*

THE FLORA OF THE ELIZABETH ISLANDS,  
MASSACHUSETTS

JOHN M. FOGG, JR.

(Continued from page 221)

PART II. ANNOTATED LIST OF THE VASCULAR FLORA

In the Catalog of Vascular Plants of the Elizabeth Islands which follows several conventions and abbreviations have, for the sake of convenience, been adopted; these are here explained:

NOMENCLATURE. The International Rules of Botanical Nomenclature have been followed.

ELEMENTS IN THE FLORA. The various elements constituting the flora have been differentiated thus:

Indigenous species appear in capital letters.

Introduced species are given in *italics*.

Discredited records are included in brackets.

CITATIONS AND SYNONYMY. Synonyms are given in *italics* and, in general, are included only when they represent names which have been superseded since the last edition of Gray's Manual (Ed. 7, 1908). Usually, in such cases, a reference is given to the place where the new name was published or its status discussed.

LOCALITIES. The seven main islands are indicated by taking the first three letters of the name of each; thus:

NON: Nonamesset, including Pine Island.

UNC: Uncatena

NAU: Naushon, including Captain's Island, Ram's Head, Monohansett, Buck, East Buck, West Buck and the Weepeckets.

PAS: Pasque.

NAS: Nashawena.

CUT: Cuttyhunk.

PEN: Penikese, including Gull Island.

COLLECTORS. Those who have collected specimens from the islands, or who have reported plants from there, are designated by the use of the surname; this is followed by the serial collection number, where the collector has employed a numbering system, otherwise by the date. A list of the chief collectors is here given in alphabetical order:

Cushman, J. A. (1906)	Northrop, Alice R. (1901, 1903)
Duggar, B. M. (1911)	Pennell, F. W. (1911)
Faxon, C. E. (1875)	Sanford, S. N. F. (1917)
Faxon, Walter (1873)	Simons, Elizabeth A. (1901)
Fernald, M. L. (1927)	Sipe, S. B. (1901)
Hervey, E. W. (no date)	Svenson, H. K. (1926)
Hollick, Arthur (1898)	Taylor, W. R. (1919–1921)
Jordan, David S. (1873)	Weir, "Miss" (1890)
MacRae, Lillian (1904)	Williams, E. F. (1911)
Moore, A. H. (1904)	

Further information concerning these collectors and the distribution of their material may be found in the section on Previous Botanical Work on the Islands (Pages 123–125).

N. B. Serial numbers unpreceded by a name are to be taken as representing material collected by the present writer.

HERBARIA. The following system of initials has been employed to designate the herbaria in which specimens have been seen or to which they are known to have been distributed:

- (A) Academy of Natural Sciences of Philadelphia
- (B) Boston Society of Natural History
- (C) Cornell University
- (G) Gray Herbarium, Harvard University
- (J) Arnold Arboretum, Jamaica Plain, Mass.
- (M) Missouri Botanical Garden
- (N) New England Botanical Club
- (P) University of Pennsylvania
- (U) United States National Museum
- (W) Marine Biological Laboratory, Woods Hole, Mass.
- (Y) New York Botanical Garden
- (o) no specimen seen

### POLYPODIACEAE

*POLYPODIUM VIRGINIANUM* L. *P. vulgare* of eastern American authors. See Fernald, RHODORA, xxiv. 125 (1922). Rare; seen growing only upon a large boulder in the woods on Naushon. NAU: Hollick (o), 2489 (N); NAS: Northrop (o).

*PTERIDIUM AQUILINUM* (L.) Kuhn, var. *LATIUSCULUM* (Desv.) Underwood. *Pteris aquilina* of the Manual. Apparently not common; sandy woods. NON: 2672 (N); NAU: 3329 (P); NAS: Northrop (o).

WOODWARDIA VIRGINICA (L.) Sm. Locally abundant; forms considerable growth around the dune ponds on Nashawena. NAU: Williams, July 10, 1911 (N); NAS: Northrop, July, 1901 (Y), 1772 (N,P).

W. AREOLATA (L.) Moore. Locally abundant; with *Thelypteris palustris*, var. *pubescens* occupying boggy hollows in open hills. PAS: Svenson, Sept. 8, 1926 (N); NAS: Northrop, Aug. 1901 (Y), 3492 (N,P); CUT: 2324 (G,N,P,M).

ASPLENIUM PLATYNEURON (L.) Oakes. Reported by Mrs. Northrop from Nashawena; no specimen seen.

ATHYRIUM ANGUSTUM (Willd.) Presl. *Asplenium filix-femina* of American authors in part. See Butters, RHODORA, xix. 190 (1917). Boggy woods and open hillsides. NAS: 3515 (P); CUT: 2535 (N).

A. ANGUSTUM, var. ELATIUS (Link) Butters. RHODORA, xix. 191 (1917). Dry, exposed hillside. PEN: 459 (N,P,W).

THELYPTERIS PALUSTRIS (Salisb.) Schott, var. PUBESCENS (Lawson) Fernald. *Aspidium Thelypteris* of Manual. See Fernald, RHODORA, xxxi. 34 (1929). Common in low, boggy ground and around borders of ponds. NON: 2238 (N); UNC: 2993 (N); NAU: Sipe, Aug. 1901 (W); NAS: Northrop (o), 2349 (N,P); CUT: Sanford, Aug. 15, 1917 (N), 2323 (N); PEN: 460 (N,P,W,M).

T. SIMULATA (Dav.) Nieuwl. *Aspidium simulatum* Dav. See Weatherby, RHODORA, xxi. 174, 178 (1919). Apparently rare on the islands. NAU: Sipe, July, 1901 (W); PAS: Svenson, Sept. 8, 1926 (N).

T. NOVEBORACENSIS (L.) Nieuwl. *Aspidium noveboracense* (L.) Sw. Moist woodland. NON: 2907 (G,N,P,M,C); NAS: Northrop (o), 3514 (P).

T. SPINULOSA (O. F. Müller) Nieuwl. *Aspidium spinulosum* (O. F. Müller) Sw. Reported by Mrs. Northrop from Nashawena; no specimen seen.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. *Dicksonia punctilobula* (Michx.) Gray. Rocky, open hillsides. NAS: Northrop (o), 3509 (P); CUT: 2534 (N,P); PEN: 461 (N,P,W,M).

ONOCLEA SENSIBILIS L. Apparently not abundant. NAS: Northrop (o); CUT: Sanford, Aug. 15, 1917 (N).

### OSMUNDACEAE

OSMUNDA REGALIS L., var. SPECTABILIS (Willd.) Gray. Occasional in open bogs. NAS: Northrop (o), 1777 (P).

O. CINNAMOMEA L. Bogs and wet hollows. NON: 2881 (N); UNC: 3029 (N); NAS: Northrop (o), 3513 (P); CUT: 3450 (P).

### OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Found only in a sandy field at the east end of Cuttyhunk, near Cuttyhunk Pond. NAS: Northrop (o); CUT: 3582 (N,P).

[*BOTRYCHIUM MATRICARIAE* (Schrank) Spreng. is reported by Mrs. Northrop for Nashawena. This may refer to *B. dissectum* Spreng. or one of its allies, but in the absence of herbarium material it seems best to disregard the record entirely.]

### EQUISETACEAE

*EQUISETUM ARVENSE* L. Seen only in a boggy clearing in the woods at the east end of Naushon. NAU: 701 (P,W).

### LYCOPODIACEAE

*LYCOPODIUM INUNDATUM* L., var. *BIGELOVII* Tuckerm. Peaty margins of ponds. NON: 3381 (N); NAU: 3865 (P).

### ISOETACEAE

*ISOETES ENGELMANNI* A. Br. A single sheet of this species collected on Nashawena by C. E. Faxon, but bearing no date, is in the Gray Herbarium.

### PINACEAE

*PINUS STROBUS* L. Reported by Mrs. Northrop from Nashawena, where probably introduced; no specimen seen.

*P. RIGIDA* Mill. A small group of these trees grows at the extreme east end of Naushon near the West Gutter. Seen nowhere else, although perhaps more common. NAU: 3425 (N,P).

*P. sylvestris* L. Scotch Pine has been introduced on several of the islands but seems nowhere to be spreading. NAU: 3871 (N); NAS: Northrop (o), 3482 (P); PEN: 462 (W).

*Larix decidua* Mill. Planted at several localities along the north shore of Naushon. NAU: 3870 (N,P,M,C).

*Picea Abies* (L.) Karst. *P. excelsa* Link. This and the next two have been planted extensively along the north shore of Naushon. NAU: 3692 (J,P).

*P. glauca* Voss. *P. canadensis* B. S. P. NAU: 3690 (J,P), 3691 (J,P), 3869 (J,N).

*P. pungens* Engelm. NAU: 3868 (J,P).

*CHAMAECYPARIS THYOIDES* (L.) B. S. P. Of infrequent occurrence on the islands, although plentiful around a large pond near Tarpaulin Cove on Naushon. NAU: Williams, July 10, 1911 (N), 3884 (P,M,C).

*JUNIPERUS COMMUNIS* L., var. *DEPRESSA* Pursh. Collected only on the north shore of Naushon, where it may possibly have been introduced. NAU: 3872 (N,P).

*J. VIRGINIANA* L. Plentiful in the woods near the East Gutter on Nonamesset; not seen elsewhere. NON: 2668 (N, P); NAS: Northrop (o).

### TYPHACEAE

*TYPHA LATIFOLIA* L. Swamps and pond borders. NON: 2675 (N); NAS: Northrop (o); PEN: 463 (N,W).

*T. ANGUSTIFOLIA* L. Mostly in brackish areas near the shore. NON: 3165 (N); NAU: 3887 (P); NAS: *Northrop* (o), 1766 (P).

### SPARGANIACEAE

*SPARGANIUM EURYCARPUM* Engelm. Found at two stations; both of them swampy hollows in woods at east end of Naushon. NAU: 3153 (N,P), 3678 (P,M).

*S. ANDROCLADUM* (Engelm.) Morong. *S. lucidum* Fernald & Eames. See Fernald, RHODORA, xxiv. 27 (1922). Growing in swampy area at east end of Naushon near Hadley Harbor. NAU: 2469 (N,P).

*S. AMERICANUM* Nutt. Including var. *androcladum* of the Manual. Swampy woods and pond holes; rather common. NON: 2904 (N,P); UNC: 3015 (N,P), 3113 (P); NAU: 2382 (P,C), 2383 (N,P,M); NAS: 3527 (N,P,M).

### NAJADACEAE

*POTAMOGETON OAKESIANUS* Robbins. In a small pool bordered by *Decodon verticillatus* along the north shore of Naushon, near the east end. NAU: 3867 (N,P,M).

*P. PULCHER* Tuckerm. The commonest Pondweed on the islands; met with frequently in the small pond holes, where it often continues to grow upon the mud after the ponds become dry in late summer. This species produces fruit rather abundantly. UNC: 2997 (G,N,P), 3013 (P,M); NAU: 711 (P); PAS: 710 (P,M); NAS: *Faxon, C. E.*, no date (G), 3505 (N).

*P. BUPLEUROIDES* Fernald. Found growing abundantly in Gosnold or West End Pond on Cuttyhunk on July 15, 1925. This pond, formerly fresh, had evidently been inundated by the sea the preceding winter; it has remained brackish ever since. CUT: 1001 (P,W).

[*P. PUSILLUS* L. is reported by Mrs. Northrop for Nashawena but no specimen has been seen. Inasmuch as *P. pusillus* has been a source of considerable confusion and there is no way of deciding the correct application of this name without material this record can not be allowed.]

*P. DIVERSIFOLIUS* Raf. *P. hybridus* of the Manual, in part. Collected only from the sandy borders of the dune ponds on Nashawena, but probably more widespread. NAS: 1083 (P,W), 1775 (N,P).

*P. PECTINATUS* L. Abundant in a somewhat brackish pond along the south shore of Nonamesset; should be found elsewhere. NON: 2875 (N,P).

*RUPPIA MARITIMA* L., var. *LONGIPES* Hagström. See Fernald & Wiegand, RHODORA, xvi. 125 (1914). NON: 2246 (N,P,M,C), 2876 (N); NAU: *Pennell* 3151 (W); CUT: 2333 (G,N,P,M,C).

All of the material of *R. maritima* with long podogynes (1-6 cm.) seems to have, at least in maturity, peduncles which are well over 3 cm. in length and which are often much longer and usually spiralled.

If var. *rostrata* Agardh, with mature peduncles 0.5–3 cm. long, occurs on these islands it has still to be collected.

*R. MARITIMA* L., var. *SUBCAPITATA* Fernald & Wiegand. *RHODORA*, xvi. 126 (1914). NON: 2251 (N,P); NAU: *Duggar*, July, 1911 (G); *Pennell* 3152 (P,W); PAS: 712 (N,P,W).

This variety with very short podogynes (2–6 mm.) was originally described from material collected on Naushon. Its range has since been extended from Quebec and Prince Edward Island to Block Island, Rhode Island.

*ZOSTERA MARINA* L. Frequent in the shallow coves and small tidal streams. NON: 2285 (G,N,P); NAS: *Northrop* (o); PEN: 464 (W), 1762 (N,P).

Material collected in Sheep Pen Harbor on Nonamesset and from near the landing on Penikese is remarkable for the copiousness with which it produces flowers and fruits; this fact has been observed without fail for several seasons.

### JUNCAGINACEAE

*TRIGLOCHIN MARITIMA* L. Apparently rare on the Elizabeth Islands, although common in brackish marshes on the adjacent mainland. NAS: *Northrop*, Aug. 1901 (Y).

### ALISMACEAE

*SAGITTARIA LATIFOLIA* Willd. Not common; swampy hollow in woods near Tarpaulin Cove. NAU: 2384 (N).

*S. LATIFOLIA* Willd., forma *HASTATA* (Pursh) Robinson. Form with very narrow, acute leaves. UNC: 3003 (N).

### HYDROCHARITACEAE

*VALLISNERIA AMERICANA* Michx. *V. spiralis* of Manual; see Fernald, *RHODORA*, xx. 108 (1918). Abundant in "Sheep Pond" near west end of Cuttyhunk. CUT: 2532 (G,N,P,M).

### GRAMINEAE

*ANDROPOGON SCOPARIUS* Michx., var. *FREQUENS* Hubbard. See *RHODORA*, xix. 103 (1917). Abundant everywhere on open hills and sandy lowlands. NON: 2585 (P,C), 2911 (N,P,M); UNC: 3109 (N), NAU: 3924 (N,P,M); PAS: *Svenson*, Sept. 8, 1926 (N), 3753 (P); CUT: *Sanford*, Aug. 15, 1917 (N).

*A. SCOPARIUS* Michx., var. *POLYCLADOS* Scribn. & Ball. *A. littoralis* Nash. *A. scoparius*, var. *littoralis* (Nash) Hitchc. See *RHODORA*, xix. 103 (1917). Collected on the white sand beach bordering West End Pond on Naushon. NAU: 2940 (G,N,P).



*A. GLOMERATUS* (Walt.) B. S. P. Seen only in a low brackish marsh near the east end of Naushon; probably more abundant. NAU: 3333 (N,P,M).

*A. VIRGINICUS* L. Open grassland and pond borders: material collected on Nonamesset has conspicuously hairy lower leaves and sheaths. NON: 3915 (N,P,M,C); UNC: 3118 (N).

*A. FURCATUS* Muhl. Sandy fields and clearings; not common. UNC: 3011 (N,P); NAU: 2603 (N,P).

*Digitaria sanguinalis* (L.) Scop. Disturbed sandy areas. UNC: 3107 (P,M), 3053 (N,P); PEN: *Jordan* (o).

*PASPALUM SETACEUM* Michx. Found growing abundantly on the exposed grassy slopes at the extreme east end of Nashawena. NAS: 3549 (N,P).

This grass, rare in New England, is known elsewhere in Massachusetts only from Nantucket. See Weatherby, RHODORA, xxx. 133 (1928).

*P. PUBESCENS* Muhl. Including *P. Muhlenbergii* Nash. See Weatherby, RHODORA, xxx. 134 (1928). Abundant everywhere on open grassy hillsides. UNC: 2967 (N,P), 3642 (P); NAU: 2599 (N), 3885 (P,C); CUT: *Sanford*, Aug. 15, 1917 (N), 2538 (N,P,M).

*PANICUM CAPILLARE* L. Seen growing only along border of salt marsh at west end of Nonamesset. NON: 2899 (N,P,M).

*P. DICHOTOMIFLORUM* Michx. Occasional in moist grassy hollows. NON: 3197 (N,P).

*P. VIRGATUM* L., var. *SPISSUM* Linder. RHODORA, xxiv. 14 (1922). This variety with densely tufted culms seems entirely to replace the species on the Elizabeth Islands. Common in open grassland, wet hollows and sandy clearings. NON: 2632 (P); UNC: 3030 (N,P,M); NAU: 3908 (N,P); PAS: 3763 (P,C), 3786 (N,P,M); NAS: 2360 (N,P); PEN: 1093 (P,W).

*P. LONGIFOLIUM* Torr. This species, known elsewhere in Massachusetts only from Marion, Plymouth County, was collected in the peaty and boggy hollows at the east end of Pasque on August 28, 1928. See Fogg, RHODORA, xxxi. 39 (1929). PAS: 3787 (N,P,W).

*P. DEPAUPERATUM* Muhl., var. *PSILOPHYLLUM* Fernald. RHODORA, xxiii. 193 (1921). This species is represented on the islands only by the smooth-leaved variety. Grassy and sandy slopes. NON: 2579 (N); NAU: 2491 (N,P), 3319 (P).

*P. DICHOTOMUM* L. Mostly in open sandy woods. NON: 2650 (N), 3423 (P,M); NAU: 2478 (N,W), 2483 (P), 3906 (N,P,C).

*P. LINDHEIMERI* Nash, var. *FASCICULATUM* (Torr.) Fernald. *P. huachucae* Ashe. *P. huachucae*, var. *silvicola* Hitchc. & Chase. *P. tennesseense* Ashe. See Fernald, RHODORA, xxiii. 223 (1921). NON: 2295 (N,P,W), 2301 (W,C), 2589 (P), 2633 (P,M), 2648 (P,W), 2660 (N), 3176 (P), 3374 (P,U), 3375 (P), 3376 (P,U), 3420 (P,U); NAU: 2931 (N,P), 3903 (P,U); CUT: 2266 (N,P,M), 3433 (P,U,C), 3456 (P,U); PEN: 478 (N,P,W), 3405 (P).

This is the most ubiquitous and the most variable *Panicum* on the islands. Of the specimens cited Mrs. Agnes Chase, who has kindly examined some of the material from the Elizabeths, has designated no. 3374 as *P. implicatum* Scribn., no. 3420 as typical *P. huachucae* Ashe, and nos. 3376, 3433, 3456 and 3903 as *P. huachucae*, var. *silvicola* Hitchc. & Chase. In speaking of no. 3420 Mrs. Chase says, "The pubescence on upper surface of blades varies from very scant or almost wanting to fairly copious." Thus, degree of pubescence varies, not only as between separate plants, but in different parts of the same plant and, in view of the many intermediates which make it impossible here to draw sharp specific or even varietal lines, it seems best to follow the more conservative treatment of this species proposed by Fernald, l. c. p. 226. Viewed in this light, the Elizabeth Islands material with spikelets 1.5–2.1 mm. long and leaf-blades short-pilose to glabrous above, falls into the variety *fasciculatum*.

*P. MERIDIONALE* Ashe. Abundant on exposed grassy slopes. Often very slender with leaves not over 1.5 mm. wide. NON: 2582 (P); NAU: Taylor, July 24, 1917 (P); NAS: 2452 (N), 3550 (N,P); CUT: 2537 (N,P); PEN: 3404 (P).

*P. ALBEMARLENSE* Ashe. This southern species, found abundantly in recent years on the "Middle" Cape, is known from two stations on the Elizabeth Islands, both of them exposed sandy areas. UNC: 3082 (N,P); CUT: 2264 (N,P,W).

*P. ORICOLA* Hitchc. & Chase. Sandy woods, hillsides and pond borders. NAU: 718 (W), 2492 (P), 2714 (N), 3681 (P); NAS: 2359 (N), 3466 (P); PEN: 479 (P,W).

The lines between this and *P. meridionale* are not always sharp; in fact, the two behave more like varieties of one polymorphic species. Differences in size of spikelets are trivial, pubescence cannot be relied upon, and habit varies with the situation in which these plants grow. To be sure, there is a well marked *meridionale* extreme and an equally characteristic *oricola* one, but between them an almost complete series of integrations.

*P. COMMONSIANUM* Ashe. Met with only on an open sandy bank along the north shore of Naushon, west of Kettle Cove. NAU: 3875 (N,P,M,C).

*P. SPHAEROCARPON* Ell. Occasional on open grassy downs. NON: 2647 (N,W), 3419 (P); NAS: 3556 (N).

*P. CLANDESTINUM* L. Sandy woods and clearings; not common. UNC: 3041 (N); NAU: 3148 (N,P).

*Echinochloa Crusgalli* (L.) Beauv. A weed near cultivated areas. UNC: 3063 (N); NAS: Northrop (o); PEN: 1092 (P, W).

*E. WALTERI* (Pursh) Nash. Moist, usually brackish, situations. NON: 3188 (N); UNC: 2992 (N); NAU: 3156 (C), 3888 (P,M,C).

*SETARIA GENICULATA* (Lam.) Beauv. See Hitchc. Contr. U. S. Nat. Herb. xxii. 168 (1920). Open grassland and around borders of brackish areas. NON: 2695 (N,P); UNC: 3033 (N,P), 3103 (N,P).

This species is in urgent need of further study, for even a casual examination of a large series of specimens is sufficient to indicate that our perennial Foxtail of the salt marshes of New England is distinct from the far-ranging southern plant which occurs in tropical and subtropical America.

*S. glauca* (L.) Beauv. See RHODORA, xxxi. 109, 110 (1929). Disturbed sandy area near beach. UNC: 3098 (N).

*S. viridis* (L.) Beauv. Reported by Jordan from Penikese; no specimen.

*CENCHRUS PAUCIFLORUS* Benth. *C. carolinianus* of Manual. See Chase, Contrib. U. S. Nat. Herb., xxii. 67 (1920). Seen only in sandy field near east end of Pasque. PAS: 3766 (N,P,M,C).

[*C. TRIBULOIDES* L., reported by Mrs. Northrop from Nashawena, probably refers to the preceding. *C. tribuloides* is unknown east of Long Island.]

*LEERSIA ORYZOIDES* (L.) Sw., forma *INCLUSA* (Wiesb.) Fogg. See RHODORA, xxx. 81 (1928). The only material of the Rice Cut-grass seen on the islands grew on the sandy margin of Mary's Lake and had the panicles enclosed within the upper leaf-sheaths. NAU: 3135 (G,N,P,M).

*Phalaris canariensis* L. Sandy area near landing at east end of Pasque. PAS: 1794 (P).

*Anthoxanthum odoratum* L. Everywhere in open grassland. NON: 2250 (N,P,M); NAU: 3315 (P,C); PEN: 468 (N,P,W,M).

*STIPA AVENACEA* L. Apparently rare and local. NAS: Northrop (o), 3560 (P).

*ARISTIDA PURPURASCENS* Poir. Abundant on exposed hillsides, especially on Naushon. NAU: 1010 (P,W), 3140 (N), 3683 (P).

*Phleum pratense* L. Seemingly only on outer islands, where abundant on open slopes. CUT: 2280 (N); PEN: 480 (W).

*AGROSTIS STOLONIFERA* L. *A. alba* of most American authors, not L. See Malte, Canada Dept. Mines, Bull. no. 50. (1926). Grassland and sandy fields. NON: 2653 (N), 3418 (P); PAS: 3772 (P); NAS: Pennell 2914 (P); PEN: 3390 (N,P).

*A. STOLONIFERA* L., var. *COMPACTA* Hartm. *A. alba*, var. *maritima* (Lam.) Mey. See Malte, l. c. Beaches and brackish situations. NON: 2721 (P), 3417 (N); NAU: 2713 (N); PEN: 3397 (N,P,M,C).

*A. TENUIS* Sibth. *A. vulgaris* With. *A. alba*, var. *vulgaris* (With.) Thurb. Doubtfully *A. capillaris* L. See Malte, l. c. Dry hillsides and hollows. NON: 3352 (P); PEN: 466 (P,W), 3391 (P).

A. HYEMALIS (Walt.) B. S. P. Sandy woods; occasional. NAU: Pennell 3124 (W,P), 3918 (N).

A. PERENNANS (Walt.) Tuckerm. Sandy woods and clearings; more frequent than the preceding. NAU: 2679 (P), 3881 (N,P), 3904 (N).

CALAMAGROSTIS CANADENSIS (Michx.) Beauv. Wet hollows and borders of ponds. NON: 3359 (N); NAS: 1007 (P,W), Williams, July 10, 1911 (N); CUT: 3453 (P,M).

C. CINNOIDES (Muhl.) Barton. Seen only in a boggy thicket near Job's Neck. NAU: 2604 (N,P).

AMMOPHILA BREVILIGULATA Fernald. *A. arenaria* of Manual. See Fernald, RHODORA, xxii. 70 (1920). Cobble and sandy beaches. NON: 2698 (N,P,M,C); UNC: 3058 (N); PEN: 467 (W).

*Holcus lanatus* L. Ubiquitous in grassland and sandy fields and clearings. NON: 2291 (N,P); NAU: 2709 (N,P); NAS: Northrop (o); CUT: Taylor 2408 (P), 3455 (P,C); PEN: 477 (N,P,W,M).

DESCHAMPSIA FLEXUOSA (L.) Trin. Dry woods near Tarpaulin Cove. NAU: 1009 (N,P,W).

*Avena sativa* L. Sandy soil near cultivated area. PEN: 469 (W).

DANTHONIA SPICATA (L.) Beauv. Abundant on dry knolls and open clearings. NON: 2249 (N,P), 2658 (P); PEN: 473 (P,W).

Several trends are evident in material of this species from these islands and elsewhere in eastern North America. Specimens collected from the beach near French Watering Place, Naushon, for example, have lemmas with the aristate teeth of *D. sericea*, although lacking the pubescence of that species. This material can be satisfactorily referred to nothing included in our existing treatments of the genus. It is hoped that the intensive study of our American material already embarked upon by the writer may lead to a better understanding of these puzzling forms. A large series of collections is being held for critical examination and comparison with types, but the preceding may be referred to as fairly typical of *D. spicata* as it is commonly understood.

SPARTINA MICHAUXIANA Hitchc. Boggy hollows and pond margins, often near shore. NON: 2908 (N); NAU: 2380 (N); NAS: 2341 (N,P); CUT: 3440 (P).

S. ALTERNIFLORA Loisel., var. PILOSA (Merrill) Fernald. *S. glabra*, var. *pilosa* Merrill. See Fernald, RHODORA, xviii. 179 (1916). Brackish marshes and upper borders of beaches. NON: 2896 (P), 2909 (P), 2910 (N,P,M); UNC: 3095 (N,P); NAU: 3685 (N); PAS: Svenson, Sept. 8, 1926 (N); PEN: 482 (P,W).

S. PATENS (Ait.) Muhl. Brackish marshes; fairly common. NON: 2292 (N,P,M,C); NAS: Northrop (o); PEN: 483 (P,W).

S. PATENS (Ait.) Muhl., var. JUNCEA (Michx.) Hitchc. Seen grow-

ing only on sandy upper beach on Uncatena. NON: *Cushman* 126 (B); UNC: 3049 (N).

*S. PATENS* (Ait.) Muhl., var. *CAESPITOSA* (A. A. Eaton) Hitchc. This variety, characterized by its densely tufted habit, was collected in a brackish marsh near Tarpaulin Cove, where it formed a dense turf. NAU: 2377 (N,P).

*DIPLACHNE MARITIMA* Bickn. Bull. Torr. Bot. Cl. xxxv. 195 (1908.) Found only along a brackish ditch near Tarpaulin Cove. NAU: 3889 (N,P,M).

*PHRAGMITES COMMUNIS* Trin. Occasional in swampy situations. NAU: 1803 (N,P,W), 2608 (P); NAS: *W. Faxon*, Aug. 1873 (G), *Northrop*, Aug. 1901 (Y).

*TRIPLASIS PURPUREA* (Walt.) Chapm. Abundant on beaches and low sandy stretches. NON: 2871 (N,P,W,M,C); UNC: 3009 (N,P,M); NAU: 2510 (N), 2732 (P); PAS: 3754 (P).

*ERAGROSTIS PECTINACEA* (Michx.) Steud. Common everywhere on open grassland and in sandy clearings, except on the outer islands. NON: 2580 (P,W), 3167 (N); UNC: 3651 (P); NAU: 3919 (N,P,C); PAS: 3765 (P,M); NAS: *Northrop*, Aug. 1901 (Y).

An intensive search has failed completely to reveal var. *spectabilis* Gray with smooth sheaths, which is abundant on Martha's Vineyard and Nantucket.

*DISTICHLIS SPICATA* (L.) Greene. With *Spartina patens* in brackish marshes. NON: 2901 (P), 3208 (N); UNC: 2694 (P), 3097 (N); PAS: 3737 (P,M); PEN: 1091 (P,W).

*Dactylis glomerata* L. Sandy soil near cultivated area on Penikese; otherwise not seen, although probably more general. PEN: 472 (N,P,W,M).

*Poa annua* L. Not common. Disturbed sandy areas on two of the islands. NAU: 3311 (P); PEN: 3389 (P).

[*P. SEROTINA* Ehrh. Reported by Jordan from Penikese. This may refer to *P. palustris* L. (*P. triflora* Gilib.), but, in the absence of material, it seems best to disregard the record.]

*P. PRATENSIS* L. Fairly common on open downs. NON: 3249 (N,P), 3351 (P); PEN: 481 (P,W), 3388 (N,P,M).

*GLYCERIA OBTUSA* (Muhl.) Trin. Pond borders and moist hollows. NAU: 2934 (N,P); NAS: *Northrop*, Aug. 1901 (Y), 2348 (N,P,C).

*G. CANADENSIS* (Michx.) Trin. Border of *Decodon* swamp near Tarpaulin Cove. NAU: 2396 (N,P).

*G. STRIATA* (Lam.) Hitchc. *G. nervata* (Willd.) Trin. Boggy woods; apparently local. NAU: 2479 (N).

*G. PALLIDA* (Torr.) Trin. Swampy woods and wet hollows. NON: 2575 (N,P), 3358 (P), 3371 (P); NAU: 2470 (P); NAS: 3525 (N,P,M,C).

*G. ACUTIFLORA* Torr. Found almost completely submerged in several small ponds on Nonamesset and one on Nashawena. NON: 2243 (G,N), 3344 (P), 3380 (P,C); NAS: 3524 (N,P,M).

[PUCCINELLIA MARITIMA (Huds.) Parl. Reported by Jordan from Penikese but probably refers to the following which, though unknown from Penikese, grows on the neighboring island of Cuttyhunk.]

P. PAUPERCUA (Holm) Fernald & Weatherby, var. ALASKANA (Scribn. & Merr.) Fernald & Weatherby. RHODORA, xviii. 18 (1916). Abundant on mud flats bordering Cuttyhunk Pond. CUT: 3572 (N,P,W,M,C).

*Festuca Myuros* L. Edge of sandy road leading to Tarpaulin Cove. NAU: 2509 (N,P).

F. OCTOFLORA Walt. Apparently not general. NON: Pennell 2847 (W).

F. RUBRA L. One of the commonest grasses on the islands. Gravel banks, borders of beaches, open downs, sandy clearings, etc. NON: 2845 (W,P), 3349 (P), 3350 (N,P), 3370 (P), 3416 (P); NAU: 2712 (N,P,M), 3877 (N,P,C); CUT: 2279 (N,P); PEN: 476 (N,P,W).

Extremely variable as to habit, texture of foliage and degree of glaucousness.

F. OVINA L. Reported by Mrs. Northrop from Nashawena and by Jordan from Penikese. No material seen, but this record is allowed to stand for the present.

*F. elatior* L. Found only on Penikese, where abundant in certain areas. PEN: 475 (P,W).

*Bromus secalinus* L. Growing in dry sandy ground along east shore of Penikese. PEN: 470 (W).

*B. hordeaceus* L. Disturbed sandy areas on Nonamesset and along path near landing on Penikese. NON: Pennell 2839 (W), 3304 (N,P), 3347 (P,M,C); PEN: 3412 (N,P).

*Agropyron repens* L. Apparently not abundant except on outer islands, where it takes possession of large sandy areas. CUT: 2278 (N,P,M); PEN: 465 (W), 3387 (N,P).

ELYMUS VIRGINICUS L. Collected only on Gull Island, Penikese, where the plant is unusually robust. Reported by Jordan from Penikese proper, but not seen there recently. PEN: 474 (N,P,W).

E. VIRGINICUS L., var. HALOPHILUS (Bickn.) Wiegand. RHODORA, xx. 83 (1918). Dry sandy banks facing the sea at west end of Uncatena. UNC: 3119 (N), 3648 (P).

### CYPERACEAE

CYPERUS DIANDRUS Torr. Wet depressions and pond borders. NON: 3198 (N); UNC: 3021 (N); NAU: 2737 (N,P,W).

C. RIVULARIS Kunth. Seen only growing with the preceding on grassy bank bordering French Watering Place. NAU: 2739 (N); NAS: Northrop (o).

C. FILICINUS Vahl. *C. Nuttallii* Eddy. Borders of fresh ponds and low brackish areas. NON: 2700 (N,P), 2889 (P); UNC: 3007 (N,P), 3048 (P); NAU: Cushman 313 (B), 2725 (N), 3864 (P).

*C. DENTATUS* Torr. Not common; sandy margins of several ponds on Naushon. NAU: 2467 (C), 2920 (P,M), 2935 (N,P,M).

*C. ERYTHORRHIZOS* Muhl. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*C. FERAX* Rich. Borders of brackish marshes and low swales; not common. NON: 2897 (N); NAU: 2369 (G,P,C), 3155 (N,P,W,M).

*C. STRIGOSUS* L. Of rather frequent occurrence in pond-holes, borders of salt marshes, upper beaches, and moist clearings. NON: 2665 (P); UNC: 2982 (P), 2991 (N,P), 3057 (W); PAS: 3781 (P).

*C. STRIGOSUS* L., var. *ROBUSTIOR* Kunth. Moist depression in open hills. UNC: 3083 (N,P,W).

*C. STRIGOSUS* L., var. *COMPOSITUS* Britton. Small pond-hole at west end of island. UNC: 3020 (N,P,W).

*C. FILICULMIS* Vahl, var. *MACILENTUS* Fernald. Dry open ground and sandy clearings everywhere. NON: 2587 (N); UNC: 3061 (N); NAU: 742 (P,W); PAS: 3769 (N); NAS: *Northrop*, as "*C. filiculmis*" (o), 3553 (P); CUT: *Sanford*, Aug. 15, 1917 (N), 2265 (P,M).

*DULICHIMUM ARUNDINACEUM* (L.) Britton. Swampy hollows. NAU: 745 (W); PAS: 744 (W); NAS: *Northrop*, Aug. 1901 (Y), 2343 (N,P); CUT: *Sanford*, Aug. 15, 1917 (N).

*ELEOCHARIS PARVULA* (R. & S.) Link. *Scirpus nanus* Spreng. See Svenson, RHODORA, xxxi. 168 (1929). Brackish ponds and salt marshes. NON: 2287 (P,M), 2708 (N,P); UNC: 3050 (P); NAU: 1804 (N); NAS: *Pennell* 2924 (W).

*E. OBTUSA* (Willd.) Schultes. Moist hollows and pond margins. NON: 2574 (P,M), 3204 (N,P); NAS: *Northrop*, Aug. 1901, labelled "*E. ovata*" (Y); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 485 (W).

*E. ACICULARIS* (L.) R. & S. Peaty and sandy pond borders: apparently not common. NON: 2913 (N,P); NAU: 2507 (N,P,M); PEN: *Jordan* (o).

*E. SMALLII* Britton. See Fernald & Brackett, RHODORA, xxxi. 57-77 (1929). Peaty and boggy pond margins and low swampy areas. UNC: 3002 (N,P); NAS: 3498 (N,P,M,C); CUT: 746 (P,W); PEN: 849 (P,W).

*E. UNIGLUMIS* (Link.) Schultes. See Fernald & Brackett, l. c. 71. This essentially boreal sedge is near the extreme southern limit of its range on Cuttyhunk where, on August 11, 1927, it was collected from the peaty margin of Sheep Pond. CUT: 2526 (N).

*E. UNIGLUMIS* (Link) Schultes, var. *HALOPHILA* Fernald & Brackett, l. c. 72. Sandy or peaty margins of brackish ponds; rather frequent. NON: 2703 (N,P,M,C), 2912 (P,M); NAU: 1028 (N,P,W), 3316 (P); NAS: *Williams*, July 10, 1911 (N), 1029 (P,W).

*E. ROSTELLATA* Torr. Apparently infrequent. Seen only from a low brackish marsh along the north shore of Naushon near Kettle Cove. NAU: 3878 (N,P,M,C).

*FIMBRISTYLIS AUTUMNALIS* (L.) R. & S. *F. Frankii* Steud. See Blake, RHODORA, xx. 25 (1918). Grassy pond borders. NON: 3199 (N,P); NAU: 2738 (N,P).

*SCIRPUS AMERICANUS* Pers. Everywhere bordering ponds, both fresh and saline. NON: 2239 (P), 2888 (M); UNC: 2998 (P), 3025 (N); NAU: 2375 (P), 2921 (N), 2923 (P), 2723 (P,C); NAS: *Northrop*, Aug. 1901 (Y), *Pennell* 2910 (W), *Williams*, July 10, 1911 (N), 2355 (P,M); CUT: *Sanford*, Aug. 15, 1917 (N), 2277 (P,M); PEN: 486 (P,W).

*S. OLNEYI* Gray. Seen growing at edge of salt marsh along south shore of Nonamesset; probably more general. NON: 2898 (N,P); NAS: *Northrop*, Aug. 1901 (Y).

*S. VALIDUS* Vahl. Common in wet depressions and swampy borders of ponds. NON: 2244 (N,P); UNC: 2999 (N,P); NAU: 1033 (P,W); NAS: *Northrop*, as "*S. lacustris*" (o); CUT: 3573 (P); PEN: 488 (N,P,W,M).

*S. ROBUSTUS* Pursh. Not common. NAS: *Northrop*, Aug. 1901 (Y)

*S. CAMPESTRIS* Britton, var. *PALUDOSUS* (A. Nelson) Fernald. Occasional in brackish marshes. NON: 2288 (P,M), 3209 (N,P); PEN: 487 (N,P,W,M,C).

*S. CAMPESTRIS* Britton, var. *NOVAE-ANGLIAE* (Britton) Fernald. Collected only from swampy clearing in woods near Job's Neck. NAU: 3154 (N,P).

*S. CYPERINUS* (L.) Kunth. Everywhere in wet depressions and around ponds. NON: 2566 (N,P), 3169 (P,M); UNC: 2990 (N,P); NAU: 2922 (N,P,M), 3149 (P); PAS: *Svenson*, Sept. 8, 1926 (N), 3791 (C); NAS: *Northrop* (o), 2340 (N,P); CUT: 2308 (N,P).

*S. CYPERINUS* (L.) Kunth, var. *PELIUS* Fernald. Found only along the edge of a swamp near Tarpaulin Cove. NAU: 2395 (N).

*ERIOPHORUM TENELLUM* Nutt. Occasional in boggy situations. NAU: *Pennell* 2905 (P); NAS: *Northrop*, Aug. 1901, labelled "*E. gracile*" (Y); CUT: 1030 (N).

*E. VIRGINICUM* L. Rather frequent in open bogs and wet peaty hollows. NON: 2879 (N,P,M), 3180 (P); PAS: 3792 (N,P), *Svenson*, Sept. 8, 1926 (N); NAS: *Northrop* (o), 3497 (P); CUT: *Sanford*, Aug. 15, 1917 (N), 1014 (P,W), 2517 (P,C).

*RYNCHOSPORA FUSCA* (L.) Ait. f. Apparently rare; seen only in a low, boggy hollow near Tarpaulin Cove. NAU: 2512 (P,W).

*R. ALBA* (L.) Vahl. Open bogs and peaty depressions; seemingly not abundant, although plentiful in an extensive bog at the west end of Cuttyhunk. NAS: *Northrop*, Aug. 1901 (Y); CUT: 2319 (N,P).

*R. CAPITELLATA* (Michx.) Vahl. *R. glomerata* of Manual in part. See Blake, *RHODORA*, xx. 25 (1918). Much more common than the preceding. Bogs, pond-holes and pond borders. NON: 2644 (N); UNC: 3014 (N,P), 3116 (P,M,C); NAU: 2393 (N); PAS: 1782 (N,P); NAS: 3471 (P).

*MARISCUS MARISCOIDES* (Muhl.) Kuntze. *Cladium mariscoides* Torr. See *RHODORA*, xxv. 49 (1923). Mostly on sandy beaches bordering ponds. NAU: 2924 (N); PAS: 3776 (P); NAS: *Pennell* 2917 (W), 2339 (N); CUT: 740 (P,W).



*CAREX SCOPARIA* Schkuhr. Not common on the Elizabeth Islands. Dryish border of small pond. NON: 3384 (N,P,M,C); PEN: Jordan (o).

*C. SCOPARIA* Schkuhr, var. *SUBTURBINATA* Fernald & Wiegand. *RHODORA* xiv. 115 (1912). Seen around margin of *Decodon* swamp near Tarpaulin Cove. NAU: 2399 (N).

*C. LONGII* Mackenzie. *C. albolutescens* of Manual. See Mackenzie, Bull. Torrey Bot. Club, xlix. 372 (1922). Frequent in open grassland. UNC: 3078 (N), 3099 (P); NAS: 3469 (P); CUT: Sanford, Aug. 15, 1917 (N), 1013 (N,P,W,M); PEN: 848 (N,P,W).

*C. STRAMINEA* Willd. This is the plant with obovate perigynia selected by Mackenzie as true *C. straminea*; see Bull. Torrey Bot. Club, xlii. 603 (1915). It has been found growing only on the edge of a bog at the west end of Cuttyhunk. CUT: 2327 (N,P).

*C. HORMATHODES* Fernald. Moist, occasionally brackish, situations as well as dry slopes near shores. NON: 2297 (N); UNC: 3644 (P); NAS: Williams, July 10, 1911 (N); CUT: 726 (P,W); PEN: 1754 (N,P).

*C. SILICEA* Olney. Dry, sandy banks and hillsides. PAS: 1780 (N,P); CUT: 2258 (N), 2267 (P,M,C); PEN: 1497 (P), 1498 (N,P,W).

*C. ALATA* Torr. Plentiful around edge of an extensive boggy area near the center of Nashawena. NAS: 2486 (N,P).

*C. FESTUCACEA* Schkuhr. This is the small-fruited sedge retained by Mackenzie as genuine *C. festucacea*. See Bull. Torrey Bot. Club, xlii. 604 (1915). Apparently rare and local on the islands. NAU: 736 (N,P).

*C. HOWEI* Mackenzie. *C. scirpoides*, var. *capillacea* (Bailey) Fernald. See Mackenzie, Bull. Torrey Bot. Club, xxxvii. 245 (1910). Abundant in boggy woods and pond borders. NON: 2654 (N,P,M), 2659 (P), 3377 (C), 3299 (P); NAU: 728 (W), 1018 (P,W), 1088 (P,W); NAS: Pennell 2922 (W), 3542 (N,P); CUT: 727 (P,W).

*C. INCOMPERTA* Bicknell. Bull. Torrey Bot. Club, xxxv. 494 (1908). NAU: Pennell 2907 (G,W).

*C. SEORSA* E. C. Howe. Seen growing only in a boggy wooded hollow on the south shore of Nonamesset. NON: 3379 (N,P).

*C. CEPHALANTHA* (Bailey) Bicknell. *C. stellulata*, var. *cephalantha* (Bailey) Fern. See Bull. Torrey Bot. Club, 1. 346 (1923). Boggy woods at east end of Nashawena. NAS: 3643 (P).

*C. CANESCENS* L., var. *DISJUNCTA* Fernald. Boggy woods and wet borders of ponds. NON: 3378 (N), 3398 (P); NAU: Williams, July 10, 1911 (N), 1019 (P,W).

*C. BRUNNESCENS* Poir., var. *SPHAEROSTACHYA* (Tuckerm.) Kükent. See Fernald, *RHODORA*, xxviii. 162 (1926). Rare. Boggy hollow in woods at east end of Naushon, NAU: 2480 (P,W).

*C. ROSEA* Schkuhr, var. *RADIATA* Dewey. Apparently local. Collected in dry sandy woods at east end of Naushon. NAU: 2475 (P,W).

*C. contigua* Hoppe. *C. muricata* of most American authors. See Mackenzie, Bull. Torrey Bot. Club, 1. 236 (1923). Dry, open, sandy ground. NAU: 734 (P,W); CUT: 2283 (N,P), Taylor 2413 (P); PEN: 484 (P,W).

*C. MUHLENBERGII* Schkuhr. Rather frequent on exposed downs and in sandy clearings. NON: Pennell 2838 (W), 2245 (N), 3361 (P,M); NAU: 733 (W).

*C. CEPHALOPHORA* Muhl. Sandy oak and beech woods; local. NON: 2594 (N,P,W); NAU: 2463 (P).

*C. VULPINOIDEA* Michx. Wet depressions. NAU: 2394 (N,P,M,C); NAS: 3485 (N).

*C. LAEVIVAGINATA* (Kükent.) Mackenzie. See Britton & Brown, Ill. Fl. ed. 2, i. 371. (1913). Low, wet hollows; local. NAS: 3473 (P); CUT: 2281 (N).

*C. CRINITA* Lam. Swampy and boggy depressions. NAU: 723 (W); 2398 (P), 2936 (N); NAS: 3475 (P).

*C. MITCHELLIANA* Curtis. See Weatherby, RHODORA, xxv. 17 (1923). Rare on the Elizabeths. NAS: Pennell 2921, labelled "*C. crinita*" (W).

A species of the southern coastal plain ranging north to Cape Cod and Plymouth County.

*C. VIRESCENS* Muhl. Boggy woods; rare and local. NAU: 1020 (P,W), 3141 (N,P,M).

*C. SWANII* (Fernald) Mackenzie. Bull. Torrey Bot. Club, xxxvii. 246 (1910). *C. virescens*, var. *Swanii* Fernald. Dry, open ground and sandy woods. NON: 2588 (N,P), 3354 (P,C); NAU: Pennell 3132 (W), 3680 (N); CUT: 1012 (N,P,W,M), 3452 (P).

*C. COMMUNIS* Bailey. Dry, sandy beech woods; rare. NAU: 3324 (N,P).

*C. VARIA* Muhl. Sandy clearings, exposed knolls and hillsides; widespread. Some of the material approaches the scarcely separable forma *colorata* (Bailey) Kükent. NON: 3284 (N,P,C), 3300 (N,P), 3301 (P), 3285 (P); NAU: 3322 (N,P); NAS: 2361 (N,P,W,M).

*C. PENNSYLVANICA* Lam. Sandy banks and open grassland. NON: 3283 (N,P), 3353 (P,C); NAU: 3321 (N,P,M).

*C. PENNSYLVANICA* Lam., var. *SEPARANS* Peck in E. C. Howe, N. Y. State Mus. 48 Ann. Rep. 174 (1896). Var. *lucorum* (Willd.) Fernald. Seen only in dry beech woods at east end of Naushon. NAU: 2476 (P,W,M,C).

*C. LIMOSA* L. A far northern sedge which reaches the southern limit of its coastwise distribution in a bog at the west end of Cuttyhunk. CUT: 2311 (N,P,W).

*C. DIGITALIS* Willd. Apparently not common; sandy beech woods near Hadley Harbor. NAU: 2461 (P), 3323 (N,P).

*C. DEBILIS* Michx., var. *RUDGEI* Bailey. Collected only in a moist hollow on the hillsides of Cuttyhunk. CUT: 1011 (P).

*C. LANUGINOSA* Michx. Peaty margin of a slightly brackish pond at the extreme west end of Nashawena. NAS: 3500 (N,P).

*C. COMOSA* Boott. Swampy clearings and wet depressions; locally abundant. NON: 2905 (N,P); CUT: *Sanford*, Aug. 15, 1917 (N), 722 (W).

*C. LURIDA* Wahlenb. Pond borders and moist hollows. UNC: 2989 (N,P), 3646 (P,C); NAU: 2385 (N,P,M); NAS: 3474 (N,P).

*C. LUPULINA* Muhl. Boggy clearings and low moist situations. NAU: 2486 (N,P), 3882 (P,M,C); PAS: 519 (P,W); CUT: 731 (P,W).

### ARACEAE

*ARISAEMA TRIPHYLLUM* (L.) Schott. This seems to be the only *Arisaema* on the islands. It is abundant in the boggy and swampy woods at the east end of Naushon, and in similar situations on Nashawena. NAU: 752 (N), 3133 (W), 3317 (P,M,C), 3331 (P); NAS *Northrop* (o), 3528 (N,P).

*SYMPLOCARPUS FOETIDUS* (L.) Nutt. Seen only in a low swampy area at the extreme west end of Nashawena. NAS: *Northrop* (o), 3496 (N,P).

*ACORUS CALAMUS* L. Wet grassy hollows and swampy pond borders; locally abundant. NAS: *Northrop* (o), 3565 (P); CUT: 2282 (N).

### LEMNACEAE

*LEMNA MINOR* L. Occasional in small ponds in clearings. NAU: 2376 (N,P).

### ERIOCAULACEAE

*ERIOCAULON SEPTANGULARE* With. *E. articulatum* (Huds.) Morong. Sandy and peaty pond margins. NAU: *Pennell* 3118 (P), 2508 (P,M), 2942 (N); NAS: *Northrop*, Aug. 1901 (Y).

### XYRIDACEAE

*XYRIS CAROLINIANA* Walt. Apparently not sommon. Sandy beach bordering West End Pond, Naushon. NAU: 2919 (N,P); NAS: *Northrop*, Aug. 1901 (Y).

*X. TORTA* Smith. *X. flexuosa* Muhl. Reported by Mrs. Northrop from Nashawena; no specimen seen.

### PONTEDERIACEAE

*PONTEDERIA CORDATA* L. Collected only in swampy border of dune ponds on Nashawena. NAS: *Northrop* (o), 2368 (N,P), 3547 (P).

### JUNCACEAE

*JUNCUS BUFONIUS* L. Moist sandy or peaty soil. NAS: *Northrop*, Aug. 1901 (Y), *Williams* 1279 (N), *Pennell* 2918 (W), 3467 (P,M); CUT: 3575 (N,P).

*J. GERARDI* Loisel. Brackish areas; general. NON: 2877 (N); PAS: 1779 (P); NAS: *Northrop*, Aug. 1901 (Y); CUT: 2276 (N,P,M,C); PEN: 1094 (P,W), 1753 (N,P).

*J. TENUIS* Willd. Common everywhere; dry woods, gravelly shores, sandy paths and open fields. NON: 3191 (N); UNC: 3645 (P); NAU: 3136 (N); NAS: *Northrop*, Aug. 1901 (Y), 3468 (P); CUT: 3441 (N,P,M); PEN: 492 (P,W), 3400 (P).

Much of the material which has been collected can not satisfactorily be referred here, but is being held pending a critical comparison of our American *J. tenuis* with Old World collections, a comparison which may necessitate a careful revision of the entire species. The preceding few numbers are, however, cited as fairly typical.

*J. TENUIS* Willd., var. *WILLIAMSII* Fernald. This phase, with strongly divergent floriferous branchlets, has been met with occasionally. NAU: 2400 (N), 2710 (P,M).

*J. DICHOTOMUS* Ell. NAU: 1800 (P,W), 3162 (P); PEN: 1756 (N,P,W).

Under this heading is grouped a large series of variations, of which the variety *platyphyllus*, perhaps specifically distinct, represents only one trend. This matter is under consideration at present, and, until the species can be completely studied and revised, a few numbers only, out of an extensive series of collections, are cited.

*J. DICHOTOMUS* Ell., var. *PLATYPHYLLUS* Wiegand. PAS: 1781 (P); CUT: 1039 (P).

*J. GREENEI* Oakes & Tuckerm. This is one of the commonest plants of the dry open hillsides, being found on all of the islands. NON: 2247 (N,P,M,C), UNC: 3130 (P); NAU: 766 (P,W), 1802 (P); PAS: 765 (W); NAS: *Northrop*, Aug. 1901 (Y), 2362 (N); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 491 (N,P,W,M).

*J. EFFUSUS* L., var. *COSTULATUS* Fernald. RHODORA, xxiii. 239 (1921). Abundant in wet hollows and around ponds. NON: 2303 (P,M,C), 2567 (N,P); NAU: 2397 (P); PAS: *Svenson*, Sept. 8, 1926 (N); NAS: *Northrop*, Aug. 1901 (Y), *Williams*, July 10, 1911 (N), 1767 (N,P), 2347 (P); CUT: 2320 (N,P,M); PEN: 852 (P,W).

*J. EFFUSUS* L., var. *SOLUTUS* Fernald & Wiegand. RHODORA, xii. 81 (1910). Collected by the writer only in a boggy hollow in woods near Tarpaulin Cove. NAU: 2883 (N,P,M,C); NAS: *Northrop*, Aug. 1901, on sheet with var. *costulatus* (Y).

*J. CANADENSIS* J. Gay. Abundant in moist depressions and around ponds. UNC: 2994 (P); 3114 (N,P,C); NAU: 2918 (N,P,M); PAS: 3778 (P); NAS: *Northrop*, Aug. 1901 (Y); CUT: *Sanford*, Aug. 15, 1917 (N).

*J. PELOCARPUS* Mey. Sandy shores and sandy or peaty pond borders. NON: 2638 (P), 3203 (N); NAU: 1042 (W), 2379 (P),

2724 (M,C), 2925 (N,P); PAS: 3780 (P); NAS: *Northrop*, Aug. 1901 (Y); PEN: *Jordan* (o).

*J. MILITARIS* Bigel. Sandy and swampy pond margins. NAU: 1038 (P), 2917 (N,P); NAS: *Northrop*, Aug. 1901 (Y), *Williams*, July 10, 1911 (N), *Pennell* 2915 (P,W), 1037 (P,W).

*J. ACUMINATUS* Michx. Abundant in wet depressions and on boggy or peaty borders of small ponds in open hills. NON: 2242 (P,C), 2704 (N), 3163 (N,P,M); UNC: 2995 (N,P); NAU: 1041 (P,W), 2391 (N,P); PAS: 757 (W); NAS: *Northrop*, Aug. 1901 (Y), *Pennell* 2909 (W); CUT: 3442 (P); PEN: 489 (N,P,W,M), 1757 (P,W).

*J. ARTICULATUS* L. Occasional in boggy depressions. PEN: 490<sup>1</sup> (P), 1499 (W).

*J. ARTICULATUS* L., var. *OBTUSATUS* Engelm. Peaty, usually brackish, hollows. NAU: 3866 (N); CUT: 3574 (N,P).

*J. MARGINATUS* Rostk. Muddy borders of ponds. UNC: 3117 (N); NAU: 2390 (N,P,M), 2731 (P); PAS: 3779 (P); NAS: *Northrop*, Aug. 1901 (Y), 3562 (N).

*LUZULA CAMPESTRIS* (L.) DC., var. *MULTIFLORA* (Ehrh.) Čelak. Sandy bank at east end of Nonamesset. NON: 3369 (N).

*L. CAMPESTRIS* (L.) DC., var. *ECHINATA* (Small) Fernald & Wiegand. RHODORA, xv. 38 (1913). Collected only in sandy beech woods on Naushon. NAU: 3325 (N,P).

### LILIACEAE

*UVULARIA PERFOLIATA* L. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*OAKESIA SESSILIFOLIA* (L.) Wats. Seen in a boggy, wooded hollow along the south shore of Nonamesset. NON: 3295 (N,P); NAS: *Northrop* (o).

*LILIUM PHILADELPHICUM* L. Reported by Mrs. Northrop from Nashawena and said by wife of caretaker there to grow abundantly at certain localities on the island today; no specimens seen.

*L. tigrinum* Ker. Found persisting around leper cottages on Penikese. PEN: 494 (P,W).

*Asparagus officinalis* L. In sandy soil near areas under cultivation. NAS: *Northrop* (o); PEN: 493 (N,P,W).

*MAIANTHEMUM CANADENSE* Desf. Abundant in boggy wooded hollow along south shore of Nonamesset. NON: 3296 (N); NAS: *Northrop* (o).

*MEDEOLA VIRGINIANA* L. Boggy woodland on Nonamesset and edge of brackish marsh at east end of Naushon. NON: 3337 (P); NAU: 3332 (N); NAS: *Northrop* (o).

*SMILAX ROTUNDIFOLIA* L. Rather abundant in thickets and wet, overgrown hollows. NON: 2296 (N,P); UNC: 3044 (N); NAS: *Northrop* (o); PEN: 495 (W).

<sup>1</sup>This is the material erroneously reported from Penikese as *J. debilis* Gray in RHODORA, xxvi. 223 (1924).

*S. HERBACEA* L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*S. GLAUCA* Walt., var. *LEUROPHYLLA* Blake. See *RHODORA*, xx. 78 (1918). Known only on basis of Mrs. Northrop's collection from Nashawena. NAS: *Northrop*, "July-Aug." 1901 (Y).

### AMARYLLIDACEAE

*HYPOXIS HIRSUTA* (L.) Coville. Abundant on open, sandy slopes and knolls at west end of Cuttyhunk. NAS: *Northrop* (o); CUT: *Sanford*, Aug. 15, 1917 (N); 2310 (P).

### IRIDACEAE

*IRIS VERSICOLOR* L. Wet depressions and pond borders; abundant. NON: 2678 (N); UNC: 3031 (P), 3121 (N); NAS: *Northrop* (o), 2357 (N); PEN: 496 (P,W).

*I. PRISMATICA* Pursh. Apparently not common; reported and collected by Mrs. Northrop from Nashawena. NAS: *Northrop*, "July-Aug." 1901 (Y).

*SISYRINCHIUM ANGUSTIFOLIUM* Mill. Seen growing only in dry sand along east shore of Penikese, where fairly plentiful. NAS: *Northrop* (o); PEN: 497 (P,W).

*S. GRAMINOIDES* Bicknell. *S. gramineum* Curtis, not Lam. Grassy slopes and pond borders. NON: 2300 (P), 3360 (N,P); CUT: 3449 (N,P,C); PEN: 3408 (N,P,M), 3415 (P).

*S. ATLANTICUM* Bickn. Wet hollows, open slopes and bogs. UNC: 3081 (P); CUT: 771 (W), 2318 (N,P,M,C), *Hervey* (N); PEN: 3401 (P).

### ORCHIDACEAE

*HABENARIA BRACTEATA* (Willd.) R. Br. Reported by Mrs. Northrop as "common in meadow" on Nashawena; no specimen seen. NAS: *Northrop* (o).

This is one of the surprises of the Northrop list. It is hard to believe that the compiler could have confused this species of the damp upland woods with *H. clavellata*, *H. blephariglottis* or *H. lacera*, all of which she likewise reported and the first two of which are represented by specimens at the New York Botanical Garden. It is greatly to be regretted that she did not also collect *H. bracteata*. As it is, however, there seems no course but to let this record stand.

*H. CLAVELLATA* (Michx.) Spreng. Open bogs, boggy pond borders and wet, peaty depressions. NAS: *Northrop*, July 1901 (Y), 3540 (N,P); CUT: *Sanford*, Aug. 15, 1917 (N), 2527 (P.)

*H. ORBICULATA* Torr. NAU: *MacRae*, July 25, 1904 (N).

Collected by Lillian J. MacRae on Naushon, July 25, 1904. Specimen originally in the local herbarium at Woods Hole but since

transferred to the collections of the New England Botanical Club. This, like *H. bracteata*, constitutes another remarkable addition to the flora of southeastern Massachusetts, for this plant has not previously been reported from nearer than Norfolk County.

*H. BLEPHARIGLOTTIS* (Willd.) Torr. Apparently rare; known only from Mrs. Northrop's collection on Nashawena. NAS: *Northrop*, Aug. 1901 (Y).

*H. LACERA* (Michx.) R. Br. Swampy and boggy hollows. NAU: 2606 (N); PAS: 1787 (P); NAS: *Northrop* (o); CUT: 2315 (P), 3576 (N).

*POGONIA OPHIOGLOSSOIDES* (L.) Ker. Locally abundant in open peaty and boggy depressions. PAS: 1789 (P); NAS: *Northrop* (o), *Williams*, July 10, 1911 (N); CUT: 524 (W).

*CALOPOGON PULCHELLUS* (Sw.) R. Br. Not infrequent; usually with the preceding. PAS: 1788 (N,P); NAS: *Northrop* (o); CUT: 523 (W).

*ARETHUSA BULBOSA* L. Mrs. Northrop reports this from Nashawena with the comment "quite common in some places." Unfortunately, no specimen is extant, but there seems to be no good reason for questioning this record. NAS: *Northrop* (o).

*SPIRANTHES BECKII* Lindl. Rare; seen only on dry hillside west of French Watering Place. NAU: 2946 (N).

*S. GRACILIS* (Bigel.) Beck. Dry, grassy, open slopes; fairly abundant. NON: 2622 (N); NAU: 2601 (N); NAS: *Northrop*, Aug. 1901 (Y).

*S. CERNUA* (L.) Richard. Local; wet, peaty hollows. UNC: 3024 (N,P); NAU: *Cushman & Morse*, Aug. 25, 1906 (B).

*LIPARIS LOESELII* (L.) Richard. Local; Mrs. Northrop's comment is "moist hollow in face southern cliffs." Taylor's sheet is from border of Sheep Pond. NAS: *Northrop*, Aug. 1901 (Y); CUT: *Taylor*, July 15, 1919 (N).

*TIPULARIA DISCOLOR* (Pursh) Nutt. This rare orchid, hitherto known on the islands of Massachusetts<sup>1</sup> only from an old collection on Martha's Vineyard, is listed by Mrs. Northrop from Nashawena as "quite common in 3 or 4 localities, c. & ne. part island." Fortunately, in this instance a specimen was preserved and is now in the herbarium of the New York Botanical Garden. NAS: *Northrop*, Aug. 1901 (Y).

### SALICACEAE

[*SALIX AMYGDALOIDES* Andersons. Appears on Mrs. Northrop's Nashawena list. This record probably refers to *S. alba* or some other willow and, in the absence of material, can scarcely be admitted.]

*S. pentandra* L. Introduced on Naushon and Penikese; apparently thriving on latter island. NAU: 3873 (P); CUT: 590 (N,P,W,M,C).

*S. alba* L. ×? This hybrid, probably *S. alba* × *fragilis*, is abund-

<sup>1</sup> See Fogg, *RHODORA*, xxxii. 114 (1930).

ant around a small freshwater pond on Penikese. PEN: 591 (N,P,W, M).

*S. DISCOLOR* Muhl. Reported by Jordan from Penikese; no specimen.

*Populus alba* L. In boggy woods near farmhouse on Nashawena and around dwellings on Penikese. NAS: *Northrop* (o), 3511 (P); PEN: 499 (N,P,W).

*P. TACAMAHACCA* Mill. *P. balsamifera* of most American authors. See Sargent, Jour. Arn. Arb. i. 61 (1919). Reported by Mrs. Northrop for Nashawena; no specimen seen.

*P. BALSAMIFERA* L. *P. deltoides* Marsh. See Sargent, Jour. Arn. Arb., i. 62 (1919). Small clump near landing on Penikese. PEN: 500 (P,W).

### MYRICACEAE

*MYRICA GALE* L. Only locally abundant, as around dune ponds on Nashawena. NAU: *Williams*, July 10, 1911 (N); NAS: *Northrop* (o), 1773 (N,P,W,M).

*M. CAROLINIENSIS* Mill.<sup>1</sup> A common shrub on the Elizabeths; thickets, pond margins, and sheltered hollows in open hills. NON: 2237 (N,P); UNC: 2951 (N); PAS: 1783 (N,P,W); NAS: *Northrop* (o), 2342 (N); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 498 (N,P,W).

### JUGLANDACEAE

*JUGLANS CINEREA* L. On Mrs. Northrop's list for Nashawena; no specimen seen.

*CARYA ALBA* (L.) Koch. Occasional in mixed woods. UNC: 2454 (N,P); NAU: 777 (P,W); NAS: *Northrop* (o).

### BETULACEAE

*CORYLUS CORNUTA* Marsh. *C. rostrata* Ait. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*OSTRYA VIRGINIANA* (Mill.) K. Koch. An important constituent of the native woods, especially on Nonamesset and Naushon. NON: 2593 (N); NAU: 779 (P,W); NAS: *Northrop* (o).

*BETULA LUTEA* Michx. Mrs. Northrop reports two specimens near Choptauk Lake, Nashawena; no material seen.

*B. POPULIFOLIA* Marsh. Bordering woods and in protected hollows, where it often forms dense thickets. NON: 2635 (N,P,M); UNC: 3043 (N,P); NAS: *Northrop* (o); PEN: Jordan (o).

*B. pendula* Roth. Planted and established near eastern end of Naushon. NAU: 2471 (N,P).

*B. pubescens* Ehrh. *B. alba*, var. *pubescens* Spach. With the last. NAU: 2472 (N,P,M).

<sup>1</sup> This was the original spelling employed by Miller, Gard. Dict. ed. 8 (1768) and not *carolinensis*, as usually given.



**FAGACEAE**

**FAGUS GRANDIFOLIA** Ehrh. The most important tree on the islands. Forms a pure stand over large areas on Naushon and Nonamesset, and occurs mixed with other trees on these two islands as well as parts of Uncatena and Nashawena. When growing in the heavier woods this tree apparently does not form fruit, but an occasional isolated specimen in the open will be found laden with nuts. NON: 2592 (N); NAU: 3147 (N); NAS: *Northrop* (o), 3532 (P,M).

**F. GRANDIFOLIA** Ehrh., forma **PUBESCENS** Fernald & Rehder. See Rehder, *RHODORA*, ix. 111 (1907). Occasional with the species. UNC: 3125 (N); NAU: 3137 (P), 3693 (N,P).

**QUERCUS ALBA** L. Abundant; dry sandy woods. NON: 2657 (P); UNC: 3127 (N); NAS: *Northrop* (o), 3531 (P).

**Q. RUBRA** L. A single tree near landing on Penikese, where possibly introduced. PEN: 592 (N,P,W).

**Q. VELUTINA** Lam. Next to the Beech the most important constituent of the wooded areas. NON: 2656 (N), 3309 (P,M), 3916 (P); UNC: 3126 (P); NAU: 780 (P,W), 3880 (P); NAS: *Northrop* (o), 3530 (N,P).

[**Q. MARILANDICA** Moench is reported from Nashawena by Mrs. Northrop but is not represented by a specimen. The Black Jack Oak is unknown northeast of Long Island and it seems probable that this record refers to some other species, possibly a sapling of *Q. velutina*.]

**URTICACEAE**

**ULMUS AMERICANA** L. Reported by Mrs. Northrop from Nashawena, no specimen seen.

*Urtica urens* L. Listed by Mrs. Northrop as growing "about houses" on Nashawena; no specimen seen.

**BOEHMERIA CYLINDRICA** (L.) Sw. Moist woods and pond borders. Extremely variable and its relation to the variety *Drummondiana* not clearly understood. An extensive series has been collected and is being held for further study. The following is typical. NAU: 3151 (N,P,M,C); NAS: *Northrop* (o).

**B. CYLINDRICA** (L.) Sw., var. **DRUMMONDIANA** Weddell. Var. *scabra* Porter. See Fernald, *RHODORA*, xii. 10 (1910). Borders of salt marshes; perhaps distinct from var. *Drummondiana* of the south Atlantic states. CUT: 2523 (N).

**POLYGONACEAE**

**RUMEX BRITANNICA** L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

**R. crispus** L. Waste places and pond margins; often appearing indigenous. NAS: *Northrop* (o); PEN: 598 (N,P,W,M), 3399 (P).

**R. obtusifolius** L. Occasional; the Nashawena collection was made from the swampy margin of thick woods. NAS: *Northrop* (o), 3566 (N); PEN: *Jordan* (o).

*R. VERTICILLATUS* L. Swampy margin of woods at east end of Nashawena with the last. NAS: *Northrop* (o), 3529 (N).

This and Block Island are the only stations for the plant in southeastern New England.

*R. MARITIMUS* L., var. *FUEGINUS* (Phil.) Dusén. *R. persicaroides*, in part, of the Manual. See St. John, RHODORA, xvii. 73 (1915). Brackish situations or muddy pond borders. NAU: 2372 (N,P); PEN: *Moore* 1917 (N), 450 (P,W).

*R. Acetosella* L. Exposed knolls, slopes and sandy clearings. NAS: *Northrop* (o); CUT: 2262 (N); PEN: 597 (N, P, W).

*POLYGONUM GLAUCUM* Nutt. *P. maritimum* of Manual. See Fernald, RHODORA, xv. 69 (1913). Sand and cobble beaches. NON: 2868 (P); UNC: 3051 (N); NAU: *Cushman & Morse*, Aug. 25, 1906 (B), *Williams*, July 10, 1911 (N); NAS: *Northrop*, Aug. 1901 (Y).

*P. AVICULARE* L. Sandy patches; not common. NAS: *Northrop* (o); PEN: 594 (P,W).

*P. PENNSYLVANICUM* L. Not common; borders of small ponds. UNC: 2987 (N).

*P. PENNSYLVANICUM* L., var. *LAEVIGATUM* Fernald. RHODORA, xix. 70 (1917). Moist situations; local. PAS: *Svenson*, Sept. 8, 1926 (N).

*P. HYDROPIPER* L., var. *PROJECTUM* Stanford. RHODORA, xxix. 86 (1927). Seen only from margin of small pond near east end of Nonamesset. NON: 3202 (N).

*P. PUNCTATUM* Ell. *P. acre* HBK. See Stanford, RHODORA, xxix. 77 (1927), where, in a footnote, reason is given for attributing priority to *P. punctatum* over *P. acre*. Pond borders, margins of swamps and wet situations generally. NON: 2893 (N,P,M), 2699 (P,M,C); UNC: 2986 (N,P), 3018 (P); NAU: 2371 (P), 2460 (P,C), 3150 (N,P,M); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 593 (N,P,W).

*P. Persicaria* L. Pond margins and moist depressions. UNC: 3017 (N); PAS: *Svenson*, Sept. 8, 1926 (N); NAS: *Northrop* (o); PEN: 596 (N,P,W,M).

*P. HYDROPIPEROIDES* Michx. Apparently not common. PAS: *Svenson*, Sept. 8, 1926 (N).

*P. OPELOUSANUM* Riddell, var. *ADENOCALYX* Stanford. See RHODORA, xxviii. 28 (1926). Pond borders. NON: 3207 (P); PAS: 3747 (N,P).

*P. Convolvulus* L. Trailing over thicket and low growth surrounding pond. PEN: 595 (N,P,W,M,C).

*P. SCANDENS* L. Covering scrub growth in swampy hollows. NON: 3172 (N,P); UNC: 3038 (N,P).

*P. DUMETORUM* L. This species, with smaller fruit than the preceding, was found only on Pine Island, Nonamesset, where it formed a dense tangle over the other vegetation on the beach. NON: 3912 (N,P).

**CHENOPODIACEAE**

*Chenopodium album* L. Beaches and exposed sandy areas. UNC: 2956 (N); NAS: *Northrop* (o); CUT: *Pennell* 2993 (P); PEN: 1401 (P,W).

ATRIPLEX ARENARIA Nutt. Sea beaches; not abundant. UNC: 3106 (N); PAS: 1793 (N,P), 3756 (P,M); NAS: *Northrop* (o); PEN: *Jordan* (o).

A. PATULA L., var. HASTATA (L.) Gray. One of the commonest plants of the sea beaches and disturbed sandy areas near the shore. UNC: 2978 (N,P); PAS: 1791 (N,P); NAS: *Northrop* (o), 3502 (P); CUT: *Pennell* 2996 (P), 2272 (N); PEN: 1400 (P,W), 3386 (M,C).

SALICORNIA MUCRONATA Bigel. Salt marsh areas; less frequent than the two following. NAU: *Pennell* 3146 (W); PAS: *Svenson*, Sept. 8, 1926 (N).

S. EUROPAEA L. Salt marshes and brackish mud flats. NON: 2892 (N); UNC: 3094 (N,P); PAS: *Svenson*, Sept. 8, 1926 (N); 3742 (P); NAS: *Northrop* (o); CUT: 3570 (N,P); PEN: *Jordan* (o).

S. AMBIGUA Michx. Same situations as last. NAU: *Pennell* 3112 (P), *Pennell* 3145 (W); PAS: *Svenson*, Sept. 8, 1926 (N), 3741 (N,P); CUT: 3571 (N,P,M,C).

SUAEDA MARITIMA (L.) Dumort. Reported by *Jordan* from Penikese; no specimen.

S. LINEARIS (Ell.) Moq. Salt marshes and brackish muds. UNC: 2963 (P,W), 3076 (N); PAS: 3739 (N,P); CUT: 3567 (P,M,C).

SALSOLA KALI L. Beaches and brackish marshes. NON: 2286 (N,P); NAU: *Cushman & Morse*, Aug. 25, 1906 (B), 3886 (P); NAS: *Northrop* (o), 2364 (N); CUT: 2273 (P); PEN: *Jordan* (o).

S. KALI L., var. CAROLINIANA (Walt.) Nutt. With the last; less abundant. UNC: 2961 (P), 3075 (N,P); PAS: 1792 (N,P).

**AMARANTHACEAE**

*Amaranthus retroflexus* L. Dry sandy soil near cultivated area. PEN: 1402 (N,P,W,M).

**PHYTOLACCACEAE**

PHYTOLACCA AMERICANA L. *P. decandra* L. See RHODORA, xvii. 180 (1915). Apparently rare; seen growing only along edge of boggy depression at east end of Pasque. NAU: *Pennell* 3174 (W); PAS: 3785 (N).

**AIZOACEAE**

*Mollugo verticillata* L. Bare, grassy slopes and sandy patches. NON: 2891 (N); UNC: 3052 (N,P); NAS: *Northrop* (o), 3470 (P).

**CARYOPHYLLACEAE**

SPERGULARIA RUBRA (L.) J. & C. Presl. Dry exposed slopes and sandy clearings. NAS: *Northrop* (o), *Williams*, July 10, 1911 (N), 3465 (P,M); CUT: 3459 (P); PEN: 1410 (P,W).

*S. SALINA* J. & C. Presl. Sand and cobble beach along Northwest Gutter. Rare; represented on these islands usually by the next species. NAU: 3132 (N, W).

*S. LEIOSPERMA* (Kindb.) F. Schmidt. *S. marina* of Manual, in part. See Fernald & Wiegand, RHODORA, xii. 157 (1910). Sandy and cobbly beaches, mud flats and brackish marshes. NON: 2290 (N); UNC: 2962 (N,P,M); NAU: 2455 (N); PAS: 3738 (N,P,C); CUT: 3569 (N,P); PEN: 1409 (P,W).

*Spergula arvensis* L. Not common. NAS: Northrop (o); PEN: Jordan (o).

*SAGINA PROCUMBENS* L. Upper beaches and dry, gravelly banks. NON: 2692 (N,P); NAU: 2728 (N); NAS: Northrop (o), 3464 (P); PEN: 1408 (W).

*ARENARIA LATERIFLORA* L. Seen growing only in sandy thicket along north shore of Naushon near the east end. NAU: 3318 (N); NAS: Northrop, "July-Aug." 1901 (Y).

*A. PEPLOIDES* L., var. *ROBUSTA* Fernald. See RHODORA, xi. 109 (1909). Occasional on sandy or cobbly beaches. CUT: 2274 (N,P); PEN: 1403 (W).

*A. serpyllifolia* L. Sandy and gravelly areas; occasional. NON: Pennell 2840 (W); NAU: 3424 (N); NAS: Northrop (o).

*Stellaria graminea* L. Grassland on Penikese. PEN: 1411 (P,W); 1760 (N,P).

*S. media* (L.) Cyrill. Dry, sterile soil and grassland on Penikese; probably more widespread. PEN: 855 (W), 3395 (N, P).

*Cerastium vulgatum* L. Abundant on open, grassy hillsides and sandy clearings. NON: 3367 (N,P,M), 3286 (P); NAS: Northrop (o); CUT: 3438 (P); PEN: 1404 (N,P,W).

*Agrostemma Githago* L. Reported by Mrs. Northrop from Nashawena; no specimen.

*Lychnis alba* Mill. Occasional in grassland on Penikese. PEN: 1407 (W).

*Gypsophila paniculata* L. Persistent around leper cottages on Penikese. PEN: 1406 (P,W).

*Dianthus barbatus* L. Same situation as the preceding. PEN: 1405 (W).

*D. Armeria* L. Seen only on edge of wet hollow at west end of Cuttyhunk. CUT: 3445 (N,P).

### PORTULACACEAE

*Portulaca oleracea* L. Sandy ground, usually near cultivated areas. NAS: Northrop (o); PEN: 1412 (W).

### NYMPHAEACEAE

*NYMPHOZANTHOS VARIEGATUS* (Engelm.) Fernald. *Nymphaea adenata*, var. *variegata* Fernald. See Fernald, RHODORA, xxi. 183 (1919).

Dune ponds on Nashawena and Sheep Pond, Cuttyhunk; possibly more general. NAS: *Northrop* (o), 2366 (N,P); CUT: 786 (W), 2531 (N).

*NYMPHAEA ODORATA* Ait. *Castalia odorata* Woodv. & Wood. See RHODORA, xviii. 161 (1916). Rather general in smaller ponds as well as Sheep Pond, Cuttyhunk. UNC: 3004 (P); NAU: 2734 (N); NAS: *Northrop* (o), 2367 (N,P); CUT: 2530 (N).

### RANUNCULACEAE

*RANUNCULUS CYMBALARIA* Pursh. Sandy and gravelly shores; rather frequent. NON: 2302 (N,P); NAU: 528 (W,P); CUT: *Hervey*, no date, (N); PEN: *Northrop* (o), 1414 (W).

*R. DELPHINIFOLIUS* Torr. Small, grassy-bottomed ponds in open hills. NAS: *Northrop* (o), 3522 (P); PEN: 451 (P,W), 1759 (N,P,M).

[*R. REPTANS* L. appears on Mrs. Northrop's list. It is hard to say what this may refer to in the absence of a specimen. *R. reptans*, var. *ovalis* (*R. Flammula*, var. *reptans* of the Manual) is unknown from southeastern Massachusetts and it seems hardly justifiable to report it on the basis of such an ambiguous record.]

*R. bulbosus* L. Seen only on a steep gravel bank at the extreme east end of Nonamesset; possibly more abundant. NON: 3282 (N).

*R. acris* L. Rather common in open grassland, especially on outer islands. NAS: *Northrop* (o); CUT: 2325 (N); PEN: 1413 (N,P,W).

*THALICTRUM REVOLUTUM* DC. Reported by Mrs. Northrop as *T. purpurascens*, but had probably best be referred here. NAS: *Northrop* (o).

*ANEMONE VIRGINIANA* L. Collected in dry, sandy woods on "Captain's Island," Naushon. NAU: 3907 (P).

*A. QUINQUEFOLIA* L. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*COPTIS GROENLANDICA* (Oeder) Fernald. *C. trifolia* of the Manual. See Fernald, RHODORA, xxxi. 136 (1929). Included in Mrs. Northrop's list with the comment "in one filled up pond under fern lvs. Very small, no fruit." NAS: *Northrop* (o).

This is an interesting addition to the flora of the islands. *Coptis* is unknown from Barnstable County, although represented in both Plymouth and Bristol Counties. Moreover, it is reported by Bicknell for Nantucket, where, as on Nashawena, it may be a remnant of a formerly more dominant continental flora. There seems to be no real reason, even in the absence of herbarium material, to discredit this record.

### BERBERIDACEAE

*Berberis Thunbergii* DC. Occurs scattered over the open hills at the east end of Uncatena. UNC: 2975 (N).

**LAURACEAE**

**SASSAFRAS OFFICINALE** Nees & Eberm. *S. variifolium* (Salisb.) Ktze. See Blake, RHODORA, xx. 98 (1918). Scattered abundantly throughout all of the wooded areas. NAS: Northrop (o), 3533 (P).

**S. OFFICINALE** Nees & Eberm. var. **ALBIDUM** (Nutt.) Blake. RHODORA, xx. 98 (1918). Occasional with the species. UNC: 3123 (N).

**BENZOIN AESTIVALE** (L.) Nees. Reported by Mrs. Northrop from Nashawena; no specimen.

**PAPAVERACEAE**

*Glaucium flavum* Crantz. Established on beach near Tarpaulin Cove. NAU: 789 (P,W), 1798 (N).

**CRUCIFERAE**

*Berteroa incana* (L.) DC. Dry sandy soil near landing at east end of Pasque. PAS: 3798 (N,P,M).

**LEPIDIUM VIRGINICUM** L. Open grassland and low sandy stretches. UNC: 3056 (N,P); PAS: 3762 (P); NAS: Northrop (o); CUT: 2259 (N,P); PEN: 1417 (N,P,W,M,C).

*Capsella Bursa-pastoris* (L.) Medic. Occasional in disturbed situations. NAS: Northrop (o); PEN: 854 (P,W).

**CAKILE EDENTULA** (Bigel.) Hook. Sandy and cobbly sea beaches, especially outer islands. NAS: Northrop (o); CUT: 2271 (N); 3431 (P); PEN: 1416 (P,W).

*Raphanus Raphanistrum* L. Disturbed sandy soil near cultivated areas. NAS: Northrop (o); CUT: 2268 (N,P,M,C); PEN: 1418 (W).

*R. sativus* L. Same situations as last. PEN: 1419 (N,P,W).

*Brassica juncea* (L.) Cosson. On peninsula, east end of Penikese. PEN: 1415 (P,W).

*B. nigra* L. Dry, sandy slope. NAU: 790 (W); PEN: Jordan (o).

*Sisymbrium officinale* (L.) Scop., var. *leiocarpum* DC. Barren, sandy ground; waste places. PEN: (N,P,W,M).

*S. altissimum* L. Same situations as the preceding. PEN: 1420 (W).

*Rorippa Nasturtium-aquaticum* (L.) Schinz & Thel. *Radicula Nasturtium-aquaticum* Britt. & Rendle. Seen growing along a moist rill draining into Sheep Pond, Cuttyhunk. NAS: Northrop (o); CUT: 1054 (P,W).

**DROSERACEAE**

**DROSEROTA ROTUNDIFOLIA** L. Boggy situations and borders of ponds. NON: 2652 (N), 3362 (P); PAS: 1786 (N,P); NAS: Northrop (o), 3472 (P).

**D. INTERMEDIA** Hayne. *D. longifolia* of Manual. Apparently not common; borders of dune ponds on Nashawena. NAS: 1778 (N,P), Northrop (o), Williams, July 10, 1911 (N).

**SAXIFRAGACEAE**

*RIBES HIRTELLUM* Michx., var. *CALCICOLA* Fernald. See Fernald, *RHODORA*, xiii. 76 (1911). Seemingly rare. NON: 2844 (P).

**HAMAMELIDACEAE**

*HAMAMELIS VIRGINIANA* L. Dry to moist woodland and thickets. Some of this material approaches the variety *parvifolia* Nutt. NON: 2591 (N,P); NAU: 3152 (N,P); NAS: *Northrop* (o), 3512 (P).

**ROSACEAE**

*SPIRAEA TOMENTOSA* L. Pond borders and moist hollows; abundant. NON: 2564 (N); PAS: 1784 (N,P); NAS: *Northrop* (o), 2345 (N,P).

*PYRUS ARBUTIFOLIA* (L.) L. f. Thickets and wet depressions; of frequent occurrence. NON: 2885 (N,P); UNC: 3046 (N,P); NAS: 1774 (N,P), 3495 (P).

*P. ARBUTIFOLIA* (L.) L. f., var. *ATROPURPUREA* (Britton) Robinson. Same situations as the last but less common. NON: 3175 (N,P); UNC: 3124 (N,P); NAS: *Northrop*, Aug. 1901 (Y).

*AMELANCHIER OBLONGIFOLIA* (T. & G.) Roem. Dense thickets and sheltered hollows; abundant. NON: 2630 (P), 2883 (N,P), 3205 (P), 3202 (P,C), 3308 (P,M,C); PEN: 1421 (P,W).

*CRATAEGUS PRUINOSA* (Wendl.) C. Koch. Single tree on dry hillside near Tarpaulin Cove. NAU: 1801 (N,P).

*CRATAEGUS spp.* This genus is to be met with scattered throughout the dry, sandy beech woods, mostly on Naushon. Several collections have been made, but it has not been found possible to match this material with existing specimens or to reconcile it with available descriptions. Each individual plant appears to possess its own characteristics which differ from those of its neighbor, and, rather than give to these specimens names which assume a definiteness that they do not own, the problem is here left in abeyance.

*FRAGARIA VIRGINIANA* Duchesne. Dry open slopes and hollows. NON: 3287 (N); NAS: *Northrop* (o); PEN: 1422 (W).

*F. VIRGINIANA* Duchesne, var. *TERRAE-NOVAE* (Rydb.) Fernald & Wiegand. *RHODORA*, xiii. 106 (1911). Seen only in a sandy meadow near Cuttyhunk Pond. CUT: 3581 (N,P).

*F. vesca* L. Reported by Jordan from Penikese: no specimen.

*POTENTILLA NORVEGICA* L., var. *HIRSUTA* (Michx.) Lehm. *P. monspeliensis* L. See *Bibliot. Bot.* 16, Heft lxxi. 404 (1908). Dry open ground. PEN: 1424 (N,P,W,M).

*P. argentea* L. Dry sandy and gravelly soil. NAS: *Northrop* (o); PEN: 1423 (N,P,W,M).

*P. recta* L. Sandy clearing in woods near West Gutter. NAU: 3923 (N,P).

*P. PACIFICA* Howell. *P. Anserina* of Manual, in part. See Fernald, RHODORA, xi. 1 (1909). Shingle beach along south shore of Nonamesset. NON: 2874 (N,P,M); NAS: Northrop, as "*P. Anserina*" (o).

*P. PUMILA* Poir. Dry knolls and exposed sandy and grassy hillsides. NON: 2677 (N,P), 3288 (P,M,C); PEN: 1425 (N,P,W).

*P. CANADENSIS* L., var. *SIMPLEX* (Michx.) T. & G. The Elizabeth Islands material seen all has narrow, oblanceolate leaves and short, more or less appressed, pubescence. Dry slopes and sandy clearings. NON: 3355 (N,P,M); CUT: 2536 (N).

*GEUM CANADENSE* Jacq. Apparently rare; boggy woods at east end of Nashawena. NAS: Northrop (o), 3544 (P).

*RUBUS OCCIDENTALIS* L. Edge of woods at west end of Nonamesset. NON: 2676 (N).

*R. PERGRATUS* Blanchard. Thickets and margins of boggy hollows. NAS: 3487 (P); PEN: 1428 (N,P,W).

*R. laciniatus* Willd. Well established on peninsula of Penikese. PEN: 1429 (N,P,W).

*R. ANDREWSIANUS* Blanchard. This is the commonest Blackberry on the Islands, occurring in wet overgrown hollows and in thickets on open slopes. NON: 2577 (P), 2626 (N,P); UNC: 3034 (P); NAU: Pennell 3135 (W), 2496 (P), 2497 (P).

*R. HISPIDUS* L. Abundant; apparently as much at home on the dry exposed hillsides as in the boggy depressions. NAS: Northrop (o), 3539 (N); CUT: 2312 (P), 2321 (N,P,M).

*R. FLAGELLARIS* Willd. *R. procumbens* of many authors. *R. villosus* of the manual. See Bailey, Gentes Herb. i. 234 (1925). Trailing over dry open sandy and gravelly ground. NAS: Northrop (o); PEN: 1430 (N,P,W).

*Rosa rugosa* Thunb. Established and thriving, usually along beaches, on several of the islands. NAU: Taylor 3077 (P); CUT: 3439 (N); PEN: 1427 (P,W).

*R. rubiginosa* L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*R. PALUSTRIS* Marsh. *R. carolina* of Manual and most American authors. See Fernald, RHODORA, xx. 91. (1918). Wet margins of ponds. NAS: Northrop, July, 1901 (Y), 2354 (N,W); PEN: 1426 (W).

*R. CAROLINA* L. *R. humilis* Marsh. See Fernald, l. c. Wet hollows and pond margins. NON: 2631 (N,P); NAS: Northrop (o), 3477 (P); CUT: 3461 (N).

*R. NANELLA* Rydb. N. Am. Fl. xxii (pt. 6), 497 (1918). Material collected from sandy thicket on Uncatena has dwarf stature and very narrow leaflets and corresponds in all essentials to Rydberg's description of this species. UNC: 3112 (N).

*R. VIRGINIANA* Mill. Moist hollows and swampy borders of ponds. NON: Pennell 2843 (P), 3173 (N,P), 3346 (P,M); PAS: 3746 (N,P).

*PRUNUS SEROTINA* Ehrh. Sheltered hollows, thickets and sandy woods. NON: 2671 (N,P); UNC: 3108 (P); NAU: 2501 (N,P); NAS: Northrop (o), 3519 (P); PEN: 1431 (W).



*P. MARITIMA* Wang. Apparently not very common; forms a dense thicket at east end of Nonamesset. NON: 3206 (N), 3303 (P,M); NAS: *Northrop* (o).

### LEGUMINOSAE

*Gleditsia triacanthos* L. Sandy woods near dwellings at east end of Naushon; originally introduced. NAU: 3925 (P).

*Genista tinctoria* L. Well established and spreading in fields at east end of Naushon and on Uncatena. UNC: 2976 (N); NAU: 796 (N, P,W).

*Cytisus scoparius* (L.) Link. Abundant and spreading on parts of Naushon (see p. 155); local elsewhere. NAU: *Miss Weir*, June 22, 1890 (N), *Moore*, 1903 (N); PAS: *Hollick*, Aug. 1898 (Y); NAS: *Northrop* (o).

*Ulex europaeus* L. A single large clump along road near Mary's Lake. NAU: 797 (W).

*Trifolium arvense* L. Dry open ground and sandy areas. NON: 2669 (P); UNC: 3012 (N); NAS: *Northrop* (o); CUT: 2257 (N); PEN: 1434 (P,W).

*T. pratense* L. Grassland; occasional. NAS: *Northrop* (o); PEN: 1435 (P,W).

*T. repens* L. Open fields and grassy levels. NAS: *Northrop* (o); CUT: 2261 (N,P); PEN: 3402 (N,P).

*T. hybridum* L. Open grassland; occasional. NAS: *Northrop* (o); PEN: 1436 (P,W).

*T. agrarium* L. Disturbed sandy soil near areas under cultivation. PEN: 1433 (N,P,W).

*Coronilla varia* L. Abundant on grassy hillside toward west end of Pasque. PAS: 795 (P,W).

*Robinia Pseudo-Acacia* L. At several localities along the north shore of Naushon, where doubtless planted but now spreading. NAU: 3874 (N,P); NAS: *Northrop* (o).

DESMODIUM RIGIDUM (Ell.) DC. Sandy woods and hills; not common. UNC: 2977 (N,P); NAU: 2600 (N,P).

D. OBTUSUM (Muhl.) DC. Sandy woods and clearings. NAU: 3910 (P,M,C), 3928 (N,P).

LESPEDAZA PROCUMBENS Michx. Not abundant; seen only in sandy woods on "Captain's Island." NAU: 3909 (N,P,M).

L. VIOLACEA (L.) Pers. Reported from Nashawena by Mrs. Northrop; no specimens seen.

L. HIRTA (L.) Hornem. On Mrs. Northrop's Nashawena list; no specimen seen.

L. CAPITATA Michx. Apparently not abundant; open, sandy bank on Uncatena, west end. UNC: 3129 (N).

*Vicia tetrasperma* (L.) Moench. Disturbed sandy area near landing. PEN: 1438 (W).

*V. Cracca* L. Dry, open ground. CUT: *Taylor* 3076 (P); PEN: 1437 (N,P,W,M,C).

*V. villosa* Roth. Dry sandy strip near Cuttyhunk Pond. CUT: 3579 (N,P).

LATHYRUS MARITIMUS (L.) Bigel. Sea beaches; commoner on outer islands. NAS: *Northrop* (o); CUT: 2263 (N,P); PEN: 1432 (N,P,W).

L. PALUSTRIS L. Known only from single collection on Nashawena. This material approaches var. *pilosus*. NAS: *Northrop*, "July-Aug." 1901 (Y).

APIOS TUBEROSA Moench. Occasional in wet hollows and around ponds. UNC: 3089 (N); NAS: *Northrop* (o); CUT: 2328 (N,P).

AMPHICARPA MONOICA (L.) Ell. Sandy woods near Hadley Harbor. NAU: 3917 (N,P); NAS: *Northrop* (o).

### LINACEAE

LINUM STRIATUM Walt. Dry hillsides and peaty pond margins. CUT: 2330 (P), 2538 (N,P).

L. VIRGINIANUM L. Dry sandy woods. NAU: *Williams & Collins*, July 10, 1911 (N), 2381 (N,P).

### OXALIDACEAE

OXALIS STRICTA L. Open sandy hillsides and sandy clearings. UNC: 3096 (P); NAU: *Pennell* 3142 (W), 2498 (P), 3682 (P); NAS: *Northrop* (o); PEN: 1439 (N,P,W).

### GERANIACEAE

GERANIUM MACULATUM L. Seen only on an exposed gravel bank at upper margin of beach along north shore of Nonamesset. NON: 3364 (N,P).

G. CAROLINIANUM L. Burnt-over ground near hospital building on Penikese. PEN: 1440 (W).

### SIMARUBACEAE

*Ailanthus glandulosa* Desf. Naturalized and spreading at several localities on Naushon and Nashawena. NAS: *Northrop* (o), 3481 (P).

### POLYGALACEAE

POLYGALA POLYGAMA Walt. Open sandy and grassy hillsides. NAU: 2477 (N); NAS: *Northrop*, "July-Aug." 1901 (Y).

P. SANGUINEA L. Low boggy ground. Not common. NAS: *Northrop* (o), 3563 (N).

P. CRUCIATA L. Peaty and boggy pond borders; apparently not widespread. CUT: *Sanford*, Aug. 15, 1917 (N), 2514 (N,P).

### EUPHORBIACEAE

ACALYPHA VIRGINICA L. Known only from a sheet of Dr. Pennell's collecting on Naushon. NAU: *Pennell* 3140 (W,P).

A. DIGYNEIA Raf. See Weatherby, RHODORA, xxix. 193 (1927). Rare. Boggy depression in open hills near east end of Uncatena. UNC: 3131 (N).

A. GRACILENS Gray. Dry hillsides and moist depressions; local. UNC: 2974 (P), 3087 (N).

EUPHORBIA POLYGONIFOLIA L. Sea beaches and low sandy stretches. NON: 2870 (N); UNC: 3008 (N); PAS: 3755 (P,M); NAS: *Northrop*, "July-Aug." 1901 (Y); PEN: *Jordan* (o).

E. MACULATA L. Sandy beaches and dry exposed slopes. NON: 2869 (N); NAU: 2499 (P); PEN: *Jordan* (o).

### CALLITRICHACEAE

CALLITRICHE PALUSTRIS L. Apparently rare and local. NAS: *Northrop* (o), 3521 (P).

C. HETEROPHYLLA Pursh. Small ponds in hills; more frequent than last. NON: 2235 (N); PEN: 456 (W), 1095 (P,W), 1758 (N,P).

(*To be continued*)

THE FLORA OF THE ELIZABETH ISLANDS,  
MASSACHUSETTS

JOHN M. FOGG, JR.

(Continued from page 258)

**ANACARDIACEAE**

*RHUS TYPHINA* L. Occasional in sheltered hollows on hillsides.  
NAS: Northrop (o), 3479 (N); PEN: 1441 (P,W), 3409 (N,P).

*R. GLABRA* (L.) Gray. No material seen; reported by Mrs. Northrop from Nashawena.

*R. GLABRA* (L.) Gray, var. *BOREALIS* Britton. See Britton's Man. Fl. No. St. Can. 601 (1901). Forming a small grove along the Northwest Gutter at the west end of Uncatena. UNC: 2453 (P,M).

*R. COPALLINA* L. Open slopes and moist depressions. UNC: 3039 (N); PAS: 3793 (N,P); NAS: Northrop, Aug. 13, 1901 (Y).

*R. VERNIX* L. Swampy woods and thickets. NAU: 2485 (N,P); PAS: 3794 (N); NAS: Northrop (o).

*R. TOXICODENDRON* L. Thickets, copses and overgrown hollows. Extremely variable as to habit, leaf-shape and fruit. NON: 3345 (N,P,M); UNC: 3040 (N,P); PAS: 1785 (N,P); NAS: Northrop (o), 2352 (N); CUT: 2314 (N); PEN: Jordan (o).

**AQUIFOLIACEAE**

*ILEX OPACA* Ait. Occasional in sandy wooded areas. NAU: 2488 (P,M,C); NAS: Northrop (o), 3535 (N).

*I. OPACA* Ait., forma *SUBINTEGRA* Weatherby. RHODORA, xxiii. 118 (1921). Sandy woods with the last; rare. NAU: 2484 (N,P,W,M,C).

I. VERTICILLATA (L.) Gray. Moist overgrown depressions and wet borders of ponds. NON: 3174 (N,P,M); NAS: 3490 (P).

I. VERTICILLATA (L.) Gray, var. FASTIGIATA (Bickn.) Fernald. RHODORA, xxiii. 274 (1921). In similar situations as last; occasional. NON: 2884 (N, P, M); NAS; *Northrop*, "July-Aug." 1901 (Y), 3494 (N).

I. LAEVIGATA (Pursh) Gray. Reported by Mrs. Northrop for Nashawena; no specimen seen.

I. GLABRA (L.) Gray. The Inkberry is evidently very rare on the Elizabeth Islands. Although sought for repeatedly, it is known only from a single specimen collected on Nashawena by Mrs. Northrop. NAS: *Northrop*, Aug. 1901 (Y).

### ACERACEAE

ACER RUBRUM L. Sandy and boggy woods and thickets; var. *tridens* was nowhere seen. NON: 2655 (N,P); NAS: *Northrop* (o), 3534 (N).

*A. platanoides* L. Planted in small grove near hospital building on Penikese. PEN: 1443 (W).

*A. Pseudo-Platanus* L. A few trees with the preceding. PEN: 3410 (P,M).

### SAPINDACEAE

*Aesculus Hippocastanum* L. Included in Mrs. Northrop's list with the comment, "Single good sized tree in midst of native trees about Choptauk Lake. Introduced." No specimen seen.

### BALSAMINACEAE

IMPATIENS BIFLORA Walt. Wet borders of ponds. NON: 2887 (N); NAU: 2735 (N,P); NAS: *Northrop* (o).

### VITACEAE

PARTHENOCISSUS QUINQUEFOLIA (L.) Planch. *Psedera quinquefolia* Greene. Occasional in thickets. NON: 2294 (N,P); NAS: *Northrop* (o); PEN: 856 (W).

*P. tricuspidata* (Sieb. & Zucc.) Planch. Trailing over stone wall near hospital building on Penikese. PEN: 3411 (N,P).

VITIS LABRUSCA L. Thickets and moist hollows. UNC: 3028 (N); NAS: *Northrop*, July, 1901 (Y), 3493 (P).

V. AESTIVALIS Michx. Trailing over low trees, edge of sandy woods. NAU: 2490 (P).

### MALVACEAE

*Malva rotundifolia* L. Dry sandy soil, waste places. NAU: *Pennell* 3115 (W); NAS: *Northrop* (o); PEN: 1442 (P,W).

*Althaea officinalis* L. Mrs. Northrop, in listing this species for Nashawena, says, "2 or 3 plants on different parts of shore." No specimen seen.

HIBISCUS MOSCHEUTOS L. Borders of salt marshes. NON: 2673 (P); UNC: 2985 (N,P); NAU: 2378 (N).

### HYPERICACEAE

*Hypericum perforatum* L. Abundant everywhere on dry hillsides. NON: 2679 (P); UNC: 2968 (N); NAS: *Northrop* (o), 3552 (P); CUT: 2332 (N); PEN: 1445 (N,P,W,M,C).

H. BOREALE (Britton) Bickn. Pond borders and wet hollows; abundant. NON: 2642 (P,W), 2701 (N,P); UNC: 2983 (N); NAU: 2726 (N,P); PAS: 3738 (P); NAS: 3523 (P).

H. MUTILUM L. Same habitats as last; less frequent. NON: 2569 (N); NAU: *Pennell* 3125 (W), 2389 (P); NAS: *Northrop* (o); PEN: *Jordan* (o).

H. CANADENSE L. Peaty pond margins and boggy hollows. NON: 2645 (N); UNC: 3023 (N,P), 3085 (N,P); NAS: *Northrop* (o); CUT: *Sanford*, Aug. 15, 1917 (N).

H. GENTIANOIDES (L.) BSP. Dry sandy hillsides and clearings. NON: 2694 (P); UNC: 3086 (N); NAS: *Northrop* (o).

H. VIRGINICUM L. Sandy and peaty pond borders, often partly immersed. NON: 2640 (P), 3171 (N,P,C); UNC: 3022 (N); NAU: 2927 (N,P); NAS: *Northrop* (o), 2351 (P,M); CUT: *Sanford*, Aug. 15, 1917 (N).

### ELATINACEAE

ELATINE MINIMA (Nutt.) F. & M. See Fernald, RHODORA, xix. 10 (1917). Sandy bottoms and borders of ponds. NON: 2706 (N,P); NAU: *Pennell* 3202 (W), 2727 (P), 2943 (N); PAS: 1061 (P), 1064 (P); NAS: *Northrop* (o); CUT: 2533 (N).

### CISTACEAE

HELIANTHEMUM CANADENSE (L.) Michx. Open grassland and dry sandy clearings; abundant. NON: 2625 (N,P), 2578 (P,M), 2903 (N); NAU: 2474 (P,M), 2598 (N,P); NAS: *Northrop* (o), 3558 (P).

H. PROPINQUUM Bickn. See Bull. Torrey Bot. Club, xl. 615 (1913). Seen only on sandy bank bordering West End Pond. NAU: 2915 (N,P).

H. BICKNELLII Fernald. *H. majus* of Manual. See RHODORA, xxi. 36 (1919). Dry, open, grassy slopes. NAU: 2493 (P), 2945 (N); PAS: *Svenson*, Sept. 8, 1926 (N); NAS: *Northrop*, Aug. 1901 (Y).

H. DUMOSUM (Bickn.) Fernald. See Bull. Torrey Bot. Club, xl. 613 (1913), and RHODORA, xix. 60 (1917). Grassland and sandy clearings. NAU: 2494 (P,W), 2944 (N); PAS: *Svenson*, Sept. 8, 1926 (N); NAS: *Northrop*, Aug. 1901 (Y), 3557 (P,M).

HUDSONIA TOMENTOSA Nutt. Open sandy areas. NAU: *Williams*, July 10, 1911 (N); PAS: 800 (N,P,M); NAS: *Northrop*, "July-Aug." 1901 (Y), *Williams*, July 10, 1911 (N), *Pennell* 2916 (W), 2365 (P,M).

LECHEA VILLOSA Ell. Apparently not common; sandy woods on Naushon. NAU: 2462 (P).

*L. MARITIMA* Leggett. Abundant on open downs and sandy stretches. NON: 2584 (N), 2624 (P); NAU: 2473 (P), 2481 (P), 2597 (N); PAS: 3770 (P).

*L. LEGGETTII* Britton & Hollick. Reported by Mrs. Northrop from Nashawena; no specimen seen.

### VIOLACEAE

*VIOLA PAPILIONACEA* Pursh. Not common; seen only in sandy beech woods on Naushon. NAU: 3314 (P), 3326 (N,P).

*V. FIMBRIATULA* Sm. Abundant on open downs and dry, grassy slopes. NON: 2581 (N), 3289 (P); NAU: *Pennell* 3129 (W), 3126 (P); CUT: *Sanford*, Aug. 15, 1917 (N), 2457 (P,M); PEN: 1444 (N,P,W).

[*V. SAGITTATA* Ait. Reported by Jordan for Penikese and by Mrs. Northrop for Nashawena but probably refers to the preceding.]

*V. LANCEOLATA* L. Open bogs and peaty borders of ponds. NON: 2568 (P,M), 2894 (N), 3307 (P); UNC: 3088 (N); NAU: *Pennell* 3122 (W), 2511 (N); NAS: *Northrop* (o); CUT: *Sanford*, Aug. 15, 1917 (N).

*V. PALLENS* (Banks) Brainerd. Peaty and boggy hollow at west end of Nashawena. NAS: 3499 (N,P).

[*V. BLANDA* Willd. Appears on Mrs. Northrop's Nashawena list. In absence of specimens it seems most likely that this refers to the preceding.]

### LYTHRACEAE

*DECODON VERTICILLATUS* (L.) Ell. Abundant in swamps, borders of ponds and low wet thickets. NON: 2563 (N,P), 3170 (N,P); NAU: 2387 (N); PAS: 3795 (P); NAS: *Northrop* (o), 2338 (N,P,M,C); CUT: *Sanford*, Aug. 15, 1917 (N).

### MELASTOMACEAE

*RHEXIA VIRGINICA* L. Wet, peaty depressions and borders of small ponds. NON: 2639 (N,P,M); NAS: *Northrop*, "July-Aug." 1901 (Y), *Northrop*, Sept. 1901 (Y), 3548 (P); CUT: 2522 (P).

### ONAGRACEAE

*LUDVIGIA PALUSTRIS* (L.) Ell. Floating or growing on moist mud; small pond holes. NON: 2240 (C), 2571 (P,M), 3164 (N,P); NAU: 2468 (N,P); PAS: 3784 (P); NAS: *Northrop* (o), 3526 (N,P); CUT: 3447 (P); PEN: 457 (P,W).

*EPILOBIUM DENSUM* Raf. Reported by Mrs. Northrop from Nashawena as *E. lineare*; no specimen seen.

*E. PALUSTRE* L., var. *MONTICOLA* Haussk. Collected in an open sphagnum bog at the west end of Cuttyhunk on July 28, 1927. CUT: 2307 (N).

*E. COLORATUM* Muhl. Seen only on the shingle at French Watering Place; perhaps more general. NAU: 2718 (N).

*E. GLANDULOSUM* Lehm., var. *ADENOCAULON* (Haussk.) Fernald.  
*E. adenocaulon* Haussk. See RHODORA, xx. 34 (1918). Reported from Nashawena by Mrs. Northrop; no specimen seen.

*OENOTHERA MURICATA* L. Dry sandy soil, east end of Pasque; probably more common. PAS: 3761 (P).

*O. BIENNIS* L. Dry sterile ground, occasionally in grassland. NAS: *Northrop* (o); PEN: 1446 (N,P,W).

*O. grandiflora* Ait. On Penikese, where probably introduced. PEN: 1447 (W).

### HALORAGIDACEAE

*MYRIOPHYLLUM SCABRATUM* Michx. Rather frequent; small ponds and wet pond holes. NON: 2241 (G,N,P), 3363 (P); UNC: 2996 (N,P,M,C), 3647 (P); NAU: 801 (N); NAS: *C. E. Faxon*, Sept. 1875 (G), *Northrop* (o); PEN: 453 (N,P,W), 3398 (P).

*M. HUMILE* (Raf.) Morong. Abundant and variable; forma *capillaceum* and forma *natans* have both been met with but appear to be nothing more than mere ecological variations. NON: 2705 (N,P,M,C); NAU: 2503 (N,P,M); PAS: 845 (N,P); NAS: *Northrop* (o), 3520 (N,P); CUT: 3448 (P).

*M. TENELLUM* Bigel. Muddy borders and bottoms of several small ponds. NAU: 2401 (N), 2753 (N,P); PAS: 1068 (W); NAS: *Northrop* (o); CUT: *Hervey*, no date (N).

*PROSERPINACA PALUSTRIS* L. Ponds and pond borders, often submerged. NON: 2570 (P), 2643 (N,P), 3382 (P,M); UNC: 3026 (N); PAS: 554 (P,W); NAS: *Northrop*, July, 1901 (Y); CUT: 803 (W), *Sanford*, Aug. 15, 1917 (N).

### UMBELLIFERAE

*SANICULA CANADENSIS* L. Dry sandy woods; not common. NAU: 2459 (P,M), 3927 (N,P,C).

*HYDROCOTYLE UMBELLATA* L. Shallow water of ponds and muddy or grassy pond margins. UNC: 3001 (N); NAU: *Williams et al.*, July 10, 1911 (N), 1805 (N), 2502 (N,P), 2729 (M), 2947 (N,P,C); NAS: *Northrop*, "July-Aug." 1901 (Y), *Pennell* 2923 (W); CUT: *Sanford*, Aug. 15, 1917 (N).

*H. CANBYI* Coult. & Rose. NAU: 1069 (G), 2948 (N,P).

In the Gray Herbarium there is a specimen of *H. Canbyi* labelled *H. umbellata*, var. *ambigua* which was collected at "Woods Holl, Sept. 10, 1876, on shores of Nobska Pond." This sheet is further labelled "Herb. W. G. Farlow," and, though no collector's name appears, may have been collected by Farlow himself. It constituted the only known record for this plant north of southern New Jersey until 1925 when, on July 14, Dr. H. K. Svenson and the writer found it growing around the shores of French Watering Place on Naushon.



On Aug. 31, 1927, the writer again visited this locality and found the plant, this time along another portion of the shore of the same pond. *H. Canbyi* is thus definitely established as a member of the flora of New England.

*H. VERTICILLATA* Thunb. NON: 2895 (G,N,P); UNC: 2981 (G, N,P,W), 3000 (P).

The reported occurrence of this species in Massachusetts has apparently been based upon a sheet collected by Thomas Morong at Woods Hole on Aug. 10, 1877. This sheet, which is in the Gray Herbarium, bears the determination "*H. interrupta* Muhl." and is perfectly typical *H. verticillata* as understood today. Also, there is a sheet of this species in the herbarium of the Boston Society of Natural History collected at New Bedford and further labelled merely "Oakes Coll." Southwest of Massachusetts the plant has been known only from Block Island before "jumping" to southern New Jersey (Cape May County).

On August 30, 1927, while exploring the west end of Nonamesset, the writer came upon a small pond in the open hills which was filled with a species of *Hydrocotyle*. This, upon examination, proved to be *H. verticillata*. Three days later, September 2, this same species was found growing in profusion in two small grassy ponds along the north shore of Uncatena toward the east end. Thus, a second member of this genus is restored to our list for this region after a lapse of half a century.

*PTILIMNIUM CAPILLACEUM* (Michx.) Raf. Borders of brackish ponds and salt marshes. NON: 2595 (N), 2664 (P); UNC: 3019 (N,P); NAU: 2370 (P,M,C), 2715 (N,P); NAS: *Northrop* (o), 3501 (P).

*CICUTA MACULATA* L. On Mrs. Northrop's list for Nashawena; no specimen seen.

*SIUM SUAVE* Walt. *S. cicutaeifolium* Schrank. See Blake, RHODORA, xvii. 131 (1915). Swampy hollows in woods and borders of ponds. UNC: 2988 (P); NAU: 2386 (N,P); NAS: *Northrop* (o), 2350 (N,P); CUT: 3443 (P).

*LIGUSTICUM SCOTHICUM* L. Sandy and gravelly beaches. NON: 3210 (N); UNC: 2979 (N,P); PAS: 557 (P,W); PEN: 1449 (P,W).

† *COELOPLEURUM LUCIDUM* (L.) Fernald. *C. actaeifolium* (Michx.) C. & R. See Fernald, RHODORA, xxi. 144 (1919). Sand and cobble beaches; not very common. CUT: 3435 (N,P); PEN: *Jordan* (o).

*Pastinaca sativa* L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*HERACLEUM LANATUM* Michx. Seen growing only on gravelly bank along East Gutter. NON: 3310 (N); NAS: *Northrop* (o).

*Daucus Carota* L. Dry grassland; apparently not common. NAS: Northrop (o); CUT: 2326 (N,P); PEN: 1448 (P,W).

### CORNACEAE

*CORNUS FLORIDA* L. Fairly abundant in boggy woods in hollows along south shore of Nonamesset; perhaps elsewhere. Seen in full "flower" on May 28, 1928. NON: 3302 (N,P,M,C); NAS: Northrop (o).

*NYSSA SYLVATICA* Marsh. A common tree both in the wet wooded hollows and in the moist portions of the beech-oak forests. NON: 2636 (P), 2667 (W,M), 2886 (N,P); NAU: Simons, July 23, 1901 (W), 2932 (N); NAS: Northrop (o), Williams, July 10, 1911 (N), 3517 (P).

### ERICACEAE

*CLETHRA ALNIFOLIA* L. Thickets and pond borders; abundant. NON: 2293 (P,C), 2627 (N,P), 2882 (N,M); UNC: 3649 (N,P); NAS: Northrop (o), 1771 (P); CUT: 2309 (P).

*CHIMAPHILA MACULATA* (L.) Pursh. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*PYROLA ROTUNDIFOLIA* L., var. *AMERICANA* (Sweet) Fernald. *P. americana* Sweet. See RHODORA, xxii. 122 (1920). Mrs. Northrop, who reports this from Nashawena, says, "Few plants in one station." No specimen seen.

*MONOTROPA UNIFLORA* L. Dry sandy beech and oak woods. NAU: Williams, July 10, 1911 (N), 806 (P,W); NAS: Northrop (o), 3537 (P).

*M. HYPOPITHYS* L. Seen only in sandy woods at east end of Nashawena; perhaps more common. NAS: 3538 (N).

*M. HYPOPITHYS* L., var. *RUBRA* (Torr.) Farwell. See Amer. Midl. Nat., x. 39 (1926). The crimson variety was collected in dense beech woods near Witches' Glen on Naushon; seen nowhere else. NAU: 3687 (N).

*RHODODENDRON VISCOSUM* (L.) Torr. Thickets and pond borders. NON: 2629 (N); NAS: Northrop (o), 1769 (N,P,M); CUT: 2317 (N).

*R. VISCOSUM* (L.) Torr., var. *GLAUCUM* (Michx.) Gray. Known only from a single specimen collected by Williams on Nashawena; probably more abundant. NAS: Williams, July 10, 1911 (N).

*KALMIA ANGUSTIFOLIA* L. Apparently rare; reported by Mrs. Northrop from Nashawena, but no specimen seen.

*LEUCOTHOE RACEMOSA* (L.) Gray. Occasional around sandy margins of ponds. NAU: 2482 (P,M), 2938 (N,P).

*LYONIA LIGUSTRINA* (L.) DC. Dense thickets and wet borders of ponds. NON: 2628 (N,P); UNC: 3650 (N,P,M); NAS: Northrop (o), 1768 (N,P).

*CHAMAEDAPHNE CALYCVLATA* (L.) Moench. Seen growing only around borders of dune ponds on Nashawena. NAS: Northrop, Aug. 1901 (Y), 1770 (N,P,W).

*EPIGAEA REPENS* L. Reported by Mrs. Northrop from Nashawena with the remark, "On bank near Mirror Lake." No specimens seen.

*GAULTHERIA PROCUMBENS* L. Apparently not common. Reported from Nashawena and found there growing sparingly in boggy woods at east end. NAS: *Northrop* (o), 3545 (N).

*GAYLUSSACIA DUMOSA* (Andr.) T. & G., var. *BIGELOVIANA* Fernald. See RHODORA, xiii. 95 (1911). Also RHODORA, xxiii. 248 (1921). Decidedly not common; so far known only from Nashawena. NAS: *Northrop*, July, 1901 (Y), *Northrop*, "July-Aug." 1901 (Y), *Taylor*, July 6, 1920 (P).

*G. FRONDOSA* (L.) T. & G. Occasional in thickets and about ponds. NON: 2236 (N,P); NAS: *Northrop*, Aug. 1901 (Y).

*G. BACCATA* (Wang.) C. Koch. This is the commonest Huckleberry on the islands; it is everywhere in the open areas, often forming an impenetrable growth in the hollows or under the lee of protecting hills. NON: 2576 (N,P), 2651 (P); NAU: 2504 (P,C), 2941 (N,P, M), 3689 (P); NAS: *Northrop* (o), 3559 (P).

*VACCINIUM CORYMBOSUM* L. Abundant around ponds, in moist depressions and in boggy woods. NON: 2637 (P); NAS: *Northrop* (o), 3516 (P).

*V. ATROCOCCUM* (Gray) Heller. Same situations as last but apparently less common; flowers and fruit earlier. NAS: 1776 (P).

*V. MACROCARPON* Ait. Open bogs and peaty hollows. NAS: *Northrop* (o); CUT: 2313 (P), 2519 (N,P,M).

### PLUMBAGINACEAE

*LIMONIUM NASHII* Small, var. *TRICHOGONUM* Blake. *L. carolinianum* of the Manual. See RHODORA, xxv. 58 (1923). The following numbers, out of a large series being held for study, may be cited. UNC: 3122 (P); NAU: 2456 (P).

In his recent revision of the Sea Lavenders Blake characterizes the New England material as having the calyx densely pubescent, at least at the base. Nevertheless, specimens collected from the Elizabeth Islands show the calyx nearly smooth or with a few scattered hairs and, according to Blake's treatment, would come closer to *L. carolinianum*, which name he restricts to the southern material with glabrous calyx. It is obvious that the last word has not yet been said concerning this genus as it is represented in the eastern United States.

### PRIMULACEAE

*SAMOLUS FLORIBUNDUS* HBK. Sandy and peaty pond margins; not common. NON: 2873 (N); NAU: 1078 (W), 2722 (N).

*LYSIMACHIA QUADRIFOLIA* L. Sandy woods; infrequent. NAU: 3327 (P); NAS: *Northrop* (o).

*L. TERRESTRIS* (L.) BSP. Open bogs and pond borders. NAS: *Northrop* (o), 2344 (N); CUT: 2316 (P).

TRIENTALIS BOREALIS Raf. *T. americana* (Pers.) Pursh. See Blanchard, RHODORA, xi. 236 (1909). Boggy woods. NON: 3297 (N,P); NAU: 3328 (N,P); NAS: *Northrop* (o).

*Anagallis arvensis* L. Cobble beaches and sandy waste places. UNC: 2957 (N); NAS: *Northrop* (o); CUT: 3434 (P); PEN: 1450 (N,P,W).

### OLEACEAE

FRAXINUS AMERICANA L. Certainly not common; seen only on edge of swampy hollow along north shore of Nashawena. NAS: *Northrop* (o), 3480 (N).

F. PENNSYLVANICA Marsh. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*Ligustrum vulgare* L. Escaped from cultivation on Penikese. PEN: 1451 (W).

### GENTIANACEAE

BARTONIA VIRGINICA (L.) BSP. Open bogs and peaty hollows or pond borders. PAS: 3782 (P); NAS: *Northrop*, Aug. 1901 (Y), 3508 (N); CUT: 2515 (N,P).

B. PANICULATA (Michx.) Robinson. A single specimen of this species was collected in the woods on Naushon by Professor Fernald and the writer on Aug. 10, 1927, but the material was subsequently mislaid. The plant is surely uncommon on the Elizabeth Islands.

MENYANTHES TRIFOLIATA L., var. MINOR Michx. See RHODORA, xxxi. 198 (1929). Seen growing only in a small boggy area bordering Sheep Pond. NAS: *Northrop* (o); CUT: *Hervey*, no date (N), 810 (P,W).

NYMPHOIDES LACUNOSUM (Vent.) Fernald. Collected in a small pond on Nonamesset. NON: 2707 (P).

### APOCYNACEAE

APOCYNUM ANDROSAEMIFOLIUM L. Exposed sandy bank bordering beach on Uncatena; possibly more general. UNC: 3639 (N,P).

### ASCLEPIADACEAE

ASCLEPIAS TUBEROSA L. Sandy hillsides and clearings; rare and local. NAU: *Simons*, July 16, 1901 (W), 2602 (N); PAS: 589 (W).

A. INCARNATA L., var. PULCHRA (Ehrh.) Pers. The commonest Milkweed on the islands. Swamps and wet pond margins everywhere. NON: 2674 (N,P); UNC: 3059 (P); NAU: 2736 (N); NAS: *Northrop* (o), 3478 (P); PEN: *Jordan* (o).

A. SYRIACA L. Occasional in dry sandy ground. NAS: *Northrop* (o); PEN: 1452 (W).

A. PHYTOLACCOIDES Pursh. Reported by Mrs. Northrop as *A. exaltata* with the comment "Not uncommon." No specimen seen.

A. VERTICILLATA L. Known only from Mrs. Northrop's collection from Nashawena. NAS: *Northrop*, Aug. 1901 (Y).

**CONVOLVULACEAE**

**CONVOLVULUS SEPIUM** L. Occasional in thickets and overgrown depressions. NON: 2890 (P); NAS: *Northrop* (o).

**C. SEPIUM** L., var. **PUBESCENS** (Gray) Fernald. On sea beaches; apparently not abundant. PEN: 1454 (N,P,W).

**C. arvensis** L. Cobble beach of isthmus on Penikese. PEN: 1453 (W).

**CUSCUTA GRONOVII** Willd. Swamps, boggy clearings, wet thickets, etc., NAU: *Pennell* 3127 (W), 2495 (P), 2605 (N,P,M), 2914 (P,C), 2933 (P), 3139 (N,P,M), 3890 (P,C); NAS: *Northrop* (o), *Williams*, July 10, 1911 (N), 2353 (P).

This is apparently the only species of Dodder on the islands. A large and variable series has been collected and has been studied in the light of T. G. Yuncker's recent monograph of the genus (1921), but it has not been found possible to recognize more than this single polymorphic species.

**VERBENACEAE**

**VERBENA HASTATA** L. Collected on gravelly upper beach on Uncatena and in swampy clearing on Naushon. UNC: 2980 (N); NAU: 2465 (P).

**LABIATAE**

**TEUCRIUM CANADENSE** L., var. **LITTORALE** (Bickn.) Fernald. Abundant near beaches, borders of brackish areas, wet thickets, etc. NON: *Cushman*, July 27, 1906 (B), 2586 (N); UNC: 2960 (P), 3047 (N,P,C); NAU: 1797 (P), 2500 (P,M); NAS: *Northrop* (o); PEN: 1460 (N,P,W).

**TRICHOSTEMA DICHOTOMUM** L. Frequent on open downs and sandy knolls. NON: 2623 (N); UNC: 2973 (P), 3120 (N); NAS: *Northrop* (o).

**SCUTELLARIA LATERIFLORA** L. Listed as "common" on Nashawena by Mrs. Northrop; no specimen seen.

**S. EPILOBIIFOLIA** Hamilton. *S. galericulata* of the Manual. See Fernald, *RHODORA*, xxiii. 85 (1921). Abundant in wet hollows and around ponds. NON: *Cushman*, July 27, 1906 (B), 2298 (N,P,C); UNC: 3045 (P); NAU: *Cushman & Morse*, Aug. 25, 1906 (B), *Pennell* 3116 (P), 2373 (P,M), 2607 (N); NAS: *Northrop* (o), 3476 (P); CUT: *Sanford*, Aug. 15, 1917 (N), 815 (W,P); PEN: 1459 (N,P,W), 3406 (P).

**Marrubium vulgare** L. Sandy soil, waste places. NAU: *Moore* 1904 (N), 814 (W); NAS: *Northrop* (o), *Williams*, July 10, 1911 (N), *Pennell* 2911 (W).

**Nepeta Cataria** L. Dry, sterile soil. UNC: 3054 (N); NAS: *Northrop* (o); PEN: 1458 (N,P,W).

**Prunella vulgaris** L. Apparently not common; dry ground. NAS: *Northrop* (o), 3484 (P).

**P. VULGARIS** L., var. **LANCEOLATA** (Barton) Fernald. *RHODORA*, xv. 179 (1913). The indigenous variety was met with on dry, sandy slopes near center of Uncatena. UNC: 3032 (P).

*Leonurus Cardiaca* L. Fairly abundant on Penikese; not collected elsewhere. NAS: Northrop (o); PEN: 1455 (W).

PYCNANTHEMUM FLEXUOSUM (Walt.) BSP. Known only from specimen in Woods Hole herbarium collected on Naushon. NAU: Simons, July 23, 1901 (W).

P. MUTICUM (Michx.) Pers. Reported and collected by Mrs. Northrop from Nashawena. NAS: Northrop, Aug. 1901 (Y).

LYCOPUS VIRGINICUS L. Rare and local on the islands; seen growing only on the sandy beach bordering West End Pond. NAU: Cushman & Morse, Aug. 25, 1906 (B), 2926 (N).

L. UNIFLORUS Michx. The most abundant species of the genus here; pond margins, wet hollows, etc. NON: 2565 (N,P,W), 2663 (P); UNC: 2969 (N); NAU: Williams, July 10, 1911 (N), 2487 (P); NAS: 2346 (N); CUT: 2525 (N); PEN: 1457 (W).

L. AMERICANUS Muhl. Frequent; moist situations. UNC: 2970 (N); NAS: Northrop (o), 3749 (N,P); CUT: 2524 (N,P), PEN: 1456 (N,P,M,W,C).

*Mentha spicata* L. Occasional in wet hollows. NAS: Northrop (o), 3491 (P,M).

*M. Cardiaca* Gerarde. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*M. crispa* L. Collected in a swampy hollow at the east end of Cuttyhunk. CUT: 2284 (N).

### SOLANACEAE

*Solanum Dulcamara* L. Seen only trailing over a dense thicket bordering pond on Uncatena. UNC: 3042 (N).

S. NIGRUM L. Very abundant as a littoral plant, often fringing the sandy or cobbly beaches with a solid growth. NON: Cushman, July 27, 1906 (B), 2872 (N,P); NAS: Northrop (o); CUT: 3446 (P); PEN: 1462 (N,P,W).

*S. rostratum* Dunal. Sandy waste areas; infrequent. NAU: Taylor, July 24, 1921 (P); PEN: Hollick (o).

*S. triflorum* Nutt. This western species was found growing on beach near Tarpaulin Cove; possibly introduced in the days when the Cove served as a refuge for sailing vessels. NAU: 1806 (N).

*Datura Stramonium* L. Sandy and cobbly beaches; of casual occurrence. UNC: 2958 (N); NAU: Cushman & Morse, Aug. 25, 1906 (B); PEN: 1461 (W).

*D. Tatula* L. On Mrs. Northrop's Nashawena list; may refer to the preceding; no specimen seen.

### SCROPHULARIACEAE

*Verbascum Thapsus* L. Open, sandy ground and waste places. NAU: 2720 (N,P); NAS: Northrop (o); PEN: 1465 (N,P,W).

*Linaria vulgaris* Hill. Decidedly not common on the islands; seen only on Penikese. PEN: 857 (W).

*L. CANADENSIS* (L.) Dumont. Grassy slopes and open sandy stretches. NON: 3373 (P); NAS: *Northrop* (o), 3483 (N); CUT: 2331 (N); PEN: 1464 (P,W), 3403 (P).

*LIMOSELLA SUBULATA* Ives. *L. aquatica*, var. *tenuifolia* of Manual. See RHODORA, xx. 160 (1918). Sandy and muddy margins of ponds on Pasque and Nashawena. PAS: 3745 (N,P); NAS: *Northrop*, "July-Aug." (Y), 2356 (N).

*ILYSANTHES DUBIA* (L.) Barnhart. Reported by Mrs. Northrop from Nashawena as *I. gratiolooides*; no specimen seen.

*I. INAEQUALIS* (Walt.) Pennell. *I. anagallidea* (Michx.) Robins. See Pennell, *Torrey*, xix. 149 (1919). Sandy and peaty pond borders. NON: 2702 (N); NAS: *Williams*, July 10, 1911 (N); PEN: 454 (N, P,W).

*GRATIOLA AUREA* Muhl. Peaty margins of small ponds. NON: 2641 (P), 3194 (N,P), 3383 (N,P); NAU: *Taylor* 2347 (P), 1079 (P,W).

*Digitalis purpurea* L. A few plants persistent around leper cottages on Penikese. PEN: 1463 (W).

*VERONICA SERPYLLIFOLIA* L. Reported from Nashawena by Mrs. Northrop; no specimen seen.

*V. PEREGRINA* L. Occasional in sandy soil. The Naushon material is very sparingly pubescent, approaching var. *xalapensis* (HBK.) Pennell. NAU: 3330 (P); NAS: *Northrop* (o); CUT: *Hervey*, no date (N).

*V. arvensis* L. Seen only in a sandy field near center of Nonamesset. NON: 3306 (N,P).

*AGALINIS PURPUREA* (L.) Pennell. *Gerardia purpurea* L. See Bull. *Torrey Bot. Club*, xl. 126 (1913). Listed by Mrs. Northrop for Nashawena; no specimen seen.

*A. MARITIMA* Raf. *Gerardia maritima* Raf. Seen only on border of brackish area on Uncatena; probably more general. UNC: 3005 (N,P).

*MELAMPYRUM LINEARE* Lam. Mrs. Northrop reports this for Nashawena; no specimen seen.

*PEDICULARIS CANADENSIS* L. Dry, sandy beech woods near Hadley Harbor. NAU: 3313 (N,P).

### LENTIBULARIACEAE

*UTRICULARIA GEMINISCAPA* Benj. *U. clandestina* Nutt. In a small pond on Nashawena; probably commoner. NAS: 3504 (P).

*U. GIBBA* L. Known only from sheet in Woods Hole herbarium collected on Naushon. NAU: *Simons*, July 23, 1901 (W).

*U. BIFLORA* Lam. Reported from Nashawena by Mrs. Northrop; no specimen seen.

*U. CORNUTA* Michx. Reported and collected by Mrs. Northrop. NAS: *Northrop*, Aug. 1901 (Y).

### OROBANCHACEAE

*EPIFAGUS VIRGINIANA* (L.) Bart. Fairly abundant in beech woods on Naushon; should be found on other islands as well. NAU: *Williams*, July 10, 1911 (N), 2937 (P), 3138 (N).

**BIGNONIACEAE**

*Catalpa bignonioides* Walt. Well naturalized in certain areas on Nashawena. NAS: 3546 (P).

**PLANTAGINACEAE**

PLANTAGO MAJOR L. Cobbly beaches, grassy slopes, etc. NON: 2697 (P), 2900 (N); NAS: *Northrop* (o); PEN: 1467 (N,P,W), 3407 (N,P).

P. MAJOR L., var. INTERMEDIA (Gilibert) Dcne. Material so labelled was collected by A. H. Moore on Penikese in 1904. Here also may be referred tentatively specimens collected by Hollick on Naushon and by Mrs. Northrop (labelled *P. halophila* Bickn.) on Nashawena. This is done with the realization that the maritime phase of *P. major* is in need of very careful study in order that its status may be satisfactorily determined. NAU: *Hollick*, Aug. 11, 1898 (Y); NAS: *Northrop*, Aug. 1901 (Y); PEN: Moore 1916 (G, N).

P. JUNCOIDES Lam., var. DECIPIENS (Barneoud) Fernald. *P. maritima* of American authors in part, not L. See Fernald, RHODORA, xxvii. 100 (1925). Collected on exposed gravelly bank along north shore of Naushon west of Kettle Cove. NAU: 3876 (N,P).

P. OLIGANTHOS R. & S. *P. maritima* of American authors in part. See Fernald, l. c. 93-104. Salt marshes and brackish muds. PAS: 3740 (N,P,M,C); CUT: 3568 (P).

*P. lanceolata* L. Grassland; not common. NAS: *Northrop* (o); PEN: 1466 (P,W), 3394 (N,P).

*P. lanceolata* L., var. *sphaerostachya* Mert. & Koch. See Fernald, RHODORA, xxiv. 203 (1922). Sandy and cobbly beach on Uncatena. UNC: 3055 (N,P).

*P. lanceolata* L., var. *sphaerostachya* Mert. & Koch., forma *eriphora* (Hoffmans. & Link) Beck von Man. See Fernald, l. c. Sandy soil at east end of Cuttyhunk. CUT: 2269 (N).

*P. aristata* Michx. Occasional in sandy fields. UNC: 3652 (N,P); NAU: *Simons*, July 23, 1901 (W); CUT: *Northrop* (o).

P. VIRGINICA L. Mrs. Northrop reports this from Nashawena, saying, "Common on downs, about 2 in. high." No specimen seen.

**RUBIACEAE**

GALIUM APARINE L. Listed by Mrs. Northrop for Nashawena; no specimen seen.

G. PILOSUM Ait. Dry sandy woods and clearings. NON: 2562 (P); NAU: *Pennell* 3150 (W), 2930 (N), 3686 (P); NAS: *Northrop* (o).

G. CIRCAEZANS Michx. Collected by Pennell on Naushon. NAU: *Pennell* 3110 (W).

G. TRIFIDUM L. Borders of brackish areas; not common. NAU: 2513 (N), 3684 (P,M); NAS: *Northrop* (o), 3541 (P).

Erroneously reported from Penikese; see RHODORA, xxvi. 228 (1924). The Penikese material proves to be *G. Claytoni*.



*G. CLAYTONI* Michx. Wet thickets, pond margins and grassy slopes; very abundant. NON: 2572 (C), 2646 (N), 2666 (P), 2880 (P), 2906 (P); UNC: 3027 (N); NAU: 2374 (P), 2716 (N,P,M); PAS: 3748 (P); CUT: 2516 (N,P); PEN: 1468 (N,P,W).

*G. TRIFLORUM* Michx. Collected only at edge of beach near east end of Naushon; possibly more general. NAU: 2457 (N,P).

*MITCHELLA REPENS* L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*CEPHALANTHUS OCCIDENTALIS* L. Not common; collected in boggy pasture on Nashawena. NAS: *Northrop* (o), 3564 (P).

### CAPRIFOLIACEAE

*Lonicera japonica* Thunb. Occasional as an escape. UNC: 3037 (N); PEN: 1469 (N,P,W).

*TRIOSTEUM PERFOLIATUM* L. Seen only on dry open hillside on Pasque. PAS: 567 (N,P).

*VIBURNUM ACERIFOLIUM* L. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*V. PUBESCENS* (Ait.) Pursh. *V. venosum* Britton. See Blake, RHODORA, xx. 11 (1918). This is the only *Viburnum* seen growing upon the islands. It is of frequent occurrence in moist hollows and in thickets bordering ponds. UNC: 3010 (N,P); NAU: 2458 (P,M). 3320 (P,C); NAS: 3489 (N), 3518 (P).

*VIBURNUM DENTATUM* L. is reported by Mrs. Northrop from Nashawena. It is possible that this refers to the preceding, but in the absence of specimens this record is permitted to stand.

*SAMBUCUS CANADENSIS* L. Occasional; thickets and moist depressions. NAS: *Northrop* (o), 3488 (N); PEN: 1470 (N,P,W).

### CUCURBITACEAE

*Cucurbita maxima* Duchesne. Sandy soil near cultivated area on Penikese. PEN: 1471 (W).

### CAMPANULACEAE

*SPECULARIA PERFOLIATA* (L.) A. DC. Reported from Nashawena by Mrs. Northrop; no specimen seen.

### LOBELIACEAE

*LOBELIA CARDINALIS* L. Found only in a swampy clearing at the east end of Naushon. NAU: 2466 (P,M).

### COMPOSITAE

*EUPATORIUM VERTICILLATUM* Lam. Mrs. Northrop reports *E. maculatum* from Nashawena, but it is probable that this refers to the plant treated by Wiegand as *E. verticillatum* (See RHODORA, xxii. 57 (1920)),

a coastal plain species the general absence of which from the Elizabeths is indeed surprising. NAS: *Northrop* (o).

*E. HYSSOPIFOLIUM* L. Rather frequent on open grassy and sandy slopes. NON: 2590 (P); UNC: 2953 (N); NAU: *Oakes?* (Herb. Lowell) (B); PAS: 1790 (P,W).

*E. VERBENAEFOLIUM* Michx. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*E. PERFOLIATUM* L. Wet hollows; uncommon. UNC: 2966 (N); NAS: *Northrop* (o).

*CHRYSOPSIS FALCATA* (Pursh) Ell. Open downs and sandy clearings. NON: 2583 (P); NAU: 2596 (N,P); PAS: 3788 (N); NAS: *Northrop* (o).

*SOLIDAGO BICOLOR* L. Dry, sandy woods; not abundant. NAU: 3161 (N), 3905 (P).

[*S. ULIGINOSA* Nutt. is reported from Nashawena by Mrs. Northrop; this doubtless refers to some other species, but since, in the absence of material, it is impossible to say which one, this record is discredited.]

*S. SEMPERVIRENS* L. Sandy and cobbly beaches. NON: 3211 (P); UNC: 3110 (N); PAS: 3744 (P); NAS: *Northrop* (o); CUT: 2270 (N); PEN: 1492 (N,P,W).

*S. JUNCEA* Ait. Known only from bare gravelly slopes on Penikese. PEN: 1489 (P,W).

*S. SUAVEOLENS* Schoepf. *S. odora* Ait. See Standley, RHODORA, xxi. 69 (1919). Collected only in dryish peaty border of bog on Cuttyhunk; perhaps more abundant. NAS: *Northrop* (o); CUT: 2520 (N,P,M).

*S. ELLIOTTII* T. & G. Dry thickets on Uncatena. UNC: 3105 (P), 3111 (N,P,M).

*S. RUGOSA* Mill. Dry, boulder-covered slopes on Penikese. PEN: 1491 (N,P,W).

*S. RUGOSA* Mill., var. *ASPERA* (Ait.) Fernald. *S. aspera* Ait. See RHODORA, xvii. 7 (1915). Open grassy downs and pond borders. NON: 3186 (N,P,M); UNC: 3093 (P); CUT: 2521 (N,P).

*S. NEMORALIS* Ait. Dry hillsides. UNC: 2971 (N,P); PAS: 3797 (P); NAS: *Northrop* (o); PEN: 1490 (W).

*S. CANADENSIS* L. Collected only on dry southwest slopes of Penikese. PEN: 1488 (W).

*S. ALTISSIMA* L. Collected only in thickets on dry hillsides of Uncatena. UNC: 3102 (N).

*S. TENUIFOLIA* Pursh. Everywhere on open downs and borders of *Gaylussacia* thickets. NON: 2561 (P); 3168 (N,P); UNC: 3084 (N,P,M); NAU: *Cushman*, Aug 25, 1906 (B), 2505 (M,C), 2719 (N,P), 2929 (N,P); NAS: *Northrop* (o); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 455 (N,P,W,M).

*S. GRAMINIFOLIA* (L.) Salisb. Same situations as the preceding; somewhat less abundant. NON: 3179 (N,P,M,C); UNC: 2952 (N,P); PAS: 3750 (P).

*S. MINOR* (Michx.) Fernald. This southern species, ranging from Mississippi and Florida to Virginia and reported by Bicknell from Nantucket, was collected by Professor Fernald and the writer on open grassy hillsides near the central part of Naushon. NAU: 2506 (N,P).

*ASTER DIVARICATUS* L. Occasional in dry open woods. NON: 3193 (N); NAU: 3160 (N,P).

*A. PATENS* Ait. Grassland and sandy thickets. NON: 3190 (P); NAU: 3142 (N); NAS: *Northrop* (o).

*A. UNDULATUS* L. Dry woods; common. NON: 3183 (N,P), 3187 (P,C); UNC: 3080 (N,P,M); NAU: 3158 (N,P,M); PEN: 1474 (W).

*A. ERICOIDES* L. Reported by Hollick from Pasque; no specimen seen, nor has this Aster, so abundant on the adjacent mainland, been found growing on the Elizabeth Islands, despite diligent search for it.

*A. MULTIFLORUS* Ait. Fairly abundant on grassy slopes. NON: 3184 (N), 3192 (N,P); PAS: 3751 (P,C); CUT: 3577 (P,M); PEN: 1098 (P, W).

*A. DUMOSUS* L. With the last. NON: 3178 (P), 3189 (N,P,W), 3195 (P); UNC: 2972 (N,P), 3091 (P); NAU: 3144 (P), 3159 (P); PAS: 3764 (N,P).

*A. DUMOSUS* L., var. *CORIDIFOLIUS* (Michx.) T. & G. Clearing in dry beech woods near Mary's Lake. NAU: 3145 (N,P).

*A. DUMOSUS* × ? This plant, probably representing *A. dumosus* × *vimineus*, was collected in sandy woods on Naushon. NAU: 3143 (N).

*A. VIMINEUS* Lam. Abundant in sandy woods and on open downs. NON: 3196 (P,M,C), 3200 (N,P,W,M); UNC: 3100 (N,P); NAU: 3134 (N,P,C), 3157 (P); PEN: 1475 (P).

*A. LATERIFLORUS* (L.) Britton. Apparently not common; dry, shady beech woods on Naushon. NAU: 3146 (N).

*A. NOVI-BELGII* L. Abundant in dry, open ground, especially along borders of thickets; extremely variable. NON: 3181 (W,C), 3182 (M), 3192 (N,P,C), 3201 (N,P); UNC: 3090 (N,P), 3101 (P); PAS: 3771 (P); CUT: 2518 (N).

*A. UMBELLATUS* Mill. Reported by Mrs. Northrop from Nashawena; no specimen seen.

*A. LINARIIFOLIUS* L. Dry, open hillsides; not frequent. UNC: 3092 (N); PAS: 3790 (P); NAS: *Northrop* (o).

*ERIGERON RAMOSUS* (Walt.) BSP. Open sandy slopes. UNC: 3643 (P); NAS: *Northrop* (o).

*E. CANADENSIS* L. Disturbed, sandy soil; rare. PEN: 1485 (W).

*E. PUSILLUS* Nutt. See Robinson, RHODORA, xv. 205 (1913). Open, sandy slopes. NON: 2902 (N,P); PAS: 3768 (P); PEN: 1486 (P,W).

*SERICOCARPUS ASTEROIDES* (L.) BSP. Open downs. UNC: 3062 (N); PAS: 3789 (P); NAS: *Northrop* (o).

*S. LINIFOLIUS* (L.) BSP. Reported from Pasque by Hollick; no specimen seen.

*PLUCHEA CAMPHORATA* (L.) DC. Margins of brackish ponds and

borders of salt marshes. NON: 2289 (N), 2662 (P); UNC: 3036 (N); NAU: *Cushman & Morse*, Aug. 25, 1906 (B), 1799 (N,P,W).

ANTENNARIA PLANTAGINIFOLIA (L.) Richards. Grassy knolls and exposed hillsides. NON: 2670 (N), 3280 (N,P); UNC: 3640 (N,P); NAU: 3312 (P); NAS: *Northrop* (o).

A. NEGLECTA Greene. Same situations as last. NON: 3281 (P); NAS: 3506 (P), 3554 (N); CUT: 3458 (N,P).

ANAPHALIS MARGARITACEA (L.) B. & H. Grassland and open ground everywhere. NON: 2560 (P); UNC: 3035 (N); PAS: 3796 (P); NAS: *Northrop* (o); CUT: 3454 (N,P).

GNAPHALIUM OBTUSIFOLIUM L. *G. polycephalum* Michx. Open, sandy and grassy slopes and clearings. UNC: 2954 (N), 3077 (P); NAU: 2730 (N); PAS: 3760 (P); NAS: *Northrop* (o); CUT: *Sanford*, Aug. 15, 1917 (N); PEN: 1482 (N,P,W,M,C).

G. ULIGINOSUM L. Upper beaches and low sandy ground, occasionally bordering salt marshes. UNC: 3006 (N); NAU: *Cushman & Morse*, Aug. 25, 1906 (B), 2388 (N,P); NAS: *Northrop* (o); PEN: 1096 (N,P,W).

G. PURPUREUM L. Dry, sandy soil; rare and local. NAU: 834 (W); NAS: 3507 (N); CUT: *Hervey*, no date (N).

IVA ORARIA Bartlett. Reported by Jordan from Penikese; no specimen.

AMBROSIA ARTEMISIIFOLIA L. Not common except on Penikese where abundant on grassy slopes of peninsula. NAS: *Northrop* (o); PEN: 1473 (P,W).

XANTHIUM CANADENSE Mill. Reported by Mrs. Northrop from Nashawena; no specimen seen.

X. ECHINATUM Murr. Occasional on beaches. NON: 3177 (N), 3914 (P); PAS: 3759 (P); PEN: 458 (W).

*Rudbeckia hirta* L. Open grassland. UNC: 3641 (P); NAS: *Northrop* (o); CUT: 2329 (N); PEN: 1487 (P,W).

*Helianthus annuus* L. Sandy ground near area under cultivation on Penikese. PEN: 1483 (P,W).

COREOPSIS ROSEA Nutt. Apparently rare; seen only on sandy beach bordering West End Pond. NAU: 2916 (N,P,M,C).

*C. lanceolata* L. Persistent around leper cottages on Penikese, where planted. PEN: 1480 (P,W).

BIDENS CONNATA Muhl. Border of small pond in hills at north end of Penikese. PEN: 1476 (N,P,W,M,C).

B. CONNATA Muhl., var. PETIOLATA (Nutt.) Farwell. See RHODORA, x. 197 (1908). Wet borders of ponds; occasional. UNC: 3016 (P), 3115 (N,P); NAU: 3133 (N,P,W,M,C).

ACHILLEA MILLEFOLIUM L. Common everywhere on open grassy hillsides and in sandy fields and clearings. NON: 3166 (N); UNC: 2959 (N); NAS: *Northrop* (o), 3555 (P); CUT: 2260 (P,M), 2322 (N); PEN: 1472 (N,P,W).

*Anthemis Cotula* L. Disturbed sandy areas. UNC: 2955 (N); NAS: *Northrop* (o); CUT: 3580 (P); PEN: 858 (N,P,W).

*Chrysanthemum Leucanthemum* L., var. *pinnatifidum* Lecoq. & Lamotte. Certainly not common; occasional on open grasslands. NAS: Northrop (o); PEN: 1477 (N,P,W).

*Tanacetum vulgare* L. Sandy soil near habitations. PAS: 3767 (N); PEN: 1097 (W).

*Artemisia Stelleriana* Bess. Occasional on sandy and cobbly beaches. NON: Cushman, July 27, 1906 (B); CUT: 2275 (N,P,M).

ERECHTITES HIERACIFOLIA (L.) Raf. Sandy clearings; moist pond margins and depressions. NON: 2696 (N); NAU: 2928 (N); NAS: Northrop (o); PEN: 1481 (W).

E. HIERACIFOLIA (L.) Raf., var. PREALTA (Raf.) Fernald. See RHODORA, xix. 27 (1917). Moist hollow. NON: 2661 (N,P).

E. MEGALOCARPA Fernald. See RHODORA, xix. 24 (1917). Moist depressions; local. UNC: 2965 (P,C); 2984 (N,P,W,M).

*Arctium minus* Bernh. Reported by Mrs. Northrop for Nashawena; no specimen seen.

*Cirsium lanceolatum* (L.) Hill. Sandy and gravelly banks and hillsides. NON: 2693 (N,P), Cushman, July 28, 1906 (B); NAU: 2717 (N,P); NAS: Northrop (o); CUT: 827 (P,W); PEN: 1479 (P,W).

C. HORRIDULUM Michx. *C. spinosissimum* of the Manual. See Robinson, RHODORA, xiii. 239 (1911). Occasional in open exposed situations. NON: 2299 (N); NAU: Miss Weir, June 22, 1890 (N); NAS: Northrop (o).

C. DISCOLOR (Muhl.) Spreng. Occasional in sandy clearings and borders of thickets. UNC: 3104 (N); PAS: 3752 (P).

C. PUMILUM (Nutt.) Spreng. Not common; met with only in grassland on Naushon. NAU: 828 (P,W); NAS: Northrop (o).

*C. arvense* (L.) Scop. Abundant on Penikese, where it forms a fringe on the upper beach to the south; local elsewhere. NAS: Northrop (o); PEN: 1478 (N,P,W).

*Centaurea arenaria* Bieb. Reported from Nashawena by Hollick as the first record for North America;<sup>1</sup> no specimen seen.

*Cichorium Intybus* L. Listed by Mrs. Northrop from Nashawena; no specimen seen.

KRIGIA VIRGINICA (L.) Willd. Sandy fields. NON: 3305 (N,P); NAU: 3879 (N,P).

K. BIFLORA (Walt.) Blake. *K. amplexicaulis* Nutt. See RHODORA, xvii. 135 (1915). On Mrs. Northrop's Nashawena list; no specimen seen.

*Leontodon autumnalis* L. Occasional in grassland or on dry banks. UNC: 3060 (N); NAU: 2392 (N); NAS: Northrop (o).

*L. autumnalis* L., var. *pratensis* Koch. In tall grass on slopes at west end of Penikese. PEN: 1484 (W).

*Taraxacum officinale* Weber. Not common; collected only near landing on Penikese. NAS: Northrop (o); PEN: 1496 (N,P,W).

*Sonchus arvensis* L. Occasional on beaches and sandy areas. NAS: Northrop (o); PEN: 1493 (N,P,W,M,C).

<sup>1</sup> Hollick, A. Cont. Geol. Dept. Columbia Univ xi. no 72. (1901)

*S. oleraceus* L. Seen mostly growing in the litter of upper sea beaches. CUT: 3432 (P); PEN: 1495 (N,P,W), 1755 (P).

*S. asper* (L.) Hill. With the last; less common. CUT: *Pennell* 2992 (W); PEN: 1494 (W).

LACTUCA CANADENSIS L. Reported by Mrs. Northrop from Nashawena; no specimen seen.

L. CANADENSIS L., var. INTEGRIFOLIA (Bigel.) Gray, forma ANGUSTATA Wiegand. See RHODORA, xxii. 10 (1920). Collected in dry, sandy soil at east end of Pasque. PAS: 3773 (P).

L. HIRSUTA Muhl. Seen growing only in sandy woods on Naushon; probably more common. NAU: 2464 (N); NAS: *Northrop* (o).

PRENANTHES SERPENTARIA Pursh. Mrs. Northrop reports this from Nashawena; no specimen seen.

P. TRIFOLIOLATA (Cass.) Fernald. Sandy woods; apparently rare. NAU: 3921 (P).

HIERACIUM PANICULATUM L. Dry, sandy woods; not common. NAU: 3920 (N,P).

H. MARIANUM Willd. Reported from Nashawena by Mrs. Northrop; no specimen seen.

H. SCABRUM Michx. On Mrs. Northrop's list for Nashawena; no specimen seen.

H. GRONOVII L. This is the commonest member of the genus on these islands; dry woods, sandy clearings, etc. NON: 2634 (P), 3185 (P); NAU: 2939 (N); PAS: 572 (W), 3775 (N); NAS: 3536 (P).

H. CANADENSE Michx. Apparently not abundant; collected only in dry, sandy soil at east end of Pasque. PAS: 3774 (N); NAS: *Northrop* (o).

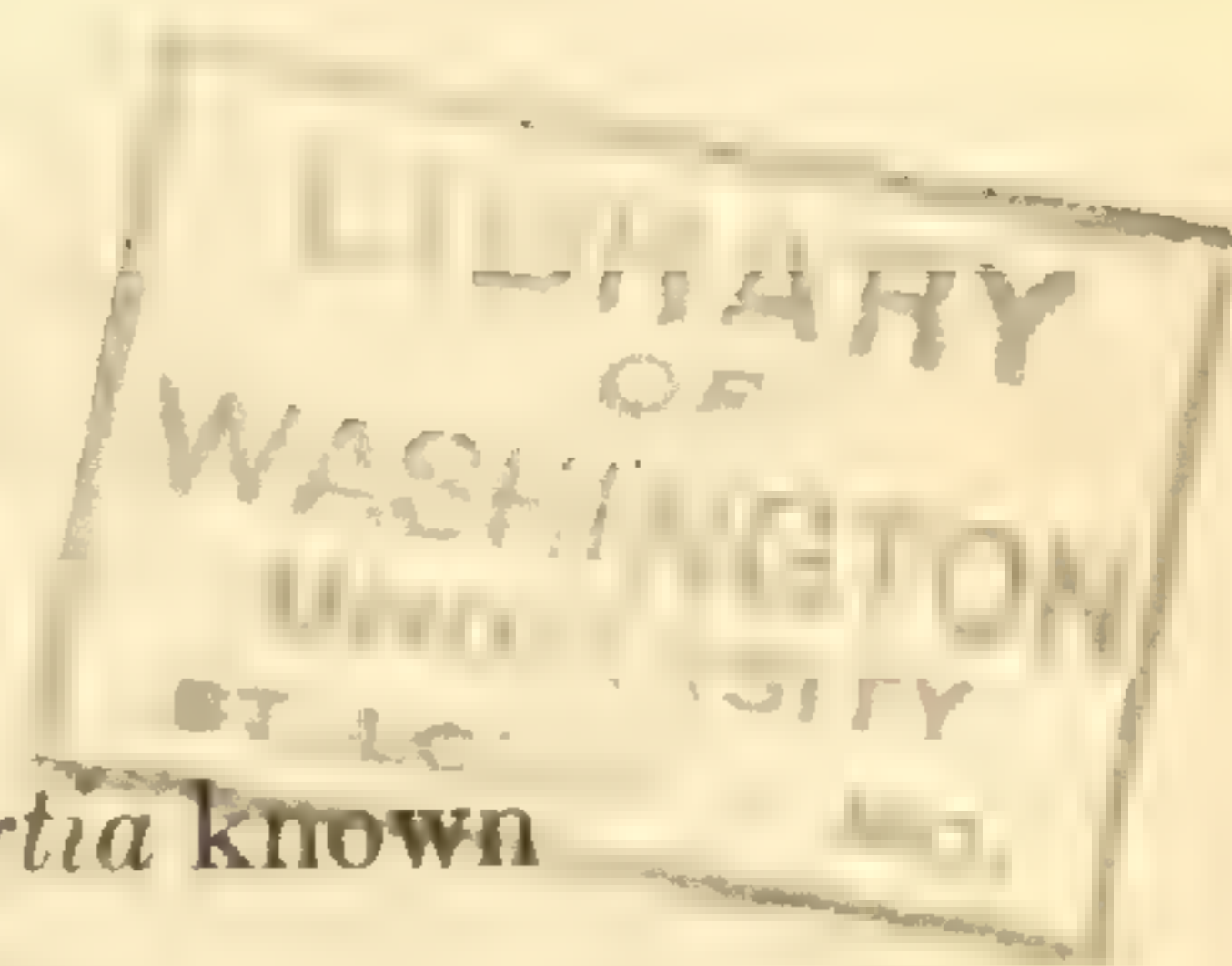
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STUDIES IN THE BORAGINACEAE,—VIII.

I. Observations on the Species of <i>Cordia</i> and <i>Tournefortia</i> known from Brazil, Paraguay, Uruguay and Argentina.	
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By

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# I. OBSERVATIONS ON THE SPECIES OF *CORDIA* AND *TOURNEFORTIA* KNOWN FROM BRAZIL, PARAGUAY, URUGUAY AND ARGENTINA.

## 1. PREFATORY DISCUSSION.

ALMOST simultaneously about two years ago I received two large collections of *Cordia* and *Tournefortia* from Brazil and Argentina. In an attempt to name this material it quickly became evident that the existing treatments of these genera for the species of Brazil and the countries to the south, indeed for those of the whole of South America, were antiquated and completely inadequate and that even reasonably precise identifications for the specimens would necessitate a rather extensive survey of all the species of eastern and southern South America. Upon attempting this survey I soon found so much that needed careful attention as to arouse particular interest and I decided to give the groups more detailed study and to prepare a revision of them which was so obviously needed. These genera, accordingly, have been a special interest for the past year, during which I have seen many hundred specimens including practically all those of historic or critical interest found either in this country or abroad. As a result I am able to present in this paper critical synopses of the species of *Cordia* and *Tournefortia* known from Brazil, Paraguay, Uruguay and Argentina. Although by no means a final treatment of these complex groups in the region mentioned I hope it will at least be a workable one and that it may make identifications of materials from the region not only less onerous but far more precise than in the past.

For ordinary considerations the work on the species of *Cordia* and *Tournefortia* in our region may be said to begin with Chamisso who published, in 1829 and 1833, a large number of the most common species. This work is of a model sort, Chamisso having carefully compared his plants with authentic material of the older species and described them at length with a keen appreciation of detail. It is marred only by the very unfortunate vagueness as to the precise locality at which the types were obtained, an obscurity which in the last analysis must be attributed to Sellow who collected the specimens. If we except the sketchy hack compilation by Gürke, E. & P. Nat. Pflanzenf. iv. Abt. 3a, 81-85 and 91-92 (1893), the only notable general accounts of our species are those by De Candolle in the *Prodromus*, ix. 468-501 and 513-531 (1845), and by Fresenius in the *Flora Brasilensis*, viii. pt. 1, 3-28 and 48-58 (1857), which were published respectively 85 and 73 years ago. De Candolle published an account of the

genera for the world. The studies were made in his usual scholarly manner, his treatment still standing as the last and best general account of these two large and difficult genera. So far as it relates to the species here under consideration it is necessarily brief and contains many errors, but it is nevertheless remarkable in view of the fact that its author had from the region less than fifty specimens of *Cordia* and much less than half that number of specimens of *Tournefortia*. The work on the Brazilian species of *Cordia* and *Tournefortia* by Fresenius is quite uninspired and although impressive in setting falls much below the scholarly standard generally maintained in the *Flora Brasiliensis*, being scarcely more than an indiscriminate compilation deriving much of its merit and part of its faults from the work of De Candolle upon which it was largely based. The author showed no particular feeling for relationships and seems actually to have had scruples against the reduction of any species proposed by his predecessors, an attitude of mind which I have been unable to evoke in saving from the depths of synonymy the majority of the species he proposed.

The subjoined treatment of the *Cordias* and *Tournefortias* from Brazil, Paraguay, Uruguay and Argentina is the first one ever based upon a large series of specimens. For its preparation I visited Europe in 1929 and studied the important collections of the Royal Botanic Gardens at Kew (K), the British Museum of Natural History at South Kensington (BM), the Botanical Museum at Berlin-Dahlem (BD), and the Delessert Herbarium (DL) and Barbey-Boissier Herbarium (BB) at Geneva. Also studied at these herbaria were various small but very important collections that have been kept as units. The most significant of these for my work were the Willdenow Herbarium (Willd) at Berlin and the Prodromus Herbarium (DC) and Hassler Herbarium (Hass) at the Delessert Herbarium in Geneva. In the United States I have visited and studied the collections at the New York Botanical Garden (NY) and at the National Herbarium at Washington (US). For detailed study at the Gray Herbarium I have also received on loan a large number of selected specimens from various of the institutions I have mentioned. My most important loan, however, was the very extensive and extremely interesting one received from the Botanical Section of the Riks Museum at Stockholm (RS). Supplementing the large amount of authentic and diversified material studied either abroad or here in the United States are three large collections of *Cordia* and *Tournefortia* which I have had the very good fortune to receive from South American botanists. The first of these was from Sr. F. C. Hoehne of São Paulo and consisted of the very

interesting Brazilian collections from the herbarium of the Botanical Section of the Museu Paulista (SP), a section that has subsequently become a part of the Instituto Biologico de Defesa Agricola e Animal. From Prof. M. Lillo of the University of Tucumán I received another valuable collection, largely of species from northwestern Argentina. Beautifully supplementing this, and thus giving me a very representative collection of the Argentine species for study, is a collection received more recently, through the interest of Prof. José Molfino, from the herbarium of the Instituto de Botanica y Farmacología of Buenos Aires. Without access to the wealth of material that I have been able to examine from all the above named sources I could scarcely have prepared this paper. I was welcomed and treated most kindly by those in charge of the institutions which I was fortunate enough to visit and have met with continued courtesy and helpfulness from those of my other friends that have assisted me from a distance by sending specimens and notes. To all these, both to those whom I have met and to those whom I know only through correspondence, I wish to express my keenest appreciation and sincerest thanks for their valuable help and sympathetic interest.

Practically all the material examined during the preparation of this paper has been cited under the species concerned. The location of the particular specimens seen is indicated by initials (characteristic of the names of the various herbaria) that are enclosed in parentheses and directly follow the collection-number. In citing collections I have, with the investment of no small effort, done my best to arrange them geographically, grouping them first under countries and then under the major political division of the country. This procedure is very time-consuming and risks possible error, but in any case has permitted me to give the collections a logical arrangement and one best calculated to bring out most clearly the salient features of geographical distribution. It may be well to explain that I have purposely ignored one boundary that has a place on the map of Brazil, namely that between the State of Rio de Janeiro and the small Federal District which includes and extends somewhat to the west of the city of Rio Janeiro. I have arbitrarily treated the Federal District as though it were a part of the State of Rio Janeiro. In defense of this action I can plead, not ignorance, but merely reasons of convenience.

## 2. TREATMENT OF *CORDIA*.

Among the species of *Cordia* in our area only those ranging to the south and west of the southern portions of the state of Minas Geraes

have been collected sufficiently to be regarded as reasonably well understood, but even these, except about the important cities near the coast, must be collected very much more before the details of their distribution are known and the final word on their classification be said. North of southern Minas Geraes most of the collecting of *Cordia* has been done in eastern Bahia and about the city of Pará. Not only do we have very imperfect knowledge as to just what species occur to the north of southern Minas Geraes but we have only fragmentary information as to the distribution there of even the most common species. It seems certain that it will be in this extensive region that most of the as yet undescribed species will be discovered. The region contains a number of endemics, most of them apparently local, some having not been re-collected since they were described fifty to seventy-five years ago. It will be after a study of extensive collections from this eastern corner of Brazil that the most important additions and corrections to this present treatment will be made. The species of the Amazon Basin are also in much need of further representation. The existing collections of them are most inadequate and must be greatly augmented before we can have even a reasonably workable provisional treatment of them. The one here presented is, from lack of sufficient material, very unsatisfactory.

Not only must the final statement on the classification of the Brazilian species of *Cordia* await the time when more representative and numerous collections are to be had for study but it must also await the day when more progress has been made in the classifying of the species of the genus from adjacent countries. Our spicate species of the section *Varronia* can be said to have had only preliminary treatment until the species of northwestern South America, where that particular group centers, have been worked out in detail and our plants correlated with them. Our Amazonian species of the section *Pili-cordia* can not be definitely settled before the related ones of northern South America, particularly those of the Guianas, are understood. Not only will these necessary studies of extralimital forms undoubtedly give reasons for some readjustments in specific lines but, I fear, almost certainly show the necessity of certain changes in accepted specific names also. There are a half dozen species of *Cordia* from French Guiana that were described over a hundred years ago which have yet to be identified or correlated with any of the more recent species. The identification of such obscure or confused species must have its effects on the taxonomy of our plants.

Although this paper is primarily a regional study of *Cordia* I have taken every opportunity to study our plants in relation to those from

other parts of America. As a result of the general familiarity with the various American species thus obtained and with the benefit of certain special studies I have been able to work out what seems to be a natural grouping of the American species of *Cordia*. The definition and characterization of the sections of *Cordia* that are presented in this paper are accordingly new. It will be noted that I have been unable to agree with the system of subgeneric groups, based upon anatomical studies, that has been proposed by Mez, Bot. Jahrb. xii. 526-588 (1890). The definition of Mez's groups (indiscriminately called by him groups, sections and subgenera) is entirely in terms of anatomy. The result is a series of groups too impracticable for ordinary systematic work and, if we may judge of them by the representative species cited, too open to serious challenge as to their naturalness. Unfortified by a microtome I am quite unable to justify such groups as those Mez has treated as *Myxae*, *Strigosae*, *Pilicordia* and *Crassifoliae*. They seem to be quite heterogeneous and incapable of definition by those characters of habit, leaves, flowers and fruit that are, not only readily examined, but have been tested and are known to have phylogenetic significance.

#### KEY TO THE SECTIONS OF *CORDIA* IN AMERICA.

Corolla marcescent and very tardily deciduous.

Fruit with fiber-bearing chartaceous walls, ellipsoidal or sausage-shaped, capped by a cartilaginous discoid base of the style, completely and closely invested by the calyx and falling inclosed by it. . . . . GERASCANTHUS, pg. 8.

Fruit with bony walls, conic-ovoid, from below the middle contracted to a subulate apex bearing the style, only loosely and partially clothed by the calyx, falling away naked; a Mexican monotype, *C. elaeagnoides* DC. . . . . RHABDOCALYX.

Corolla withering after anthesis and soon deciduous.

Flowers in spikes or heads or glomerules, rarely in small open cymes; fruit small, 3-5 mm. long; calyx cupulate or globose, investing at least half if not the entire fruit; corolla-limb usually only very shallowly and broadly lobed. . . . VARRONIA, pg. 18.

Flowers in very loose panicles or cymes; fruit larger, 6-16 mm. long.

Corolla large and conspicuous, 1.5-6.5 cm. long; calyx remaining cupulate or completely investing the fruit, usually much accrescent. . . . . EUCORDIA, pg. 40.

Corolla small, 0.6-1.5 cm. long; calyx becoming explanate or reflexed or falling away, scarcely if at all accrescent, not at all investing the fruit.

Corolla funnelform, lobes broader than long, distinctly emarginate; calyx 3-5-toothed and usually irregularly circumscissile at the apex; a monotypic section containing *C. alba* Jacq., which ranges from Mexico and the West Indies to northern South America; *Calyptrocordia* Britt. . . . . CALYPTRACORDIA.

Corolla salverform; lobes commonly elongate and longer than broad, apex rounded.

Stems with conspicuous subnodal swellings that serve as ant-domatia; calyx very irregularly ruptured by the corolla.....PHYSOCLADA, pg. 46.

Stems without subnodal swellings; plant not myrmecophilous; calyx opening by 3-5 more or less regular teeth or lobes.....PILICORDIA, pg. 47.

Section **Gerascanthus** [P. Browne] Don, Gen. Syst. iv. 380 (1837); DC. Prodr. ix. 471 (1845). *Gerascanthus* [P. Browne, Hist. Jamaica 170, t. 29, f. 3 (1756)] Raf. Sylva Tellur. 40 (1838); Lindley, Veg. Kingd. 629 (1847); type-species, *C. Gerascanthus* L. *Cordia* subgenus *Gerascanthus* Schlecht. & Cham. Linnaea v. 115 (1830). *Cerdana* R. & P. Prodr. 37, t. 6, (1794); type-species, *C. alliodora* R. & P. *Cordia-Cerdanae* R. & S. Syst. iv. 467 (1819). *Cordiada* Vell. Fl. Flum. 98 (1825) and Icones ii. t. 156 (1827); type-species, *C. trichotoma* Vell.

The section *Gerascanthus* is restricted to America and consists of about a dozen species. Of these only one, *C. alliodora*, is widely distributed, the remaining species centering in Mexico and southern Brazil. The section is a very distinct and natural one being closely related only with the monotypic Mexican section, *Rhabdocalyx* with which it agrees in all corolla-structures but differs from in profound structures of fruit. The fruit of the section *Gerascanthus* is, indeed, unique in the genus. It is sausage-shaped or ellipsoidal and has the rounded or truncate apex capped by a definite discoid cartilaginous expansion of the style-base. The carpellary walls are not thickened and bony but thin, fibrous and chartaceous. Only a single seed is normally matured. I have a suspicion that the flowers are only 1-2-ovulate. In maturing the fruit becomes tightly invested by the calyx and commonly also by the tube of the marcescent corolla. When it is ripe the flower detaches at the base of the calyx from the short pedicels and the whole, calyx, corolla and inclosed fruit, fall away, with the corolla perhaps acting in some species as a parachute and thus aiding somewhat in the dispersal of the seed. Also distinctive of the section *Gerascanthus* are its marcescent corollas, a development which it shares in the genus only with *C. elaeagnoides* DC., the single species of the related section *Rhabdocalyx*. These corollas, white or occasionally yellow, when fresh, do not drop away after anthesis but drying buff or brownish remain expanded, almost unshriveled, in position until they fall with the calyx and fruit or, as rarely happens, are pushed out of the calyx on top of the maturing ovary. The corolla is somewhat funnel-form with a well developed tube that is abruptly widened above to form a shallow throat and five ascending

usually pinnately veined lobes. Usually included in the calyx the tube protrudes conspicuously only in *C. insignis*. In most species the corolla-lobes are oblong with more or less definitely parallel sides and a truncate, rounded or abruptly obtuse apex. In *C. insignis* and *C. glabrata*, however, they tend to be orbicular and in *C. latiloba* they are ovate and evidently contracted to the apex. The calyx is cylindrical and except for species like *C. Goeldiana* is definitely 10-costate. It is not conspicuously accrescent in age being only stretched by the ripening fruit which it incloses.

## KEY TO SPECIES.

## Leaves glabrous.

Corolla-lobes deltoid-ovate, about as long as broad, from below the middle contracted to a broadly triangular apex; Rio Janeiro.....1. *C. latiloba*.

Corolla-lobes oblong, about twice as long as broad, apex obtuse or retuse; Pará.....2. *C. Goeldiana*.

## Leaves pubescent.

Pubescence on stems and leaves almost exclusively simple; corolla-lobes broader and usually more rounded than in next.

Corolla large; calyx 17-20 mm. long; leaves dull, very heavy in texture, usually elongate.....3. *C. insignis*.

Corolla moderate; calyx 10-14 mm. long; leaves somewhat lucent above, texture much less firm, outline ovate or orbicular-ovate.....4. *C. glabrata*.

Pubescence on stems and leaves almost exclusively stellate.

Corolla small, lobes 1.5-2.5 mm. broad; Matto Grosso...5. *C. alliodora*.

Corolla moderate, lobes 3-7 mm. broad; east and south of Matto Grosso.....6. *C. trichotoma*.

1. ***Cordia latiloba***, sp. nov., arbor ?; foliis graciliter longi-petiolatis ellipticis vel obovato-ellipticis integerrimis in sicco nigrescentibus, subtus subpallidioribus opacis minute elevato-reticulatis, apice abrupte acutis vel breviter acuminatis, basi gradatim vel rariter abrupte contractis, lamina petiolo duplo vel triplo longiori 2.5-7 cm. lata 4-15 cm. longa; inflorescentia terminali paniculata multiflora, partibus juvenalibus sparse inconspicue brunneo-puberulentis minute glanduliferis mox glabrescentibus; pedicellis gracilibus rigidis 2-5 mm. longis; calycibus cylindricis 10-costatis ut videtur glabris sed sub lente inconspicue sparseque glandulifero-puberulentis mox glabrescentibus 10-12 mm. longis 2-3 mm. crassis fructiferis accrescentibus fructus arcte investientibus apice in lobos 2-3 rotundos vel obtusos inaequales ca. 3 mm. profunde fassis; corolla infundibuliformi marcescenti 25-33 mm. longa glaberrima tubo in calyce occulto, lobis 5 deltoideo-ovatis ascendentibus 9-11 mm. longis latisque apice late acutis haud truncatis, sinibus aliquantum plicatis; staminibus 5 apice tubi corollae insertis filamentis ad basem versus barbellatis; fructu botuliformi ca. 12 mm. longo ca. 3.5 mm. crasso glaberrimo.

BRAZIL. RIO JANEIRO: indefinite, *Glaziou 1106* (Kew, TYPE); Rio Janeiro *Riedel* (RS).

This species is closely related only to *C. Goeldiana*, a plant known only from a single station in eastern Pará. It differs in having the corolla-lobes deltoid-ovate, about as broad as long and broadly acute, rather than having them oblong, twice as long as broad and obtuse or even retuse. In addition the new species has the calyces and the branchlets of the inflorescence much less copiously puberulent and glandular than its northern relative. The corolla-lobes are very broadly acute, the margins, which start to converge below the middle of the lobe, meet at the apex forming a definite angle of  $65^{\circ}$ – $90^{\circ}$ . The species is a distinctive one in the section *Gerascanthus* and is notable even among the representatives of the entire genus in South America because of its glabrous herbage, very elongate petioles and deltoid corolla-lobes. The only material I have seen of it consists of two collections with incomplete data indicating that the home of the species must be in the general region centering about Rio Janeiro. That such a well marked species can have lurked in this region and be so poorly represented in herbaria is only to be explained by assuming it to be very rare or local.

2. **C. Goeldiana** Huber, Bol. Mus. Goeldi vi. 89 and 201 (1910).  
Known only from the eastern part of the state of Pará.

BRAZIL. PARÁ: Peixeboi, railroad betw. Pará and Bragança, Sept. 23, 1907, *Goeldi 8319* (BM, BD, DL, RS, ISOTYPES); Peixeboi, Oct. 24, 1907, *R. Siqueira Rodrigues 8788* (BM).

This very distinct species is known only from the type-locality. Its nearest relative is *C. latiloba*, a species from the region about Rio Janeiro. Huber described the fruit of *C. Goeldiana* as being globose and 2 cm. in diameter. I have a very strong suspicion that this is quite incorrect and that perhaps Huber's description is based upon extraneous material belonging to some wholly different species, perhaps of even a different family. *Cordia Goeldiana* is so clearly a member of the section *Gerascanthus* and so obviously related to *C. latiloba* that it is unbelievable that it should have fruit so very markedly different from that species and the other members of the section. I feel certain that the fruit of Huber's species will be found to be essentially the same as that produced by *C. latiloba*.

3. **C. insignis** Cham. Linnaea viii. 122 (1833); Fresen. in Mart. Fl. Bras. viii. pt. 1, 3, t. 1 (1857). *Lithocardium insigne* Kuntze, Rev. Gen. ii. 977 (1891). *Gerascanthus aspera* Mart. (Herb. Fl. Bras. pg. 166, sub. no. 269) Flora Regenb. xxi. Bd. 2, Beibl. 86 (1838). *C.*



*Martii* DC. Prodr. ix. 471 (1845). *C. Nettoana* Taub. Bot. Jahrb. xv. Beibl. 38, 11 (Feb. 1893). *C. jucunda* Moore, Trans. Linn. Soc. ser. 2, iv. 401 (Dec. 1893).

From Minas Geraes and Rio Janeiro westward through Matto Grosso to easternmost Bolivia.

BRAZIL. MINAS GERAES: indefinite, *Lhotzky* (BD, TYPE of *C. insignis*). RIO JANEIRO: woods, Cabo Frio, *Glaziou 11283* (BD, TYPE of *C. Nettoana*; K, ISOTYPE). MATTO GROSSO: shrub 1 m. tall, corolla white, S. Luiz de Caceres, Aug. 24, 1908, *Hoehne 208* (BD); corolla white, Tapirapôan, March 1909, *Hoehne 1612* (BD); Morro de Ernesto, Cuyabá, *Martius Herb. Bras 269* (NY, K, DC, ISOTYPES OF *G. aspera*); shrub 3 m. tall, corolla creamy white, rocky soil, Cuyabá, May 1927, *Smith 125* (K); arborescent shrub 2 m. tall, branches few and somewhat flexuose, bark smooth, corolla yellowish green becoming white, Cuyabá, April 2, 1894, *Malme 1504* (RS); shrub ca. 1.7 m. tall, Cuyabá, Jan. 10, 1902, *Malme 1680* (RS); large shrub, Serra do Itapirapuan, April 28, 1894, *Lindman A3355* (RS); Matto Grosso, 1886, *Leeson* (BM, TYPE of *C. jucunda*); shrubby plant of the campo, 1-2 m. tall, May 17, 1899, *Meyer* (BD). BOLIVIA. SANTA CRUZ: corolla yellowish, Velasco, 200 m., July 1892, *Kuntze* (NY, BD).

Var. **glabrifolia** (Kuntze), comb. nov.—Leaves glabrescent beneath and conspicuously less reticulate than in the typical form.—*Lithocardium insigne*, var. *glabrifolium* Kuntze, Rev. Gen. iii. pt. 2, 206 (1898).

Known only from Matto Grosso.

BRAZIL. MATTO GROSSO: corolla white, tree 7-8 m. tall, Corumbá, July 20, 1908, *Hoehne 100* (BD); shrub 1 m. tall, corolla white, São Luiz de Caceres, Jan. 1909, *Hoehne 1120* (BD); indefinite, July 1892, *Kuntze* (NY, TYPE; BD, ISOTYPE).

This species is quickly distinguished from all other members of its section by its very large white or yellowish corollas and by its commonly rather large leaves. It appears to be a loosely branched bush or small tree 1-3 m. tall. A small proportion of the specimens examined have the twigs tunneled apparently by ants. The common form of the species has leaves of heavy texture that are prominently veined and hence conspicuously reticulate beneath. The lower surface is usually velvety. Under the name, var. *glabrifolia*, I have followed Kuntze in recognizing a peculiar form of the species from Matto Grosso. This plant has leaves that are usually smaller than is common in the usual form of the species and are glabrescent and very much less evidently reticulate beneath.

4. **C. glabrata** (Mart.) A. DC. Prodr. ix. 473 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 6 (1857). *Gerascanthus glabrata* (Herb. Fl. Bras. pg. 167, sub no. 269) Flora Regenb. xxi. Bd. 2, Beibl. 87 (1838). *Lithocardium glabratum* Kuntze, Rev. Gen. ii. 977 (1891). *C. longipeda* Mez, Bot. Jahrb. xii. 550 (1890). *L. longipedum* Kuntze, l. c.

*C. glabrata*, var. *longipeda* Chodat, Bull. Soc. Bot. Genève, ser. 2, xii. 212 (1921). *L. longipedum*, var. *glabrifolium* Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *L. longipedum*, var. *eriophyllum* Kuntze, l. c. 206. *C. glabrata*, var. *amambayensis* Chodat, l. c. *C. glabrata*, var. *orbicularis* Chodat & Vischer in Chodat, l. c. fig. 305. *C. longituba* Chodat & Vischer in Chodat, l. c. 213, fig. 310 and 313.

In Brazil from Piauhly and central Minas Geraes southwestward through Goyaz and Matto Grosso to southern Paraguay.

BRAZIL. PIAUHY: tree 12 m. tall, corolla white, common on banks of the Gurgoa, Aug. 1839, *Gardner 2686* (NY, K, BM, DC, DL, BB). GOYAZ: betw. Meiaponte and Caisara, Oct. 23, 1827, *Burchell 6290* (K); small tree 6-9 m. tall, corolla white, throat darkish, base of lobes with dark lines, near Chapel of Santo Amaro, Goyaz, July 8, 1828, *Burchell 7323* (G, K); tree 6-9 m. tall, Goyaz, June 15, 1828, *Burchell 7183* (K); tree 4-6 m. tall, Goyaz, June 1828, *Burchell 7186* (K); corolla white, small tree, base of Serra Dourada, Aug. 1895, *Glaziou 21782* (NY, K, BM, BD, DL, RS). MINAS GERAES: high dry campo near Contendas, *Martius, Herb. Bras. 1569* (BD, ISOTYPE of *G. glabrata*). MATTO GROSSO: Cuyabá, *Martius Herb. Bras. 1068* (NY, K, BD, DC, ISOTYPES of *C. longipeda*); Cuyabá, June 30, 1902, *Malme 1869* (RS); Cuyabá, Sept. 1, 1902, *Malme* (RS); Villa Maria, July 1892, *Kuntze* (NY, BD).

PARAGUAY: a tree with habit of *Populus alba*, solitary or in groups on campo, Colonia Risso near Rio Apa, Oct. 20, 1893, *Malme, 1092b* (RS); Sierra de Amambay, Sept., *Rojas in Hassler 10600* (BB, TYPE of v. *amambayensis*; BM, BD, Hass, DL, ISOTYPES); Concepción, Sept. 1892, *Kuntze* (NY, two collections, one the type of v. *eriophyllum*); tree 4-8 m. tall, near Concepción, Aug., *Hassler 7155* (BM, BD, DL, Hass, BB); Rincon betw. Concepción and Horqueta, 1914, *Chodat 363* (BB, TYPE of *C. longituba*); tree 5-6 m. tall, forest betw. Asunción and La Trinidad, Oct. 10, 1875, *Balansa 2029* (K, BM, BD, DL, BB, RS); Asunción, Tuyucua, Oct. 7, 1893, *Lindman A2135* (RS); Asunción, *Morong 792* (G, NY, K, BM, BB); Cord. de Altos, Aug. 3, 1902, *Fiebrig 6* (G, K, BM, BD, DL, Hass); woods near Cord. de Altos, July, *Hassler 596a-e* (NY, K, BM, Hass, BB); Cord. de Altos, 1914, *Chodat 366* and *369* (BB); near Lag. Ypacaray, Sept., *Hassler 11865* (G, BM, BD, Hass) and *11865a* (G, BM); Ypacaray, *Hassler 3222* (BM, BD, DL, Hass, BB); San Bernardino, Sept., 1896, *Endlich 183* (BD); tree 10-15 m. tall, campo, San Bernardino, Sept., *Hassler 3227* (K, BM, Hass, BB); San Bernardino, Aug. 1915, *Hassler 327a* and *1327* (Hass); near San Bernardino, Aug. 1914, *Chodat 364, 367, 367a-e* (BB); Paraguari, Sept. 1914, *Chodat 368* (BB); indefinite, *Hassler 3050* (BM).

A well marked species, which is restricted to our area, where it is characterized in its section by its simple trichomes and its ovate leaves that are glabrous and shiny above. It appears to be prevailingly deciduous and is said to develop, at the beginning of the growing season, its inflorescence before its leaves. There is a striking variation in the amount of pubescence developed on the leaves. In some forms the mature foliage is glabrous or only obscurely villulose below, in others it is pale and satiny with very abundant closely appressed silky hairs. The type of *L. longipedum* var. *eriophyllum*, *C. glabrata* var. *orbicularis* and *C. longituba* all represent this form with the leaves

silky-pubescent beneath. As this is a very striking phase of the species it may be convenient to have a name for it; it may appropriately be called **C. glabrata**, forma **eriophylla** (Kuntze), comb. nov. This form appears to be restricted to the southern parts of the range of the species where it appears to grow with the typical glabrate phase. Malme has noted on one of his labels that the trees of this form along the Rio Apa recall those of *Populus alba*. *Cordia longituba* seems to have been based upon a very mature specimen of the typical form in which the maturing fruit has pushed the marcescent corolla out of the calyx and hence exposed the tube. *Cordia glabrata* shows tendencies towards myrmecophily, stems of specimens frequently having been tunneled and inhabited by ants. As in *C. insignis*, however, these stems show only a slight increase over their normal diameter and are never distorted by conspicuous irregular swellings as is common in *C. alliodora*.

5. **C. alliodora** (R. & P.) Cham. ex DC. Prodr. ix. 472 (1845); Urban, Symb. Ant. viii. 574 (1921). *Cerdana alliodora* R. & P. Fl. Peru. ii. 47, t. 184 (1799). *Lithocardium alliodorum* Kuntze, Rev. Gen. ii. 976 (1891). *L. Gerascanthus*, var. *alliodorum* Kuntze, l. c. iii. pt. 2, 206 (1898). *Cordia Cerdana* R. & S. Syst. iv. 467 (1819). *Cordia cujabensis* Manso & Lhotzky ex Cham. Linnaea viii. 121 (1833); DC. Prodr. ix. 473 (1845). *Cerdana cujabensis* Manso ex DC. l. c. 473, in synonymy. *Cordia velutina* Mart. (Herb. Fl. Bras. pg. 165, no. 268) Flora Regenb. xxi. Bd. 2, Beibl. 85 (1838). *Gerascanthus velutina* Mart. ex Fresen. in Mart. Fl. Bras. viii. pt. 1, 5 (1857). ? *G. vulgaris* Mart. (Herb. Fl. Bras. pg. 166, sub no. 268) Flora Regenb. l. c. 86, in discussion. *Cordia Gerascanthus*, var. ? *subcanescens* DC. l. c. 472. *Cordia Gerascanthus*, var. *domingensis* Cham. l. c. 121; DC. l. c. 472. *L. Gerascanthus*, var. *domingense* Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *Cordia alliodora*, var. *glabra* A. DC. l. c. 472. ? *Cordia Hartwissiana* Regel, Gartenflora vi. 342 (1857). ? *L. Hartwigsiana* Kuntze, Rev. Gen. ii. 977 (1891). *Cordia Rusbyi* Chodat, Bull. Soc. Bot. Genève, ser. 2, xii. 187 and 198 (1921), not Britt. (1896). *Cordia Gerascanthus*, f. *martinicensis* Chodat, l. c. 210. *Cordia Gerascanthus*, f. *micrantha* Chodat, l. c. 210. *Cordia consanguinea* Klotzsch ex Chodat, l. c. 211, incidental mention. *Cordia alliodora*, var. *boliviana* Chodat & Vischer in Chodat, l. c. 211. *Cordia andina* Chodat, l. c. 211. *Cordia Chamissoniana*, var. *complicata* [R. & P.] Chodat, l. c. 215. *Cerdania complicata* R. & P. ex Chodat, l. c. 215, in synonymy. *Cordia Goudoti* Chodat, l. c. 215. *Cordia macrantha* Chodat, l. c. 215. ? *Cerdania exaltata* R. & P. ex Chodat, l. c. 216, incidental mention. *Cordia Gerascanthus* of Jacq. Sel. Stirp. Amer. 43, t. 175, f. 16 (1763) and many

subsequent authors, notably Griseb. Fl. W. Indies 478 (1861) and Chodat, l. c. 209; not *Cordia Gerascanthus* L. Syst. ed. 10, 936 (1759) nor *Gerascanthus* P. Browne, Hist. Jamaica 170, t. 29, f. 3 (1756)!! cf. Johnston, Contr. Gray Herb. lxxiii. 77-78 (1924).

From Mexico, Central America and the West Indies south into Venezuela and Colombia and then southward along the Andes to Amazonian Bolivia from whence it extends eastward into southwestern Brazil (Matto Grosso).

BRAZIL. MATTO GROSSO: Cuyabá, June 1832, *Manso & Lhotzky 13* (BD, TYPE of *C. cuyabensis*; DC, ISOTYPE); Morro do Ernesto near Cuyabá, *Martius Herb. Bras. 268* (NY, K, DC, DL); Cuyabá, June 8, 1902, *Malme 1651* (RS); Santa Anna da Chapada, July 27, 1902, *Malme 2110* (RS).

This widely distributed plant just enters our area, being known there only from Matto Grosso where it replaces the closely related *C. trichotoma*. Although *C. alliodora* and *C. trichotoma* are very closely related, it is to be noted that the two differ rather strikingly in their relation with ants. *Cordia alliodora* is a well-known myrmecophyte, its stems, usually just below the inflorescence, developing conspicuous irregular globose or turbinate gall-like swellings that become ant-domatia. Material of *C. trichotoma* only very rarely shows any suggestion of such developments. In the very rare cases where the stems are occupied by ants they are merely tunneled and although slightly increasing in thickness over the normal they are never conspicuously deformed as in *C. alliodora*. The complete and rather staggering list of synonyms of *C. alliodora* which I have given above might give the impression that the species, as here defined, is an uncommonly variable one. There is some variation in the size of the flowers and some in the amount of pubescence on the leaves, but less than in the related *C. trichotoma*. Chodat, l. c., the only person who has tried to split up the species, has failed most evidently in defining clearly, not only his numerous varieties, but even his proposed specific segregates. I am of the opinion that several varieties or forms would account for the principal phases of this species. Chodat, l. c., having insisted that the name *Cordia Gerascanthus* is the correct name for this species, it may be noted in substantiation of my arguments made several years ago, l. c., that I have recently examined the specimens in the Linnaean Herbarium which are the basis of *Cordia Gerascanthus* L. These specimens were collected by Browne in Jamaica and represent the plant treated by him as *Gerascanthus*. There can be no doubt whatsoever that they represent the plant described as *C. gerascanthoides* HBK! and hence one quite distinct from the one I am here calling *C. alliodora*.

6. ***C. trichotoma*** (Vell.) Arrab. ex Steud. Nom. ed. 2, 419 (1840).

*Cordiada trichotoma* Vell. Fl. Flum. 98 (1825) and Icones ii. t. 156 (1827). *Cordia frondosa* Schott ex Spreng. Syst. iv. pt. 2, 403 (1827). *Cordia tomentosa* Cham. Linnaea iv. 472 (1829), not R. & S. (1819). *Gerascanthus excelsa* Mart. (Herb. Fl. Bras. pg. 166, sub no. 269) Flora Regenb. xxi. Bd. 2, Beibl. 86 (1838). *Cordia excelsa* A. DC. Prodr. ix. 473. (1845). *Lithocardium excelsum* Kuntze, Rev. Gen. ii. 977 (1891). *Cordia Chamissoniana* Steud. l. c. 417, not Don (1837). *L. Chamissonianum* Kuntze, l. c. 976. *Cordia hypoleuca* DC. l. c. 472. *L. hypoleucum* Kuntze, l. c. 977. *Cordia alliodora*, var. *tomentosa* A. DC. l. c. 472; Fresen. in Mart. Fl. Bras. viii. pt. 1, 4 (1857). *Cordia asterophora* Mart. ex. Fresen. l. c. 5. *L. asterophorum* Kuntze, l. c. 976. *L. Gerascanthus*, var. *puberulum* Kuntze, Rev. Gen. iii. 206 (1898). *Cordia Gerascanthus*, f. *puberula* Kuntze ex Fries, Ark. Bot. vi. no. 11, 20 (1906). *Cordia hypoleuca*, f. *minor* Chodat, Bull. Herb. Boiss. ser. 2, ii. 815 (1902). *Cordia Hassleriana* Chodat, l. c. 815. *Cordia Chamissoniana*, var. *Gardneri*, var. *Blancheti*, var. *Martii*, var. *nemorensis* and var. *Aemilii* Chodat, Bull. Soc. Bot. Genève, ser. 2, xii. 214 (1921). *Cordia cujabensis*, var. *glabrescens* Hass. ex Chodat, l. c. 214, in synonymy.

Eastern Brazil from Ceará to Rio Grande do Sul and extending west through Paraguay to northwestern Argentina and adjacent Bolivia. Doubtfully occurring also in northernmost Brazil near the Guianan border.

BRAZIL. AMAZONAS: tree 5-12 m. tall, Mniam, Surumu, Rio Branco, Nov. 1909, *Ule 8290* (K, BD, DL). CEARÁ: Crato, Sept. 1838, *Gardner 1781* (BM); Crato, 1838, *Gardner 1780* (BB, TYPE of *C. Cham. v. Gardneri*; G, NY, K, DL, RS). RIO GRANDE DO NORTE: bank of Potengy River near Natal, July 1914, *Dawe 13* (K). PERNAMBUCO: Pernambuco, July 1925, *Pickel 1068* (BD). BAHIA: in woods, Catingas, *Martius* (BD, ISOTYPE of *C. asterophora*); Serra Jacobina, *Blanchet 2559* (BB, TYPE of *C. Cham. v. Blancheti*; NY, K, BM, BD, DC, DL). MINAS GERAES: tree 9 m. tall, Rio Claro, June 1840, *Gardner 5040* (NY, K, DL, RS); tree 7.5 m. tall, betw. Rio Claro and São Romão, June 1840, *Gardner 5040* (BM); Ouro Preto, *Casaretto 2915* (DL); betw. Carandahy and Queluz, *Glaziou 11282* (K, BD), *14143* (K, BM, BD, DL) and *14144* (NY, K, BD, DL); Barbacena, *Glaziou 14145* (NY, K, BD) and *15276* (K, BD); near Rio Novo, Sept. 1895, *Schwacke 11856* (BD); near Cipó, July 1897, *Schwacke 12858* (BD); Capivary, Caldas, May 10, 1874, *Mosén 1917* (G, K, BD, RS); Cachoeira do Campo, July 1839, *Claussen 62* (DL); Paraisópolis, April 15, 1927, *Hoehne, Mus. Paul. 20057* (G); indefinite, May 22, 1871, *Regnell III 1690* (BD); indefinite, *Claussen* (NY, K, BM) *358* (BM). RIO JANEIRO: Petropolis near San Antonio, *Glaziou 8475* (K, BD, DL); Petropolis, March 27, 1886, *Glaziou 16278* (NY, K, BD); Corcovado, 1839, *Guillemin 767* (BD, DC, DL); near Rio Janeiro, 1834, *Lund 66* (DC, TYPE of *C. hypoleuca*; BD, ISOTYPE); vicinity of Rio Janeiro, *Glaziou 1105* (K, DL), and *6855* (K, BD). SÃO PAULO: Itu, *Wier 254* (K, BM); San José do Campos, *Herb. Mendonça 188* (BD); San José do Barreiro, April 29, 1926, *Hoehne & Gehrt, Mus. Paul. 17642* (G); Mogy-Mirim, May 21, 1927, *Hoehne, Mus. Paul. 20412* (G); Mogy-Guassú, 1874, *Mosén 2006* (RS); Campinas, June 20, 1875, *Mosén 3905* (RS);

near Campinas, May 1898, *Noack* (BD). PARANÁ: Capão Grande, March 4, 1904, *Dusén 4005* (DL, RS); Jaguariahyra, *Dusén 497a* (G, RS), *10024* (RS) and *11743* (RS). RIO GRANDE DO SUL: São Leopoldo, Feb. 17, 1902, *Malme 1374* (RS); Ijuhy, April 4, 1893, *Lindman* (RS); Victoria on Rio St. Leopold, *Tweedie 28* (K); near Porto Alegre, *Fox 426* (K, BM). INDEFINITE: Brazil, *ex herb. Spreng* (BD, authentic *C. frondosa*); Bras. aequin. *Sellow 1571* and *1572* (BD, TYPE of *C. tomentosa*); Brazil, *Sellow* (K, BM, BD, DC, DL); Brazil, *Pohl, Herb. Mus. Vind. 1738* (K, BD); Brazil, *Martius Herb. Bras. 1067* (BB, TYPE of *C. Cham. v. Martii*; G, NY, K, BM, BD, DC, DL, ISOTYPES) and *486* (NY, K, BM, BD, DC, DL, ISOTYPES of *G. excelsa*); Brazil, *Glaziou 12087* (K).

PARAGUAY: Alto Paraná, *Fieberg 6164* (G, K, BM, BD); Sierra de Amambay, May, *Hassler 11225* (BB, TYPE of *C. Cham. v. Aemilii*; G, K, BD, DL) and *11235* (G, K, BM, BD, DL, Hass, BB); Itacurubi to Union, June 1898, *Endlich 184* (BD); tree 6–8 m., Cord. de Altos, March, *Hassler 3952* (BB, TYPE of *C. Hassleriana*; BM, BD, DL, Hass, ISOTYPES); shrub, Cord. de Altos, July, *Hassler 610* (DL, Hass); Lag. Ypacaray, Aug. 1913, *Hassler 11525* (G, BM, BD, Hass, DL) and *11808* (G, BM, BD, DL); tree 10–15 m., near San Bernardino, June, *Hassler 3050* (K, BM, BD, DL, BB); tree 8–15 m., near San Bernardino, June, *Hassler 3012* (BM, BD, DL, Hass, BB); tree 7–8 m., Cerro de Paraguari, Oct. 7, 1875, *Balansa 2030* (BM, DL, RS); tree 8–10 m. tall, Ybyty-mi, Sept. 1874, *Balansa 2030a* (BB, TYPE of *C. hypol. f. minor* and *C. Cham. v. nemorensis*; K, ISOTYPES); tree 10–15 m., Villa Rica, Feb. 1829, *Jørgensen 3469* (G); tree 10–20 m. Villa Rica, July 1929, *Jørgensen 3737* (G).

ARGENTINA. MISIONES: near Iguazú, May 5, 1902, *Thays 11* (K); Puerto Aguirre, July 1914, *Curran 672* (G, US, BM); Puerto Aguirre, Jan. 1922, *Molfino* (G); Puerto Leon, July 1914, *Curran 701* (G, US, BM); Santa Ana, May 1910, *Rodríguez 10318* (G); Misiones, April 1888, *Niederlein A61* (BD). SALTA: Tabacal near Orán, July 1873, *Lorentz & Hieronymus 527* (NY, TYPE of *L. Gerasc. v. puberulum*; BD, DL, RS, ISOTYPES). JUJUY: Ledesma, July 4, 1911, *Lillo, Stuckert Herb. 22345* (DL); Ledesma, July 5, 1911, *Lillo 10820* (G); tree ca. 10 m., Quinta near Laguna de la Brea, June 13, 1901, *Fries 172* (RS); Jujuy, 1906, *Dinelli* (BM).

BOLIVIA. TARIJA: Chiquiacá, 1000 m. alt., March 20, 1904, *Fiebrig 2745* (G, K, BM, BD).

*Cordia trichotoma* is very closely related to *C. alliodora*, differing only in its larger flowers, usually more copious and conspicuous pubescence and more eastern and southern distribution. Although these differences are not strong ones and even though the two species do show a slight tendency to intergrade I am inclined to believe that their acceptance as species is perhaps desirable since the division is a natural one and seems to be in the vast majority of instances a practicable one also.

*Cordia trichotoma* exhibits some variation in the size of the flowers but its most conspicuous variations are those involving the character, abundance, distribution and to some extent the color of the stellate-pubescence particularly on the leaves. The extremes of this variation are very striking and quite different at first sight. They have, accordingly, attracted attention and have been largely the cause of the imposing array of synonyms that I have listed above. These extreme variations of pubescence, however, are thoroughly connected by an abundance of intermediate forms and, what I consider very

significant, show very little if any tendency to be geographically correlated. Since these extreme forms have attracted and no doubt will continue to attract more attention than they merit I have defined below, for convenience and in the hope that they may forestall further multiplication of synonyms, a group of four forms into which all the material of this species may be placed by those who feel the need of a detailed classification of such fluctuating forms.

Forma **typica**. Lower surface of the leaves felty with a very dense close usually yellowish indument of abundant minute stellate hairs; upper leaf-surface glabrate or with minute sparse inconspicuous stellate hairs.

Forma **Blancheti** (Chodat), comb. nov. Lower surface of the leaves velvety with a loose evident grayish or grayish-yellow tomentum of abundant stellate hairs; upper surface of leaves sparsely stellate or glabrate.—*C. Chamissoniana*, var. *Blancheti* Chodat, l. c.

Forma **puberula** (Kuntze), comb. nov. Lower surface of the leaves very sparsely clothed with stellate hairs, frequently almost glabrescent; upper surface usually glabrescent.—*L. Gerascanthus*, var. *puberulum* Kuntze, l. c.

Forma **tomentosa** (Cham.) comb. nov. Upper as well as lower surface of the leaves clothed with a loose very abundant fulvescent tomentum of evident stellate hairs.—*C. tomentosa* Cham., l. c.

The type of *C. trichotoma* came from Brazil in "silvis maritimis Regii Praedii Sanctae Crusis" at the western end of the Federal District. Unfortunately no mention is made in the original description of the pubescence and so consequently it is necessary to place the species entirely upon what can be derived from our knowledge of its type-locality and from a study of the plate given by Vellozo. The form of our species that has been collected by others in the Federal District is almost exclusively that which I have indicated as the forma *typica*. The plate given by Vellozo has no pubescence indicated, but inasmuch as the artist in his various illustrations has indicated only the most conspicuous types of pubescence I believe that we may assume that the plate of the present species of *Cordia* was probably based upon the form with very fine dense felty yellowish indument, that is to say upon the predominating form in the Federal District, the forma *typica*. I have seen this form from Paraguay, northeastern Argentina and from the Brazilian states south of Rio Janeiro. *Cordia frondosa* is a clear synonym. *Cordia excelsa* is typical except that it is aberrant in having the calyx only weakly rather than strongly ribbed.

The forma *Blancheti* is probably the most widely distributed form

of the species occurring throughout most of its range. It differs from *typica* only in its velvety, much looser indument of much coarser trichomes. The lower leaf-surface is obviously hairy and not as in the f. *typica* so densely and finely pubescent that extreme forms might, with a hasty glance, be thought to be glabrous with a waxy indument. To this common form I would refer *C. Chamissoniana* vars. *Gardneri*, *Blancheti*, *nemorensis*, *Aemilii* and *C. cujabensis* var. *glabrescens*. The forma *Blancheti* is slightly less distinct than the f. *typica*, being connected by very numerous intergrades with both f. *tomentosa* and f. *puberula*.

The forma *puberula* is simply the extreme phase of f. *Blancheti* in which the leaves become glabrescent or are only sparsely pubescent beneath. It occurs sporadically in various parts of the range of the species and seems to be less common than *Blancheti*. It has synonyms in *C. asterophora* and *C. Hassleriana*.

The forma *tomentosa* is another extreme phase of f. *Blancheti*, in this case one in which the very copious velvety tomentum is formed on both surfaces of the leaves rather than on merely the lower one. It appears to be uncommon and seems to occur only in the coastal states of Brazil north of Rio Janeiro. It has synonyms in *C. tomentosa*, *C. Chamissoniana* and *C. Chamissoniana* var. *Martii*.

Section **Varronia** [P. Browne] Don, Gen. Syst. iv. 382 (1837). *Varronia* [P. Browne, Hist. Jamaica 172, t. 13, f. 2 (1756)] L. Syst. ed. 10, 916 (1754) and Gen. ed. 6, 102 (1764), type-species ? *C. globosa* HBK. *Cordia-Varroniae* HBK. Nov. Gen. et Sp. iii. 71 (1818); R. & S. Syst. iv. 458 (1819). *Cordia* subgenus *Varronia* Schlecht. & Cham. Linnaea v. 115 (1830). *Cordia* § *Sebestena* subsect. *Varronia* Endl. Gen. 644 (1838). Not *Varronia* DC. nor *Cordia* § *Varronia* Gürke. *Cordia-Dasycephalae* HBK. l. c. 76 (1818), type-species, *C. globosa* HBK. *Cordia* § *Varronia* subsect. *Dasycephalae* Don, l. c. 383 (1837). *Cordia* § *Myxa* subsect. *Dasycephalae* Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 84 (1893). *Cordiopsis* Desv. ex Hamilton Prodr. Pl. Ind. Occ. 23 (1825); Urban, Symbol. Ant. viii. 580 (1921), type-species, *C. mirabilloides* Ham. *Cordia* § *Cordiopsis* A. DC. Prodr. ix. 498 (1845). *Catonia* Raf. Fl. Tellur. ii. 36 (1836), type-species *C. lantanoides* Raf. *Piloisia* Raf. Sylva Tellur. 43 (1838), type-species, *P. globosa* (Jacq.) Raf. *Topiaris* Raf. Sylva Tellur. 43 (1838), type-species, *T. geniculata* Raf.

The section *Varronia* is confined to America, where its approximately 60 species are widely dispersed in the tropics. The greatest diversity of form, however, is found in Mexico and in Brazil. It contains only shrubs or suffrutescent plants. The group is polymorphous but



evidently a natural one and because of the large number of species, their variability and their indefiniteness probably the most perplexing and poorly understood in the entire genus. The most characteristic feature of the species of this section is the development of dense, distinctly spicate, globose or glomerate flower-clusters. Although the vast majority of the species have the numerous flowers densely congested, a few show not unexpected departures from this habit. The widely distributed *C. corymbosa* commonly has the rather numerous flowers in definite glomerules but frequently these loosen up to form flat cymes several centimeters in diameter. Another extreme is found in the few species related to *C. Greggi* Torr. of Mexico. Here the flowers are very few and form small loose cymes that occasionally are reduced to a single flower. Morphologically the characteristic spikes and heads of the section are very interesting being what Gray has termed "reversed or determinate." The flowering in them begins at the apex and proceeds downward towards the base thus showing their cymose origin. The calyx of *Varronia* is cupulate, crateriform or somewhat globose and is always clearly accrescent at maturity and more or less sheaths the fruit. It is never explanate. In some forms it becomes a deep cup closely investing the lower half or two thirds of the mature fruit, in others it becomes slightly inflated, completely surrounds the fruit and eventually seems to fall away with it ensheathed. In consequence of the crowding of the calyces in the head they frequently become quite angulate. The calyx-lobes are quite variable in form but apparently valvate and always 5 in number. These lobes vary from deltoid to lanceolate and in many species develop very characteristic linear apical appendages. They are generally erect but in species where the accrescent calyx surpasses the fruit in length they are almost always inflexed. The corolla in the section shows great variety of development as to size and general form, but with occasional exception is characterized by its subentire or very shallowly lobed limb. The corolla-lobes are not particularly conspicuous, usually being short, extremely broad and rounded or truncate. The fruit is either globose or ovoid and appears to be always small, becoming only 3-6 mm. in length. It is generally 1-2-seeded although it is not uncommon for plants to develop all 4 of its ovules.

#### KEY TO THE SPECIES.

- Corolla large, 1.5-6 cm. long, limb many times as broad as the tube,  
tube and throat evidently differentiated.  
Tips of calyx-lobes with conspicuous slender subulate appendages  
2-4 mm. long.

- Leaves with distinct slender petioles 1-2 cm. long; corolla very large 4-5.5 cm. long; loosely branched shrub becoming 25 dm. tall; river banks.....7. *C. grandiflora*.
- Leaves sessile or the cuneate base rarely drawn out into a winged petiole 1-5 mm. long; corolla smaller, 2-2.5 cm. long; undershrub with several simple or sparsely branched strict stems 1-5 dm. tall; dry campos.....8. *C. paucidentata*.
- Tips of calyx-lobes unappendaged or with stubby inconspicuous appendages ca. 1 mm. long.
- Calyx and peduncles glabrous, conspicuously studded with minute sessile glands.....9. *C. longifolia*.
- Calyx and peduncles evidently strigose or hirsute, sparingly glandular.
- Upper leaf-surfaces glabrous or with only a few scattered hairs springing from conspicuous pale disks of mineralized cells; leaves lanceolate, inconspicuously crenate or serrate; corolla-lobes ovate.....10. *C. poliophylla*.
- Upper leaf-surfaces abundantly strigose, conspicuous disks of pale mineralized cells absent; leaves ovate to lanceolate, conspicuously serrate; corolla-lobes very broad and rounded, semicircular.....11. *C. leucocephala*.
- Corolla small, usually 1 cm. long or less, limb only 2-4 times as broad as the tube, throat and tube seldom clearly differentiated.
- Inflorescence clearly spicate, the spikes 3-20 times as long as broad.
- Leaves muriculate or verrucose above, not hairy, blades lanceolate.....12. *C. verbenacea*.
- Leaves hairy above.
- Leaves 1-2.5 cm. broad, usually lanceolate or lance-ovate; erect shrubs.
- Peduncles and leafy stems with appressed, usually curled hairs.....13. *C. chacoensis*.
- Peduncles and leafy stems with stiffish straight spreading hairs.....14. *C. intonsa*.
- Leaves 3-7 cm. broad, ovate or ovate-lanceolate; shrubs frequently becoming scandent.....15. *C. multispicata*.
- Inflorescence capitate or glomerate or rarely becoming somewhat open, never more than twice as long as broad.
- Flowers glomerate or rarely loosening and forming a small open cyme.....16. *C. corymbosa*.
- Flowers distinctly capitate, not glomerate nor becoming loosened.
- Peduncles prevailingly axillary, the petiole of the subtending leaf partially decurrent on the peduncle.
- Upper leaf-surface (except along the impressed nerves) glabrous, roughened only by the tubercles or cusps representing undeveloped hairs; calyx-lobes commonly tipped by linear appendages; plants of the Amazonian headwaters.....17. *C. buddleyoides*.
- Upper leaf-surfaces hairy; calyx-lobes tipped by very short stout appendages if at all; plant from (except in Goyaz) east and south of the Amazon Basin.18. *C. axillaris*.
- Peduncles exclusively terminal or if not then opposite the leaves or internodal, not axillary.
- Freely branching shrubs 1-2 m. tall; peduncles frequently opposite the leaves or internodal as well as terminal; leaves with slender evident petioles 5-10 mm. long.
- Lower leaf-surface conspicuously floccose, white.19. *C. leucomalla*.

Lower leaf-surface not at all floccose, green.

Calyx and peduncles very sparingly hairy, covered with extremely numerous sessile or stalked glands.....20. *C. corchorifolia*.

Calyx and peduncles conspicuously hairy, glands sparse or absent.

Leaves very hairy, somewhat velvety, provided with stalked glands; flower-heads 1.5–2 cm. in diameter; calyx-lobes with very conspicuous apical appendages 3–4 mm. long....21. *C. caput-medusae*.

Leaves sparsely hairy, the hairs frequently appressed, glands sessile if present; flower-heads 6–12 mm. in diameter; calyx-lobes with much less conspicuous appendages only 0.5–2 mm. long.....22. *C. globosa*.

Sparingly branched shrubs or undershrubs 1–10 dm. tall, frequently with simple or once-branched leafy stems springing from a woody caudex; peduncles terminal; leaves sessile or with inconspicuous petioles up to 5 mm. long.

Calyx-lobes with very conspicuous apical linear appendages 4–5 mm. long; leaves ovate or ovate-oblong, broadest below the middle, lower surface white-tomentose.....23. *C. calocephala*.

Calyx-lobes with apical appendages 0.5–2 mm. long; leaves obovate (or rarely elliptical) to narrowly oblanceolate, usually broadest at or above the middle, lower surfaces rarely if at all white-tomentose.

Stems brown, hispid with slender spreading hairs; leaves 0.8–5 cm. broad.....24. *C. sessilifolia*.

Stems pale, clothed with appressed or incurved hairs; leaves 0.4–2.3 cm. broad.

Leaves elliptical to broadly oblanceolate, the secondary veining thickened and prominently reticulate beneath; hairs on the lower surface springing from the veins and directed over the vein-areoles; flower-heads very dense and usually fulvous.....25. *C. truncata*.

Leaves elongate, narrowly oblanceolate, the secondary veining very obscurely developed beneath, hairs on lower surface antrorse; flower-heads less dense, fewer-flowered and never fulvous.....26. *C. guaranitica*.

7. ***C. grandiflora*** (Desv.) HBK. Nov. Gen. et Sp. iii. 77 (1818); Fresen. in Mart. Fl. Bras. viii. pt. i, 21, t. 3, f. 2 (1857). *Varronia grandiflora* Desv. Jour. de Bot. i. 273 (1808). *Lithocardium grandiflorum* Kuntze, Rev. Gen. ii. 977 (1891). *V. lantanoides* Willd. ex Cham. Linnaea iv. 492 (1829), in synonymy. *C. rufa* Klotzsch ex Schomburgk, Fauna u. Fl. Brit. Guiana 960 (1848), nomen.

Known only from central Venezuela and eastward along the Orinoco to British Guiana and from the following single collection on the lower Amazon in Brazil.

BRAZIL. PARÁ: shrub ca. 2.5 m. tall, growing into the water, corolla white, Rio Trombetas, vicinity of Obidos, Dec. 1849, *Spruce 515* (G, K, BM, BD, DL, BB).

A very distinct species and the one having the largest flowers in its section. The plant must be a rare one for despite its conspicuous flowers it has been collected in only a few scattered localities, in all cases apparently in low wet ground near rivers. The corollas, suggestive of those of *Ipomoea*, have a tube 6–9 mm. long and 2–2.5 mm. thick, and a very well developed throat 2–2.5 cm. long and 11–14 mm. thick at the summit; the limb is 3–4 cm. in diameter and has broad shallow ascending lobes. In our Brazilian material the throat is narrowly obconic and is gradually expanded upward from the tube. In the specimens from British Guiana and Venezuela, however, the throat is campanulate and very abruptly expanded at the base. In other characters our plant is remarkably like these from farther north. The species, in fact, is very stable and shows practically no other noteworthy variations. The type of *C. grandiflora* was obtained in central Venezuela.

8. ***C. paucidentata*** Fresen. in Mart. Fl. Bras. viii. pt. 1, 25 (1857). *C. sessilifolia*, var. *macrantha* Cham. Linnaea viii. 130 (1833). *Lithocardium macranthum* Kuntze, Rev. Gen. ii. 976 (1891). *C. uruguayana* Arech. Anal. Mus. Nac. Montevideo, ser. 1, iv. 16, t. 7 (1902) and l. c. vii (Fl. Urug.) 170 (1911). *C. paucidentata*, var. *subulata* Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 481 (1905). *C. paucidentata*, var. *valenzuelensis* Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 217 (1921).

From northeastern Paraguay and from Paraná in Brazil southward into northern Uruguay.

PARAGUAY: suffrutex 4–5 dm. tall, Punta Pará, Dec., *Rojas in Hassler 9903* (BM, BD, Hass); suffrutex 3–5 dm. tall, Yerbales, Sierra de Maracayú, *Hassler 5039* (BB, TYPE of var. *subulata*; BM, BD, DL, Hass, RS, ISOTYPES); Alto Paraná, *Fiebrig 6385* (BD, Hass); suffrutex 5–6 dm. tall, vicinity of Rio Yhú, Nov. 1905, *Hassler 9618* (Hass); Caaguazú, Sept. 11, 1874, *Balansa 2663* (BB); suffrutex 3–5 dm. tall, Valley of Rio Y-acá near Valenzuela, 1900, *Hassler 6964* (BB, TYPE of var. *valenzuelensis*; BM, Hass, ISOTYPES); herb 2–3 dm. tall, near Sapucay, Dec., *Hassler 1620* (Hass); on ant-nests in campo, Est. Santa Maria, Feb. 2, 1896, *Anisits 2692* (RS); Cerro del Gobierno, Dec. 10, 1907, *Berro 4945* (BB).

ARGENTINA. MISIONES: San Ignacio, Oct. 23, 1913, *Quiroga* (G); betw. Santa Ana and Loreto, Feb. 14, 1883, *Niederlein* (BD); Bonpland, Feb. 1922, *Molfino* (G); Posadas, Feb. 1922, *Molfino* (G); Posadas, Jan. 1922, *Molfino* (G); Posadas, Dec. 1, 1909, *Rodríguez 10054* (G).

BRAZIL. PARANÁ: shrubby campo, Rio Capinzal, Feb. 29, 1916, *Dusén 17885* (RS). RIO GRANDE DO SUL: grassy campo, Cruz Alto, Jan. 20, 1903, *Malme 1163* (RS). INDEFINITE: Bras. merid. *Sellow 3096* and *d1728* (BD, authentic material of *C. paucidentata* and *C. sessilifolia* v. *macrantha*); Bras., *Sellow* (K).

URUGUAY. ARTIGAS: Catalan, Nov. 27, 1927, *Herter 999* (G, RS).

A well marked, very distinct species which appears to frequent open places, particularly on dry campos. Among the South American species which have this habit *C. paucidentata* is quickly distinguished by its conspicuous corollas. The plant may be a shrubby perennial with a tuft of subsimple stems 1.5–3 dm. tall or may become a shrub with only a few very sparsely and strictly branched stems 5 or rarely as much as 8 dm. tall. The corollas are funnelform, 2–2.5 cm. long and nearly as broad. The broad limb is only very shallowly lobed. I have seen a photograph of the type of *C. uruguayana*, this was obtained for me several years ago through the kindness of Dr. Herter of Montevideo. The species is clearly conspecific with *C. paucidentata*, the type in fact being remarkably like the type-collection of *C. sessilifolia*, var. *macrantha* Cham., the nomenclatorial basis of the name *C. paucidentata* Fresen. I am unable to distinguish the two varieties proposed by Chodat.

9. ***C. longifolia*** A. DC. Prodr. ix. 495 (1845). *Lithocardium longifolium* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from the eastern part of the state of Bahia.

BRAZIL. BAHIA: Muritiba, 1847, *Blanchet* (DC); Feira Santa Anna, *Blanchet* (DC); Bahia, *Blanchet* 268 (DL); corolla white, forests, Bahia, 1834, *Blanchet* 1739 (DC, TYPE; BM, DL, BB, ISOTYPES); "Ilhios, Moricand" 1739 (K); southern part of prov. Bahia, 1840, *Blanchet* 3190A (DL); Bahia, 1840, *Blanchet* 3190 (DL); Muritiba, *Blanchet* 3986 (K, DL, BB); corolla white, Bahia, *Blanchet* 23 (BM); corolla white, shrub in shady woods, Feira Santa Anna, April, *Blanchet* (BB).

This extremely well marked species is known only from Bahia where it appears to have been collected only by Blanchet. The flowers are borne in a short stout not very densely flowered spike terminating a very slender elongate distinctly supra-axillary peduncle. Although the calyces and peduncle are devoid of any hairs they have a pruinose covering of abundant minute sessile glands. The calyces are funnel form, the basal part being distinctly contracted into a definite tube almost 1 mm. thick and nearly 2 mm. long. Above this tube the calyx expands rapidly forming an open throat. The calyx-lobes are triangular, 1–1.5 mm. long, and have unappendaged tips. After the fall of the corolla the calyx-lobes are more or less inflexed and consequently enclose the developing fruit. The fruit, which is ovoid-turbinate, almost 5 mm. long and 3 mm. thick and conspicuously lacunose, develops in the tube of the calyx and consequently distorts and apparently with frequency even ruptures it as it increases in size in maturing. The developed corolla, unknown to De Candolle, is white and funnelform having a very slender tube, 4–5 mm. long and 1 mm. thick, that much surpasses the calyx. The wide corolla-throat is abruptly

expanded from the tube. The limb of the corolla is nearly 2 cm. broad and, by sinus 4–5 mm. deep, is cut into five broad ascending emarginate lobes. The leaves are lanceolate, somewhat firm in texture, with the lower surface noticeably pale. As with the inflorescence it is pruinose with minute sessile glands. The upper surface is occasionally provided with pustules formed by the thickening and mineralization of disks of epidermal cells. Although similar to the hair-bases formed on the leaves of other species, these disks do not produce hairs in *C. longifolia*.

10. **C. poliophylla** Fresen. in Mart. Fl. Bras. viii. pt. 1, 26 (1857).  
*Lithocardium poliophylla* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from southeastern Bahia or adjacent Espirito Santo.

BRAZIL. ESPIRITO SANTO OR BAHIA: betw. Vittoria and Bahia, *Sellow* (BD, COTYPE). INDEFINITE: no locality given, *Blanchet* (DL).

I have not seen the type of this species which was collected by Martius at an undesignated locality "in silvarum Oceano conterminarum margine," but I have studied a cotype at Berlin that was collected by Sellow somewhere on the coast in southern Bahia or northern Espirito Santo. My study of the original description and of the cotype, however, makes me feel confident in referring to the species a collection made in Bahia by Blanchet. This came from the Moricand Herbarium, now a part of the Delessert Herbarium at Geneva, and is labeled as having been received under and perhaps as a part of Blanchet's no. 3190, a number which represents *C. longifolia*. *Cordia poliophylla* is most closely related to *C. longifolia* but seems to be quickly distinguished by its abundant appressed pubescence and particularly by its pubescent globose and stouter less elongate calyces. Blanchet's specimen has corollas with the tube ca. 8 mm. long, almost 2 mm. thick and much surpassing the calyx. The throat is abruptly expanded, broad and open. The lobes are ovate, obtuse and 5–6 mm. long. Although the corolla is glabrous, outside it is sprinkled with short-stipitate yellowish glands.

11. **C. leucocephala** Moricand, Pl. Nouv. d'Amér. 148, t. 88 (1846).  
*Lithocardium leucocephalum* Kuntze, Rev. Gen. ii. 977 (1891). *C. leucocalyx* Fresen. in Mart. Fl. Bras. viii. pt. 1, 22, t. 7 (1857). *L. leucocalyx* Kuntze, l. c. 977. *C. affinis* Fresen. l. c. 22, t. 9, f. 10. *L. affine* Kuntze, l. c. 976. *C. striata* Fresen. l. c. 23. *L. striatum* Kuntze, l. c. 977. *C. nivea* Fresen. l. c. 26. *L. niveum* Kuntze, l. c. 977.

Ranging from northwestern Ceará southward through eastern Piauí and central and east-central Bahia to northern Minas Geraes.

BRAZIL. CEARÁ: Jatobá, March 30, 1910, *Loefgren* 432 (RS). PIAUÍ: shrub 18 dm. tall, corolla white, near Boa Esperança, Feb. 1839, *Gardner* 2265

(K, BM). BAHIA: corolla white, Serra do Assuruá towards the Rio San Francisco, 1838, *Blanchet 2854* (NY, K, BM, BD, DL, BB, ISOTYPIC of *C. nivea* ?); corolla yellow, Pouço d'Areia near Jacobina, *Blanchet 3880* (DL, TYPE of *C. leucocephala*; BM, BB, ISOTYPES); Pouço d'Areia, Jan. 1844, *Blanchet 3879* (DL); near Cachoeira, Feb. 1819. *Martius* (BD, ISOTYPE of *C. affinis*). MINAS GERAES: near Formigas, July 1818, *Martius* (BD, COTYPE of *C. affinis*).

In founding his species Moricand cited two collections of Blanchet, nos. 2854 and 3880, giving both of them as from "Serra Açurua." *Blanchet 2854* is in bud only and doubtlessly came from the Serra Assuruá. The other collection, no. 3880, however, is in flower. There can be no doubt that this latter collection is not only the basis of Moricand's illustration but also of the important parts of his description. Consequently I have accepted *Blanchet 3880* as the type-collection, although in doing so I question strongly that the collection came from the locality given by Moricand. The locality, Serra Açurua, written on the label of the type in a script different from those which are familiar on Blanchet's labels, does not agree with that given on the labels of this collection in the De Candolle or Boissier herbaria or at the British Museum. In these three herbaria the specimens of *Blanchet 3880* are provided with the data which I have used above in citing collections examined. *Cordia nivea* is a clear synonym of *C. leucocephala* having no doubt been based upon another specimen of *Blanchet 3880*. I have seen the two basic collections of *C. affinis* and so feel confident in referring that species also to the synonymy of *C. leucocephala*. I have seen no authentic material of either *C. striata* or *C. leucocalyx*. The latter species is well illustrated. A study of the plate and of the original description leaves me with no doubt as to its identity. *Cordia striata* comes from east-central Bahia, the region in which Blanchet has collected good *C. leucocephala*. As a species, *C. leucocephala* is well marked by the elongate throat of its large corollas, by the pronounced crowding of the ovoid calyces in the head and by its leaves which are evidently strigose above. It may be mentioned that Blanchet, in notes on his labels, has given the corolla as either white or yellow.

12. ***C. verbenacea*** DC. Prodr. ix. 491 (1845). *Lithocardium verbenaceum* Kuntze, Rev. Gen. ii. 977 (1891). *C. salicina* DC. l. c. 492. *L. salicinum* Kuntze, l. c. 977. *L. Fresenii* Kuntze, l. c. 976. *C. cylindristachya* and *curassavica* auct. bras.

In eastern Brazil, generally at no great distance inland, from Ceará to Rio Grande do Sul; in the south apparently ranging westward through Misiones and southern Paraguay to northwestern Argentina.

BRAZIL. CEARÁ: Serra Araripe, April 21, 1910, *Loefgren 630* (RS). PERAMBUCO: Garanhuns, June 18, 1887, *Schenck 4184* (BD). BAHIA: Catinga

near Calderão, Oct. 1906, *Ule* 7263 (K, BD); Prov. Jacobina, 1842, *Blanchet* 3608 (K, BM, BB); Bahia, *Blanchet* 211 (DL); vicinity of Toca de Onca, June 1915, *Rose & Russell* 20125 (NY). MINAS GERAES: betw. Carandahy and Ouro Preto, *Glaziou* 13036 (K, BD); indefinite, *Claussen* (K, BM, DL) 300 (BM, BD, DL). RIO JANEIRO: Nictheroy, Dec. 25, 1901, *Dusén* 144 (RS); Morro do Cavallão, Nictheroy, April 17, 1929, *Smith & Brade* 2318 (G); Itaborahy, March 1888, *Mendonça* 946 (BD); shrub becoming 18 dm. tall, corolla white, Freguezia, Nov. 18, 1921, *Holway* 1318 (NY); Ilha do Governador, 20 m. Nov. 7, 1920, *Patschke* 180 (BD); shrub, corolla white, São Christovão, Oct. 21, 1871, *Glaziou* 4963 (BD, RS); common in valley of Rio Comprido, Sept. 1836, *Gardner* 84 (K); corolla white, valley of Catumbi, Jan. 31, 1826, *Burchell* 1779 (K); shrub 12–20 or 30 dm. tall, corolla white, along the aqueduct near Rio Janeiro, Aug. 16, 1825, *Burchell* 777 (K); Rio Janeiro, *Gaudichaud* (DC, TYPE of *C. verbenacea*; NY, DL, ISOTYPES), *Vauthier* 204 (DC, TYPE of *C. salicina*; G, DL, ISOTYPES), *Gaudichaud* 103 (DL), *Gardner* 84 (NY, BM, DL), *Weddell* 396 and 1672 (DL), *Miers* 3073 (K), *Widgren* 401 (RS), *Regnell* 152 (RS), *Gaudichaud* (K, BD), *Sellow* (K, BD). SÃO PAULO: corolla white, fruit scarlet, shrub, Guarujá near Santos, Feb. 11, 1924, *Bailey* 942 (G); near Santos, Sept. 20, 1915, *Rose & Russell* 21138 (NY); slender shrub with white flowers, frequent about Santos, Jan. 1875, *Mosén* 3447 (RS); Montserrat, Santos, Sept. 1894, *Brenning* (BD); Conceição de Itanhaen, Sept. 13, 1894, *Loefgren & Edwall* 2606, *Mus. Paul.* 11307 (G). SANTA CATHARINA: shrub, Capoeira, road to Brusque, Nov. 12, 1886, *Schenck* 4184 (BD); Barra do Itajahy, *Mueller* 378 (K); Itajahy, Oct. 1885, *Ule* 479 (BD); dunes, Laguna, June 24, 1909, *Dusén* 8431 (RS). RIO GRANDE DO SUL: shrub 1 m. tall, corolla white, fruit scarlet, San Pedro do Rio Grande, Nov. 22, 1892, *Lindman* A727 (RS); sand near Emigration Station, Tristeza, *Reineck & Czermak* 125 (DC, RS); Rio Grande do Sul, shore of L. da Mangueira, Oct. 29, 1901, *Malme* 60 (RS); S. Lourenço, 1887, *Ihring* 45 (BD).

ARGENTINA. MISIONES: San José, Feb. 1922, *Molfino* (G); Posadas, Jan. 1922, *Molfino* (G); Posadas near "La Granja," Nov. 14, 1907, *Ekman* 1784 (RS); Santa Ana, Sept. 1909, *Rodríguez* 10019 (G). SALTA: Cerro de San Bernardino, March 8, 1905, *Spegazzini* (G); Reprisa to Campo Gasano, Tartagal, 500 m., Feb. 6, 1925, *Schreiter* 3817 (G).

PARAGUAY: Encarnación, Sept. 1915, *Hassler* 1467 (Hass); Rio Pilcomayo Exped. 1890–91, *Kerr* (K).

This species, along with *C. multispicata*, *C. chacoensis* and *C. intonsa*, belongs to the group of spicate-flowered shrubs, exemplified by *C. cylindristachya* (R. & P.) R. & S. and *C. curassavica* (Jacq.) R. & S., which has its center of distribution beyond our limits in northwestern South America. The group is one of exceptional difficulty and is very imperfectly understood. Its species are extremely variable and ill-defined; their taxonomy is complicated and indefinite through an over-excess of names, many of which have been almost traditionally misapplied. It is a group in crying need of detailed attention but its study must be undertaken as a whole for only thus can the intricacies of its variation be appreciated and even a reasonably satisfactory and logical taxonomic expression of them attained. In the treatment in this paper of the few outlying members of the group found in our area I have deliberately adopted a provincial view-point and have used for our plants the names which have been based upon plants from the



area and hence indubitably applicable to them. While I am rather certain that some of our plants of this group are either identical with, or at most no more than varietally distinct from, certain plants of northern and western South America I feel it preferable to maintain them as species provisionally distinct than to guess at their relationships in this complex very poorly understood group and thereby, perhaps, add another bit of confusion by a misidentification and a few more useless trinomials to an already overly copious synonymy. It will be noted, therefore, that I have been concerned here chiefly with the distinguishing characters, the limits and the interrelation of the several "species" found in our area and that, although I have been by no means blind to it, I have offered very scanty notes on the obvious relation which our plants show with the extralimital ones.

*Cordia verbenacea* seems to be closely related and perhaps conspecific with the plants of the West Indies and northern Venezuela which appear to be properly referable to *C. curassavica* (Jacq.) R. & S. and *C. macrostachya* (Jacq.) R. & S. In our area the species is reasonably well defined and occurs in its characteristic typical form, generally near the coast, from Ceará to São Paulo. In this form the elongate, frequently lanceolate leaves are glabrous above and usually roughened by small and commonly abundant minute tubercles or murications that are morphologically the bases of undeveloped trichomes. The spikes are usually slender and elongate and tend to be interrupted in age. This typical form of the species has about the same range of distribution as *C. multispicata*, but except for a very few collections that may possibly represent hybrids, the two species are quickly separated on size and shape of leaves and on the presence or absence of hairs on the upper leaf-face. The difficulties in defining *C. verbenacea* appear in southernmost Brazil, in northern Argentina and southern Paraguay where it meets and completely intergrades with *C. chacoensis*. This latter species is one of the interior, ranging in northern Argentina and in Paraguay. In its extreme forms it differs from *C. verbenacea* in having usually smaller proportionately broader leaves that are strigose or hirsute above, as well as usually hairy calyces and denser, shorter and somewhat thicker spikes. In sorting the specimens preparatory for citing them in this paper I have been finally forced to distinguish *C. verbenacea* and *C. chacoensis* on the presence or absence of hairs on the upper leaf-surface. This has brought most of the coastal plants under *C. verbenacea* and most of those from the interior under *C. chacoensis*, although certain plants from the general range of the latter have had to be placed in *C. verbenacea*. These latter plants as well as those from the two most southern states of Brazil have the broadish leaves and the

stout spikes of *C. chacoensis*. The shape of the leaves and spikes, however, do not furnish characters capable of precise definition and hence I feel it best to place my emphasis on the more practicable criterion of leaf-pubesence and accept these aberrant southern and western plants as forms verging off towards *C. chacoensis*. As will no doubt have been inferred I am inclined to believe that *C. chacoensis* and *C. verbenacea* are incapable of even reasonably sharp separation and so consequently am of the opinion that we are probably concerned here with no more than a species and a geographic variety. Being uncertain as to the status of *C. verbenacea* I have, however, kept them both as provisionally distinct.

13. ***C. chacoensis*** Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 218 (1921).

From southern Matto Grosso southward through Paraguay to Corrientes and thence westward to Salta and La Rioja.

BRAZIL. MATTO GROSSO: Rio Paraguay near Pão d'Assucar, Feb. 1892, Moore 1086 (BM, BD).

PARAGUAY: along the upper Rio Apa, Feb., Hassler 8442 (BM, BD, DL, Hass, BB); Puerto Casado, El Chaco, Oct. 23, 1893, Lindman A2231 (RS); Colonia Risso near Rio Apa, Oct. 30, 1893, Malme 1110 (BD, RS); San Salvador, May 26, 1876, Balansa 1042 (K, BD, BB); shrub 1.5–2.5 m. tall, corolla white, in thickets on Isla Chaco-y near Concepción, Aug., Hassler 7248 (BB, TYPE; BM, BD, Hass, DL); Concepción, Sept. 1892, Kuntze (NY, BD); Est. Santa Maria, Jan. 14, 1897, Anisits 2607 (RS); Villa Encarnación, Oct. 15, 1886, Niederlein 1826 (BD).

ARGENTINA. MISIONES: Posadas, Feb. 9, 1883, Niederlein (BD); road to San Javier, Feb. 1922, Molfino (G). CORRIENTES: Empedrada, Aug. 23, 1892, Niederlein 304 (BD). SALTA: Rio Blanco betw. Bado Hondo and Santa Cruz near Orán, Sept. 25, 1873, Lorentz & Hieronymus 249 (BD); near Orán, Oct. 1873, Lorentz & Hieronymus 27 (BD); Monte Alto, Orán, Nov. 19, 1913, Rodríguez 1127 (G); Rio Piedras, Orán, Nov. 4, 1911, Rodríguez 145 (G); Embarcación, Dept. Orán, 450 m., Feb. 18, 1925, Schreiter 5165 (G); Rosario de la Frontera, 1100 m., Jan. 7, 1905, Lillo 3839 (G). TUCUMÁN: Cerro del Campo, Dept. Burruyacu, 800 m., Nov. 21, 1928, Venturi 7584 (G); Burruyacu, 1100 m., Dec. 10, 1906, Lillo 5333 (G). LA RIOJA: Quanchin, Dept. Famatina, 1600 m., Dec. 24, 1928, Venturi 7848 (G).

I assemble here a group of plants, which are probably not specifically distinct from *C. verbenacea*, but which differ in being definitely plants of the interior, rather than of the coast, and in having hairy upper leaf-surfaces, frequently shorter and broader leaves, shorter and somewhat thicker spikes and perhaps more pubescent calyces. For further discussion see my notes under *C. verbenacea*.

14. ***C. intonsa***, nom. nov. *C. hirsuta* Fresen. in Mart. Fl. Bras. viii. pt. 1, 19 (1857), not Willd. (1798). *Lithocardium hirsutum* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from northern Minas Geraes.

BRAZIL. MINAS GERAES: betw. Salgado and Vão do Paranán, Sept. 1818, Martius (BD, ISOTYPE).

I know this species only from the type-collection which was made by Martius in northwestern Minas Geraes. It is related to *C. verbenacea* but differs in having the younger parts of the stems hirsute, the spikes very dense and the leaves as distinctly hairy above as in *C. chacoensis*.

15. ***C. multispicata*** Cham. Linnaea iv. 490 (1829); Fresen. in Mart. Fl. Bras. viii. pt. 1, 17 (1857). *Lithocardium multispicatum* Kuntze, Rev. Gen. ii. 977 (1891). *C. bahiensis* DC. Prodr. ix. 489 (1845). *Varronia spicata* Salzm. ex DC. l. c. in synonymy. *C. glandulosa* Fresen. l. c. 19. *L. glandulosum* Kuntze, l. c. 977. *C. campestris* Warm. Kjoeb. Vidensk. Meddel. 1867: 12, f. 2 (1868).

From the mouth of the Amazon southward through eastern Goyaz and the coastal states of Brazil to Rio Janeiro.

BRAZIL. PARÁ: shrub 1-2 m. tall, corolla white, Ilha do Mosqueiro, Nov. 1929, Killip & Smith 30403 (G, US); compact shrub 9 dm. tall, corolla white, Tapaná near Pará, Oct. 25, 1929, Killip & Smith 30237 (US); banks of Ura Creek, Pará, Aug. 15, 1849, Spruce 199 (K); stems elongate and scandent, corolla white, Pará, Jan. 26, 1829, Burchell 9395 (K); ca. 2.5 m. tall, corolla truncate and white, Pará, Aug. 20, 1829, Burchell 9558 (K); a shrub 1.5 m. tall in clearings but becoming scandent in forest, corolla white, Pará, Dec. 30, 1829, Burchell 9987 (G, K); near Pará, Feb. 4, 1907, Brenning 929 (BD); vicinity of Pará, 1849, Spruce (K, BM); vicinity of Pará, Dec. 16, 1907, Baker 41 (BM, BD, DL, RS) and 282 (DL); corolla purple, beach at Prainha, Nov. 26, 1873, Traill 561 (K). MARANHÃO: Maranhão near Rio Grande, Feb. 24, 1904, Brenning 970 (BD). CEARÁ: Quixada, Feb. 27, 1910, Loefgren 32 (RS). PERNAMBUCO: shrub ca. 18 dm. tall, moist places near Bot. Garden near Olinda, Dec. 1837, Gardner 1081 (K); near Pernambuco, Nov. 1837, Gardner 1081 (K, BM); corolla white, Iguarassu, Oct. 21, 1887, Ridley, Lea & Ramage (BM); corolla white, Dois Irmãos, July 15, 1887, Ridley, Lea & Ramage (BM); Pernambuco, April 18, 1918, Curran 51 (G). ALAGÓAS: shrub ca. 18 dm. tall, banks of Rio San Francisco near Piassabassú, March 1838, Gardner 1365 (K, BM). GOYAZ: shrub, corolla white, Formosa, Dec. 24, 1894, Glaziou 21781 (K, BD, DL, RS). BAHIA: Ilha Itaparica near Bahia, Casaretto 2013 (DL); Bahia, Blanchet 142 (DC), 142-633 (BM), 633 (NY, DC), 295 (BM), 735 (BM, DC), 877 (BM, DL), and 1235 (BM, DL); Bahia, Salzmann (K, DL) 376 (DC, TYPE of *C. bahiensis*); Bahia, Lockhart (BM); Bahia, June 21, 1920, Silva, Mus. Paul. 4181 (G); near Villa Ilhéos, Martius (BD, ISOTYPE of *C. glandulosa*). MINAS GERAES: in campo near Cabezeiras da lagoa, Lagoa Santa, March 8, 1864, Warming (BD, ISOTYPE of *C. campestris*); indefinite, Claussen (K, DL) 221 (G, RS). RIO JANEIRO: Rio Janeiro Nov. 1830, Meyen (BD). INDEFINITE: Brazil, Sellow (K, BM, BD, DL) 46 (BD, TYPE of *C. multispicata*), Claussen 417 in pt. (BB), Herb. Mus. Vind. 1745 (K, BD).

This is a large bushy or more or less clambering shrub probably most closely related to *C. Aubletii* DC. and such related forms of northern South America and the West Indies. It is distinguished in our area by its large broad ovate or oblong leaves which are evidently hirsute

on the upper surface. The types of *C. multispicata*, *C. bahiensis* and *C. campestris* are very much alike and represent the common form of the species, a form which does not have a very abundant velvety indument on the lower leaf-face. In the type of *C. glandulosa*, as in some collections made by Blanchet, no. 877, the lower surfaces of the leaves have a much denser and much paler indument that is almost felty rather than velvety. This pale form is probably the most striking variation in the species but I doubt if it is striking enough to merit special nomenclatorial recognition.

16. **C. corymbosa** (L.) Don, Gen. Syst. iv. 383 (1837); Urban, Symb. Ant. iv. 519 (1910). *Lantana corymbosa* L. Sp. Pl. 628 (1753). *C. ulmifolia* Juss. in Dum.-Cours. Bot. Cult. ed. 1, ii. 148 (1802). *Varronia guasumaefolia* Desv. Jour. de Bot. i. 276 (1808). *C. guazumaefolia* R. & S. Syst. iv. 463 (1819). *L. guazumifolium* Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *C. discolor* Cham. Linnaea iv. 482 (1829). *Lithocardium discolor* Kuntze, Rev. Gen. ii. 977 (1891). *C. urticifolia* Cham. Linnaea iv. 483 (1829). *C. hermanniaefolia* Cham. l. c. 484. *L. hermanniaefolium* Kuntze, Rev. Gen. ii. 977 (1891). *C. hermanniaefolia*, var. *calycina* Cham. l. c. 486. *C. Salzmanni* DC. Prodr. iv. 494 (1845). *C. Salzmanni*, var. *lanceolata* Fresen. in Mart. Fl. Bras. viii. pt. 1, 20 (1857). *C. lapensis* Warm. Kjoeb. Vidensk. Meddel. 1867: 9, f. 4 (1868). *L. corymbosum*, forma *glabriusculum* Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *C. paraguariensis* Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 305 (1905); Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 217 (1921).

Widely distributed in the American tropics and extending south to the mouth of the Rio La Plata where in the vicinity of Buenos Aires it sets the southern limit for the genus *Cordia* in America.

BRAZIL. AMAZONAS: shrub 1-2 m. tall, Juruá Miry, Rio Juruá, July 1901, Ule 5687 (K, BD, DL); Rio Negro, Jan. 11, 1887, Moura 568 (BD); shrub ca. 2.5 m. tall, mouth of Rio Negro to Capoenas, July 1851, Spruce 1695 (K, BM); Igarape Burete, Pracuá, Rio Surumu, Feb. 1909, Ule 7962, (BD); Falls of the Madeira, Oct. 1886, Rusby 2053 (G, NY). PARÁ: slender brittle shrub 3.5 m. tall, bushy places, Santarém, March 1850, Spruce 748 (G, K, BD, DL, BB). PERNAMBUCO: Tapera, Feb. 1927, Pickel 549 (BD); Inaranham, July 7, 1887, Ridley Lea & Ramage (BM). BAHIA: S. Amargo, Casaretto 2181 (DL); Bahia, Lockhart (BM); Bahia, Blanchet 1171 (BM, DL); Bahia, Salzmann (K, DL); Bahia, 1830, Salzmann 377 (DC, TYPE of *C. Salzmanni*); Vittoria to Bahia, Sellow 1223 (BD). GOYAZ: Villa de Natividade, Dec. 1839, Gardner 3368 (NY, BM, DL, BB, RS); shrub 1.5-2 m. tall, branches pendulous, woods near Natividade, Jan. 7, 1840, Gardner 3368 (K); at Goyaz, Feb. 5, 1828, Burchell 6624 (K); island below Santo Antonio Falls, May 16, 1829, Burchell 9086 (K). MINAS GERAES: Ribeirão near Ouro Preto, Sept. 1894, Schwacke 10936 (BD); Santa Luzia do Rio das Velhas, Jan. 31, 1895, Schwacke 11459 (BD); Sitio, March 19, 1887, Schenck (BD); Caldas, Mosén 1506 (RS), Mosén 961 (RS), Lindberg 497 (RS), Regnell III 908 (BD, RS); Albertão, Caldas, Feb. 17, 1847, Regnell III

908 (RS); Serra de Caldas, 1848, *Regnell III 908* (RS); indefinite, *Claussen* (K) 409 (BB) and 224 (G, NY, RS). RIO JANEIRO: Mauá, Aug. 1897, *Schenck 2682* (BD); Copacabano, *Miers* (BM); hills near Catombi, Dec. 29, 1825, *Burchell 1317* (K); Corcovado, April 26, 1910, *Seler 3* (BD); Tijuca, 1860, *Wichura 500* (BD); Morro da Babylonia, 1871, *Glaziou 4964* (K, BD); São João de Carahy, Jan. 10, 1826, *Burchell 1501* (K); Rio Janeiro, *Vauthier 101* and 565 (DL), *Peckott 80* (BD), *Martius Herb. Bras. 125* (G, NY, K, BD, DL, DC), *Miers 3674* (K), *Glaziou 7777* (K), *Burchell 1075* (G, K), *Burchell 733* (K), *Dusén 33* (RS), *Widgren 334* (RS); Suruhy, June 1888, *Moura 567* (BD); Magé, *Casaretto 1487* (DL); betw. Frechal and Magé, Feb. 25, 1826, *Burchell 2661* (K); Therezopolis, Feb. 23, 1887, *Schenck 2682* (BD); Therezopolis, *Glaziou 6053* (K); Novo Friburgo, *Claussen 70* (DL); Serra d'Estrella, *Sellow 14* (BD); Itatiaya, Dec. 1892, 1200 m., *Kuntze* (NY); Nictheroy, July 2, 1872, *Mosén 23½* (RS). SÃO PAULO: Sierra de Caracol, Dec. 30, 1863, *Mosén 1507* (RS); São Paulo, Nov. 8, 1873, *Severin 176b* (RS); São Paulo, *Fermino de Toledo, Mus. Paul. 18136* (G); Baruary, Oct. 1914, *Brade 7371* (G, BD); Perituba, Dec. 14, 1913, *Brade 6744* (G, BD); Ypiranga, March 12, 1908, *Luederwaldt 683, Mus. Paul. 11317* (G); Tiete, São Paulo, Feb. 28, 1905, *Usteri, Mus. Paul. 11309* (G); M. d. Jaraguá, June 23, 1815, *Bowie & Cunningham 229* (BM); Morumbi, March 7, 1827, *Burchell 4406* (K); São Bernardo, Jan. 18, 1827, *Burchell 3895* (K); São Paulo near Parça da Alegria, March 24, 1827, *Burchell 4681-50* (K); Campinas, *Mus. Paul. 22464* (G); Campinas, Nov. 8, 1873, *Severin 176b* (RS); Mogy Marim, March 20, 1874, *Mosén 1508* (RS); Ribeirão to Preto, Oct. 25, 1889, *Loefgren 1447, Mus. Paul. 11311* (G); Corrego to Alegre, Jan. 3, 1897, *Loefgren 3493, Mus. Paul. 11315* (G); Est. de Alferes Rodrigues, Oct. 1899, *Edwall, Mus. Paul. 11316* (G); Jundiacanga, May 26, 1887, *Loefgren 249, Mus. Paul. 11314* (G); Itapira, May 17, 1927, *Hoehne, Mus. Paul. 20364* (G). PARANÁ: Jaguariahyva, May 14, 1914, *Dusén 346a* (G, RS); Iacarehý, Sept. 28, 1908, *Dusén 6624* (RS); Ponta Grossa, Dec. 13, 1903, *Dusén 2640* (RS); Volta Grande, Serra do Mar, 400 m., July 29, 1914, *Dusén 756a* (G, RS); Therezina, Jan. 22, 1911, *Dusén* (RS). SANTA CATHARINA: Santa Catharina, *Mueller 306*, (K); near Itajahy, Feb. 1886, *Ule 512* (BD); Santa Catharina, *Gaudichaud 161* (NY, DL). RIO GRANDE DO SUL: Cruz Alto, Apr. 17, 1893, *Lindman A1577* (RS); Santo Angelo, Jan. 18, 1893, *Lindman A995* and *A995½* (RS); Porto Alegre, Nov. 3, 1892, *Malme 256* (RS); Minino Deus near Porto Alegre, Nov. 21, 1901, *Malme 492* (RS); Porto Alegre, *Reineck 43* and *Reineck & Czermack 143* (RS); Rio Grande, 1837, *Tweedie* (K); Quinta near Rio Grande, Nov. 5, 1901, *Malme 210* (RS); Pavo Novo near Pelotas, Nov. 12, 1901, *Malme 396* (RS); indefinite *Isabelle 6* (DL) and *Ihering 43* (BD). MATTO GROSSO: Serra da Chapada, Aug. 1891, *Moore 129* (BM); Santa Anna da Chapada, May 24, 1903, *Malme 3402* (RS). INDEFINITE: Brazil, *Herb Mus. Vind. 1742, 1743* and *1744* (K), *Lund 42* (DC), *Martius Herb. Fl. Bras. 1080* (G, NY, K, BM, DL, BB). *Glaziou 11296* (K, BD); Bras. trop. *Sellow* (K, BD, DC, authentic *C. discolor*); Bras. trop. *Sellow 397, 47, d2338* and *d2309* (BD, authentic *C. discolor*); Bras. merid., *Sellow* (K, BM, BD, BB, authentic *C. hermanniaefolia*); Bras. merid., *Sellow* (K, BD, authentic var. *calycina*); *Sellow d1387* (BD, var. *calycina*). URUGUAY. RIO NEGRO: Isla del Vizcaino, Jan. 1908, *Berro 4424* and *4456* (BB). COLONIAS: Isla San Gabriel, Jan. 1902, *Berro 1757* (BB); Isla San Gabriel, Feb. 1920, *Molfino 26/92* (G). SAN JOSÉ: Selvas de San José, Pavon, March 1895, *Arechavaleta* (BD). PARAGUAY: near Igatimi, Nov., *Hassler 5552* (BM, BD); Loma Clavel, lat. 23° 20', Nov. 1903, *Rojas ex Hassler 2618* (G, BM, BD, DL, Hass, BB); near Atira, Oct., *Hassler 1335* (BM, Hass, BB); Cord. de Altos, Nov. 1902, *Fiebrig 453* (K, BD, Hass, DL); Cord. de Altos, Dec., *Hassler 3600* (BM, Hass, BB); near Lag. Ypacaray, 1913, *Hassler 12131, 12609* and *12609a* (G, BM, BD, Hass, DL); San Bernardino, Sept. 1896, *Endlich 329* (BD); near Valenzuela,

valley of Rio Y-acá, Feb. 1900, *Hassler 7065* (BM, Hass, BB); upper Rio Y-acá, Feb. 1900, *Hassler 7069* (BD, BB); near Paraguari, Dec. 1900, *Hassler 6575* (BB, TYPE of *C. paraguariensis*; BD, Hass, DL, ISOTYPES); betw. Paraguari and Ibitimi, Feb. 11, 1876, *Balansa 2654* (DL); Ibitimi, Sept. 1874, *Balansa 2043* (K, DL, BB); Villa Rica, 1928, *Jørgensen 3735* (G); Villa Rica, Dec. 1874, *Balansa 2655* (DL); Villa Occidental, May 1874, *Balansa 2044* (K); Encarnación, Oct. 15, 1886, *Niederlein 2220* (BD); Rio Pilcomayo, *Morong 987* (G, NY, K); Asunción, Trinidad, Nov. 24, 1893, *Anisits 167* (RS); Est. Armonia, Jan. 17, 1900, *Anisits 1887* (RS).

ARGENTINA. MISIONES: Falls of Iguazú, King Albert Archipel., March 17, 1883, *Niederlein* (BD); Campo Eré, Jan. 1887, *Niederlein 1818* (BD); east of San Daniel, March 12, 1883, *Niederlein* (BD); San Ignacio, Dec. 16, 1919, *Muniez* (G); San Ignacio, Feb. 1922, *Molfino* (G); San Ignacio, Nov. 1913, *Quiroga* (G); Santa Ana, March 31, 1910, *Rodríguez 10237* (G); Santa Ana, Feb. 11, 1908, *Ekman 1789* (RS); Bonpland, Feb. 1922, *Molfino* (G); Loreto, March 26, 1884, *Niederlein 61* (BD); Posadas, Dec. 28, 1907, *Ekman 1790* and *1791* (RS); Posadas near "La Granja," Dec. 24, 1907, *Ekman 1785* and *1786* (RS); San José, Feb. 1922, *Molfino* (G); Apostoles, Jan. 29, 1926, *Parodi 7024* and *Clos 2077* (G). CORRIENTES: Monte de Tareiry, Dept. San Tomé, Oct. 11, 1886, *Niederlein 1834* (BD). ENTRE RIO: Arroyo Cupalen, Concepción del Uruguay, March 1879, *Lorentz 1768* (G, BD). BUENOS AIRES: Rio Chaña, Delta of the Paraná, Jan. 1916, *Hauman 26/90* (G); Cruz Colorado, Nov. 29, 1928, *Parodi 8649* (G); Tigre, Feb. 1919, *Molfino 1228* (G). FORMOSA: indefinite, Feb. 1919, *Jørgensen 3274* (G). SALTA: near Orán, Oct. 1873, *Lorentz & Hieronymus 389* and *420* (BD); Orán, Feb. 1916, *Hauman 26/91* (G). JUJUY: San Lorenzo, Oct. 31, 1873, *Lorentz & Hieronymus 579* (BD); Jujuy, Jan. 16, 1906, *Spegazzini* (G). TUCUMÁN: crest of Puerto de San Javier, Feb. 1874, *Lorentz & Hieronymus 952* (BD); Yerba Buena, 550 m., *Lillo 12054* (G); Naranjal, 500 m., *Schreiter 1596* (G).

One of the most widely distributed of American *Cordias* and at least the most frequently collected if not the most common species in our area. Over most of its range it is quickly distinguished by its glomerate or small cymose inflorescences. Only along the Andes is it apt to be confused, for in that region are found its closest relatives, such habitually similar species as *C. scaberrima* HBK., *C. lanceolata* HBK., *C. lantanoides* Spreng., etc. Ranging widely and being rather variable *C. corymbosa* has a large synonymy much of which is founded upon material from north of our region. In the present treatment I have given only the basic names and those synonyms established upon plants from the area in which we are interested.

There are several distinctive variations of *C. corymbosa* developed in our region. Having spent considerable time sorting and studying the specimens I have finally become convinced that these variations are only vaguely correlated with geography, that from much intergradation they are very indefinite and that in all probability they represent chiefly ecological forms. The most important of these variations are in pubescence. Since this affects the gross aspect of the plant and gave the reason for most of the synonyms it may be desirable to have names for its major manifestations. The extremes

of these principal forms of the species may be, accordingly, distinguished by the following key.

- Lower leaf-surface decidedly tomentulose with an abundant fine close pubescence.  
 Coarse hairs sparse or absent, the fine pubescence frequently ferruginous.....forma *typica*.  
 Coarse hairs abundant.....forma *intonsa*.  
 Lower leaf-surface without a fine pubescence or this very sparse.  
 Coarse hairs absent or sparse and weakly developed, appressed.....forma *detonsa*.  
 Coarse hairs abundant, usually more or less spreading.....forma *hirsuta*.

The type of *C. corymbosa* comes from the West Indies where the prevailing form is that which I have indicated as the forma *typica*. In our region it has been described under the names *C. discolor* Cham. and *C. Salzmanni* DC. In Bolivia a phase of it has been called *C. boliviana* Gandoger. The typical form occurs over most of the range of the species. In our area it has been most frequently collected about Rio Janeiro where it appears to be locally the predominating form. The lower surface of the leaves is distinctly tomentulose with copious fine flexuous or curved hairs among which glands are frequently intermixed. The indument of this fine pubescence is frequently rusty brown. Only scattered if any coarse appressed hairs arise from the mass of fine tomentum. The types of *C. hermanniacifolia* and its variety *calycina* represent a form with rather numerous scattered coarse hairs which tends towards the forma *intonsa*. *Cordia lapensis* Warm., to judge from description, must be a phase of the forma *typica* in which the fine tomentum is pallid rather than distinctly ferruginose.

The forma *intonsa* is a frequent one in our area and is characterized by having numerous erect or frequently even appressed hairs arising from a fine tomentum similar to, although usually not quite so abundant as that found on the lower leaf-surfaces in forma *typica*. The limits of the form are indefinite for it intergrades completely into both forma *typica* and forma *hirsuta*.

The forma *detonsa* appears to be most frequent from Ecuador to Bolivia, where it has been called *Varronia dichotoma* R. & P., and *C. bifurcata* R. & S. It seems to extend into western and southern Brazil, Paraguay and northern Argentina. It is also sporadic in the coastal states of Brazil. The lower surfaces of the leaves in this form are devoid of the fine pubescence found in forma *typica* or this pubescence is short coarsened and very sparse. The lower surface of the leaves is frequently glandular and commonly develops a few scattering coarse appressed hairs. As might be expected the form intergrades completely with forma *hirsuta* and to a less extent with forma *typica*.

The forma *hirsuta* is a frequent one in southern Brazil and north-eastern Argentina. It has been described as *C. urticifolia* Cham. and *C. paraguariensis* Chodat & Hass. and possibly also as *C. guasumacifolia* Desv. In this form the lower leaf-surface may be more or less glandular but it is practically devoid of the fine tomentum found among the coarse hairs on the leaves in perhaps unseparable forma *intonsa*.

Besides the extensive variation in pubescence, *C. corymbosa* also exhibits variation not only in the size of leaf-blade but also in the conspicuousness of the marginal toothing. More significant, however, is the variation in the development of the inflorescence. In some forms this is glomerate at maturity being quite congested and suggesting the truly capitate flower-clusters of those species which are typical of the section *Varronia*. In other forms the inflorescence loosens up in maturity frequently to form open cymes several centimeters broad that are suggestive, on a smaller scale, of the inflorescence in the section *Pilicordia*. *Cordia corymbosa*, indeed, seems to be a primitive member of its section, and in the variable development of its inflorescence probably gives us a good idea of the manner in which the characteristic capitate and spicate flower-clusters of the section *Varronia* must have evolved.

17. **C. buddleoides** Rusby, Mem. Torr. Bot. Cl. vi. 83 (1896). *Lithocardium guazumifolium*, var. *santacruzense* Kuntze, Rev. Gen. iii. 206 (1898).

Amazonian headwaters from central Bolivia to northeastern Peru.

PERU. LORETO: Maynas, *Poeppig* 2471 (BD, DL). PUNO: along streams, San Gaban, Aug. 1854, *Lechler* 2424 (K, RS).

BOLIVIA. COLONIAS: corolla pale, shrub 1-3 m. tall, Cobija, Rio Acre, Dec. 1911, *Ule* 9714 (K, BD). LA PAZ: Mapiri, July-Aug. 1892, *Bang* 1530 (NY, TYPE of *C. buddleoides*; G, ISOTYPE). SANTA CRUZ: Sierra de Santa Cruz, May 1892, *Kuntze* (NY), TYPE of var. *santacruzense*.

While this species has not been actually collected in Brazil it is most certainly to be expected within our western limits inasmuch as Ule has obtained it at Cobija in northwestern Bolivia just across the Rio Acre from Brazilian territory. The types of *C. buddleoides* and *L. guazumifolium* var. *santacruzense* are very much alike and clearly represent the same species. Lechler's collection from San Gaban matches these types closely, but Ule's material has the flowers in a cylindrical spike rather than in a globose head. Although striking at first sight this difference is probably due to the state of maturity, the material collected by Rusby, Kuntze and Lechler having been obtained at a very early stage in flowering and that of Ule in early fruiting



condition after the fall of the corollas. Poeppig's collection from northern Peru is the most different among the specimens cited. In this collection the calyx-lobes lack the definite apical appendages so clearly developed in the other specimens from Peru and Bolivia.

18. *C. axillaris*, sp. nov. *C. patens*, var. *monocephala* Cham. *Linnaea* iv. 486 (1829). ? *C. patens*, var. *polycephala* Cham. l. c. *C. patens*, var. *angustifolia* Warm. *Kjoeb. Vidensk. Meddel.* 1867: 11 (1868). *C. patens* of Fresen. in *Mart. Fl. Bras.* viii. pt. 1, 21 (1857).

Known in Brazil from Goyaz, western and southern Minas Geraes, northern and western Rio Janeiro and eastern São Paulo, and in Argentina from Misiones.

BRAZIL. GOYAZ: shrub ca. 12 dm. tall, corolla white, road betw. Tambau and Cercado, Aug. 23, 1827, *Burchell 5326* (K); shrub 3 m. tall, along stream at Farinha Podre, Sept. 11, 1827, *Burchell 5695* (K). MINAS GERAES: shrub nearly 2 m. tall, Uberava, Sept. 2, 1848, *Regnell III 909* (K, BD, RS); Grandahy, Sept. 17, 1818, *Sellow B1565-c658* (BD). RIO JANEIRO: shrub, corolla white, base of Picú, Rio Parahyba, Boa Vista, July 29, 1881, *Glaziou 13038* (K, BM, BD, DL); indefinite, 1894, *Neves Armond 14834* (US); indefinite, *St. Hilaire A<sup>1</sup>, 904* (K). SÃO PAULO: shrub, corolla white, Taubate, Sept. 9, 1892, *Loefgren & Edwall 1837, Mus. Paul. 11313* (G); roadside near Pindamonhangaba, Aug. 22, 1815, *Bowie & Cunningham* (BM); S. José dos Campos, Nov. 1833, *Lund 735* (DC). INDEFINITE: Bras. trop. *Sellow* (BD, authentic var. *monocephala*; K, BM); Bras. trop. *Sellow* (BD, authentic var. *polycephala*; K); Brasil, *Sellow 1564* (BD, authentic var. *monocephala*); Brasil, *Pohl. Herb. Mus Vind. 1739* (K, in pt., BD).

ARGENTINA. MISIONES: subscandent, margin of forest, Salto de Iguazú, Sept. 23, 1910, *Rodríguez 10460* (G).

Var. *gymnocarpa*, var. nov. A varietate genuina differt capitulis paullo minoribus, calycibus maturitate vix accrescentibus fructu evidenter brevioribus.

Southern Minas Geraes.

BRAZIL. MINAS GERAES: suffruticose, corolla white, Ouro Preto, Dec. 20, 1891, *Schwacke 7548* (BD); indefinite, *St. Hilaire B<sup>1</sup>, 285* (K); indefinite, *Claussen* (Kew, TYPE).

The present species, based upon *C. patens* var. *monocephala* Cham., includes those plants from Brazil treated as *C. patens* by Fresenius and subsequent authors. The type of *C. patens* HBK., *Nov. Gen. et Sp.* iii. 75 (1818), was collected by Humboldt and Bonpland in northeastern Venezuela about 110 km. southeasterly from Cumana. I have not seen any authentic material of this species. Mr. Killip has written me that during his studies of *Cordia* in the European herbaria he also failed to find any authentic collections of the species, even at Paris where one would expect to find the type. As no plants closely simulating *C. axillaris* or *C. buddleoides*, the species that have been identified with *C. patens* HBK., have been found in Venezuela I am

inclined to agree with Mr. Killip in believing that true *C. patens* HBK. must be some form of the variable and widely distributed *C. corymbosa* (L.) Don. In any case as it seems very improbable that our Brazilian plant will prove referable to this obscure species of northern South America its treatment as a distinct species appears both justifiable and desirable.

The exact source of the type of *C. patens* var. *monocephala* Cham., and hence that of *C. axillaris*, is uncertain. It was originally given as merely from "Brasilia tropica." The authentic collections at Berlin named by Chamisso are evidently part of the same collections as the specimens from Sellow's private herbarium which bear the number 1564, but no exact geographic data. Perhaps significant is the fact that this number is the next smaller than the first number in the complex designation, "B1565, c658," found on another sheet from Sellow's private collection. This latter complex number occurs with material that is very evidently part of the same collection as that upon which *C. patens* var. *polycephala* Cham. was founded, and is accompanied by definite geographical data giving its source as Grandahy, a locality in southern Minas Geraes between Barbacena and Ouro Preto.

After some indecision I am now of the opinion that the two varieties of *C. patens* described by Chamisso represent merely the fruiting (var. *monocephala*) and the early flowering (var. *polycephala*) states of the same species. It is even possible that both may have been obtained in the same region. In the authentic material of both varieties the leaves, stems and calyces are covered with a darkly brown pubescence, the coarse stems being conspicuously shaggy with spreading brown hairs. These are the striking characters of the plants which I have cited from Rio Janeiro, São Paulo and Misiones. The material collected by Burchell in Goyaz and by Regnell in Minas Geraes, however, differs slightly in having much less conspicuous, shorter pubescence and a decidedly lighter cast to the plant as a whole. As this northern material is not mature I consequently hesitate to give it the varietal recognition which I suspect the study of complete material will show it to deserve.

The calyces of *C. axillaris* are crowded in the head and become quite congested as the fruit matures and the calyces enlarge. The calyx is accrescent becoming inflated and completely, although loosely, invests the fruit. Certain material from Minas Geraes, however, does not have accrescent calyces, the smaller heads being less dense and the fruit at maturity protruding from the calyx. This is the form that I have recognized above as constituting the var. *gymnocarpa*. It seems to be a distinctly more slender plant than the typical *C. axillaris* and

it is quite possible that it may eventually be thought distinct enough to merit specific rank.

19. **C. leucomalla** Taub. Bot. Jahrb. xv. Beibl. 38, 14 (1893).

State of Rio Janeiro.

BRAZIL. RIO JANEIRO: shrub, Ilha do Cabo Frio, Oct. 17, 1899, *Ule 4775* (BD); shrub in woods, Laranjeiras, *Glaziou 4146* (BD, TYPE; K, ISOTYPE); Morro Flamengo, *Miers* (BM); shrub nearly 2 m. tall, Praia de Copacabana, Feb. 1841, *Gardner 5563* (K, BM); Tedreiva, *Miers 3931* (K).

This well marked plant is known only from the vicinity of Rio Janeiro and from the coast to the eastward. It appears to be a loosely branched shrub of thickets and to be a very distinct species. Its most conspicuous features are its very contrastedly bicolored leaves, these being green and somewhat velvety above and white with a floccose tomentum beneath. The dense heads of small flowers are usually ovoid.

20. **C. corchorifolia** A. DC. Prodr. ix. 496 (1845). *Lithocardium corchorifolium* Kuntze, Rev. Gen. ii. 976 (1891).

Known only from southeastern Alagóas and from Bahia, growing probably at no great distance from the coast.

BRAZIL. ALAGÓAS: shrub 1.5 m. tall, banks of the Rio San Francisco near Penedo, March 1838, *Gardner 1364* (K, BM, DL). BAHIA: Bahia, 1833, *Blanchet 1073* (DL); Bahia, *Blanchet 2073* (DL); small shrub, in moist shady places, corolla white, Dec., *Blanchet* (DL). INDEFINITE: Brazil, *Herb. Douville* (DL, TYPE).

Very closely related to *C. globosa* and perhaps only a well marked local form of it differing in its much sparser pubescence and in the presence of very abundant commonly stipitate glands on the herbage and calyces.

21. **C. caput-medusae** Taub. Bot. Jahrb. xv. Beibl. 38, 15 (1893).

Known only from a single collection made in southern Minas Geraes.

BRAZIL. MINAS GERAES: shrub, Gandarela, *Glaziou 15273* (BD, TYPE; K, ISOTYPE).

Obviously related to *C. globosa* but differing in its large heads, its very long appendages on the calyx-lobes, its copious glandularity and its conspicuously hairy almost velutinous leaves. Until more collections of the plant are available for study, however, the status of the species must remain a little doubtful.

22. **C. globosa** (Jacq.) HBK. Nov. Gen. et Sp. iii. 76 (1818); Urban, Symb. Ant. iv. 520 (1910). *Varronia globosa* Jacq. Enum. Syst. Pl. 14 (1760) and Sel. Stirp. Amer. 41 (1763).

Widely distributed in the West Indies and in northern South America; in our area known only from the island of Fernando do Noronha and on the Brazilian mainland in Alagóas and in southeastern Minas Geraes.

BRAZIL. PERNAMBUCO: shrub ca. 18 dm. tall, Sapate, Fernando do Noronha, Aug. 20, 1887, *Ridley, Lea & Ramage 89* (K). ALAGÓAS: shrub ca. 18 dm. tall, very common on banks of the Rio San Francisco, Feb. 1838, *Gardner 1367* (K); at Propia, Feb. 1838, *Gardner 1367* (BM). MINAS GERAES: shrub, Serra da Mantiqueira, João Gomez, *Glaziou 13037* (K, BD); shrub, João Gomez, *Glaziou 14141* (K).

I am unable to distinguish the above cited collections from *C. globosa*, a species widely distributed north of our area. In Brazil it is partially replaced by the closely related *C. corchorifolia* and *C. caput-medusae*, plants which may eventually be found unworthy of specific separation. I have not attempted to give complete synonymy of this species since all of its names are based upon material from outside our area.

23. ***C. calocephala*** Cham. *Linnaea* iv. 488 (1829) and l. c. viii. 129 (1833); Fresen. in *Mart. Fl. Bras.* viii. pt. 1, 24, t. 8 (1857). *Lithocardium calocephalum* Kuntze, *Rev. Gen.* ii. 976 (1891).

Southern Goyaz, western Minas Geraes and adjacent São Paulo.

BRAZIL. GOYAZ: plant shrubby, diffuse and decumbent, 3–10 dm. tall, at Canja, Nov. 5, 1828, *Burchell 8300* (K); ca. 6 dm. tall, corolla white, near Almas, Oct. 1839, *Gardner 3366* (K); Serra do Natividade, Feb. 1840, *Gardner 3912* (K); campos near Arrayas, March 1840, *Gardner 3913* (K); erect, corolla white, Goyaz, Feb. 11, 1828, *Burchell 6699* (K); betw. Chico Lobo and the source of the Rio Torto, *Glaziou 21780* (K, BD, DL). MINAS GERAES: 12 dm. tall, Caldas, March 26, 1867, *Regnell II 213* (RS); Serrinha dos Cabritos, Caldas, Dec. 27, 1862, *Regnell II 213* (BD, RS); indefinite, 1845, *Widgren* (RS); indefinite, 1840, *Claussen 222* (G, K, DL, RS). SÃO PAULO: Retiro da Lagem, March 1857, *Regnell II 213* (RS); Mursa Jundiahy, Feb. 4, 1915, *Brade, Mus. Paul.* 18814 (G). INDEFINITE: Bras. trop., *Sellow 5611* (BD, TYPE) and *B1563-c626* (BD).

A very well marked species, which probably has its closest relative in the evidently distinct *C. sessilifolia* Cham. The exceptionally well developed and very conspicuously elongate apical appendages on the calyx-lobes are very characteristic. The brown flower-heads, which are usually globose at first, tend to become 2–3 times as long as broad in maturity. The plant is apparently a small shrub with a very few sparsely branched coarse stems and becomes as much as 12 dm. tall.

24. ***C. sessilifolia*** Cham. *Linnaea* iv. 488 (1829). *Lithocardium sessilifolium* Kuntze, *Rev. Gen.* ii. 977 (1891). *C. sessilifolia*, var. *micrantha* Cham. l. c. viii. 129 (1833).

Minas and Goyaz; reported from Bahia by Fresenius.

BRAZIL. GOYAZ: calyx dark, corolla white campanulate, betw. Ribeirão dos Macacos and Olhos da Agoa, Sept. 2, 1829, *Burchell* 7506 (K). MINAS GERAES: Quartel de S. Antonio, 1818, *Sellow* B1562-c655 (BD, TYPE). INDEFINITE: Brasil, *Sellow* (K), 1562 (BD), *Claussen* 410 (BB).

Var. **tomentosa** (Chodat & Hass.), comb. nov. *C. villicaulis*, var. *tomentosa* Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 481 (1905). *C. villicaulis* Fresen. in Mart. Fl. Bras. viii. pt. 1, 24 (1857). *Lithocardium villicaule* Kuntze, Rev. Gen. ii. 977 (1891). *C. caaguazuensis* Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 216 (1921).

Ranging from São Paulo and Paraná, in Brazil, to northeastern Paraguay; Fresenius reports it from Goyaz.

BRAZIL. SÃO PAULO: Canna Verde, April 1848, *Regnell* III 910 (RS); Sarapuhy, Oct. 30, 1887, *Loefgren* 289, *Mus. Paul.* 11272 (G). PARANÁ: betw. Sengés and Itararé, Dec. 11, 1910, *Dusén* 10936 (RS); Itararé, Nov. 7, 1910, *Dusén* 10399 (RS). INDEFINITE: Brazil, *Pohl*, *Herb. Mus. Vind.* 1740 (K, BD); Brazil, *Sellow* 5414 (BD).

PARAGUAY: Alto Paraná, *Fiebrig* 6355 (BD); suffruticose, 4-6 dm. tall, sandy place near Rio Corrientes, Yerbales, Sierra de Maracayú, *Hassler* 5848 (BB, TYPE of var. *tomentosa*: BM, Hass, ISOTYPES); shrubby, 4-6 dm. tall, dry campo near Caaguazú, March 1905, *Hassler* 9108 (BB, TYPE of *C. caaguazuensis*; BM, Hass, DL, ISOTYPES); indefinite, *Hassler* 6355 (Hass.).

*Cordia sessilifolia* and its variety agree with *C. calocephala* in having brownish hairs on the calyx and stems. In the present plants, however, these are more distinctly spreading and more conspicuous than in *C. calocephala*. The calyx also is very different, the tips of the lobes having inconspicuous appendages only 1-2 mm. long; the calyx proper, hence, being evident and not obscured by the tangle of slender appendages as in *C. calocephala*. Although *C. sessilifolia* has been generally maintained as specifically distinct from *C. villicaulis* I have been quite unable to discover in the latter species more than a broad-leaved southern variety of *C. sessilifolia*. While *C. sessilifolia* has elongate lanceolate leaves 8-20 mm. broad *C. villicaulis* has ovate elliptical or broadly lanceolate leaves 2.5-5.5 cm. broad. As I do not consider these differences as specific I have treated the broad-leaved southern plant under the name, *C. sessilifolia* var. *tomentosa*.

25. **C. truncata** Fresen. in Mart. Fl. Bras. viii. pt. 1, 25 (1857). *Lithocardium truncatum* Kuntze, Rev. Gen. ii. 977 (1891).

Goyaz and Minas Geraes.

BRAZIL. GOYAZ: small shrub, betw. Chico Lobo and the head of the Rio Torto, *Glaziou* 21779 (K, BD, DL). MINAS GERAES: indefinite, *Claussen* 220 (G, NY, K, DL, RS). INDEFINITE: "Serra dos Cristaes," *Pohl*, *Herb. Mus. Vind.* 1741 (K, ISOTYPE ?).

Although probably most closely related to *C. sessilifolia*, from which it is separated by its very different appressed much less brownish

pubescence, this species is most difficult to separate by readily statable characters from the very obviously distinct, *C. guaranítica*.

26. ***C. guaranítica*** Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 305 (1905); Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 217, f. 312 (1921). *C. guaranítica*, var. *pedunculosa* Chodat & Hass. l. c. *C. guaranítica*, var. *foliosa* Chodat & Hass. l. c.

Northeastern Bolivia, Paraguay and northern Argentina.

BOLIVIA. SANTA CRUZ: Velasco, 200 m., July 1892, Kuntze (NY, as *L. hermanniaefolium*).

PARAGUAY: shrubby 4–8 dm. tall, in campo, San Rafael, Rio Apa, Oct. Hassler 7655 (BB, TYPE of var. *pedunculosa*; BM, BD, Hass, ISOTYPES); shrubby 5–10 dm. tall, in campo near Igatimi, Dec., Hassler 5619 (G, BM, BD, DL, Hass, BB); shrubby 8–10 dm. tall in sandy places near Cerro de Tobaty, Sept. 1900, Hassler 6359 (BM, BD, DL, Hass, BB); shrubby 3–10 dm. tall, margin of woods, Cord. de Altos, Oct. 1897, Hassler 3381 (BB, TYPE of *C. guaranítica*; G, BM, BD, DL, Hass); stony hills, Cord. de Altos, Nov. 1902, Fiebrig 444 (BD); old fields, Cord. de Altos, Sept. 1902, Fiebrig 110 (BD); campos de Cord. de Altos, Jan., Hassler 1022 (Hass.); shrubby 5–10 dm. tall, campo near Valenzuela, upper Rio Y-acá, Jan. 1900, Hassler 6962 (BB, TYPE of var. *foliosa*; BM, BD, DL, Hass, ISOTYPES); Paraguari, March 25, 1875, Balansa 2653 (K, DL, BB); bush 6 dm. tall, Est. Santa María, Dec. 29, 1896, Anisits 2667 (RS); "Camp Dr. Abente," Dec. 1898, Anisits 2748 (RS).

ARGENTINA. SALTA: Orán, Rio Santa María, Feb. 8, 1906, Spegazzini (G); Campo Chico, Orán, 550 m., Nov. 23, 1927, Venturi 5533 (G).

A very distinct species probably closest to *C. truncata*, but readily separated from its relative by its paler cast, the antrorse pubescence on the more elongate leaves, its more slender habit, more conspicuously appendaged calyx-tips, fewer-flowered less dense heads and more southern range. It appears to be a few-stemmed strictly branched shrub 5–10 dm. tall frequenting dry open ground. The two varieties of this species that have been described are based upon characters too variable and trivial to warrant recognition.

Section **Eucordia** Johnston. *Cordia* L. Gen. 87 (1754) and Sp. Pl. 190 (1753), type-species, *C. Sebestena* L. *Sebesten* Adans. Fam. Pl. ii. 177 (1763); Britt. & Wils. Bot. Porto Rico ii. 124 (1925), type-species, *C. Sebestena* L. *Cordia-Sebestenae* HBK. Nov. Gen. et Sp. iii. 68 (1818), type-species, *C. Sebestena* L. *Cordia* § *Sebestenae* Don, Gen. Syst. iv. 374 (1837). Not *Sebestena* Gaertn. Fruct. et Sem. Pl. i. 364, t. 76, f. 1 (1788). *Pavonia* Dombey ex Lam. Tab. Encyc. i. 421 (1791), in synonymy; type-species, *C. lutea* Lam. *Coilanthera* Raf. Sylva Tellur. 38 (1838), type-species, *C. rotundifolia* R. & P. *Ectemis* Raf. l. c. 39 (1838), type-species, *C. lutea* Lam. *Cordia* § *Sebestenoides* DC. Prodr. ix. 476 (1845), type-species, *C. speciosa* Willd. ?*Macria* Tenore, Mem. Math. Fis., Soc. Ital. Sci. Modena xxiv. 366 (1847); type-species, *M. callipticantha* Tenore, which see in my list of doubtful species.

*Paradigma* Miers, Trans. Linn. Soc. Bot. ser. 2, i. 31, t. 8a (1875), type-species, *C. Galeottiana* A. Rich. *Plethostephia* Miers, l. c. 32, t. 8b (1875), type-species, *C. angiocarpa* A. Rich. *Lithocardium* [L.] Kuntze, Rev. Gen. ii. 438 (1891), type-species, *C. Sebestena* L.

Under this section I have assembled a very diverse group of coarse shrubs and trees characterized by their large conspicuous corollas and large fruit that is more or less completely sheathed or even fully enclosed by the calyx. There are about a dozen species in America and certainly one, and possibly several more, in southern Asia. In the section there are some very interesting and rather extreme developments in the structure and number of floral parts. *Cordia Sebestena* L. of America and *C. subcordata* Lam. of the Old World have the calyx tightly and completely enclosing and more or less definitely adnate to the fruit. In *C. angiocarpa* A. Rich. and *C. Galeottiana* A. Rich. the stamens and corolla-lobes are increased in number, the corolla-lobes in the former species becoming as many as 15. In *C. decandra* H. & A. the stamens are uniformly 10. In another species, *C. rotundifolia* R. & P., the stamens and corolla-lobes vary independently between 5 and 9 in number. Among the Brazilian species, such as *C. superba*, there appears to be a slight tendency towards zygomorphy. Although this great diversity in corolla-structures suggests heterogeneity I am of the opinion that the group is really a natural one.

The sectional synonyms given above are those applying to the American plants. To these probably should be added *Salimori* Adans. Fam. Pl. ii. 177 (1863), which has a type-species in *C. subcordata* Lam., a species that seems to be very closely related to the American *C. Sebestena* L.

Since Britton & Wilson, Bot. Porto Rico ii. 125 (1925), have recently selected *Cordia glabrata* L. as the type of *Cordia* and have resurrected *Sebestena* Adans. to include *C. Sebestena* L., perhaps a few words are needed to give the reasons why I have gone counter to this precedent in selecting *C. Sebestena* L. as the type of its genus. In the first place the generic name, *Cordia*, was taken by Linnaeus from Plumier, Nov. Pl. Amer. Gen. 13, t. 14 (1703), who clearly applied it to *C. Sebestena*. In his *Genera Plantarum*, ed. 5, 87 (1754), Linnaeus also gives a reference to *Sebestena* Dillenius, Hort. Eltham. ii. 340, t. 255 (1732), the plate and description of which are, except for a few details relating to *C. Myxa*, completely concerned with the plant Linnaeus called *C. Sebestena*. Turning finally to the description in the *Genera Plantarum*, l. c., we find that Linnaeus according to his custom, cf. Pennell, Proc. Acad. Nat. Sci. Philadelphia lxxxii. 10 (1930), drew it to cover one species in particular, in this case *C. Sebestena*.

Certainly the phrase "drupa. . . calyce tecta" is not applicable to *C. Myxa* or *C. glabra* the other two species mentioned in the companion volume, the *Species Plantarum* for 1753. Since the original generic description of the genus *Cordia* was thus based upon *C. Sebestena*, since the cited synonym, *Sebestena* Dill., applies to that species and since even the name *Cordia* itself was historically first applied to it, I am entirely unable to see why that species should be passed over and *C. glabra* selected as the type of the genus. *Cordia glabra* is even the last in order of the three species of the genus given in the first edition of the *Species Plantarum*.

#### KEY TO THE SPECIES.

- Cymes not pedunculate, one or more springing directly from the upper leaf-axils or the cyme-axis much reduced and the flowers apparently axillary on slender pedicels.
- Leaves ovate, under surface glabrous except for dense tufts of hair in the axils of the primary nerves; flowers apparently springing directly from the leaf-axils. . . . . 27. *C. mucronata*.
- Leaves lanceolate, generally pubescent beneath; flowers borne in several slender more or less reflexing cymes. . . . . 28. *C. candida*.
- Cymes borne on well developed terminal peduncles.
- Leaves glabrous and more or less lucent below, margins entire. . . . . 29. *C. taguahyensis*.
- Leaves more or less abundantly pubescent, opaque, margins frequently serrate.
- Leaves with abundant spreading brownish hairs, the pubescence evident, more or less velvety; buds brownish velvety. . . . . 30. *C. rufescens*.
- Leaves strigose or short-hirtellous beneath, usually somewhat scabrid; buds strigose.
- Corolla 30 mm. long or more. . . . . 31. *C. superba*.
- Corolla 13-15 mm. long; rare plant. . . . . 32. *C. anabaptista*.

27. ***C. mucronata*** Fresen. in Mart. Fl. Bras. viii. pt. 1, 9 (1857).  
*Lithocardium mucronatum* Kuntze, Rev. Gen. ii. 977 (1891).

States of Rio Janeiro and Espirito Santo; rare.

BRAZIL. RIO JANEIRO: Cabo Frio, May 5, 1887, Schenck 3843 (BD); "vicinity of Rio Janeiro, Schott," Herb. Mus. Vind. 1747 (K); vicinity of Rio Janeiro, Glaziou 7778 (K, BD). INDEFINITE: Brazil, Sellow (BM) 254 (BD) and 572 (BD, TYPE).

A very distinct species readily recognized by its very reduced inflorescence and hence apparently axillary flowers, and by its small ovate leaves which are glabrous except for tufts of hairs that occur in the axils of the veins on the under surface. Fresenius reports the species, the type, from the coast between Vittoria and Bahia and hence from the state of Espirito Santo or from southern Bahia. Otherwise I know it only from the stations I have cited above.



28. **C. candida** Vell. Fl. Flum. 98 (1825) and Icones ii. t. 155 (1827). Known only from the region about Rio Janeiro; rare.

BRAZIL. RIO JANEIRO: shrub, corolla white, betw. Jerecino and Realengo, *Glaziou 12088* (K, BD). INDEFINITE: no locality given, *Bowie & Cunningham* (BM).

A very distinct species. Its inflorescence is unique, consisting of one or more slender-stemmed cymes which spring directly from the upper leaf-axils. Except for *C. mucronata*, the other species of this relationship have the cymes borne on an elongate terminal peduncle. In *C. candida* the peduncle is not developed and what would appear as branches in the pedunculate panicle of the other species here appear as axillary cymes. These cymes have a slender axis which apparently becomes more or less spreading or even reflexed in age. The fruit is drupaceous. The type of *C. candida* is said to have come from "Silvis Parochiae dictae Campo grande," evidently the present town of Campo Grande which lies about 40 km. west of Rio Janeiro.

29. **C. taguahyensis** Vell. Fl. Flum. 98 (1825) and Icones ii. t. 154 (1827). *C. glabra* Cham. Linnaea viii. 124 (1833), not L. (1753); Fresen. in Mart. Fl. Bras. viii. pt. 1, 8 (1857). *C. glomerata* Lem. Jard. Fleur. iv. t. 326 (1853). *Sebestena glomerata* Lem. l. c. in synonymy. Coastal states of Brazil from Maranhão to Paraná.

BRAZIL. MARANHÃO: Vianna, July 24, 1922, *Ozimo de Carvalho 85*, *Mus. Paul. 8112* (G). CEARÁ: shrub 3-10 mm. tall, corolla white, Serra Baturité, Sept. 1910, *Ule 9898* (K, BD). PERNAMBUCO: shrub 2 m. tall, Tapera, Dec. 1926, *Pickel 1241* (BD). BAHIA: Bahia, *Blanchet 320* (BM, DL), *239* (DL), *1490* (BM, DL), *1386* and *1915* (DL); Ilhéos, *Blanchet* (DL); Muritiba, 1842, *Blanchet 3512* (BM, DL, BB); indefinite, *Blanchet 606* (NY) *905* (BM); Rio Grongogy Basin, 1915, *Curran 182* (US). RIO JANEIRO: corolla white, rugose, shrub 12-15 dm., betw. Frechal and Magé, Feb. 25, 1826, *Burchell 2623* (G, K); corolla white rugose, valley of Catumbi, Jan. 31, 1826, *Burchell 1829* (K); corolla white rugose, shrub 15 dm. tall, Botafogo Bay, Sept. 29, 1825, *Burchell 1102* (K); shrub ca. 18 dm. tall, along road to Corcovado, Dec. 31, 1825, *Burchell 1460* (K); small shrub by side of stream in Laranjeiras Valley, Sept. 1836, *Gardner 182* (K); Pedra da Gavea, *Martius Herb. Bras. 462* (NY, K, BM, BD, DC, DL, BB, RS); corolla white, Monte da Santa Thereza, Jan. 27, 1815, *Bowie & Cunningham* (BM); Sete Pontes, Baretto, Sept. 26, 1872, *Glaziou 6051* (K, BD); Serra da Bica, Feb. 1897, *Ule 4297* (BD); Pedra Dois Irmãos, March 23, 1929, *Smith 2131* (G); vicinity of Rio Janeiro, *Glaziou 5951* (K) and *8822* (K, BD); Rio Janeiro, *Vauthier 74* (DC, DL), *Miers 3020* (K, DL), *Gaudichaud* (BD), *Graham* (K) and *Widgren* (RS). Rio Janeiro, Nov. 14, *Sellow 339* (BD, authentic *C. glabra*). SÃO PAULO: São Sebastião, March 28, 1892, *Edwall 1733*, *Mus. Paul. 18121* (SP). PARANÁ: Porto de Cima, Serra do Mar, 200 m., Jan. 24, 1914, *Dusén 14395* (RS). INDEFINITE: Brazil, *Herb. Mus. Vind. 1748* (K), *Sellow 95* (K), *Sellow* (K).

Among the species with large corollas this one is quickly distinguished by its glabrous leaves that are green above and pale and somewhat shiny beneath. Its nearest relative is *C. superba*, a species

having more or less pubescent leaves in which the lower surface is dull and the margins are frequently toothed. The flowers of this relative, also, are larger and develop a somewhat larger and more evidently pubescent calyx that is frequently calypterate. *Cordia superba* appears to range more commonly in the north and somewhat more in the interior than does the present species. The type of *C. taguahyensis* is given as from the Rio Taguahy, evidently a stream in the western end of the Federal District and possibly the one called Rio Gandú Mirim on recent maps.

30. **C. rufescens** A. DC. Prodr. ix. 476 (1845). *Lithocardium rufescens* Kuntze, Rev. Gen. ii. 977 (1891). *C. piauiensis* Fresen. in Mart. Fl. Bras. viii. pt. 1, 9 (1857). *L. piauiense* Kuntze, l. c. 977.

Eastern Brazil from Ceará to Paraná, usually well back from the coast.

BRAZIL. CEARÁ: a shrub, ca. 12 dm. tall, corolla white, Serra do Araripe, Oct. 1838, *Gardner 1782* (G, NY, K, BM, DL); Parnahyba, Serra do Araripe, Aug. 1921, *Luetzelburg 12504* and *12519* (BD); Ceará, 1910, *Loefgren* (RS). PIAUHY: shrub, Serra Branca, Jan. 1907, *Ule 7191* (K, BD); upper Piahy, May, *Martius* (BD, authentic *C. piauiensis*). BAHIA: Serra Assuruá, 1838, *Blanchet 2821* DL, TYPE of *C. rufescens*; NY, K, BM, BD, BB, ISOTYPES); indefinite, *Blanchet 3607* (K, BM, DL, BB). MINAS GERAES: indefinite, *Claussen* (K, DL). RIO JANEIRO: cultivated, corolla white, Quinta da Boa Vista, São Christovão, *Glaziou 11284* (K, BD). SÃO PAULO: Itapetininga, Dec. 1, 1887, *Loefgren 415*, *Mus. Paul. 11271* (G). PARANÁ: Pateisimonia, March 14, 1914, *Dusén* (RS); Jaguarahyva, 740 m., Jan. 1, 1915, *Dusén 16248* (G, RS); Jaguarahyva, May 20, 1914, *Jonsson 397a* (RS).

This species is very closely and very evidently related to *C. superba*, particularly to the broad-leaved form that has been described as the var. *elliptica*. As it differs from *C. superba* only in having a more abundant spreading pubescence on the lower leaf-surfaces and in the inflorescence, it may eventually be considered no more than varietally distinct from that species. It might be noted here that Blanchet's collection no. 2821, cited by De Candolle, is a mixture of two forms which differ in having the upper leaf-surface glabrous in one form and decidedly scabrous in the other.

31. **C. superba** Cham. Linnaea iv. 474 (1829) and l. c. viii. 123 (1833); Hook. Bot. Mag. lxxxii. t. 4888 (1855); Fresen. in Mart. Fl. Bras. viii. pt. 1, 6, t. 3, f. 1 (1857). *Lithocardium superbum* Kuntze, Rev. Gen. ii. 977 (1891). *C. superba*, var. *cuneata* Cham. l. c. iv. 474. *C. superba*, var. *elliptica* Cham. l. c. iv. 474. *C. grandiflora* Lindl. Bot. Reg. xviii. t. 1491 (1832), not HBK (1818). *C. Blanchetii* DC. Prodr. ix. 477 (1845). *L. Blanchetii* Kuntze, l. c. 976. ? *C. Schottiana* Fresen. l. c. 7. ? *C. intermedia* Fresen. l. c. 8. ? *L. intermedium* Kuntze, l. c. 977. *C. ipomoeaeiflora* Hook. Bot. Mag. lxxxiv.

t. 5027 (1858). *C. atrofusca* Taub. Bot. Jahrb. xv. Beibl. 38, 12 (1893).  
? *C. glabra* of Hook. Bot. Mag. xcv. t. 5774 (1869).

Eastern Brazil, from Rio Grande do Norte to São Paulo.

BRAZIL. RIO GRANDE DO NORTE: near Natal, July 1914, *Dawe* (K).  
PERNAMBUCO: small tree ca. 3.5 m. tall, Island of Itamarica, Dec. 1837, *Gardner 1082* (NY, K, BM, DL); banks of Rio San Francisco at Villa Nova, March 1838, *Gardner 1366* (BM); shrub ca. 18 dm. tall, common about Villa Nova on banks of Rio San Francisco about opposite Penedo, March 1838, *Gardner 1366* (K); Olinda, Jan. 25, 1925, *Pickel 619*, *Mus. Paul. 18128* (G).  
GOYAZ: shrub ca. 18 dm. tall, corolla white, near Boa Esperança, May 13-14, 1829, *Burchell 9049* (K). BAHIA: Bahia, *Luschnath 61* (BD); Cachoeira, *Blanchet 283* (DC); Jacobina, *Blanchet 2618* (DC, TYPE of *C. Blanchetii*; DL); indefinite, *Blanchet 3954* (K); near Toca de Onca, June 1915, *Rose & Russell 20096* (US). MINAS GERAES: shrub 1 m. tall, corolla white, Cocaes, Aug. 1840, *Gardner 5039* (K, BM); corolla white, Rio Novo, Sept. 1894, *Schwacke 10939* (BD); Pauso Alegre, April 27, 1927, *Hoehne*, *Mus. Paul. 19212* (G); tree ca. 5 m. tall, Machado, Caldas, Nov. 18, 1854, *Lindberg 499* (RS); Machado towards Faz. Boa Vista, Caldas, Dec. 20, 1864, *Regnell III 906* (RS); indefinite, Dec. 17, 1868, *Regnell III 906* (BD); indefinite, *Claussen 408* (BD).  
RIO JANEIRO: corolla white, shrub, Cabo Frio, *Glaziou 11281* (K, BD); vicinity of Rio Janeiro, *Glaziou 6052* (K) and *13035* (K, BD, DL); cultivated, Sete Pontas, Baretto, *Glaziou 12087* (BD, TYPE of *C. atrofusca*). SÃO PAULO: Souza Queiroz, 1919, *Gehrt 1632* (BM); Campinas, Dec. 1894, *Novaes 2893*, *Mus. Paul. 11274* (G); shrub, São Joas de Boa Vista, Dec. 15, 1875, *Mosén 4306* (RS). INDEFINITE: pat. ignot., *ex hort. Kew* (K, TYPE of *C. ipomoeaeiflora*); Bras. trop., *Sellow* (K, BD, DC, DL, ISOTYPIC of *C. superba* v. *cuneata*); Bras., *Sellow* (DL, ISOTYPIC of *C. superba* v. *elliptica*); Bras. trop., *Sellow 1574* and *5305* (BD, authentic *C. superba* v. *elliptica*).

The present species is a variable one. The leaves vary in shape from oblong-ob lanceolate to elliptical-obovate, the two extremes having been named by Chamisso respectively var. *cuneata* and var. *elliptica*. The leaf-margins are entire or are often very evidently serrate. The foliage of *C. superba* is commonly scabrous with strigose or weakly spreading hairs. Although the pubescence is usually not conspicuous there are some forms which have a comparatively copious pubescence and vary off thus toward *C. rufescens*, a species that differs from *C. superba* only in the conspicuous dense spreading brownish pubescence that clothes and gives a velvety surface to the lower face of its leaves. Fresenius attempted to limit *C. superba* to those forms in which the buds are subapically more or less clearly circumscissile at maturity. In these forms the calyx-lobes remain joined together and the tip of the calyx, as a calyptera, is pushed off as the corolla expands. This is very impressive in its extreme development. A study of much material, however, has shown it to be merely the extreme expression of a tendency more frequently than not either absent or only imperfectly developed. I feel rather sure that no satisfactory segregations of the species, as I have defined it, can be made by giving at-

tention to the interesting but very uncertain tendency for the calyx to open by a more or less definite apical circumscission. I have not seen authentic material of *C. Schottiana* or *C. intermedia* and am so forced to judge of them entirely upon their published descriptions. Gardner's collection no. 1082 is cited by Nees, cf. DC. Prodr. xi. 142 (1847), under *Dipteracanthus viscidulus*, a habitually somewhat similar genus of the *Acanthaceae*.

32. **C. anabaptista** Cham. Linnaea viii. 512 (1833). *Lithocardium anabaptistum* Kuntze, Rev. Gen. ii. 976 (1891). *C. ambigua* Cham. l. c. 125, not Cham. (1830).

BRAZIL. INDEFINITE: no locality given, Sellow (BD, TYPE).

This peculiar plant is known only from the type which was collected by Sellow at some unknown locality in Brazil. It is obviously related to *C. taguahyensis* and *C. superba*, but is quickly distinguished by its very much smaller corollas.

Section **Physoclada** DC. Prodr. ix. 475 (1845), type-species, *C. nodosa* Lam. *Physoclada* (DC) Lindley, Veg. Kingd. ed. 2, 629 (1847).

A monotypic section characterized by the unique and highly complex subnodal structure that is manifest in conspicuous swellings of the stem which eventually serve as ant-domatia. The calyx is also peculiar. It does not open to form more or less regular teeth or lobes but is irregularly ruptured by the expanding corolla. It is not at all accrescent nor explanate in age but if not broken apart and thrown off by the developing fruit simply disintegrates and thus reveals its fibrous structure.

33. **C. nodosa** Lam. Tab. Encyc. i. 422 (1791); Poir. Encyc. vii. 43 (1806). *Lithocardium nodosum* Kuntze, Rev. Gen. ii. 977 (1891). *C. hirsuta* Willd. Sp. Pl. i. 1076 (1798). *Firensia hirsuta* Raf. Sylva Tellur. 40 (1838). *C. formicarum* Hoffm. ex R. & S. Syst. iv. 800 (1819). *C. miranda* DC. Prodr. ix. 475 (1845). *L. mirandum* Kuntze, l. c. *C. hispidissima* DC. l. c. *L. hispidissimum* Kuntze, l. c. *C. nodosa*, var. *glabrior* Fresen. in Mart. Fl. Bras. viii. pt. 1, 16 (1857). *C. nodosa*, var. *hispidissima* Fresen. l. c. 17. *C. nodosa*, var. *angustifolia* Fresen. l. c. 17. *C. umbrosa* Spruce ex Rusby, Bull. Torr. Bot. Cl. xxvi. 147 (1899). *C. volubilis* Pittier (Explor. Bot. Cuenca de Maracaibo 41) Bol. Comer. e Indust. iv. pg. ? (1923) and Jour. Wash. Acad. Sci. xix. 184 (1929).

Occurring in the state of Pará and adjacent Maranhão, in outlying stations in Bahia and in western Brazil along the principal tributaries of the Amazon up which it extends into northern Bolivia, eastern Peru and southern Venezuela. The remainder of its range is in

northern South America where it is known only from French, Dutch and British Guiana and from northwestern Venezuela.

BRAZIL. AMAZONAS: Carmo, Rio Branco, Sept. 1, 1924, *Bequaert* (G); tree or shrub 2–8 m. tall, corolla white, Surumu, Serra do Mairary, Rio Branco, Nov. 1909, *Ule 8456* (K, BD); small slender tree 3 m. tall, corolla white, Rio Negro below mouth of Xibarú, betw. Barcellos and São Gabriel, Dec. 1854, *Spruce 3790* (NY, K, DL); shrub or tree ca. 5 m. tall, Cachoeira, Juruá, May 1901, *Ule 6921* (BD); Barreiras de Maniwá, Rio Purús, Sept. 29, 1874, *Traill 560* (K). PARÁ near Montalegre, Nov. 24, 1873, *Traill 561* (K); Prainha, Dec. 17, 1873, *Traill 562* (K); corolla white or greenish, Santarém, Aug. 1850, *Spruce 775* (K); small tree about 3.5 m. tall, drupes vermilion, Santarém, March 1850, *Spruce 775* (K); Tapaná, Oct. 29, 1929, *Killip & Smith 30355* (G, US); shrub or small tree 3.5–5.5 m. tall, cymes borne on trunk or on bare old branches, Pará, Nov. 15, 1829, *Burchell 9804* (K); shrub or tree 3.5–5.5 m. tall, Pará, Sept. 6, 1829, *Burchell 9637* (G, K); Pará, July 1, 1908, *Huber 9344* (K, BD, DL); Pará, *Martius* (BD); Pará, *Sieber 62* (BD, TYPE of *C. formicarium*); shrub 2.5–3.5 m. tall, corolla white, lower leaves large and deflexed, Village of Santa Anna, June 7, 1829, *Burchell 9357* (K). MARANHÃO: Tury-assú, Oct. 13, 1923, *Snethlage 268* (BD). BAHIA: Cruz de Casma, Jan. 28, 1835, *Luschnath 237* (BD); near Lanarro, 1832, *Blanchet 995* (DC, TYPE of *C. hispidissima*; NY, ISOTYPE); near Bahia, *Casaretto 2130* (DL); valleys, Bahia, *Salzmann* (DC, TYPE of *C. miranda*; K, ISOTYPE). RIO JANEIRO: cultivated in Quinta do Bôa Vista, São Christovão, *Glaziou 9980* (K). INDEFINITE: Brazil, *Sellow* (BD), *Wallis* (BD) and *Gardner 984* (DL).

This is an extremely distinct species. It varies somewhat in the abundance and distribution of pubescence and in the size and shape of its leaves. This variation seems to be quite erratic and shows no tendency at all to be geographically correlated. Various forms of the species are to be found in any large series of specimens from a single region. Consequently I do not believe that these merit nomenclatorial recognition. The plant is well known because of the peculiar subnodal swellings which are a classical example of ant-domatia. The most exhaustive and interesting discussion of this case of myrmecophytism and of the very strange morphology of these curious subnodal thickenings of the stem in *Cordia nodosa* is that given by I. S. Bailey, *Bot. Gaz.* lxxvii. 32–49 t. 6–7 (1924).

Section **Pilicordia** A. DC. Prodr. ix. 474 (1845), type-species *C. diversifolia* Pav. *Pilicordia* Lindley, *Veg. Kingdom* ed. 2, 629 (1847). *Borellia* Necker, *Elem.* i. 275 (1790), type-species, *C. tetrandra* Aubl. *Toquera* Raf. *Sylva Tellur.* 40 (1838), type-species, *C. toquera* Aubl. *Colococca* Raf. *Sylva Tellur.* 40 (1838), type-species, *C. macrophylla* L. *Acnadena* Raf. *Sylva Tellur.* 41 (1838), type-species, *C. elliptica* Sw. *Hymenesthes* Miers, *Trans. Linn. Soc. Bot.* i. 26, t. 6B (1875), type-species, *H. nitida* Miers.

Under this section I have placed a well marked group of trees and shrubs from the American tropics. The sectional name was originally applied to a few of the species which have conspicuously sulcate

calyces, but ignoring this particular trait, I have expanded the original concept to make it include a total of about 25 habitually similar species. These are as a group characterized by having a well developed loose paniculate inflorescence bearing commonly rather small flowers. The calyces are either smooth or sulcate and in form vary from campanulate to cylindrical. They become only very slightly if at all accrescent in age and commonly become quite explanate or are soon disrupted and reflexed by the maturing fruit. The calyx, consequently, is not conspicuously associated with the fruit and never sheathes nor covers any noticeable part of it. In a few species it is early circumscissile at the base and unaltered is soon pushed off when the ovary begins to grow. The corollas of this group are rather distinctive consisting of a rather short tube, commonly included in the calyx, a short weakly developed throat, 4-5 well developed ovate or quite oblong spreading or reflexed petals and usually 4-5 evidently exerted stamens. In most species the corolla is 6-8 mm. long, only in the coarse-flowered Caribbean species related to *C. reticulata* Vahl do the corollas become 10-13 mm. long. Most of the species have decidedly drupaceous fruits with a conspicuous mucilaginous pulp. The stone of these fruits is depressed-globose to ovoid or rarely even obovoid in shape and shows a decided and rather characteristic tendency to become quite asymmetrical. In length it varies between 6 and 15 mm. The leaves are generally broad and rather commonly turn quite dark in drying. Most of the species are trees and the majority of them are confined to South America where they are particularly numerous in Brazil and on the north coast. The group as a whole is most closely related to that of the Old World known as the Section *Myxa*. To determine the exact relationship of these two sections, however, would necessitate the comparison, close study and many dissections of a much more extended and representative suite of these Old World plants than I have available. As the species of the section *Myxa* seem to have a distinctive facies, different styles and general structures more or less intermediate between the sections *Pilicordia* and *Eucordia* I have been willing, for the present at least, to believe them sectionally separable from our American forms. This problem, however, needs study.

#### KEY TO THE SPECIES.

- Calyx regularly costate, sometimes weakly so and the ribs obscured by a copious loose pubescence but then the flowers crowded into spike-like or head-like clusters on the stiff divaricate branches of the inflorescence.
- Calyx very evidently and prominently 10-ribbed, clothed with a rather appressed pubescence.

- Calyx at anthesis 2 mm. or less thick; leaves medium-sized, 10-14 cm. long, 5-7 cm. broad, plane, the veins not conspicuously impressed; stems slender, antrorsely strigose. . . . . 34. *C. trachyphylla*.
- Calyx at anthesis 3-4 mm. thick; leaves very large, becoming 25 cm. long and 12 cm. broad, more or less bullate, with the secondary and tertiary nerves conspicuously impressed above; stems coarse, pubescence usually very conspicuously spreading. . . . . 35. *C. trichoclada*.
- Calyx with 10 regular although not very prominent ribs obscured by the rather dense somewhat spreading pubescence.  
Leaves large, becoming 13 cm. broad, very sparsely and inconspicuously pubescent. . . . . 36. *C. Chamissoniana*.
- Leaves moderate, becoming 7 cm. broad, densely and conspicuously brown-tomentose. . . . . 37. *C. Gardneri*.
- Calyx unribbed or if ribbed only very imperfectly and irregularly so, mostly strigose; branches of the inflorescence never with an evident spicate arrangement of flowers.  
Ovary more or less definitely strigose or villous.  
Upper surface of the leaves velvety, beset with stiffish erect or ascending hairs; leaves usually decidedly heteromorphic. . . . . 38. *C. toqueve*.
- Upper surface of leaves scabrous with short appressed hairs or points or at times smooth and glabrous; leaves not decidedly heteromorphic.  
Leaves glabrous above, broadest at or above the middle, velvety below with erect or somewhat antrorsely ascending stiffish or closely appressed hairs. . . . . 39. *C. Sprucei*.
- Leaves strigose above with short appressed hairs, broadest at or below the middle, beneath provided on the nerves with short appressed hairs pointing in various directions but usually inward concentrically towards the middle of the nerve-areolae.  
Lower surface of leaves green, scabrid with very short sparse stout hairs; leaves lanceolate. . . . . 40. *C. scabrifolia*.
- Lower surface of leaves pallid, finely felty with short but copious appressed slender hairs; leaves usually broadly lanceolate to ovate. . . . . 41. *C. sericalyx*.
- Ovary entirely glabrous.  
Calyx definitely pubescent.  
Petioles of average mature leaf 2-4 but usually ca. 3 cm. long; leaf-blade frequently obliquely cordate at base. . . . . 42. *C. tetrandra*.
- Petioles of average mature leaf 0.3-1.5 but usually less than 1 cm. long; leaf-blades rounded or contracted at base.  
Leaves decidedly pallid beneath with a fine dense felty indument of appressed hairs. . . . . 41. *C. sericalyx*.
- Leaves green or rufous beneath, the pubescence sparse or more or less tomentose.  
Leaf broadest at or above the middle; Amazonian. . . . . 43. *C. Ulei*.
- Leaf broadest below the middle; Extra-Amazonian.  
Leaves glabrous above; rare. . . . . 44. *C. acutifolia*.
- Leaves decidedly pubescent above; common. . . . . 45. *C. Sellowiana*.
- Calyx glabrous or very sparingly pubescent.  
Leaves glabrous or practically so.  
Leaves 1-3(-5) cm. broad; buds obovate. . . . . 46. *C. ecalyculata*.
- Leaves 3.5-8 cm. broad; buds oblong-obovate. . . . . 47. *C. magnoliaefolia*.
- Leaves rather abundantly pubescent on one or both faces.  
Leaves not scabrous, pubescence of slender usually weak hairs. . . . . 48. *C. silvestris*.

Leaves scabrous beneath with stiffish hairs or points.

Leaves lanceolate, apex acute; buds obovate. . . . 49. *C. ochracea*.

Leaves obovate to obovate-elliptical, obtuse or rounded at apex, abruptly mucronate; buds oblong-obovate.

50. *C. scabrida*.

34. ***C. trachyphylla*** Mart. (Herb. Fl. Bras. pg. 246, no. 412) Flora Regenb. xxiv. Bd. 2, Beibl. 6 (1841); Fresen. in Mart. Fl. Bras. viii. pt. 1, 10, t. 4 (1857). *Lithocardium trachyphyllum* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from southeast Bahia.

BRAZIL. BAHIA: woods near Ilhéos, Dec. 1818, *Martius*, Herb. Fl. Bras. 412 (G, NY, K, BM, BD, DC, DL, ISOTYPES); corolla white, Bahia, Sept. 1835-7, *Luschnath* 14 (BD); southern Bahia, 1840, *Blanchet* 3189a (DC); indefinite, 1840, *Blanchet* 3189 (DL, BB).

In habit this plant is extremely suggestive of such species as *C. scabrifolia*, *C. scabrida* and some forms of *C. Sellowiana*. It is, however, quickly separated from them by its very strongly ribbed calyx, and is, I believe, much more closely related to *C. trichoclada*. The material I have cited forms a very uniform series.

35. ***C. trichoclada*** DC. Prodr. ix. 474 (1845). *Lithocardium trichocladum* Kuntze, Rev. Gen. ii. 977 (1891). *C. macrophylla* Vell. Fl. Flum. 97 (1825) and Icones ii. t. 152 (1827); not L. (1763). *C. grandis* Cham. Linnaea iv. 473 (1829), not Roxb. (1824). *C. Sellowiana* Don. Gen. Syst. iv. 381 (1837), not Cham. (1829). *C. grandifolia* DC. l. c. 475; Fresen. in Mart. Fl. Bras. viii. pt. 1, 10 (1857).

Ranging from Bahia to São Paulo, although best known from about Rio Janeiro.

BRAZIL. BAHIA: indefinite, hills, 1830, *Salzmann* (DC, TYPE of *C. trichoclada*); indefinite, valleys, *Salzmann* (K, DL). MINAS GERAES: corolla white, João Gomez, *Glaziou* 14141 (NY), 14142 (K, BD, DL) and 15274 (US, K, BD). RIO JANEIRO: Vermelha, *Miers* 1845 (US); Morro Flamengo, *Miers* 3655 (K); shrub ca. 2 m. tall, along the aqueduct near Rio Janeiro, Aug. 16, 1925, *Burchell* 799 (K); fruit yellow, arborescent 6 m. tall, Corcovado, Dec. 31, 1825, *Burchell* 1443 (K); Caixa d'agua, Corcovado, July 1, 1873, *Mosén* 23 (RS); Corcovado, *Glaziou* 1505 (K, DL) and 6050 (K, BD), *Lhotsky* 41 (DC); Morro da Babylonia, Botafogo, July 1887, *Mendonça* 639 (BD); corolla white, Capoeinha near Rio, Sept. 1876, *Schwacke* 11855 (BD); Morro da Nova Cintra, Aug. 1887, *Ule* 784 (BD); Praia da Jurijuba, *Casaretto* 1554 (DL); Rio Janeiro, Nov. 4, 1815, *Banks & Solander* (BM); Rio Janeiro, *Weddell* 426 (DL) and *Tweedie* 1312 (K). SÃO PAULO: small tree, corolla white, Alto Tiete. Oct. 19, 1901, *Loefgren* 5843, *Mus. Paul.* 11312 (G); tree, corolla white, Est. Biologica, Alto da Serra, Sept. 27, 1922, *Hoehne*, *Mus. Paul.* 7979 (G). INDEFINITE: Bras. merid. *Sellow* (K, BM, DL) 174 (K), 398 (BD, authentic *C. grandis*) and L174-B398 (BD).

A very distinct species quickly distinguished by its large bullate leaves, coarse usually very shaggy stems, spreading inflorescence and



coarse strongly ribbed calyces. It is very erratic in its distribution being known only from Bahia, south central Minas Geraes, vicinity of Rio Janeiro and eastern São Paulo. Fresenius, l. c., reports it from the Rio Xipotó, Minas Geraes. This station is to the southwest of Ouro Preto and from the same region as João Gomez where Glaziou obtained it. The plant must be rather common about Rio Janeiro. A study of the variation exhibited by the many collections from this last locality shows conclusively that *C. trichoclada*, from Bahia, is completely indistinguishable from the more southern *C. grandifolia*. The two species are accordingly here united under the prior name.

36. **C. Chamissoniana** Don, Gen. Syst. iv. 381 (1837). *C. latifolia* Cham. Linnaea viii. 126 (1833), not Roxb. (1814). *C. platyphylla* Steud, Nom. ed. 2, i. 418 (1840); Fresen. in Mart. Fl. Bras. viii. pt. 1, 15 (1857). *Lithocardium platyphyllum* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from the type collected at an undesignated locality in Brazil.

BRAZIL: locality unknown, *Sellow* (BD, TYPE).

A close relative of *C. trichoclada* from which it is separated by having the slightly smaller calyces with a somewhat looser pubescence and only obscure rather than conspicuous ribs. In addition, the flowers of *C. Chamissoniana* seem to be more definitely spicate and the pubescence of the proportionately broader leaves scantier than in its relative. The source of the type and only known collection of the species is not on record.

37. **C. Gardneri**, sp. nov., fruticosa 2–2.5 m. alta; caulibus sulcatis cum pilis gracilibus rigidusculis brunneis flexuosis abundantibus laxe tomentosis; foliis alternis elliptico-ovatis vel lanceolato-oblongis 1–2 dm. longis 5–7 cm. latis firmis pinnate nervatis, supra fusciscentibus pilis rigidusculis antrorse adpressis brunneis plus minusve vestitis, subtus pallidioribus nervis prominentibus rugosis cum pilis (nervos ornantibus) brunneis ascendentibus gracilibus plus minusve velutinis, apice acutis graciliter attenuatis, basi acutis usque a rotundatis, margine integris sinuolatis, nervis primariis 9–10-jugatis simplicibus ascendentibus per nervos secundarios tenues subrectos transverse conjunctis, nervis tertiariis (reticulate conjunctis) atque secundariis foliorum pagine superiore obscuris inferiore prominentibus, petiolo 5–15 mm. longo stricto densissime brunneo-villoso; inflorescentia terminali rigida divaricate sparseque brevissime brunneo-villosa; floribus vere sessilibus ad apicem ramorum inflorescentiae aggregatis spicas densas 1–3 cm. longas cylindricas 1.5–2 cm. crassas

vel capitula densa 1.5–2 cm. diametro formantibus; calycibus campanulatis 4–5 mm. longis 3.5 mm. crassis cum pilis abundantibus laxè adpressis flexuosis gracilibus brunneo-vestitis 10-costatis (costis per pilos obscuratis) basi rotundis, dentibus 5 late triangularibus 1 mm. longis; corolla alba (?) 6–7 mm. longa, tubo cylindrico ca. 3 mm. longo, lobis oblongis 5 recurvatis ca. 3 mm. longis; filamentis exsertis usque ad 5 mm. longis ad basem versus villosis; ovario glaberrimo in stylum subulatum sparse adpresseque villosum abrupte contracto; fructu ignoto.

Southeast parts of Minas Geraes.

BRAZIL. MINAS GERAES: Arraial das Mercês, Oct. 1840, *Gardner 5126* (Kew, TYPE); Rio Novo, 1896, *Araujo, in Herb. Schwacke 11974* (BD).

This species is very distinct and, because of the spicate arrangement of its flowers, rather suggestive of some of the *Verbenaceae*. Its dense indument serves to separate it from its immediate relatives.

38. **C. toqueve** Aubl. Hist. Pl. Guian. Fr. i. 228, t. 90 (1775). *Lithocardium toqueve* Kuntze, Rev. Gen. ii. 977 (1891). *C. heterophylla* Poir. Dict. Sci. Nat. x. 409 (1818); Willd. ex R. & S. Syst. iv. 800 (1819); Cham. Linnaea iv. 480 (1829). *L. heterophyllum* Kuntze, l. c. 977. ? *C. scandens* Poir. l. c. 410. *C. pubescens* Willd. ex R. & S. l. c. 800; Cham. l. c. iv. 479 (1829) and l. c. viii. 127 (1833). *L. pubescens* Kuntze, l. c. 977. *Toquera tomentosa* Raf. Sylva Tellur. 40 (1838). *C. hebecarpa* DC. Prodr. ix. 488 (1845). *L. hebecarpum* Kuntze, l. c.

Occurring in eastern Brazil, northern South America and along the Andes to Bolivia.

BRAZIL. PERNAMBUCO: Tapara, Dec. 1926, *Pickel* (BD); Pernambuco, March 1924, *Pickel 620, Mus. Paul. 18120* (SP). BAHIA: indefinite, *Blanchet 44 and 1834* (DC, TYPES of *C. hebecarpa*), *131* (BM), *191* (BM, DL), *495* (DL) and *1839* (K, BD, BB); Injule Itaparica near Bahia, *Casaretto 2023* (DL). INDEFINITE: Brazil, *Sellow 31* (BD).

I have seen the type of *C. toqueve* in the British Museum and the specimen of *C. heterophylla* in the Willdenow Herbarium. These specimens came from French Guiana and are clearly conspecific. The type of *C. pubescens* came from near Caracas and like other Venezuelan collections of the species differs from the Guianan plants merely in having a slightly less copious pubescence on the foliage. The Brazilian material, however, varies somewhat in the abundance of pubescence and clearly demonstrates that the very slight difference between *C. toqueve* and *C. pubescens* is obliterated by intermediate forms. *Cordia hebecarpa*, from Brazil, is clearly synonymous with *C. toqueve*.

*Cordia toqueve* is distinguished among all the species of our area by its decidedly heteromorphic foliage. The foliage on a single branch

consists of suborbicular or broadly ovate leaves which alternate with or are frequently opposite much larger more elongate elliptical, narrowly ovate or even lance-oblong ones. In tropical America there are several species with a very similar leaf-heteromorphism. Some of these have passed as *C. heterophylla*. That name, however, belongs in the synonymy of *C. toqueve* which in turn is properly applied only to the South American plant which occurs in eastern Brazil, the Guianas and Venezuela and apparently south along the Andes to Bolivia. This plant is quickly and decisively distinguished from all of its relatives with strongly heteromorphic foliage by having a very hairy ovary, very pubescent fruit and denser pubescence on the leaves. In northern South America it occurs with only one close relative, *C. ierensis* Britton, which is known only from Surinam, Trinidad, Venezuela and Colombia and which differs from our plant in its very fine inconspicuous pubescence, perhaps less firm leaves and decidedly glabrous ovary and fruit. The plants of the West Indies and Central America which have been called *C. heterophylla* are referable to *C. sulcata* DC. and to *C. macrophylla* L. As already intimated these have decidedly glabrous fruit and ovaries.

39. **C. Sprucei** Mez. Bot. Jahrb. xii. 549 (1890). *Lithocardium Sprucei* Kuntze, Rev. Gen. ii. 977 (1891).

Known only from the mouth of the Rio Negro and in northern Peru.

BRAZIL. AMAZONAS: Barra do Rio Negro, Dec.-March 1850-1, *Spruce* 1019 (BD, part of TYPE); vicinity of Barra, Dec.-March, 1850-51, *Spruce sine no.* (G, K, BM); tree 4.5 m. tall, corolla white, Barra to Matiriho, Jan. 1851, *Spruce* 1234 (K, BM); fruit juicy, yellow, transversely oblong, Barra, April 1851, *Spruce* 1234 (K, BM, DL).

PERU. LORETO: tree 4.5-6 m. tall, Iquitos, ca. 100 m., Aug. 1929, *Killip & Smith* 26996 (US).

I believe that there has been some confusion in the labeling of the type-specimen of *C. Sprucei*. It is given as bearing Spruce's number 1019. Although the first and best set of Spruce's collections is at Kew there is no collection of a *Cordia* there bearing number 1019. Consulting Spruce's manuscripts and his field-books, which form a part of the Kew Library, I found that Spruce applied the number in question to a plant collected between January and September near Santarém that was determined as *Gustavia brasiliensis* DC. I believe that the type of *C. Sprucei* should have properly borne the number 1234!

40. **C. scabrifolia** A. DC. Prodr. ix. 485 (1845).

Known only from British Guiana and from scattered stations in the Amazon Basin in Brazil and southeastern Peru.

BRAZIL. AMAZONAS: tree 6 m. tall, corolla white, Rio Negro, gapó above Cabuquena, Dec. 1851, *Spruce* 1942 (K, BM). PARÁ: shrub or small tree

3-4.5 m. tall, near Pará, Nov. 8, 1819, *Burchell 9720* (K); Prainha, Nov. 18, 1873, *Traill 563* (K). GOYAZ: small tree 5.5 m. tall, near Porto Real, Dec. 17, 1828, *Burchell 8452* (K). INDEFINITE: Brazil, *Newman* (DL).

BRITISH GUIANA: "Upper Essequibo," *Schomburgk 911* (BB, TYPE; K, BM, BD, ISOTYPES).

PERU. MADRE DE DIOS: tree 8-15 m. tall, corolla white, Seringal Auristella, Rio Acre, Aug. 1911, *Ule 9717* (K, BD).

This is a very well marked species known only from the collections cited above. It is quickly distinguished by the character and distribution of its very scanty short pubescence. The leaves, which dry a brown, have on the lower surface sparse, appressed, minute hairs that do not point in one direction but, developing on the slightly prominent veins and veinlets, are directed towards the center of the adjacent vein-areoles. The nature and distribution of these minute stout hairs on the leaves is quite constant and hence very characteristic; once they have been studied under a lens and their peculiarities noted the species becomes quickly distinguished by them thereafter. Another peculiarity of the pubescence in this species is the suprabasal attachment of the hairs, particularly on the calyx. The calyx is antrorsely strigose, the hairs being abruptly bent at the point of attachment and very closely appressed. The suprabasal attachment has apparently resulted from the development of a callous or possibly glandular thickening below the attachment and in line with the main body of the hair. A suggestion of this condition is occasionally found in other species, notably *C. sericicalyx*.

41. ***C. sericicalyx*** A. DC. Prodr. ix. 485 (1845). *Lithocardium sericicalyx* Kuntze, Rev. Gen. ii. 977 (1891). *C. bicolor* A. DC. Prodr. ix. 485 (1845). *L. bicolor* Kuntze, l. c. 976. ? *C. dichotoma* Klotzsch ex Schomburgk, Fauna u. Fl. Brit. Guiana 1084 (1848), nomen. *L. Lockartii* Kuntze, l. c. 438. *C. Lockartii* Kuntze, l. c. 438, in synonymy. *C. trichostyla* Pittier, Contr. U. S. Nat. Herb. xviii. 252, f. 102 (1917). *C. carnososa* Rusby, Three Hundred N. Sp. So. Am. Pl. 104 (1920). *C. coriacea* Killip, Jour. Wash. Acad. Sci. xvii. 329 (1927).

Occurring in Amazon headwaters of western Bolivia, in scattered stations south and east of the Amazon Basin in Brazil, in northern South America from Surinam to Colombia, in Panama and Guatemala in Central America and on Trinidad and St. Vincent in the West Indies.

BRAZIL. AMAZONAS: corolla white, Roraima, 1200 m., Feb. 1910, *Ule 8748* (K, BD). CEARÁ: a large shrub near Crato, Nov. 1838, *Gardner 1781* (K). RIO JANEIRO: indefinite, 1844, *Widgren* (RS). MATTO GROSSO: small tree, Santa Anna da Chapada, Oct. 6, 1902, *Malme 2455* (RS); small tree, Santa Anna do Chapada, May 26, 1903, *Malme 2455a* (RS); indefinite, *Smith 193* (US).

Once recognized this species can be quickly distinguished from all other American species by the character of the pubescence on its foliage. The leaves are green above although somewhat dulled by a copious closely appressed pubescence in which the slightly antrorse hairs, on either side of the midrib, are directed towards the leaf-margin. The under leaf-surface is pallid with a very dense thin felty indument. This pubescence is formed of fine closely appressed slender hairs, which spring laterally from the veins and are directed inward towards the center of the vein-areoles, which are thus covered with a pallid pubescence. The veins and veinlets themselves are very sparsely clothed and consequently are very evident because of the contrast of their dark color against the gray of the hair-covered areoles.

The type of *C. sericicalyx* came from British Guiana. The ovary in the type collection is glabrous but otherwise the plant seems to be quite similar to the plants that have been described as *C. bicolor*, *C. Lockartii*, *C. trichostyla*, *C. carnososa* and *C. coriacea*. In the species as I have defined it the ovary is prevailingly pubescent. The only plants with glabrous ovaries that I have seen are those of the type-collection of *C. sericicalyx* and those collected by Gardner in Ceará. The ovaries in the collections made by Malme, which I have cited above, are very sparingly pubescent. As the vegetative characters of the plants that I have referred to *C. sericicalyx* are so constant and unique, and since they seem to characterize a species with a natural and very credible, albeit disrupted, distribution I feel that in this case the presence or absence of pubescence on the ovary should be ignored in defining the species.

42. **C. tetrandra** Aubl. Hist. Pl. Guian. Fr. i. 222, t. 87 (1775). *Lithocardium tetrandrum* Kuntze, Rev. Gen. ii. 976 (1891). *C. cordifolia* HBK. Nov. Gen. et Sp. iii. 70 (1818); Willd. ex R. & S. Syst. iv. 800 (1819). *L. cordifolium* Kuntze, l. c. 976. *C. muneco* HBK. l. c. vii. 207 (1825). *L. muneco* Kuntze, l. c. 977. *Borellia aspera* Raf. Sylva Tellur. 41 (1838). *C. umbraculifera* DC. Prodr. ix. 484 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 16 (1857). *L. umbraculiferum* Kuntze, l. c. 977.

Northeast coast of Brazil, in northern South America and along the Andes to Bolivia. Occasionally in cultivation beyond its natural range.

BRAZIL. PARÁ: corolla white, small tree or shrub 3 m. tall, mouth of the Uña near Pará, Jan. 17, 1830, *Burchell 10043* (K); small tree 3 m. tall, low ground near river north of Campinha, Pará, Dec. 30, 1829, *Burchell 9968* (K). CEARÁ: indefinite, *Fr. Allemão 1124* (US). PERNAMBUCO: Pernambuco, March 18, 1924, *Pickel 620*, *Mus. Paul. 18120* (SP). RIO JANEIRO: cultivated tree, corolla white, Passeio Publico, Rio Janeiro, *Glaziou 5949* (K, BD);

cultivated tree, corolla white, Quinta da Bôa Vista, Rio Janeiro, *Glaziou 9534* (NY, K, BD).

Among the South American species of this section *C. tetrandra* is quickly distinguished by its well developed petioles. The large non-heteromorphic leaves are usually coriaceous, oblong and conspicuously bicolored and are frequently cordate at the base. The upper surface of the leaves is green although provided with an inconspicuous indument of short slender appressed hairs. The lower surface is rufous being densely and evidently pubescent and usually more or less velvety. The petioles on the larger leaves are 2 cm. long or more, about twice the length of those in the related species. The ovary is glabrous and is commonly provided with a rather characteristic glandular or callous ring above its middle. The stamens, almost always 5 in number, are either glabrous or villous. The inflorescence frequently becomes extremely broad and corymbose. The species is well marked and very distinctive.

43. **C. Ulei**, sp. nov., arborescens 5–12 m. alta; ramulis inconspicue sulcatis hirsutulis brunnescentibus; foliis firmis penninervatis 5–12 mm. longe petiolatis obovato-oblongis vel oblongo-oblancheolatis 14–22 cm. longis 4–10 cm. latis saepissime supra medium latioribus saltem infra medium ad basem versus contractis, basi cuneatis vel rariter immam ad basem abrupte obtusis vel rotundatis, apice saepe rotundatis vel obtusis et abrupte (5–10 mm. longe) acuminatis, margine integerrimis plus minusve inconspicueque revolutis, supra glabris vel tantum in costa et in nervis primariis sparse inconspicue piliferis, subtus pallidioribus pubescentibus, per nervos secundarios tenues subrectos transverse conjunctos verrucosis, nervis primariis 5–6-jugatis conspicuis; inflorescentia terminali laxa paniculatimque e cincinnis terminalibus composita pilis rigidulis curvatis ascendentibus brunnescentibus ca. 0.7 mm. longis vestita breviter pedunculata foliis vix superante; floribus sessilibus; calyce poculiformi 4–5 mm. longo ca. 2 mm. crasso plus minusve strigoso; corolla alba fere ad 8 mm. longa 5-mera, tubo cylindrico, filamentis gracilibus exsertis ad basem versus villosis; ovario glaberrimo; fructu ignoto.

BRAZIL. ACRE: Seringal S. Francisco, Rio Acre, March 1911, *Ule 9716* (Herb. Berol. TYPE; Kew, ISOTYPE).

This species is probably most closely related to *C. Sprucei* of the Manáos region, but differs in having a glabrous rather than a decidedly pubescent ovary and fruit. It is probably also related to *C. Sellowiana* of the coastal states of southeastern Brazil from which it differs in having the leaves not only broadest above the middle but larger, with

a somewhat sparser pubescence and drying commonly much darker. The calyx in flower is scantily covered with appressed hairs whereas in *C. Sellowiana* it is densely and completely clothed. In the typical form of *C. Ulei* the upper surface of the leaf is glabrous except along the midrib and the principal nerves and hence differs in this trait from that of *C. Sellowiana* in which the upper surface of the foliage is always pubescent. Material from along the Ucayale and the Amazon rivers in eastern Peru, however, represent a variety of *C. Ulei* with the leaves pubescent on both surfaces. As this plant may be expected along the upper Amazon in western Brazil it is placed on record here as,—

**C. Ulei**, var. **ucayaliensis**, var. nov., a varietate genuina differt foliis utrinque pubescentibus.

PERU. LORETO: corolla white, tree 6 m. tall, branched 3 m. above the ground, trunk 21 cm. thick, flood-free forest, Yarina Cocha, 155 m. alt., Oct. 26, 1925, *Tessmann 5457* (Herb. Berol., TYPE); Caballo Cocha on the Amazon River, Aug. 1929, *Williams 2333* (G).

The upper surface on the leaves in this variety is evidently strigose and consequently scabrid. A collection by Poeppig, no. 2196, in the herbarium at Berlin, no doubt came from the Peruvian montaña and is very probably also referable here.

44. **C. acutifolia** Fresen. in Mart. Fl. Bras. viii. pt. 1. 11 (1857). *Lithocardium acutifolium* Kuntze, Rev. Gen. ii. 976 (1891).

BRAZIL: no locality given, *Sellow 744* and *1203* (BD, TYPE).

A peculiar plant known only from material collected by Sellow at an unknown locality in Brazil. The species is closely related to *C. Sellowiana*, particularly to the form of that species which was described as *C. obscura*. It is distinguished, however, by having the upper leaf-surfaces glabrous and the leaf-outline rather different from any I have seen in *C. Sellowiana* and much more suggestive of that of *C. scabrifolia*.

45. **C. Sellowiana** Cham. Linnaea iv. 478 (1829). *Lithocardium Sellowianum* Kuntze, Rev. Gen. ii. 977 (1891). *C. obscura* Cham. l. c. 480. *L. obscurum* Kuntze, l. c. 977. *C. obscura*, var. *glabrior* Cham. l. c. viii. 128 (1833). *C. obscura*, var. *tomentosa* Cham. l. c. viii. 128 (1833). *C. brachypoda* DC. Prodr. ix. 487 (1845). *L. brachypodum* Kuntze, l. c. 976. *C. obscura*, var. *magnifolia* Fresen. in Mart. Fl. Bras. viii. pt. 1, 15 (1857).

Ranging in the coastal states of Brazil from Bahia to Paraná, in the south extending inland to northeastern Paraguay.

BRAZIL. BAHIA: Bahia, *Blanchet* (DC, TYPE of *C. brachypoda*); Bahia, *Blanchet* (BM, DL); Bahia, *Blanchet* 306 (DL) and 648 (NY). MINAS GERAES: corolla white, Ouro Preto, *Schwacke* 9332 (BD); betw. Queluz and Ouro Preto, *Glaziou* 14135 and 11289 (K, BD); Paraisópolis, April 19, 1927, *Hoehne, Mus. Paul.* 20241 (G); Caldas, Aug. 16, 1868, *Regnell III* 907 (RS); Alfenes, April 30, 1869, *Henschen III* 907 (RS); Capivary, woods on Serra dos Cabritos, *Mosén* 960 (RS); indefinite, 1845, *Widgren* 1198 (RS); indefinite, *Langsdorff* (K). RIO JANEIRO: Novo Friburgo, *Claussen* 97 (DL); between Novo Friburgo and Conego, *Glaziou* 15277 (K, BD, DL); Theresópolis, *Glaziou* 2862 (K), 2863 (K) and 5950 (K, BD); Organ Mts., *Wilkes Exped.* (US); shrub 4 m., road betw. Frechal and Magé, *Burchell* 2689 (K); Rio Magé towards Faz. da Lagoa, *Burchell* 2751 (K); shrub ca. 2.5 m. tall, near Magé, March 1837, *Gardner* 548 (K) Magé and Piedade, *Casaretto* 1088 (DL); woods near Mauá, Oct. 1896, *Ule* 4300 (BD); Rio Janeiro, 1851, *Andersson* (RS); Rio Janeiro, *Sellow* 14 (BD); Rio Janeiro, *Miers* (BM). SÃO PAULO: Brardia, *Brade* 7466 (BD); Mogy das Cruzes, *Lund* 737 (BD) and *Glaziou* 16279 (K, BM) 17712 (NY, K, BD, DL); M. da Mursa near Jundiáhy, April 4, 1915, *Brade* 7466 (BD); São Paulo, Feb. 1840, *Guillemin* 423 (DC, DL); near São Paulo along road over Rio Tiete, Feb. 15, 1827, *Burchell* 4227-2 (K); São Paulo, near church of N. S. da Gloria, April 1827, *Burchell* 4685 (K); convent of São Bento, May 4, 1815, *Bowie & Cunningham* (BM); near São Bernardo, Jan. 1827, *Burchell* 3971 (K); Butantan, Jan. 8, 1918, *Hoehne* 1249 (BM); Araçá, Dec. 2, 1918, *Hoehne, Mus. Paul.* 2622 (G); Villa Mariana, Nov. 24, 1905, *Usteri* 125, *Mus. Paul.* 11286 (G); Moóca, May 1913, *Brade* 6336 (RS) and *Brade* 6336, *Mus. Paul.* 6478 (G); Santo Amaro, Feb. 16, 1922, *Holway* 1564 (US); Copas Campo, Nov. 15, 1829, *Sellow* 1426 (BD); Campinas, *Loefgren* 4501, *Mus. Paul.* 11290 (G); Campinas, June 10, 1875, *Mosén* 3906 (RS); Caragua ta tuba, April 14, 1892, *Edwall* 1773, *Mus. Paul.* 11288 (G); Mogy Mirim, May 24, 1927, *Hoehne, Mus. Paul.* 20524 (G); São José dos Campos, Nov. 17, 1909, *Loefgren* 468 (RS). PARANÁ: Guaratuba, Dec. 31, 1911, *Dusén* 13813 (RS); Paranaguá, March 7, 1914, *Dusén* 1a (G, RS). INDEFINITE: Bras. merid. *Sellow* (K, BM, DL); Bras. trop., *Sellow* 399 (BD, authentic *C. obscura*); Bras., *Sellow* 5731 (BD, authentic *C. obscura* v. *tomentosa*); Bras. trop., *Sellow* 1566 (BD, authentic *C. Sellowiana*); Bras. merid., *Sellow* 1566-c659 (BD); Brazil, *Glocker* 406 (BM).

PARAGUAY: Sierra de Amambay, Sept. *Rojas in Hassler* 10595 (BM, BD); Sierra de Amambay, Oct., *Rojas in Hassler* 11176 (Hass).

This appears to be especially common, in any case has been most frequently collected, in southern Minas Geraes, Rio Janeiro and eastern São Paulo. The species is variable in pubescence. The common forms are those which are copiously pubescent with spreading hairs and so more or less definitely tomentose on the lower surface of the leaves. This form has been described under the names *C. Sellowiana*, *C. obscura* var. *tomentosa* and *C. brachypoda*. The other extreme in pubescence is the comparatively uncommon form that has been described as *C. obscura* and *C. obscura* var. *glabrior*. It has a pubescence that is sparse and closely appressed, so decidedly so that its leaves might at a glance be taken for glabrous. This green-leaved form with its sparse appressed pubescence is completely connected by intermediates with the more common one that is tomentose with abundant spreading hairs. The two extreme forms occur in the



same region and I am inclined to believe them merely phases of a single species.

Among the species in our area *C. Sellowiana* is most apt to be confused with *C. toqueve* since both species grow in Bahia. *Cordia toqueve*, however, is quickly distinguished by its pubescent rather than glabrous ovary and fruit and by its very decidedly heteromorphic leaves. The leaves of *C. Sellowiana*, as in other species of the section, are often slightly heteromorphic but never so pronouncedly so as is commonly encountered in *C. toqueve*. Although ranging entirely outside and southeast of the Amazon Basin *C. Sellowiana* in appearance approaches *C. Ulei* from near the Peruvian-Brazilian frontier and *C. Sprucei* from the lower Rio Negro. Both of these Amazonian species have leaves which are broadest at or above the middle. The leaves of *C. Sellowiana* are ovate to oblong-lanceolate and almost universally broadest below the middle. Of all the many collections of the present species seen by me only two have the leaves clearly broadest above the middle and these have the dense pubescence of the typical form which is very different from the scanty indument of the two Amazonian species mentioned.

46. ***C. ecalyculata*** Vell. Fl. Flum. 96 (1825) and Icones ii. t. 149 (1827). ? *C. digynia* Vell. l. c. 97 and l. c. t. 153. *C. salicifolia* Cham. Linnaea vi. 481 (1829) and l. c. viii. 129 (1833). *Lithocardium salicifolium* Kuntze, Rev. Gen. ii. 977 (1891). *C. leptocaula* Fresen. in Mart. Fl. Bras. viii. pt. 1, 14 (1857). *L. leptocaulon* Kuntze, l. c. 977. *C. coffeoides* Warm. Kjoeb. Vidensk. Meddel. 1867: 4 and 44, fig. 3 (1868). *Patagonula Glaziovii* Mez, Bot. Jahrb. xii. Beibl. 27, pg. 17 (1890). *C. Glaziovii* Taub. Bot. Jahrb. xv. Beibl. 38, pg. 13 (1893).

Ranging in the coastal states of Brazil from southern Minas Gerais to Rio Grande do Sul and westward through northeastern Argentina to Paraguay.

BRAZIL. MINAS GERAES: Lagos Santo, 1865, *Warming* (US, ISOTYPE of *C. coffeoides*); Rio Novo, Oct. 29, 1889, *Araujo* 14827 (US); Parahybunda, Oct. 1840, *Gardner* 5038 (K, BM); indefinite, *Claussen* (K). RIO JANEIRO: Alto Macahé de Novo Friburgo, *Glaziou* 18384 (K, BD, DL); Serra do Picu, Dec. 11, 1886, *Schenck* 1481 (BD). SÃO PAULO: Sororocaca near Santos, Feb. 5, 1875, *Mosén* 3445 (RS); Serra de Caracol, Dec. 10, 1875, *Mosén* 4307 (RS); Biological Station, Alto do Serra, Feb. 3, 1922, *Hoehne*, *Mus. Paul.* 5785 (G); Campinas, Nov. 15, 1896, *Novaes* 939, *Mus. Paul.* 11283 (G); near Pico da Serra da Cubatão towards São Paulo, Dec. 22, 1826, *Burchell* 3741 and 3741-2 (K); near Cubatão at Rio das Pedras, Dec. 10, 1826, *Burchell* 3537 (K); Butantan, Jan. 1921, *Gehrt*, *Mus. Paul.* 5304 (G); Loreto, *Vecchi*, *Mus. Paul.* 18137 (G); St. Ernestina, Sept. 24, 1920, *Gehrt*, *Mus. Paul.* 4520 (G); Piracicaba, *Puttemans*, *Mus. Paul.* 11273 (SP). PARANÁ: Therezina, Jan. 21, 1911, *Dusén* 11149 (RS); Ponta Grossa, Dec. 26, 1910, *Dusén* 11309; (RS). SANTA CATARINA: Herval, June 7, 1911, *Dusén* 11888 (RS). RIO GRANDE DO SUL:

Tristeza near Porto Alegre, Dec. 11, 1901, *Malme 817* (RS); Porto Alegre to Menino Deus, Feb. 24, 1902, *Malme 817a* (RS); Excol. Santo Angelo, Jan. 19, 1893, *Lindman* (RS); Rio Grande do Sul, *Ihering 323*, *Mus. Paul. 18122* (G). INDEFINITE: Brazil, *Sellow* (BD, TYPE of *C. salicifolia*; K, DL, ISOTYPES), 272, 1567, 5056, 25II + 5116 and 5788-24I (BD); *Glaziou 13476* (BD, TYPE of *P. Glaziovii*; K, DL, ISOTYPES); *Claussen 406* (BB); *Pohl, Herb. Mus. Vind. 1924* (K, BD, ISOTYPES of *C. leptocaula*).

ARGENTINA. MISIONES: Puerto León, Oct. 1910, *Lillo 10494* (G); Puerto Aguirre, Jan. 1922, *Molfino* (G); near Posadas, Jan. 1922, *Molfino* (G); "La Granja" near Posadas, Dec. 14, 1907, *Ekman 1787* (RS).

PARAGUAY: region of the Alta Paraná, *Fiebrig 5606* (BD, Hass) and 5865 (K, BM, Hass); near Igatimi, Sierra Maracayú, Nov., *Hassler 5545* (BD, DL, Hass, BB); Cord. de Altos, Nov. 29, 1902, *Fiebrig 518* (K, BD, DL, Hass); Cord. de Altos, Dec. 1902, *Fiebrig 511* (K, BD, DL); Cord. de Altos, June, *Hassler 422* (Hass.); Cord. de Altos, *Chodat 706* (BB); Asunción, June 1858, *Gilbert 75* (K); Paraguari, March 1875, *Balansa 2091* (K, DL); San Bernardino, Dec. 1898, *Endlich 185* (BD); San Bernardino, *Hassler 3582* (BM, BD, DL, Hass, BB); Paraguay Central, 1897, *Hassler 1505* (BM, Hass, BB); Villa Rica, Jan. 1929, *Jørgensen 3470* (G); Villa Encarnación, *Bettfreund 62* (BD).

*Cordia ecalyculata* is closely related to *C. magnoliaefolia*, differing in having smaller narrower and usually less coriaceous leaves as well as less elongate obovoid, rather than cylindrical-obovoid buds. Typical *C. ecalyculata* comes from the region about Rio Janeiro and appears to represent that phase of the species, as here defined, which has rather broad firm leaves. This typical form with its broadish coriaceous leaves I know only from the northern part of the species-range where the names *C. Glaziovii* and *C. digyna* have been applied to it. The much more frequently collected and much more widely distributed form with less firm, lanceolate leaves is that which has been called *C. salicifolia* and *C. coffeoides*. *Cordia leptocaula* seems to be a form of *C. salicifolia* distinguished by its conspicuously villous anthers. As I have accepted *C. ecalyculata* it appears to be a shrub or tree becoming at least 6 m. in height. The flowers are white or ochroleucous and have the filaments very variable as to the amount of pubescence upon them. The fruit is ovoid or obovoid and becomes fleshy and red. The pulp is said to become mucilaginous. The names "Chá de Bugre" and "Chá de Frade" have been applied to the Brazilian plants and "Gomita" to the Argentine.

47. ***C. magnoliaefolia*** Cham. *Linnaea* iv. 476 (1829). *Lithocardium magnoliaefolium* Kuntze, *Rev. Gen.* ii. 977 (1891). *C. obliqua* Vell. *Fl. Flum.* 97 (1825), not Willd. (1798). *C. obliqua* Vell. *Icones* ii. t. 150 (1827), lapsu calami. *C. diospyrifolia* Cham. l. c. 477. *L. diospyrifolium* Kuntze, l. c.

Ranging from southern Minas Geraes to Paraná.

BRAZIL. MINAS GERAES: Faz. da Galena, *Sellow 1568-661* (BD); betw. Rio Pardo and Ceroada, Caldas, Dec. 15, 1845, *Regnell II 202* (RS); Caoirary,

Caldas, Nov. 30 1873, *Mosén 959* (RS); Caconde, *Regnell II 202* (RS); Caldas, Dec. 1862, *Regnell II 202* (RS); indefinite, 1845, *Widgren* (RS). RIO JANEIRO: Organ Mts., Feb. 1838, *Miers* (BM); Valley of Catumbí, Jan. 31, 1826, *Burchell 1796* (G, K); Tijuca, Feb. 14, 1872, *Glaziou 5952* (K, BM); Tijuca, June 1896, *Ule 3845* (BD); indefinite, *Glaziou 1057* (K) and *7780* (K, BD). SÃO PAULO: Pirituba, Dec. 14, 1913, *Brade 7467* (G, BD); São Paulo, 1815, *Bowie & Cunningham* (BM). PARANÁ: near Morretes, Jan. 4, 1914, *Dusén 14287* (G); Fac. Marumbý, Jan. 4, 1914, *Dusén 14287* (RS); Fac. Marumbý, April 26, 1912, *Dusén 14058* (RS); Valle Grande, Sept. 16, 1915, *Dusén* (RS). INDEFINITE: Brazil, *Pohl, Herb. Mus. Vind. 1746* (K, BD); Brazil, *Sellow 724, 1569, 1570 and 5358-489* (BD, type suite of *C. magnoliaefolia*); *Sellow*, (K, DL).

This species is characterized by its large, coriaceous, glabrous leaves which are oblanceolate or elliptical-oblanceolate in outline. There appear to be two phases of the species, one with rather strictly branched and evidently pedunculate inflorescences and rather narrowly oblanceolate leaves, and the other with more laxly branched very shortly pedunculate inflorescences and much broader leaves. The second form comes chiefly from Minas Geraes and has been described as *C. diospyrifolia*. Although rather distinct in their extremes the two forms are well connected by intermediates.

48. ***C. silvestris*** Fresen. in Mart. Fl. Bras. viii. pt. 1, 12 (1857).  
*Lithocardium silvestre* Kuntze, Rev. Gen. ii. 977 (1891).

An apparently rare plant which occurs from Bahia to Santa Catharina and reappears in a doubtful form along the Amazon in western Brazil.

BRAZIL. AMAZONAS: Marary Juruá, Sept. 1900, *Ule 5191* (BD); Barra, Oct. 1819, *Martius* (BD). BAHIA: F. Santa Anna, 1850, *Blanchet* (BB); indefinite, *Blanchet 76* (DL). MINAS GERAES: Campinho, *Martius 299* (BD, TYPE). RIO JANEIRO: Imbuhy, Organ Mts., Feb. 16, 1838, *Miers* (BM); Illicos, Organ Mts., *Miers 4584* (K); Cascadura, *Glaziou 4148* (K, BD); near Theresopolis, Dec. 1896, *Ule 4298* (BD). PARANÁ: Rio Cubatão, Dec. 28, 1911, *Dusén 13649* (RS). SANTA CATHARINA: Itajahy, *Mueller 444* (K).

The leaves in *C. silvestris* are broadly oblanceolate to obovate or elliptical and have the under surface with slender appressed hairs, not rigid enough to make the surface noticeably scabrid. It is closely related to *C. ecalyculata* from some forms of which it differs in scarcely more than the pubescence on the foliage. Usually, however, it is quickly separated from *C. ecalyculata* by its proportionately broader leaves.

I have referred to *C. silvestris* with much hesitation and doubt certain plants collected in the upper Amazon Basin. These agree with typical *C. silvestris* in general habit and leaf-outline but tend to have rather stiffish hairs on the leaves and too abundant hairs on the calyx. This Amazonian plant is involved in a series of problems concerning such other Amazon plants as *C. scabrida*, *C. Sprucei* and *C. Ulei* and

its final disposition, consequently, must await the time when more numerous collections from the region are available for study. It is possible that it may merit recognition as a distinct species.

49. **C. ochracea** DC. Prodr. ix. 485 (1845). *Lithocardium ochraceum* Kuntze, Rev. Gen. ii. 977 (1891). ? *C. brachytricha* Fresen. in Mart. Fl. Bras. viii. pt. 1, 13 (1857).

A rare species known only from Pernambuco and Rio Janeiro.

BRAZIL. PERNAMBUCO: Rio San Francisco near Joazeiro, April 1818, *Martius* (BD, ISOTYPE of *C. brachytricha*). RIO JANEIRO: near Santa Anna, *Beyrich* (BD); Morro da Babylonia, Botafogo, *Glaziou* 4149 (K, BD, DL) and 18383 (K, BD); near Rio Janeiro, Feb. 23, 1815, *Bowie & Cunningham* (BM); Rio Janeiro, *Beyrich* (BD). INDEFINITE: Brazil, *Lhotsky* (DC, TYPE of *C. ochracea*), *Luschnath* (BD) and *Sellow* (BM, DL, RS).

A species related to *C. silvestris* from which it differs in its somewhat firmer usually decidedly lanceolate leaves, which are decidedly scabrous with stiffish closely appressed hairs below. In *C. silvestris* the hairs on the leaves are more slender and by no means so stiff. *Glaziou's* collections, above cited, are quite like the type of *C. ochracea*, which no doubt also came from the vicinity of Rio Janeiro.

50. **C. scabrida** Mart. ex Fresen. in Mart. Fl. Bras. viii. pt. 1, 11 (1857). *Lithocardium scabridum* Kuntze, Rev. Gen. ii. 439 (1891).

Known with certainty only from the lower Amazon, principally in the vicinity of Pará.

BRAZIL. PARÁ: near Santarém, *Martius* (K, BD, ISOTYPES); shrub 3 m. tall, at Pará, July 1, 1829, *Burchell* 9447 (K); at Pará, March-May, 1929, *Dahlgren & Sella* 248 (G); shrub 2-3 m. tall, corolla white, Ilha do Mosqueiro near Pará, Nov. 1929, *Killip & Smith* 30434 (G, US); shrub 2-2.5 m. tall, fruit red, Ilha do Mosqueiro, Nov. 1929, *Killip & Smith* 30425 (G, US); Bragança Railroad east of Pará, June 1920, *Goeldi* 1103 (G, NY, US, DL).

This species is known definitely only from the collections cited above. It is, however, related to certain forms of French Guiana and consequently may be eventually identified with some of the very obscure and poorly understood species of that country. The very sparsely strigose calyces and the scabrid foliage set off the plant as we now know it rather well among the related Amazonian species. As with the other species from that area, however, material from more stations is needed before its limits can be defined with any certainty. I suspect *C. scabrida* will be found to intergrade with some of the other species known from higher up the Amazon.

#### EXCLUDED OR UNIDENTIFIED SPECIES.

**Cordia amplifolia** Mez, Bot. Jahrb. xii. 538 (1890), not A. DC. (1845). *Lithocardium Mezianum* Kuntze, Rev. Gen. ii. 976 (1891).

*C. Meziana* Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 84 (1893).—Described from material lacking both flowers and fruit. The type was collected by Martius in woods near Pedra Branca, a locality about 300 km. northwest from the city of Bahia. It is described as having subglabrous obovate or oblong membranaceous entire-margined leaves about 36 cm. long and 11.5 cm. wide. Mez suggests a relationship with *C. magnoliaefolia*. I have a suspicion, however, that the plant may not be a *Cordia*.

***Cordia asperrima*** Spreng. Syst. i. 649 (1825); Cham. Linnaea iv. 492 (1829).—Said to be a Labiate, *Hyptis membranacea* Benth.

***Cordia estrellensis*** Glaziou, Bull. Soc. Bot. France, lvii. Mem. 3, pg. 476 (1910).—A nomen subnudum appearing in Glaziou's catalogue where it is given merely as a shrub with white flowers and as having been collected in the Serra da Estrella, state of Rio Janeiro. The type number, *Glaziou 1073*, is given as being represented in the herbaria at Kew, Berlin and Geneva. As I did not discover this collection among the sheets of *Cordia* at these herbaria I suspect that it may not represent a species of *Cordia* and that its true affinities having been recognized the specimens have been removed from the genus-covers.

***Cordia fragrans*** Fresen. in Mart. Fl. Bras. viii. pt. 1, 28 (1857), in discussion.—According to Fresenius this name was found in the herbarium at Vienna where it is said to occur on material referable to *Aegiphila obducta* Vell.

***Cordia flavescens*** Aubl. Hist. Pl. Guian. Fr. i. 226, t. 89 (1775). *Lithocardium flavescens* Kuntze, Rev. Gen. ii. 977 (1891). *C. sarmen-tosa* Lam. Tab. Encyc. i. 422 (1791). *C. echitoides* Lam. ex Dietr. Synop. i. 612 (1839), in synonymy. *Firensia* Scop. Introd. 157 (1777).—I have seen the authentic material of this species preserved at the British Museum and at the Riks Museum in Stockholm. The species is not a *Cordia* but apparently a member of some genus of the *Lauraceae*. Although I went through the entire collection of American *Lauraceae* at the British Museum I was quite unable to find a match for it. Dr. Gleason has also examined the plant and is likewise inclined to believe it might be one of the *Lauraceae* but was also unable to find a place for it in that family. Although clearly to be excluded from the genus *Cordia* the identity of *C. flavescens* unfortunately remains doubtful.

***Cordia macrocephala*** (Desv.) HBK. Nov. Gen. et Sp. iii. 77 (1818). *Varronia macrocephala* Desv. Jour. de Bot. i. 273-4 (1808).—When *V. macrocephala* was originally published it was reported as having been collected by Dombey in Brazil. As Dombey did not collect in Brazil and as the species is known in South America only from the

west coast where Dombey did collect, it is evident that the species was reported from Brazil only through an error, probably clerical.

**Cordia Neowediana** DC. Prodr. ix. 498 (1845); Fresen. in Mart. Fl. Bras. viii. pt. i, 23 (1857). *Varronia macrocephala* of Nees & Martius, Nov. Acta, Acad. Caes. Leop.-Carol. Nat. Cur. xi. 78 (1823). *Lithocardium Neowiedianum* Kuntze, Rev. Gen. ii. 977 (1891).—This species is based upon a description of a plant given by Nees & Martius in their account of the botanical collections made in Brazil by Prince Maximilian of Wied-Neuwied. The plant described was determined by them as *V. macrocephala* and was said to have been collected in southeastern Bahia near the Ilhéos River. It apparently belongs to the section *Varronia*, its flowers being described as being in dense globose heads the size of a walnut. The calyx is given as being obconic and very hispid with darkly ferruginous hairs. The deltoid lobes are subulate at the apex. The leaves are ovate-oblong and hispid. These characters suggest that the plant might be near if not actually *C. calocephala*. Nees & Martius, however, speak of the corolla as “magna, infundibuliformis, alba; limbo inaequali quadrifido, lacinia supra majore” which would suggest that it has large conspicuous flowers. Hence the species may represent a plant, not seen by me, which would key out with *C. paucidentata*.

**Cordia oncocalyx** Allem. Trab. Comm. Sci. Explor. Bot. i. 11, cum tab. (1862).—This is a species of *Auxemma*, *A. oncocalyx* (Allem.) Baillon.

**Cordia Patagonula** Aiton, Hort. Kew. i. 259 (1789).—*Patagonula americana* L.

**Cordia tetraphylla** Aubl. Hist. Pl. Guian. Fr. i. 224, t. 88 (1777); Fresen. in Mart. Fl. Bras. viii. pt. 1, 13 (1857). *Lithocardium tetraphyllum* Kuntze, Rev. Gen. ii, 977 (1891). *Firensia lutea* Raf. Sylva Tellur. 40 (1838).—Fresenius reports a collection of this species from the Para District, Dutch Guiana, and intimates that the species may be expected in the Amazon Region. I have not seen any material of any *Cordia* from any region that is possibly referable to this obscure species. I do not believe that the fruit and fruiting branch which forms the bulk of Aublet's illustration represents a genuine species of *Cordia*. The flowers shown in the illustration appear to be those of a *Cordia*, but in any case I do not believe that they were produced by the plant with the leaves and fruit shown.

**Maciella** Vand. Fl. Lusit. et Bras. 14 (1788); Roemer, Script. Pl. Hispan. Lusitan. Bras. 88 (1796); DC. Prodr. x. 177 (1846). *M. arborea* Steud. Nom. ed. 2, ii. 87 (1841). ?*M. racemifera* Vand. ex Jackson, Index Kew. iii. 140 (1894).—This genus was based upon

Brazilian material supplied Vandelli by Vellozo. Though its brief description is entirely inadequate for its complete recognition most students have been content to follow De Candolle, l. c., and place it as a doubtful synonym of *Cordia*. I can not claim to be any more successful in identifying the genus than my predecessors and can only add that if the plant described is a *Cordia* it is most probably *C. Sellowiana* Cham. since of the species of this genus most apt to have been collected by Vellozo it agrees best with the short description given by Vandelli. The significant details given by him are as follows, "foliis inferioribus ovato-oblongis, obliquis, acuminatis, supra scabris, subtus subtomentosis; floribus cymosis; caule arboreo." A copy, rearranged as to form but complete as to substance, has been given by De Candolle, l. c. De Candolle, however, has included in his copy the binomial "*Cyrilla racemifera*" which comes directly after the description of *Macielia* in the original text. Vandelli did not, I believe, intend to have this binomial directly associated with his genus *Macielia*. A study of his work will show that he did not give species for any of his new genera. It should also be noted that the specific name selected for the *Cyrilla*, i. e. *racemifera*, is one scarcely consistent with the phrase, "floribus cymosis" of the description of *Macielia*. As I do not believe that the name *Cyrilla racemifera* is properly to be associated with *Macielia* I accordingly doubt the validity of the combination, *Macielia racemifera*, which was coined in the Index Kewensis.

**Macria** Tenore, Mem. Mat. Fis., Soc. Ital. Sci. Modena xxiv. 366 (1847). *M. callipticantha* Tenore, l. c. 367; Caesati, Atti R. Accad. Sci. Fis. e Mat. Napoli vi. no. 11, 5, t. 3 (1875). *M. calliptiantha* Tenore ex Pasquale, Cat. R. Orto Bot. Napoli 63 (1867). *M. brasiliensis* Tenore ex Pasquale, l. c. *M. calliptychantha* Caesati, l. c. *Cordia rufescens*, var. *glabrata* Caesati, l. c.—The genus *Macria* was based by Tenore upon a very young (4-5-year old) plant, grown from seed said to have originated in Brazil, which flowered at Modena in 1846. The flowers produced were either very faultily described by Tenore or, as seems likely, were precocious ones abnormal in development. In any case the original description and Tenore's plate (published subsequently by Caesati, l. c.) present a most suspicious combination in the number of floral parts. The style is given as consisting of 3 bifid lobes and the stamens, corolla- and calyx-lobes as being 5-8. No fruit was developed. The leaves are described as being shiny and quite glabrous, myrtle-green above and yellowish or even golden beneath. I am inclined to believe that we are concerned here with a plant of *C. taguahyensis*, or possibly *C. superba*, that was modified by cultivation and abnormal in the number of its floral parts.

2. TREATMENT OF *TOURNEFORTIA*.

This study of *Tournefortia* is the second of a series of projected papers of the classification of the Subfamily *Heliotropioideae*. Although this study is directly concerned with clarifying the classification of the species from the eastern half of South America the treatment of sections presented here is the result of a careful examination of all the American species and most of those of the Old World as well. The two sections recognized are very distinct. The discussion of the phylogenetic significance of these profoundly different groups is reserved for a future paper in this series.

## KEY TO THE SECTIONS.

Fruit obscurely if at all lobed, evidently bicarpellate, breaking up into 1- or 2-seeded irregular nutlets; embryo straight.

Fruit evidently lobed, obscurely bicarpellate, consisting of 4 con-  
similar 1-seeded nutlets; embryo curved. . . . . 1. *EUTOURNEFORTIA*, pg. 66.  
2. *CYPHOCYEMA*, pg. 72.

1. Section **Eutournefortia** Johnston; type-species, *T. hirsutissima* L. *Tournefortia-Pittoniae* HBK. Nov. Gen. et Sp. iii. 80 (1818); type-species *T. hirsutissima* L. *Tournefortia* § *Pittonia* Don, Gen. Syst. iv. 366 (1837); type-species *T. hirsutissima* L. *Pittonia* Plumier ex Adans. Fam. Pl. ii. 177 (1863); type-species *T. hirsutissima* L. *Oskampia* Raf. Sylva Tellur. 123 (1838); type species *O. scandens* and *O. hirsuta* Raf. see note below. *Tournefortia* § *Mallotonia* Griseb. Fl. West. Ind. 483 (1861); type-species, *T. gnaphalodes* R.Br. *Mallotonia* Britton, Ann. Mo. Bot. Gard. ii. 47 (1915); type-species, *T. gnaphalodes* R. Br.

The section *Eutournefortia*, poorly developed in our area, is most abundant along the cordilleran axis in Central America and tropical South America. A limited number of species also occur in the tropics of the Old World. The group is characterized by having straight embryos and a fruit which is more or less evidently bicarpellate. In many species the carpels do not break up into two single-seeded nutlets but fall away entire forming a broad two-seeded nutlet. Vacant cavities are frequently present in the fruit of this section.

The type-species of the genus *Tournefortia*, and hence of this section, is taken as being *T. hirsutissima* L. Among the seven species of *Tournefortia* treated by Linnaeus in the Species Plantarum, 140-1 (1753), the first in order given is a species of *Cordia*, *C. serrata* (L) Gürke, and the fifth is a *Heliotropium*, *H. ternatum* Vahl. The third species treated, *T. volubilis* L., has fruit not in accord with the generic description in the Genera Plantarum, 68 (1754). Accordingly there remain four species from among which the type-species of the genus



should be selected, i. e., no. 2 *T. hirsutissima*, no. 4 *T. foetidissima*, no. 6 *T. glabra* and no. 7 *T. siberica*. Upon consulting the *Genera Plantarum* (1754) it is found that Linnaeus cites *Pittonia* Plum. as a generic synonym and refers to the third plate of Plumier's *Nova Plantarum Americanarum Genera* (1703). In fact Linnaeus accepted Plumier's generic concept almost in its entirety. His rejection of the name *Pittonia*, in favor of the newly coined, *Tournefortia*, was merely on the ground that the latter rather than the first part of the family name of Joseph Pitton de Tournefort should be used in making the generic name, cf. L. Hort. Cliff. 49 (1737). The crude figures on Plumier's plate, t. 3, which were cited by Linnaeus probably represent the floral parts of *T. hirsutissima*, for certainly among the six species which appear under phrase names in Plumier's text, l. c. 5, that species is the only one that could have inspired the figures mentioned. With the exception of a few details, which he apparently obtained from Plumier's generic description, Linnaeus appears to have based his generic description upon the figures given by Plumier and so, thus, in ultimate analysis upon *T. hirsutissima*. It consequently seems quite logical to select *T. hirsutissima* as the genotype of *Tournefortia*. This selection keeps the name associated with the largest part of the genus as currently accepted and is in accord with an earlier selection of a genotype made by Britton & Millspaugh, Bahama Fl. 361 (1920).

I refer to *Tournefortia*, as a generic synonym, *Oskampia* Raf. Sylva Tellur. 123 (1838). The original description of this genus is as follows,—  
 "770. OSKAMPYA Raf. (bot.) cal. 5part. cor. infund. 5fida, stam. 5. antheris subsess. styl. clavatus, stig. capit. bacca scabra 2loc. 4sp. Fruct. scandens, fol. alt. fl. subrac—Types *O. scandens* and *hirsuta* Raf. *Tournefortia* do. L. auct. very dist. G. of Vines, berries not biporose." Just what species of *Tournefortia* are referred to by Rafinesque is uncertain. It is not at all impossible, however, that *T. volubilis* L. and *T. hirsutissima* L. were intended. In any case the short description of the fruit seems to apply to a species of the section *Eutournefortia* rather than to the section *Cyphocyema* and consequently I am placing *Oskampia* here under the former section.

## KEY TO SPECIES.

- Stems shaggy with abundant slender spreading brownish hairs  
 2–4 mm. long; corolla 10–12 mm. long; calyx-lobes conspicu-  
 ously subulate; doubtfully from our area . . . . . 1. *T. obscura*.  
 Stems glabrous or with short usually appressed or incurved hairs.  
 Style short, the stigma apparently sessile in the mature fruit.  
 Stems and leaves conspicuously and abundantly short-hirsute;  
 doubtfully from our area . . . . . 2. *T. hirsutissima*.  
 Stems and leaves glabrous or rarely sparsely and inconspicu-  
 ously appressed-hirsute; widely distributed in our area.  
 3. *T. bicolor*.

Style well developed and obvious even on the mature fruit.

Corolla-lobes elongate, less than 1 mm. broad; leaves alternate;

Amazonian head-waters. . . . . 4. *T. Ulei*.

Corolla-lobes broad, over 1 mm. broad; leaves very frequently  
opposite; northern Argentina and adjacent Bolivia. . . . 5. *T. Lilloi*.

1. ***Tournefortia obscura*** A. DC. Prodr. ix. 517 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 49, adnot. (1857).

Occurring in Central America and in the countries of northwestern South America from British Guiana to Bolivia. Only doubtfully accredited to Brazil.

BRAZIL: indefinite, *Glocker 227* (BM).

Fresenius, l. c., reports this species from Guiana and Maynas (eastern Peru) and states that he has not seen it from Brazil. Although it does not appear to be common, it has been collected in British Guiana, Venezuela, Colombia, Panama, Peru and Bolivia in tropical conditions at low altitudes. While I suspect that the species will eventually be found in the Amazon Basin in western Brazil I am inclined to believe Glocker's collection, despite its label, did not come from Brazil. This collection formed a part of the Shuttleworth Herbarium now in the British Museum. It was probably made by the Fernand Glocker who is reported by Nees, DC. Prodr. xi. 728 (1847), as having collected extensively in Bahia. From my own observations I can believe that some of the collections by Glocker in the British Museum may well have come from Bahia, although I should guess that most of them came from near Rio Janeiro. Whether Glocker's collection no. 227 really came from Bahia or Rio Janeiro or whether it is merely evidence of some confusion of material or labels can not be decided now. Personally I do not believe the specimen is of Brazilian origin.

2. ***T. hirsutissima*** L. Sp. Pl. 140 (1753); Fresen. in Mart. Fl. Bras. viii. pt. 1. 49 (1857). *Messerschmidtia hirsutissima* R. & S. Syst. iv. 541 (1819); Walp. Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. xix. suppl. 1, 371 (1843).

Central America, the West Indies and northern South America; doubtfully reported from Brazil.

BRAZIL. RIO JANEIRO: Rio Janeiro, Nov. 1830, *Meyen 3426* (BD).

The only basis for the inclusion of this species as a member of the flora of our region is a characteristic specimen of the plant at Berlin clearly labeled as having been collected by Meyen at Rio Janeiro. Although a hundred years have elapsed since Meyen is supposed to have collected it the species has been found in Brazil by no other person. Coming from Europe Meyen made his first landing in Amer-

ica at Rio Janeiro and from there sailed directly to Chile and Peru. After collecting in southern Peru and about Lima he sailed for Hawaii and the Orient. Consequently he visited no locality from which *T. hirsutissima* is with certainty known. It seems very improbable that this large shrub, if present, could remain undiscovered so many years in a region so frequently visited and repeatedly botanized as that about Rio Janeiro. I am therefore forced to the belief that the specimen at Berlin was not collected by Meyen, but by some other person, and that Meyen's label, through some confusion of data and material, has been incorrectly associated with it. In any case, until *T. hirsutissima* has been rediscovered at Rio Janeiro or elsewhere in our area, the authenticity of Meyen's specimen, and consequently the record based upon it, should be questioned.

3. **T. bicolor** Sw. Prodr. 40 (1788) and Fl. Ind. Occ. i. 344 (1797). *T. laevigata* Lam. Tab. Encyc. i. 416 (1791); Poir. Encyc. v. 356 (1804); Fresen. in Mart. Fl. Bras. viii. pt. 1, 49 (1857). *T. latifolia* Willd. in R. & S. Syst. iv. 540 (1819). *T. nitida* HBK. Nov. Gen. et Sp. iii. 84 (1819). *T. glaberrima* Salzm. ex DC. Prodr. ix. 519 (1845); Fresn. l. c. 49. *T. laevigata*, var. *latifolia* DC. l. c. 519. *T. bicolor*, subvar. *latifolia* Gomez, Anal. Hist. Nat. Madrid xix. 256 (1890). *T. bicolor* var. *laevigata* Gomez, l. c. ? *Heliotropium citrifolium* Lehm. Göttingische Gelehrte Anzeiger 1817: 1515 (Sept. 1817). *Stenostomum?* *dichotomum* DC. Prodr. iv. 461 (1830); Moc. & Sesse, Calq. Fl. Mex. t. 482 (1874); Hemsley, Biol. Cent. Am. ii. 372 (1882). *Antirrhoea?* *dichotoma* Hemsley, l. c. 42 (1881).

Widely distributed in tropical America.

BRAZIL. AMAZONAS: Rio Negro near confluence with Rio Solimões, May 1851, Spruce 1491 (G, K, BM); corolla white, shrub 1-4 m., Juruá Miry, Rio Juruá, June 1901, Ule 5565 (K, BD). PARÁ: tree 4-6 m. tall, Pará, 1929, Killip & Smith 30290 (G, US); corolla white, Pará, Oct. 25, 1829, Burchell 9690 (G, K). PERNAMBUCO: corolla white, Iguarassu, Nov. 3, 1887, Ridley, Lea & Ramage (BM); Beberibe near Pernambuco, June 4, 1887, Schenck 4034 (BD); Olinda, 1925, Pickel 395, Mus. Paul. 18133 (G). BAHIA: Bahia, 1830, Salzmann (DC, TYPE of *T. glaberrima*), sine no. (K); near Bahia, Blanchet 465 (DC), 662 (BM, DC), 917/1715 (BM), 1555 (BM), 1630 (DC) and 3544 (BM). MINAS GERAES: Lago Santo, Warming 555 (US); Rio Novo, Sept. 1895, Schwacke 10938 (BD); betw. Rio Novo and Ribeirão, Sept. 1894, Schwacke 10937 (BD); Parahybuna, 1901, Sebastião de Nasconcellos, Mus. Paul. 18129 (SP); Paraisópolis, April 16, 1927, Hoehne, Mus. Paul. 20211 (G); indefinite, Claussen (K, BM). RIO JANEIRO: Valley of the Rio Comprido, Aug. 1836, Gardner 83 (NY, K, BM); corolla white, betw. Cateté and Botafogo, July 7, 1826, Burchell 2989 (K); Porto da Gavea, Sept. 1829, Ule 4848 (BD); betw. Rio Janeiro and Campo Frio, Sellow 200 and 1577 (BD); Rio Janeiro, Miers (BM), Miers 3039 (K), Gaudichaud 531 (BD, DC) and Tweedie 1261 (K); Serra dos Orgãos, Lhotsky 104 (DC); Organ Mts., June 1838, Miers (BM) 4203 (K); Itatiaya, Dec. 1892, Kuntze (NY); vicinity of Monte Serrat, Mt. Itatiaya, Apr. 12, 1929, Smith 2308 (G); indefinite, Glaziou 4891 (BM, RS), 4991 (K,

BD), 7779 (K, BD) and 11294 (RS). SÃO PAULO: Campinas, Dec. 1894, *Novaes, Mus. Paul. 11261* (G); San José do R. Pardo, Sept. 17, 1889, *Loefgren 1380, Mus. Paul. 11253* (G); edge of the matto, Guarujá, Feb. 28, 1929, *Smith 2023* (G); corolla white, S. Vicinte near Santos, Feb. 10, 1875, *Mosén 3446* (RS). PARANÁ: Morretes, Nov. 6, 1908, *Dusén 7005* (RS); Morretes, Sept. 22, 1914, *Dusén 957a* (G, RS); Serra do Mar, Volta Grande, *Dusén 3622* (RS); Cubatão, Dec. 26, 1911, *Dusén 13669* (RS). SANTA CATHARINA: near Blumenau, Sept. 1888, *Ule 950* (US, BD); Blumenau, 1884, *Müller* (BD); Itajahy, *Müller 443* (K). INDEFINITE: Brazil, *Sellow 49, 783* and *5840* (BD), *Claussen 18* (BD), *Scouler* (K) and *Boog* (K).

PARAGUAY. corolla white, Yerbales, Sierra Maracayú, *Hassler 5185* (K, BM, BD, Hass, BB).

The Brazilian material of this species is indistinguishable from that found on the Caribbean islands and the adjacent mainland and is obviously conspecific. The most striking variation presented by our plants is that found in the material from the Amazon basin. Spruce's collections from Amazonas have lanceolate or subulate calyx-lobes which become 4 mm. long and in addition have the veins of the lower leaf-surfaces evidently strigose. This Amazonian form is similar to the plant of Central America described as *T. bicolor* var. *calycosa*, Donn. Sm. Bot. Gaz. xiv. 27 (1889), and is also very much like the British Guianan plant described as *T. Schomburgkii*, DC. Prodr. ix. 517 (1845). The common form of *T. bicolor* in our region has apparently glabrous leaves and has very short calyx-lobes which become only about 1 mm. long. I have seen none of our plants with the leaves sparsely though evidently strigose such as are frequently found in Central America. I might add here that this phase of the species was the basis of the very vaguely described and consequently poorly understood *T. Billbergiana* Beurl. of which I have recently had the opportunity to examine the type.

4. **T. Ulei** Vaupel, Notizbl. vi. 186 (1914).

Known only from the headwaters of the Amazon; rare.

BRAZIL. AMAZONAS: Falls of the Madeira, Oct. 1886, *Rusby 2049* (G, NY, US).

BOLIVIA. COLONIAS: Porvenir, Rio Tahuamanu, ca. 30 km. south of Cobija, Jan. 1912, *Ule 9711* (BD, TYPE: K, ISOTYPE).

VENEZUELA. AMAZONAS: near San Carlos, April 1853, *Spruce 2985* (K).

This species is closely related to *T. ovalifolia* Rusby (= *T. chin-chensis* Killip) which ranges at higher altitudes along the Cordilleras in Bolivia and Peru. It differs, however, in having the flowers sessile and the larger, proportionately broader, ovate or elliptical leaves more abruptly contracted at the base. The specimens examined have none of the leaves opposite or subopposite. The branches of *T. ovalifolia* have, on the other hand, some of the lower leaves clearly opposite or subopposite. The specimens from Venezuela are glabrate

but otherwise are quite similar to the plants of the Brazil-Bolivian frontier.

5. **T. Lilloi**, sp. nov., fruticosa 1–3 m. alta pilis minutis incurvatis rigidusculis numerosis vestita mox glabrata; ramis teretibus gracilibus; foliis lanceolatis vel non rariter elliptico-ovatis 1.5–6.5 cm. latis 6–15 cm. longis herbaceis nervosis integerrimis plerumque oppositis vel suboppositis vel rarissime ternatis subtus pallidioribus apice acuminate basi in petiolum 6–11 mm. longum gradatim contractis; inflorescentia terminali foliis plus minusve superante laxe dichotomo-ramosa 1–7 cm. longe pedunculata; spicis saepe ca. 8 ebracteatis 2.5–5.5 cm. longis; floribus in spicis unilateralibus sessilibus vel subsessilibus vel infimis rariter usque ad 2 mm. longe pedicellatis 1–3 mm. distantibus; calycibus ca. 2 mm. longis ad basem versus in lobos erectos subulatos vel lanceolatos incisus pubescentibus; corollis albis hypocrateriformibus extus strigosis intus glaberrimis, tubo cylindrico 5–8 mm. longo 1.5–2 mm. crasso quam calyce 3–4-plo longiori, limbo paullo concavo ca. 5 mm. diametro, lobis ovatis vel semiorbicularibus latioribus quam longis ca. 1.5 mm. longis post anthesin plus minusve recurvatis; antheris distinctis 1.4–1.7 mm. longis glabris supra medium tubo corollae sessilibus apice mucronatis; fructu glaberrimo leviter dorso-ventraliter et verticaliter compresso apice truncato paulo supra basim latissimo ca. 4 mm. alto et crasso, faciebus lateralibus sulcatis, faciebus dorsalibus inconspicue lateque costatis et rariter medionaliter plus minusve sulcatis; stylo subpersistenti maturitate 1.5–3 mm. longo quam stigmatate 2–3-plo longiori; ovario glabro.—*T. undulata* of Griseb. [Symb. Argent.] Abh. K. Ges. Wiss. Göttingen xxiv. 270 (1879); Lillo, [Reseña Fitogeogr. Tucumán] Prim. Reunión Nat. Soc. Argent., Bot. 221 (1919). *T. laevigata* in pt. of Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *T. polystachya* of Fries, Ark. Bot. vi. no. 11, 21 (1906). *T.* sp. Vaupel, Mededeel. Rijks Herb. no. 46, 12 (1922).

Ranging in northwestern Argentina from southern Tucumán northward through Salta and southeastern Jujuy to adjacent southernmost Bolivia.

**BOLIVIA.** TARIJA: Carapari betw. Tarija and Chaco, March 12, 1902, Fries 1347 (RS).

**ARGENTINA.** SALTA: near Rio Ityuro, Oct. 27, 1910, Herzog 1056 (BD); Tabacal near Orán, Sept. 2, 1873, Lorentz & Hieronymus 533 (BD); Tabacal, 1873, Lorentz & Hieronymus 508 and 925 (BD); vicinity of Orán, July–Aug. 1873, Lorentz & Hieronymus 461 (NY, BD, RS); Orán, Feb. 1916, Hauman 26/83 (G); Quebrada de San Lorenzo, Sept. 1919, Hauman 26/82 (G); Quebrada de San Lorenzo, 1200 m., Oct. 14, 1925, Schreiter 5076 (G); Rio de las Piedras, Orán, Nov. 30, 1911, Rodríguez R131 and 10983 (G); "El Cedrál," Orán, Oct. 13, 1913, Rodríguez 1015 (G); Sierra de la Candelaria, 900 m., Sept. 7, 1929, Venturi 9489 (G). JUJUY: Sierra de Santa Barbara, San Pedro, 700 m.,

Oct. 11, 1929, *Venturi 9637* (G); Jujuy, Oct. 1892, *Kuntze* (NY, BD). TUCUMÁN: Tafí Viejo, Sept. 22, 1907, *Lillo 7099* (TYPE, Gray Herb.); Yerba Buena, 500 m., Oct. 24, 1897, *Lillo 2082* (G); Parque Aconquija, Yerba Buena, 500 m., Oct. 12, 1917, *Schreiter 109* (G); Yerba Buena, 600 m., March 19, 1909, *Venturi 316* (G); vicinity of Tucumán, Oct. 1902, *Baer 23* (BD, RS); Rio Chico to La Calera, 500 m., Nov. 13, 1913, *Lillo 15154* (G); near Santa Ana, Nov. 1902, *Baer* (G).

The exact relationship of this very distinct previously unnamed species is uncertain. It belongs with the relatively small group of species of the section *Eutournefortia* which commonly develop opposite or subopposite leaves. Its relations are to be expected in Bolivia or Peru. The species of these countries, however, which most suggest *T. Lilloi* have fruit that is rounded or broadly conic and is drawn up at the apex into a slender elongate persistent style. In the present species the fruit is deeply sunken in at the apex and has a very much shorter and less conspicuous style. The species is named in honor of Prof. Miguel Lillo of the University of Tucumán to whom I am indebted for many of the specimens I have cited in this paper. I find it a great pleasure to be able to associate Dr. Lillo's name with another distinctive species of the flora which he has studied for so many years.

II. Section **Cyphocyema** Johnston; type-species *T. membranacea* (Gardn.) DC. cf. Miers, *Contr. Bot.* ii. tab. 53b (1869). *Verrucaria* Medic, *Malv.* 103 (1789); type-species *T. volubilis* L.; not *Verrucaria* Wegg (1780), a genus of lichens. *Messerschmidia* R. & S. *Syst.* iv. pg. li and 541 (1919); not *Messerschmidia* L. *Mant.* 42 (1767) nor *Messerschmidia* Murr. *Syst.* ed. 13, pg. 161 (1774); regarding these names see discussion below. *Tournefortia-Messerschmidtiae* HBK. *Nov. Gen. et Sp.* iii. 78 (1818); as to plants but not nomenclatorial type. *Messerschmidtia* Don, *Gen. Syst.* iv. 370 (1837); as to plants but not nomenclatorial type. *Messerschmidtia* of Miers, *Ann. & Mag. Nat. Hist.* ser. 4, ii, 191-204 (1868) and *Contr. Bot.* ii. 202-215 (1869); as to generic concept.

This very distinct and natural group of *Tournefortia* is confined to America. Its species are distinguished from all other members of the genus by the very characteristic structures of its fruit. This is normally lobed, being composed of four consimilar distinct nutlets surrounded and bound together by an epicarp which is frequently juicy. Ventrally the nutlets are angulate and have a decided intrusion into the seed-cavity. The embryo, which is bent around this intrusion, is evidently curved. In addition to these fruit-structures the species of the section *Cyphocyema* are characterized by the elongate very narrow corolla-lobes which have involute margins and are subvalvate in the bud. In many ways the section seems more closely related to

*Heliotropium* § *Orthostachys* than to *Tournefortia* § *Eutournefortia*. The most critical discussion of the characters of this section have been given by Miers, *Contr. Bot.* ii. 192 and 202-4 (1869). Its distinctive characters were indicated much earlier, however, by Robert Brown, *Prodr.* 496 (1810).

The name *Messerschmidia* has been applied to this group of *Tournefortia* by Roemer & Schultes, *Syst.* iv. pg. li. and 541 (1819), Don, *Gen. Syst.* iv. 370 (1837), Miers, *Ann. & Mag. Nat. Hist.* ser. 4, ii. 191-204 (1868) and *Contr. Bot.* ii. 202-215 (1869), and a few others. This name, which has been subjected to several variations of spelling, was first applied by Linnaeus, *Mant.* 42 (1767), to the Asiatic *T. siberica* L., a plant which has the general fruit-structures of *Eutournefortia*. Linnaeus spelt the name, *Messersmidia*, and maintained this spelling in all his writings. The first orthographic variation occurred in the 13th edition of the *Systema*, 161 (1774), by J. A. Murray who properly applied the generic name to the Asiatic plant but who spelled it *Messerschmidia*. This variant spelling generally prevailed until Kunth, *HBK. Nov. Gen. et Sp.* iii. 78 (1818), introduced the final variation, *Messerschmidtia*. Although Kunth attributed the name to Linnaeus, he applied it incorrectly to the present group of American *Tournefortiae*. With Roemer & Schultes, l. c., the use of the name *Messerschmidia* became further complicated. Accepting the studies of Robert Brown, l. c., they recognized the peculiar structures of the fruit and embryo of the American plants and gave then generic recognition, arbitrarily applying to the American plants the name *Messerschmidia*. The *Messersmidia* of Linnaeus was subordinated as a group of *Tournefortia* under the name "*Messerschmidiae antiquae*," l. c. 539. To prevent confusion in their own work (R. & S. l. c. pg. li) they referred to our group of American plants as "*Messerschmidiae vero*." This arbitrary new application of *Messerschmidia* was followed by Don, l. c. 269 and 270, Endlicher, *Gen.* 646 (1838) and Miers, l. c. De Candolle, *Prodr.* ix. 528 (1845), however, was able to introduce further complications, by giving the name still another application. His *Tournefortia* § *Messerschmidia*, apparently formed around *M. fruticosa* L. f., *Suppl.* 132 (1781), consists of four species from Africa and the Canary Islands. The original Linnean species of *Messersmidia*, *M. Argusia* L. (= *T. siberica* L.), by De Candolle, l. c. 514, was placed as *T. Arguzia* in the monotypic section *Tournefortia* § *Arguzia*. In his study of the group, Gürke, *E. & P. Nat. Pflanzenf.* iv. Abt. 3a, 94 (1893), recognized that the species treated under *Tournefortia* § *Messerschmidia* by De Candolle, l. c., were more properly placed under *Heliotropium*. In rectifying De Candolle's treatment, however, he

disregarded the nomenclatorial basis of the sectional name used by De Candolle and, adding one more blunder to the sad account of *Messersmidia*, erected *Heliotropium* § *Messerschmidia* to include the African and Canary Island plants mentioned. As if *Messersmidia* had not already been complicated sufficiently by wide variations in spelling and applications, Dalla Torre & Harms, Gen. Siphogam. 425 (1900), approaching the matter from a purely bibliographic interest and lacking any acquaintance with the plants concerned, have treated the name as a section of *Heliotropium* and cite under it as synonymous a group of references and uses of the name which apply not only to the African and Canary Island plants but to those of Asia and of America as well. It becomes more than obvious that the unfortunate name, *Messersmedia*, has been both misspelled and recklessly misapplied. As the original species of *Messersmidia*, i. e. *T. siberica* L., is very distinct and may eventually be thought worthy of generic recognition it seems best that the name *Messersmidia* (= *Arguzia* Raf.) should be maintained for the Asiatic plant. The application of the name *Messerschmidia* to the African and Canary Island species of *Heliotropium* can not be justified. Its use for the American species of *Tournefortia* was most arbitrary and irregular and can not be sanctioned. In any case the confusion that has attended the history of the name is quite sufficient to warrant its rejection as a nomen confusum, at least as far as our American plants are concerned. Consequently I have provided a new sectional name for those of our plants which have the lobed fruit and the curved embryo. The name alludes, of course, to the shape of the embryo.

Although the section *Cyphocyema* as a group is evidently well marked, the species which compose it are variable in the extreme and are notorious for the difficulties they present to classification. The group is only weakly developed in the Andean Region, having two principal centers of distribution, one in the Caribbean Region and the other in Brazil. Before the section can be said to have even a reasonably satisfactory treatment it must be studied as a whole. Hence in publishing the following treatment of the species of eastern South America it is fully realized that it presents no final classification but must be subjected to future revision when the precise relation of our species with the extralimital ones, particularly those of the Caribbean Region, becomes more clear. My purpose in this paper is to give a careful, although not detailed, survey of the principal forms of the section found in Brazil, Paraguay and Argentina. Efforts, hence, have been directed at determining just what parts of the variable assemblage found there constitute reasonably definable and natural entities



worthy of major recognition. Consequently although I have been much concerned with the interrelations of the species of our area I have not made a particular effort to discover their precise relation to the extralimital ones. I have treated as specifically distinct all our plants which can be separated by any character from the closely related ones outside our limits. Some of the forms which I have treated as species will no doubt eventually be found to be no more than geographic variations of species occurring in northwestern South America or the West Indies. In order that there be no misunderstandings I have, however, freely stated in the discussion of each species my ideas regarding their relations and the degree of the relationship. I have thought this procedure more desirable than the making of a large number of perhaps unnecessary new names.

Although some of the species I have accepted are extremely variable I have made only a single new subspecific name. It will be noted, however, that I have discussed at length under each species its more important variations. In some species, notably *T. paniculata*, a classification of the intraspecific variation can only be attained by a highly complex hierarchy of subspecific categories. As I believe such elaborate classification of tropical South American plants are not needed and can not help but be very premature at this time I prefer to leave botanical bibliography unburdened by a host of ill timed polynomials and the opportunity for such detailed classification open to the resident field-botanist of the Tropics who will be more able to judge of the needs and of the extent of the subspecific classification really useful and desirable.

## KEY TO SPECIES.

- Inflorescence axillary, frequently also terminal.  
 Plant fulvous, conspicuously strigose-tomentose; leaves ovate or suborbicular; inflorescence cylindrical, stiffish. . . . . 6. *T. mapirensis*.  
 Plant green, only obscurely if at all strigose; leaves lanceolate to narrowly elliptical; inflorescence slender and widely branched. . . . . 7. *T. breviflora*.
- Inflorescence terminal, not distinctly axillary.  
 Corolla-tube decidedly elongate, 4-10 mm. long, usually much surpassing the short lobes.  
 Mature leaves glabrous or practically so, youngest ones only sparingly strigose. . . . . 8. *T. peruviana*.  
 Mature leaves more or less strigose or tomentose, the youngest ones always densely strigose or tomentose. . . . . 9. *T. paniculata*.
- Corolla-tube less strikingly elongate, 2-5 mm. long, usually with the lobes more than half as long as the tube.  
 Inflorescence not loosely branched throughout, at least the secondary branches short and stiff; flowers congested.  
 Leaves glabrate or merely strigose beneath with straight stiff appressed not very abundant hairs.

- Upper surface of leaves sparsely strigose, the hairs (usually sparse) not restricted to the veins; blade firm but not leathery, lanceolate or rarely ovate, 1.5–3 cm. broad. 10. *T. Gardneri*.
- Upper surface of leaves glabrous or hairy only along the impressed veins; leaf-blade leathery, ovate, 3–6.5 cm. broad. . . . . 11. *T. subsessilis*.
- Leaves tomentose beneath with an abundant indument of slender somewhat curved or curly hairs.
- Upper surface of leaves glabrous. . . . . 11. *T. subsessilis*.
- Upper surface of leaves rather abundantly strigose or velutinous.
- Under surface of leaves and the corolla-tube with an appressed white pubescence; fruit pubescent. 12. *T. candidula*.
- Under surface of leaves and the corolla-tube with a decidedly tawny appressed pubescence; fruit glabrous. . . . . 13. *T. villosa*.
- Inflorescence very loosely branched throughout, the secondary branches slender and elongate; flowers loosely disposed.
- Leaves evidently although not very abundantly strigose or rarely glabrous, the hairs on the upper leaf-surface usually provided with discoid bases of thickened cells. 14. *T. rubicunda*.
- Leaves obviously tomentose, the hairs without discoid bases.
- Leaves decidedly fulvous beneath; corollas usually larger than in the following species. . . . . 15. *T. Salzmanni*.
- Leaves cinerous or only weakly fulvous beneath.
- Leaves ovate, obtusish; inflorescence very loosely and freely branched. . . . . 16. *T. membranacea*.
- Leaves lanceolate, acuminate; inflorescence slightly congested. . . . . 17. *T. salicifolia*.

6. ***T. mapirensis*** Lingelsheim in Fedde, Repert. vii. 244 (1909).  
*T. subrotunda* Rusby, Bull. N. Y. Bot. Garden viii. 115 (1912).

Amazonian head-waters from northeastern Peru to east central Bolivia.

BRAZIL. ACRE: scandent, corolla greenish yellow, Seringal S. Francisco, July 1911, *Ule 9713* (K, BD); fruit bright yellow, Seringal S. Francisco, *Ule 9712* (K, BD).

PERU. LORETO: twining shrub with pale greenish weakly scented flowers, Yurimaguas, Rio Huallaga, May 1855, *Spruce 3889* (G, K, BM).

BOLIVIA. BENI: Rurrenabaque, 300 m., Oct. 15, 1921, *Rusby 1290* (NY, K). LA PAZ: Charopampa near Mapiri, 570 m., Nov. 1907, *Buchtien 1995* (NY); Charopampa, 480 m., Sept. 19, 1901, *Williams 761* (NY, TYPE of *T. subrotunda*; K, BM, ISOTYPES). SANTA CRUZ: flowers green, Bosque de Buenavista, Prov. Sara, 520 m., July 1924, *Steinbach 6100* (K, BD); flowers green, Monte de Buenavista, 450 m., June 1915, *Steinbach 1395* (BD); flowers green, Bosque de Buenavista, 450 m., May, 28, 1916, *Steinbach 2290* (BD).

A very distinct species readily recognized by its tawny pubescence and well developed definitely axillary rather than terminal inflorescences. The flowering branches are leafless or bear only a very few much reduced leaves.

7. ***T. breviflora*** DC. Prodr. ix. 520 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 50 (1857). *T. Vauthieri* DC. l. c. 526; Fresen. l. c. 55.

*Messerschmidtia Vauthieri* Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 196 (1868) and Contr. Bot. ii. 207 (1869). *T. macroloba* DC. l. c. 527; Fresen. l. c. 55. *M. macroloba* Miers, l. c. 196 and l. c. 207. *T. lanceolata* Fresen. l. c. 55, t. 12. *M. organensis* Miers, l. c. 194 and l. c. 205. *M. ramiflora* Miers, l. c. 197 and l. c. 208. *T. catharinensis* Vaupel, Notizbl. vi. 181 (1914). *T. gracillima* Vaupel, l. c. 183. ? *T. xapuryensis* Vaupel, l. c. 186.

Ranging in the coastal states of Brazil from southernmost Minas Geraes to Santa Catharina and from thence into Paraguay; apparently reappearing in Acre Terr.

BRAZIL. MINAS GERAES: woods on bank of Rio Parahibuna, Oct. 1840, Gardner (BM, TYPE of *M. ramiflora*; K, ISOTYPE); Caldas, 1845, Widgren (RS); Caldas, June 18, 1861, Regnell III 915 (RS). RIO JANEIRO: near Petropolis, ca. 750 m., July 1882, Ball (K); Imbuy Lane, Organ Mts., Dec. 1837, Miers (BM, TYPE of *M. organensis*); Organ Mts., Miers 4204 (K); Serra dos Orgãos, 1833, Vauthier 237 (DC, TYPE of *T. Vauthieri*). SÃO PAULO: scandent, road betw. Juquiry and Rancho do Felis, July 29, 1827, Burchell 4846 (K); subscandent 3 m. long, fl. greenish yellow, Rio das Pedras, Dec. 15, 1826, Burchell 3616 (K); Serra Negra, June 1, 1927, Hoehne, Mus. Paul. 20629 (G); St. Amaro, July 29, 1894, Loefgren & Edwall 2573, Mus. Paul. 11263 (G); Prai-Grande, Santos, Nov. 25, 1898, Loefgren 4181, Mus. Paul. 11260 (G); Campinas, Dec. 1894, Novaes 147, Mus. Paul. 11252 (SP.). PARANÁ: Ponta Grossa, Oct. 19, 1911, Dusén 13216 (RS); Ponta Grossa, June 4, 1914, Dusén 15079 (G, RS); Ponta Grossa, Aug. 8, 1909, Dusén 8041 (RS); Iacarehý, Sept. 6, 1915, Dusén 17135 (RS). SANTA CATHARINA: Blumenau, Walde der Velha, July 1888, Ule 811 (BD, TYPE of *T. catharinensis*). ACRE: scandent, fl. greenish yellow, Seringal S. Francisco, Alto Xapury, Oct. 1911, Ule 9710 (BD, TYPE of *T. xapuryensis*; K, ISOTYPE). INDEFINITE: Brazil, 1834, Lund (DC, TYPE of *T. breviflora*).

PARAGUAY. Sierra de Amambay, Hassler 11290 (G, K, BM, BD, Hass); Gonzalez, Aug. 13, 1893, Lindman A1837 (RS); Picado-Buncal, June, Hassler 11791 (Hass.); Lag. Ypacaray, Aug. 1913, Hassler 11791 (G, BM, BD); San Bernardino, Aug. 18, 1916, Osten 8953 (G).

Although its rather large number of synonyms would not suggest it, this is one of the most readily recognized of the South American species of *Tournefortia*. It is one of the two known species of the genus with decidedly axillary inflorescences. The bractless flower clusters are loosely and widely branched and are developed not only at the apex of the stems but usually also from many of the leaf-axils. The lanceolate leaves are glabrous or inconspicuously and very sparsely strigose above. The lower surfaces of the leaves are paler than the upper and may be glabrous or have a very fine sparse strigosity somewhat more abundant than on the upper surface. The mature leaves of this species, however, always appear to be glabrous at first glance. The corolla-lobes are well developed being slender and elongate, commonly about equalling the corolla-tube. Of all the synonyms listed above only *T. xapuryensis* seems to merit particular note. The type of this

species was collected in the head-waters of the Amazon in southwestern Brazil. It can be separated by no important characters from the frequently collected plant of the coastal states of Brazil and adjacent Paraguay although from distributional considerations this is rather unexpected. Perhaps further collections of this form from Acre may reveal characters which will eventually justify its recognition as distinct.

8. **T. peruviana** Poir. Encyc. Suppl. iv. 425 (1816); Urban, Symb. Ant. iv. 524 (1910). *T. volubilis* of R. & P. Fl. Peruv. ii. 24, t. 148b (1799). *T. scandens* Willd. Enum. i. 188 (1809), not Mill. (1768).

From Central America and the West Indies ranging south to eastern Peru and the Amazon River; rare in our area.

BRAZIL. AMAZONAS: corolla green, Paran -mir  dos Ramos, Nov. 1850, Spruce 1129 (K); betw. Santar m and Barra do Rio Negro, Oct. 1853, Spruce (G, K, BM). PAR : climbing on low trees and shrubs, fruit yellow, Santar m, April 1850, Spruce 804 (K).

This species is a common one in northwestern South America but enters our area only in the Amazon Basin. I have seen material collected by Ruiz & Pavon and determined by them as *T. volubilis* and am consequently able fully to substantiate Urban in his application of the name *T. peruviana*!

9. **T. paniculata** Cham. Linnaea iv. 468 (1829); Fresen. in Mart. Fl. Bras. viii. pt. 1, 50 (1857). *Messerschmidtia paniculata* Don, Gen. Syst. iv. 370 (1837). *Heliotropium scandens* Vell. Fl. Flum. 69 (1825) and Icones ii. t. 41 (1827), not *T. scandens* Mill. (1768) nor Willd. (1809). *T. elegans* Cham. l. c. 469; Fresen. l. c. 50, t. 9, fig. 5. *M. elegans* Don, l. c. 371. *T. brachiata* A. DC. Prodr. ix. 525 (1845); Fresen. l. c. 51, t. 9, fig. 2. *T. intermedia* Fresen. l. c. 50, t. 9, fig. 6. *T. grandifolia* Fresen. l. c. 56, t. 13. *T. brachiata*, f. *grandifolia* Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 482 (1905). ? *T. graciliflora* Rusby, Bull. Torr. Bot. Cl. xxvi. 148 (1899).

Widely distributed in our area where it extends from the lower Amazon southward in Brazil through Goyaz and Matto Grosso to Santa Cruz (Bolivia), Paraguay, Misiones (Argentina), Rio Grande do Sul and southernmost Minas Geraes. It is absent in easternmost Brazil. Aberrant forms of the species occur in northwestern Argentina (var. *austrina*), eastern Peru, Colombia and British Guiana (*T. spigelliflora* A. DC.).

BRAZIL. PAR : Prainha, Dec. 17, 1873, Traill 566 (K). GOYAZ: a climbing shrub in forest, fl. green, Natividade, Nov. 1839, Gardner 3362 (BB, TYPE of *T. brachiata*; K, BM, ISOTYPES); betw. Natividade and Porto Real, Burchell 8253 (K). MINAS GERAES: Faz. do Funil, Sellow 668 or C668 (BD); Bello Horizonte, Dec. 4, 1921, Holway 1364 (US); fl. green, Juiz de Fora, Holway 1404 (NY);

near Rio Verde, Caldas, Dec. 15, 1873, *Mosén 1505* (RS); Caldas, 1847, *Regnell I 309* (K, BD); Caldas, 1862, *Regnell I 309* (RS); Caldas, 1854, *Lindberg 161* (RS); indefinite, 1845, *Widgren* (RS); indefinite, *Claussen* (K), *Claussen 225* (G, NY, RS), *Claussen 407* (BB, COTYPE of *T. brachiata*). RIO JANEIRO: Serra de Jacarepagua, Dec. 29, 1869, *Glaziou 3880* (BD); Organ Mts., *Wilkes Exped.* (US); indefinite, *Glaziou 8474* and *14136* (K). SÃO PAULO: Cajura, 1855, *Regnell I 309* (RS); Serra do Caracol, 1874, *Mosén 1503* and *1504* (RS); Campinas, *Novaes* (US); Campinas, 1918, *Novaes, Mus. Paul. 2093* (G); Campinas, 1894, *Novaes 324, Mus. Paul. 11257* (SP); Santa Anna, 1908, *Usteri, Mus. Paul. 11255* (G); Sapucahy, Jan. 1893, *Loefgren & Edwall 2141, Mus. Paul. 11264* (G); Ribeirão-Preto, Dec. 1889, *Loefgren 1540, Mus. Paul. 11258* (SP); Itapira, 1927, *Hoehne, Mus. Paul. 20291* (SP); São Paulo and Rio Janeiro, *Weir 83* (BM). PARANÁ: Ponta Grossa, Nov. 28, 1910, *Dusén 10890* (RS); betw. Itararé and Sengés, Dec. 9, 1910, *Dusén 10993* (RS); Jaguariahyva, Nov. 29, 1915, *Dusén 17359* (G, RS). RIO GRANDE DO SUL: Cachoeira, Jan. 7, 1902, *Malme 1003* (RS); Cachoeira, Feb. 22, 1893, *Lindman A 1133½* (RS); Santo Angelo, Feb. 1, 1893, *Lindman A 1133* (RS). MATTO GROSSO: Cuyabá, Nov. 21, 1902, *Malme 2637* (RS). AMAZONAS: Falls of the Madeira, Oct. 1886, *Rusby 1428* (NY, TYPE of *T. graciliflora*; G, US, K, BD, ISOTYPES). INDEFINITE: Bras. Merid. *Sellow d1534* and *544* (BD, TYPES of *T. elegans*); Bras. Merid. *Sellow* (K, BD, DC, ? ISOTYPES of *T. elegans*); Bras. Merid. *Sellow B1575c669* (BD, TYPE of *T. paniculata*); Brazil, *Herb. Mus. Vind. 1584* (K); Pirituba, Dec. 14, 1913, *Brade* (BD).

ARGENTINA. MISIONES: Rio Iguazú, Oct. 22, 1892, *Niederlein 328a* and *329a* (BD); Alto del Vas betw. San Pedro and Campiñas de Américo, Dec. 6, 1886, *Niederlein 1741* (BD); Yermal, Campo Grande, Nov. 26, 1884, *Niederlein 60* (BD); San Pedro, Nov. 7, 1886, *Niederlein 1747* (BD); San Javier, Feb. 1922, *Molfino* (G); corolla greenish yellow, Santa Ana, Nov. 10, 1913, *Rodriguez 12468* (G); Posada near "La Granja," Nov. 7, 1907, *Ekman 1775* (RS).

PARAGUAY. Upper Rio Apa, *Hassler 7848* (BM, BD, Hass, BB), *7848a* (BM, Hass, BB) and *7699* (BM, Hass, BB); Centurión, betw. Rio Apa and Rio Aquidabán, Nov., *Fiebrig 4240* (K, BM, BD, Hass); Sierra Maracayú, Oct., *Hassler 5180* (K, BM, BD, Hass, BB); Cerros de Tobaty, Cord. Central, 1900, *Hassler 6209* (BM, BD, Hass, BB); Asunción, Oct. 1875, *Balansa* (K in pt., BM, BD); Cord. de Villa Rica, 1905, *Hassler 8594* (BM, BD, Hass); Villa Rica, 1928, *Jørgensen 3736* (G).

BOLIVIA. SANTA CRUZ: Bosques de la Barreras, Prov. Sara, *Steinbach 3129* (BD); corollas green, Pampa Monte, Prov. Sara, 500 m., Nov. 16, 1920, *Steinbach 5105* (NY).

As I have defined *T. paniculata* it consists of a group of forms separated from *T. peruviana* by having the leaves, at least the immature ones, more or less evidently and abundantly pubescent. These pubescent plants occur almost exclusively in the area to the south and east of the range of *T. peruviana*. Although reasonably satisfactory as a differentiating character, the presence or absence of pubescence is after all merely a matter of degree. I am, hence, by no means certain than future students will all agree as to the advisability of maintaining *T. paniculata* as specifically distinct from *T. peruviana*.

The plants I have assembled under *T. paniculata* are very variable in the outline of the leaves and in the amount of pubescence. The most common leaf-form is more or less broadly ovate and acute. However,

plants with lanceolate leaves are also common, particularly in the southern states of Brazil. As there are numerous collections exhibiting leaves more or less intermediate between these two extremes I have considered the difference in leaf-outline unworthy of nomenclatorial recognition.

The bulk of the material of *T. paniculata* has leaves that are evidently though not abundantly strigose. It is only in some forms from the Amazon Basin, where the species approaches closely the main range of *T. peruviana*, that the very sparsely strigose or nearly glabrous forms occur. Occurring sporadically in the same area as the common evidently strigose forms of *T. paniculata* are plants which have leaves that are rufous or less commonly cinereous and are conspicuously villose-strigose. These conspicuously pubescent plants are mere extremes. Any extended suite of specimens will show numerous intermediate forms connecting them by transitions to the common rather green and merely strigose forms. There is absolutely no correlation in the variation of leaf-outline and that of the amount of pubescence.

The inflorescence of *T. paniculata* also shows considerable variation. It may be cylindrical or pyramidal with an evident and only slightly flexuous axis or it may be very diffuse and have the axis strongly and irregularly flexuous. It may have only a few or it may have very numerous flowers. The branches may be short or very elongate. This great variability seems to be quite erratic and is not concomitant with the variation of either leaf-outline or pubescence.

The corollas exhibit variation in size and, in accord with the foliage variations in the amount of pubescence. Some plants have almost tubular corollas. The prevailing form, however, is trumpet-shaped. There is also noticeable variation in the size of the corollas and in the proportional length of lobes and tube.

The types of *T. paniculata* and *T. elegans* are so similar that they might well be respectively the fruiting and the flowering phases of one plant. They are evidently strigose and have lanceolate leaves. The types of *T. brachiata*, *T. intermedia* and *T. grandifolia* are forms with acute ovate leaves; they are merely strigose. The type collection of *T. graciliflora* is a very puzzling plant. Its large thin oblong-ovate leaves are glabrate. Only the small immature leaves (seen only on the specimen at Kew) are densely strigose. I am forced to the conclusion that *T. graciliflora* is an extreme shade-form of *T. paniculata*.

In the synonymy, citation of specimens and discussion given above I have been concerned only with the plants coming from the area south of Pará and southeast of the Rio Madeira. Coming from out-

side of this area, however, there are a few collections which belong to *T. paniculata* in the broad sense and which should be considered in any study of the species. Some of the material comes from the region to the west and north of our area. There are two collections from Tarpoto in eastern Peru made by Spruce (no. 4916) and by Ule (no. 6568) which in their evidently strigose herbage and acute ovate leaves are like the bulk of the Brazilian material. These two collections, the only material possibly referable to the species which I have seen from Peru, are notable only because of their very slender elongate corollas. There is also a collection from Valparaiso, Dept. Antioquia, Colombia, made by Pennell (no. 10799). This is darkly tawny with an evident short appressed pubescence. In the shape of its leaves, size and form of the corolla, etc., the plant is otherwise quite like the glabrous or glabrate *T. peruviana*. The collection is of especial interest since, as it must be referred to *T. paniculata*, it consequently sets the northwest limit of the species in a region in which otherwise only *T. peruviana* has been noted. Coming from British Guiana there are also a few specimens which must be associated with *T. paniculata*. These were collected by Schomburgk (nos. 749, 427 and 427-669 $\beta$ ) apparently at Pirara, at the head of the Rio Branco near the Brazil-British Guiana border, cf. Schomb. Faun. & Fl. Brit. Guian. 1151 (1848). They subsequently became the type material of *T. spigeliaeflora* A. DC., Prodr. ix. 525 (1845). The material is notable in *T. paniculata* for its soft spreading conspicuous pubescence, its slender elongate corollas and rather well developed corolla-lobes. Among the three extralimital forms I have mentioned I would consider it alone as worthy of possible varietal recognition.

The collections I have mentioned in the last paragraph came from Peru, Colombia and British Guiana and so from outside our area. There remains for discussion, however, a group of forms which range in northwestern Argentine and which accordingly should be disposed of in this paper. There are two forms of *T. paniculata* in Argentina as one becomes readily aware when material from Misiones (true *T. paniculata*) is compared with that from Catamarca, Tucumán, Jujuy and Salta. Although the two Argentine forms are readily distinguished on mere aspect, a study of them in conjunction with material from Paraguay and Brazil reveals the fact that the plant of northwestern Argentina is not at all readily separable from *T. paniculata* taken as a whole. Realizing this fact I very early in this study decided that the forms in Argentina were unworthy of nomenclatorial recognition. Coming back to this problem at various times I have been repeatedly impressed, however, by the rather characteristic aspect of the north-

western plant and particularly by its restriction to a very natural area in Argentina. These facts have finally decided me to give this ill defined form nomenclatorial recognition as follows,—

Var. **austrina**, var. nov., planta argentinensis et austro-boliviensis a var. genuina differt paniculis longirameis diffusis, lobis corollae conspicuis subulatis ad basem versus saepe expansis et plus minusve evidenter coalitis.—*T. elegans* of Griseb. [Pl. Lorentz. 184] Abh. K. Ges. Wiss. Göttingen xix. 232 (1874) and [Symb. Argent.] l. c. xxiv. 270 (1879). *T. Salzmannii* of Kuntze, Rev. Gen. iii. pt. 2, 206 (1898). *T. grandifolia* of Lillo [Reseña Fitogeogr. Tucumán] Prim. Reunión Nat. Soc. Argentina, Bot. 219 (1919).

In Argentina from southeastern Catamarca, through Tucumán, eastern Jujuy, and western Salta to Tarija and Chaco in extreme southern Bolivia.

BOLIVIA. TARIJA: Bermejo, Nov. 18, 1903, *Fiebrig 2136* (G, K, BD). CHACO: Yacuiba, Oct. 24, 1910, *Steinbach 1637* (G).

ARGENTINA. SALTA: "El Cedrál," Orán, Nov. 1, 1913, *Rodríguez 1083* (G); corolla greenish, Campo Zuifano, Rosario de Lerma, 1500 m., Jan. 1929, *Venturi 8109* and *8176* (G). JUJUY: capital, 1100 m., Jan. 2, 1912, *Lillo 11818* (G). TUCUMÁN: corolla yellowish, Cerro del Campo, 800 m., Nov. 7, 1928, *Venturi 7472* (G); La Ramada, Dec. 1914, *Lillo 3032M* (TYPE, Gray Herb.); Cerro Duraznillo, 750 m., Jan. 1, 1914, *Lillo 15998* (G); Higuera Sola, ca. 1200 m., Dec. 1917, *Schreiter 343a* (G); Naranjal, 500 m., Oct. 17, 1917, *Schreiter 158* (G); Tucumán, 450 m., Nov. 7, 1897, *Lillo 2100* (G); corolla green, Tucumán, Nov. 1892, *Kuntze* (NY, BD); corolla yellow, Tucumán plain, *Tweedie 1194* (K); Siambón, March 1872, *Lorentz 490* (BD); La Cruz, April 1872, *Lorentz 199* and *274* (BD); Yerba Buena, 650 m., Jan. 1900, *Lillo 214V* (G); La Cocha, 440 m., Feb. 1919, *Lillo 283B* (G); La Calera, 500 m., Nov. 13, 1913, *Lillo 15153* (G); Las Cuchillas, 1100 m., Dec. 14, 1906, *Lillo* (G); Yacu-chire, 300 m., Oct. 22, 1913, *Lillo 15152* (G); Barranca de la Toma, Rio Salí, Nov. 1, 1921, *Schreiter 1682* (G); Las Pavas, Dec. 1916, *Jørgensen 61* (G). CATAMARCA: Singuil, Sierra de Catamarca, 1888, *Schunck 49* (BD); La Merced, Dec. 2, 1872, *Lorentz & Hieronymus* (BD); El Rodeo, Jan. 15, 1911, *Castillon 14269* (G).

As I have intimated above, this variety is not at all sharply set off from typical *T. paniculata*. It is significant only in so far as it proves to be a practicable geographical variety. If its distinct gross aspect proves illusionary or if it is found to be too closely approached by many forms in Paraguay and Brazil it will have little to justify its recognition. Its establishment does, however, provide a convenient means whereby the botanists of Argentina can distinguish the plant of Tucumán and Salta from the rather differently appearing plants of Misiones and adjacent Brazil.

10. **T. Gardneri** A. DC. Prodr. ix. 526 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 54 (1857). *Messerschmidia subulata* Gardn. in Hook. London Jour. Bot. i. 532 (1842); Miers, Ann. & Mag. Nat. Hist. ser. 4,



ii. 193 (1868) and Contr. Bot. ii. 204 (1869); not *T. subulata* Hochst. ex DC. (1845). *T. restingicola* Vaupel, Notizbl. vi. 184 (1914).

Brazil; at no great distance from the coast in the states of Rio Janeiro and south to Rio Grande do Sul.

BRAZIL. RIO JANEIRO: Corcovado, Caixa d'Agua, Glaziou 19682 (BD); Rio Comprido, Oct. 1836, Gardner 175 (BM, TYPE of *M. subulata*); woods, Botafoga Bay, Sept. 1836, Gardner 175 (K); Five Fathom Bay, April 1841, Gardner (BM); Jurujuba Bay, Miers 3694 (K); Restinga, Cabo Frio, May 6, 1887, Schenck 3864 (BD); Restinga, Cabo Frio, Oct. 8, 1899, Ule 4763 (BD, TYPE of *T. restingicola*); Mont Serrat, Itatiaya, Oct. 23, 1903, Dusén 2175 (RS); Rio Janeiro, 1844, Widgren (RS). SÃO PAULO: vicinity of São Paulo, Rio Tiete, July 26, 1827, Burchell 4791 (K); Pinheiros, São Paulo, July 23, 1897, Loefgren 1397, Mus. Paul. 11248 (G); São Paulo, Oct. 1913, Brade 7067, Mus. Paul. 6479 (G); indefinite, Burchell 3267 (G, K). SANTA CATHARINA: Santa Catharina, June 1868, Mueller 148 (K); Santa Catharina, 1837, Tweedie (K); Santa Catharina, July 1884, Ule 339 (BD); Blumenau, Sept. 28, 1886, Schenck 105 (BD); Blumenau, Oct. 13, 1886, Schenck 602 (BD). RIO GRANDE DO SUL: scrambling in hedges and edges of forest, Puerto Alegre, Tweedie (K). INDEFINITE: Brazil, Mart. Herb. Brasil 1223 (K, BM, BD, DC); Brasil, Herb. Mus. Vind. 1595 (K); Brasil, Blanchet 107 (BM).

Usually a slender climbing plant with lanceolate herbaceous and strigose leaves. In the type, which seems to be a form from shaded situations, the hairs on the foliage are very slender, quite scattered and inconspicuous. In some forms of the species, however, the strigose pubescence on the leaves is coarse, abundant and quite evident. The type of *T. restingicola* is one of the latter forms and obviously belongs with the plants I have referred to *T. Gardneri*, although its leaves are oblong-ovate rather than of the characteristic lanceolate outline of the species. Blanchet's collection (no. 107) is also aberrant in leaf-outline. The fruit of *T. Gardneri* is finely strigose.

11. ***T. subsessilis*** Cham. Linnaea viii. 119 (1833); DC. Prodr. ix. 521 (1845); Fresen in Mart. Fl. Bras. viii. pt. 1, 53 (1857). *Messerschmidia subsessilis* Don, Gen. Syst. iv. 370 (1837); Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 203 (1868) and Contr. Bot. ii. 214 (1869). *T. maritima* Salzm. ex DC. l. c. 526; Fresen. l. c. 54. *T. pyrhotrichia* Fresen. l. c. 53.

Eastern Brazil in Bahia and perhaps also in Minas Geraes.

BRAZIL. BAHIA: sandy plain near ocean, Bahia, 1830, Salzmann 371 (DC, TYPE of *T. maritima*). INDEFINITE: Vittoria-Bahia, Sellow (BD); Brazil, Sellow (BD, TYPE of *T. sessilis*); Brazil, Sellow (BD, TYPE of *T. pyrhotrichia*); Brazil, Glocker 406-16E (BM).

This species appears to be rare. Although it is probably most closely related to *T. villosa*, of which it may be only a glabrous derivative, it is more difficult to separate in the key from *T. Gardneri*. Its characters are chiefly found in the leaves and in the lack of pu-

bescence. The leaves are leathery in texture and ovate to lance-ovate in outline, being about twice as long as broad. The upper surface is somewhat shiny and is glabrous or has only a few hairs along the impressed veins. The lower surface may be sparsely tomentose but is more commonly provided with only a few scattered appressed slender hairs. I know *T. pyrrotrichia* from material at Berlin determined by Fresenius. This may be type material. The plant agrees very closely in details with and is almost certainly part of the same collection as the sheet (also at Berlin) from Sellow which is labeled as from "Vitoria-Bahia." The under surface of the leaves is sparsely and loosely tomentose. The types of *T. subsessilis* and *T. maritima* are extremely alike. The under surface of the leaves has a very sparse inconspicuous indument of scattered slender appressed hairs. The fruit in the present species is glabrous or, at least, glabrate.

12. **T. candidula** (Miers), comb. nov. *Messerschmidtia candidula* Ann. & Mag. Nat. Hist. ser. 4, ii. 202 (1868) and Contr. Bot. ii. 213 (1869). *T. lanuginosa* Vaupel, Notizbl. vi. 183 (1914). *T. sericea* of DC. Prodr. ix. 524 (1845) and Fresen. in Mart. Fl. Bras. viii. pt. 1. 54 (1857) as to Brazilian plant, not Vahl.

In eastern Brazil from Maranhão to Rio Janeiro.

BRAZIL. MARANHÃO: corolla yellow, in the Capoera, San Luis, Aug. 1, 1923, *Snethlage 166* (BD). CEARÁ: corolla greenish yellow, climbing in the Restinga de Benifica near Fortaleza, Sept. 1910, *Ule 9097* (BD, TYPE of *T. lanuginosa*; K, ISOTYPE); Ceará, 1926, *Bolland* (K). PERNAMBUCO: corolla dull yellow, Iguarassu, Dec. 2, 1887, *Ridley, Lea & Ramage* (BM); Itapissurua, 1887, *Ridley, Lea & Ramage* (BM); Olinda, Feb. 5, 1925, *Pickel 758*, Mus. Paul. 18130 (G); fruticose, ca. 1.5 m. tall, in dry bushy places, Pernambuco, Nov. 1837, *Gardner 1078* (BM, TYPE of *M. candidula*; NY, K, ISOTYPES). BAHIA: St. Thomé betw. Jacobina and Villanova, *Blanchet 3789/37* (BM, DC, BB); Bahia, *Blanchet 3350* (K, BM, BD, DC, BB). RIO JANEIRO: "São João da Barra near Campos," *Glaziou 11293* (K, BD).

A very distinct species readily recognized by the characteristic white pubescence which covers the under surface of the leaves and clothes the corolla-tube. While the lower leaf-surface is white tomentose, the upper is green with an ashy cast resulting from scattered pale appressed hairs. The fruit is ashy with a fine pubescence.

13. **T. villosa** Salzm. ex DC. Prodr. ix. 524 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 52 (1857). *Messerschmidtia villosa* Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 202 (1868) and Contr. Bot. ii. 213 (1869). *T. Pohlii* Fresen. l. c. 52. *M. Pohlii* Miers, l. c. 203 and l. c. 214. *T. villosa*, f. *rubriflora* Wawra, Bot. Reise Maximilian nach Bras. 92, t. 68 (1866). *T. Chamissoniana* Vaupel, Notizbl. vi. 182 (1914). *T. speciosa* Vaupel, l. c. 185.

In southeastern Brazil from Bahia to Rio Grande do Sul.

BRAZIL. BAHIA: Bahia, *Blanchet 215* (DC) and *2202* (BM, BD); indefinite, corolla pale yellow, *Salzmann 369* (DC, TYPE of *T. villosa*); indefinite, *Salzmann* (K), *Salzmann 1617* (BB) and *Lhotsky* (DC). MINAS GERAES: Lagos Santos, Jan. 28, 1864, *Warming* (BM); Aldea de Ouro Branco, *Glaziou 15271* (K, BD); Juiz de Flora, Dec. 18, 1921, *Holway 1412* (US); Caldas, Feb. 1847, *Regnell III 916* (RS); indefinite, *Claussen* (K) *228* (RS). RIO JANEIRO: slender shrub 2.5 m. tall, corolla green, Novo Friburgo, Jan. 2, 1922, *Holway 1446* (US); woody vine, corolla yellow, Therezopolis, Oct. 2, 1921, *Holway 1183* (US); a climber, Imbuhy, Organ Mts., 1837, *Gardner 546* (K, BM); Organ Mts., *Wilkes Exped.* (US); climbing in woods on the Corcovado, Sept. 1897, *Ule 4465* (BD, TYPE of *T. speciosa*); Rio Janeiro, Jan. 4, 1887, *Schenck 1853* (BD); Rio Janeiro, 1844, *Widgren* (RS). SÃO PAULO: Campinas, *Novaes* (US); Itapetininga, Nov. 17, 1887, *Loefgren 387*, *Mus. Paul. 11259* (G). SANTA CATHARINA: Santa Catharina, June 1868, *Mueller 147* (K). RIO GRANDE DO SUL: Campos to V. Vittoria, *Sellow 303* (BD). INDEFINITE: Brazil, *Claussen 412* and *417* (BB), *Sellow 226* (BD), *Sellow* (BD, TYPE of *T. Chamissoniana*), *Bowie & Cunningham* (BM), *Pohl. in Herb. Mus. Vind. 1597* (K, BD, ISOTYPES of *T. Pohlii*).

Among its relatives, those with a stiff inflorescence and crowded flowers, this species is quickly distinguished by its leaves which are velvety above and tawny with a conspicuous silky tomentum beneath. The type of *T. villosa* is more conspicuously pubescent than is common in the species. Its stems are somewhat shaggy and the under leaf-surface is quite silky. The type of *T. Chamissoniana* is quite similar as to pubescence although the primary branches of its inflorescence, like those in all the other specimens I have referred to the species, are not so elongate as they are in the type of *T. villosa*. The types of *T. Pohlii* and *T. speciosa* are quite alike and represent the common form of the species. The fruit of *T. villosa* is glabrous.

14. ***T. rubicunda*** Salzm. ex DC. Prodr. ix. 526 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 54 (1857). *T. psilostachya*, var. *rubicunda* Chodat, Bull. Herb. Boiss. ser. 2, ii. 816 (1902). *T. Martii* Fresen. l. c. 55, t. 9, fig. 8. *Messerschmidtia Martii* Miers, Ann. & Mag. Nat. Hist. ser. 4, 194 (1868) and Contr. Bot. ii. 205 (1869). *M. vicina* Miers, l. c. 197 and l. c. 208. *M. valga* Miers, l. c. 198 and l. c. 209. *T. Herzogii* Vaupel, Mededeel. Rijks Herb. xlvi. 10 (1922).

Along the east coast of Brazil (Pernambuco to Rio Grande do Sul) and westward through Matto Grosso, Paraguay and Corrientes to Tucumán, Jujuy and southern Bolivia.

BRAZIL. PERNAMBUCO: Olinda, Feb. 19, 1925, *Pickel 935*, *Mus. Paul. 18100* (G). ALAGÓAS: shrub ca 18 dm. tall, banks of Rio S. Francisco near Penedo, March 1838, *Gardner 1362* (BM, TYPE of *M. vicina*); bush ca. 2.5 m. tall, near Maceió, April 1838, *Gardner 1363* (K); Maceió, Feb. 1838, *Gardner 1363* (BM, TYPE of *M. valga*). BAHIA: Muritiba, *Blanchet 3545* (BM, BB, RS); near Bahia, *Blanchet 462* (BM), *Salzmann* (K), *Salzmann 272* (DC, TYPE of *T. rubicunda*), *Lhotsky* (DC) and *Malme* (RS); near Ilhéos, *Martius* (K, BM). RIO JANEIRO: Rio Janeiro, 1847, *Forssell* (RS). RIO GRANDE DO SUL: a slender climber in hedges near Porto Alegre, *Tweedie* (K); corolla greenish

yellow, Ilha dos Marinheiros near Rio Grande, Nov. 24, 1892, *Malme 360* (BD, RS); Piratiny near Pelotas, Nov. 10, 1901, *Malme 367* (RS). MATTO GROSSO: corolla brick-red, edge of forest near Cuyabá, Dec. 7, 1893, *Malme 1206B* (BD, RS); flood plain of river near Cuyabá, Oct. 28, 1902, *Malme 2538* (RS).

PARAGUAY: Centurión, Nov. 2, *Fiebrig 4140* (G, K, BM, BD, Hass); corolla rusty red, edge of river near Concepción, Oct. 1901-2, *Hassler, 7556* (BM, Hass.); in open woods near river, Concepción, Sept. 19, 1893, *Malme 972* (RS); Santa Elisa, Gran Chaco, lat 23° 10', Jan. 1910, *Rojas in Hassler 2749* (BM, Hass); Pilcomayo River, May, *Morong 1041* (G, K, BM); Asunción, Nov. 20, 1893, *Anisits 118* (RS); corolla yellowish green, Asunción, Oct. 1875, *Balansa 2045* (RS); corolla rusty brown, in woods near San Bernardino, *Hassler 3440* (BM, BD, Hass, BB); Colonia San Bernardino, Aug. 1896, *Bettfreund 1218* (BD); corolla rusty brown, margins of forest near Cord. de Altos, Sept., *Hassler 1119* (NY, K, BM, Hass, BB); Cord. de Altos, 1902, *Fiebrig 323* and *529* (G, K, BD, Hass).

ARGENTINA. MISIONES: Posadas near "La Granja," Nov. 1907, *Ekman 1788* (RS). CORRIENTES: Isla Apipé Grande, March 2, 1883, *Niederlein* (BD); forest of Riachuelo near Corrientes, Jan. 19, 1883, *Niederlein* (BD). FORMOSA: Pozo del Tigre, Jan. 1928, *Parodi 8508* (G); indefinite, *Jørgensen 2247* (G). SALTA: San José, Feb. 1873, *Lorentz & Hieronymus 241* (NY, BD, RS); Orán, Feb. 1916, *Hauman 26/84* (G); Monte Alto, Orán, Nov. 19, 1913, *Rodríguez 1131* (G); corolla dark purple, Rio Piedras, Orán, Nov. 30, 1911, *Rodríguez 130* and *10982* (G). JUJUY: Ledesma, Jan. 22, 1906, *Spegazzini* (G). TUCUMÁN: corolla castaneus, El Cadillal, 650 m., Nov. 24, 1907, *Lillo 7206* (G).

BOLIVIA. SANTA CRUZ: Samaipata, prov. Vallegrande, *Steinbach 3802* (BD). CHACO: Villa Montes, Rio Pilcomayo, Nov. 1910, *Herzog 1136* (BD, TYPE of *T. Herzogii*); Villa Montes, *Pflanz 2086* (BD); Tatarenda, Apr. 9, 1902, *Fries 1565* (RS). TARIJA: Bermejo, Nov. 17, 1904, *Fiebrig 2122* and *2136* (G, BD). LA PAZ: Milluguaya, Nor Yungas, Dec. 1917, *Buchtien 641* (G); ? Sorata, *Mandon 389* (G, K, RS).

In our area this is a rather well marked species which is commonly recognizable at once by having the upper surface of the leaves more or less strigose with the hairs springing each from a disk of thickened cells. The material I have cited from Rio Grande do Sul, however, has the leaves practically glabrous and entirely lacks the disks of thickened cells. The specimens from Centurión, Paraguay (*Fiebrig 4140*) and Sorata, Bolivia (*Mandon 389*) are aberrant in the very copious strigosity on the leaves. The remainder of the specimens cited are rather uniform. Among the species of our area *T. rubicunda* is probably closest to *T. breviflora* from which it is separated by its much less freely climbing or almost erect habit of growth, its lack of axillary inflorescences, its usually conspicuous strigose pubescence and its peculiar disks of thickened cells on the upper leaf-surface. The real relation of the species is, however, with *T. psilostachya* HBK., an extremely variable and very poorly understood species of northwestern South America. Although *T. rubicunda* may be only a geographic variety of *T. psilostachya*, characterized by its very detached range, its coarser and usually less copious pubescence, and the strong development of the hair-bases, I am inclined to believe that it had best be

treated as distinct until the variations and intricacies of the relationship of *T. psilostachya* are very much better understood.

15. **T. Salzmanni** DC. Prodr. ix. 524 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 51 (1857). *Messerschmidtia Salzmanni* Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 201 (1868) and Contr. Bot. ii. 212 (1869). *T. vulgaris* Salzm. ex DC. l. c. in synonymy. *T. Salzmanni*, var. *paraguariensis* Chodat, Bull. Herb. Boiss. ser. 1, vii, append. 1, 78 (1899). *T. Salzmannii*, var. *Blanchetiana* Chodat & Hass. Bull. Herb. Boiss. ser. 2, v. 482 (1905).

From Ceará to Rio Janeiro in eastern Brazil and westward into Paraguay, southern Bolivia and the northern states of Argentina; apparently also in extreme northern Brazil.

**BRAZIL.** AMAZONAS: in Campo near São Marcos, Rio Branco, Dec. 1908, *Ule 7892* (K, BD). CEARÁ: a fruticose climber in woods near Crato, Oct. 1838, *Gardner 1785* (K, BM). PERNAMBUCO: Tapera, 1926, *Pickel 1137* (BD). BAHIA: St. Thomé betw. Jacobina and Villanova, *Blanchet 3787* (BM, DC); Jacobina, *Blanchet 3288* (BM) and *3289* (BB, TYPE of var. *Blanchetiana*; BD, DC, ISOTYPES); Muritiba, *Blanchet 3289* (BM, BB); hills near Bahia, *Salzmann (K)*; corolla pale yellow, Bahia, 1830, *Salzmann 370* (DC, TYPE of *T. Salzmanni*); Bahia, *Lhotsky* (DC), *Lockhart* (BM), *Blanchet 125* (DC) and *Blanchet 215* (BM). RIO JANEIRO: near Rio Janeiro, *Glaziou 11295* (K, BD).

**PARAGUAY.** Corolla yellowish green, Colonia Risso near Rio Apa, Sept. 25, 1892, *Malme 986* (BD, RS); betw. Rio Apa and Rio Aquidabán, *Fiebrig 5225* (G, K, BM, BD, Hass); corolla yellowish green, Cord. Central, Dec. 1900, *Hassler 6532* (BM, Hass, BB); west bank of Rio Pilcomayo, Gran Chaco, lat. 23° 20'–30', Oct. 1903, *Rojas in Hassler 2398* (BM, BD, Hass); corolla yellowish green, thickets near Concepción, 1901–2, *Hassler 7430* (BM, BD, Hass, BB); Asunción, Oct., *Morong 800* (G, K, BM); corolla yellowish green, Asunción, 1874, *Balansa 2046* (K, BM, RS); Villa Morra, Asunción, Oct. 15, 1893, *Lindman A2307* (RS); Cord. de Altos, *Fiebrig 214* (K, BD, Hass); corolla yellowish green, woods near Altos, Aug., *Hassler 891* (BB, TYPE of var. *paraguariensis*; NY, K, BM, BD, Hass, ISOTYPES); corolla olivaceous, woods near San Bernardino, Nov. 1897, *Hassler 3460* (G, K, BM, BD, Hass, BB); near Sapucay, Sept. 1913, *Hassler 12152* (G, BM, BD, Hass); near Lake Ypacaray, March 1913, *Hassler 12142* (G, BM, BD, Hass).

**ARGENTINA.** FORMOSA: San Francisco de Laishí, 1923, *Herb. Mision. Francisc. del Chaco* (G). CHACO: Colonia Benitez, April 1, 1917, *Hauman 26/81* (G). SALTA: corolla yellowish green, Rio Piedras, Nov. 6, 1911, *Rodríguez 49* and *10901* (G); flowers greenish, Tartagal, 500 m., Feb. 22, 1925, *Schreiter 3599* (G); corolla greenish, Embarcación, Rio Bermejo, Orán, 500 m., Nov. 25, 1925, *Schreiter 5044* (G). JUJUY: Ledesma, Jan. 22, 1906, *Spegazzini* (G); corolla greenish, Sierra de Calilegua, Ledesma, 800 m., Oct. 12, 1927, *Venturi 5392* (G); Sierra de Santa Barbara, San Pedro, 750 m., Oct. 17, 1929, *Venturi 9638* (G).

**BOLIVIA.** LA PAZ: Coripati, Nor Yungas, March 1, 1894, *Bang 2076* (G, NY, K, BM, BD); Milluguaya, Nor Yungas, 1300 m., Dec. 1917, *Buchtien 4190* (G). TARIJA: Villa Montes, *Pflanz 2121* (BD). GRAN CHACO: Tatarenda, April 5, 1902, *Fries 1532* (RS).

This species is very closely related to *T. floribunda* HBK. of northern South America but differs in having corollas about twice as large. It also has a detached range. It is also closely related to *T. membrana-*

*cea*, of the region about Rio Janeiro, from which it differs in its larger more acute leaves, more darkly tawny pubescence of the foliage, evidently larger corollas and more elongate corolla-lobes.

16. **T. membranacea** (Gardn.) DC. Prodr. ix. 530 (1845). *Messerschmidia membranacea* Gardn. in Hook. London Jour. Bot. i. 181 (1842); Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 200 (1868) and Contr. Bot. ii. 211 (1869). *T. laxiflora* DC., l. c. 525. *T. floribunda* of Fresen. in Mart. Fl. Bras. viii. pt. 1, 51 (1857), in pt.

Known only from near the coast in the states of Rio Janeiro and São Paulo, Brazil.

BRAZIL. RIO JANEIRO: Restinga de Copacabana, Dec. 17, 1886, *Schenck 1575* (BD); corolla greenish, subscaudent, Ilha da Governador, Nov. 15, 1825, *Burchell 1105-112* (K); flower yellowish green, hills west of Catumbi, Dec. 29, 1825, *Burchell 1312* (K); scandent, 15-18 dm. tall, betw. São Christovão and Engenho Velho, Jan. 18, 1826, *Burchell 1638* (G, K); shrub 1.5 m. tall, corolla white, Botafogo Bay, Sept. 29, 1825, *Burchell 1103* (K); subscaudent, ca. 18 dm. tall, Botafogo, July 6, 1826, *Burchell 2993* (K); Botafogo Bay, *Miers 3836* (K); Botafogo Bay, Oct. 1836, *Gardner 82* (K); in thickets on Morro do Flamengo, 1836, *Gardner 82* (BM, TYPE of *M. membranacea*; G, NY, ISOTYPES); Ilha Paquetá, Oct. 18, 1901, *Dusén 4* (US, RS); Rio Janeiro, *Gaudichaud 530* (DC, TYPE of *T. laxiflora*; BD, ISOTYPE), *Vauthier 236* (DC, COTYPE of *T. laxiflora*), *Gaudichaud 531 bis* (DC), *Tweedie 1234* (K), *Claussen 61* (BM), *Sellow L93* (BD), *Ule 827* (BD), *Meyen* (BD), *Rudio* (BD), *Widgren* (RS), *Andersson* (RS), *Gay* (NY), and *Wilkes Exped.* (US). SÃO PAULO: Ilha dos Alcatrazes, Santos, Oct. 1920, *Luederwaldt & Fonseca, Mus. Paul. 11265* (G); São Sebastião, Santos, March 25, 1892, *Edwall 1719, Mus. Paul. 11266* (G). INDEFINITE: Brazil, *Bowie & Cunningham* (BM), *Banks & Solander* (BM) and *Herb. Mus. Vind. 1594* (G, K, BD).

While it is possible that this may be only a local form of the widely distributed *T. Salzmanni*, differing in its much less tawny pubescence, smaller flowers and much less elongate corolla-lobes, it seems to be closest to *T. floribunda* HBK., a species to which it was referred by many past authors and from which, in fact, it appears to differ only in its detached range and its more obtuse leaves.

17. **T. salicifolia** (Gardn.) DC. Prodr. ix. 530 (1845); Fresen. in Mart. Fl. Bras. viii. pt. 1, 56 (1857). *Messerschmidia salicifolia* Gardn. in Hook. London Jour. Bot. i. 181 (1842); Miers, Ann. & Mag. Nat. Hist. ser. 4, ii. 195 (1868) and Contr. Bot. ii. 206 (1869). *T. volubilis*, var. *hirsuta* Fresen. l. c. 54.

Known only from the vicinity of Rio Janeiro, Brazil.

BRAZIL. RIO JANEIRO: Botafogo Bay, Sept. 1836, *Gardner 81* (K); Morro Flamengo, Sept. 1836, *Gardner 81* (BM, TYPE of *M. salicifolia*; G, NY, ISOTYPES); Morro Flamengo, *Miers 3596* (K); Morro Flamengo, Aug. 1822, *Beyrich* (BD); north base of Pão de Assucar, March 14, 1887, *Schenck 3038* (BD); summit of Pedra Dois Irmãos, March, 23, 1929, *Smith 2137* (G); Rio Janeiro, 1837, *Tweedie 1235* (K); Rio Janeiro, *Wilkes Exped.* (US). INDEFINITE: Brazil, 1814-17, *Bowie & Cunningham 91-110* (BM); Brazil, *Pohl in Herb. Mus. Vind. 1596* (K, BD).

This is a reasonably well defined local species, which is known only from the vicinity of the city of Rio Janeiro. It is probably most closely related to *T. membranacea*, which also occurs in the same region, but differs in its lanceolate leaves, more congested inflorescence, slightly larger flowers, more elongate calyx-lobes and spreading pubescence.

#### UNRECOGNIZED SPECIES.

**Heliotropium erectum** Vell. Fl. Flum. 69 (1825) & Icones ii. t. 42 (1827).—Perhaps a species of *Tournefortia*, but if so, one not known to me. The type came from the region about Rio Janeiro.

**Tournefortia Blanchetii** DC. Prodr. ix. 524 (1845).—The type of this species was collected by Blanchet (no. 1914) in Bahia. Besides the type I have seen an authentic specimen (lacking the inflorescences) in the herbarium of the British Museum. I am uncertain as to its correct disposition. The flowers and inflorescence suggests *T. rubicunda* and it may be that the plant is only a very strigose, broad-leaved form of that species. The only other species particularly suggested by *T. Blanchetii* is *T. Gardneri*. That latter, however, has somewhat smaller leaves and a much more condensed inflorescence.

**Tournefortia brasiliensis** Poir. Encyc. v. 357 (1804); DC. Prodr. ix. 529 (1845).—A plant said to be native of Brazil. It may possibly be *T. paniculata*.

**Tournefortia megapotamica** Spreng. Syst. iv. pt. 2, 66 (1827); DC. Prodr. ix. 530 (1845).—I know this species only from the short description, which is as follows, "T. foliis oblongis obtusis glabris medio dentatis subtus flavicantibus, spicis axillaribus elongatis, calycibus verticillatis hirsutis. *Rio grande*. Sello." The identity of the species is a complete mystery to me.

## II. TAXONOMIC NOTES CONCERNING VARIOUS BORAGES.

**HELIOTROPIUM PROCUMBENS** Mill. Dict. ed. 8, no. 10 (1768). *H. americanum* Mill. Dict. ed. 8, no. 11 (1768). *H. brasilianum* Roth, Nov. Pl. Sp. 103 (1821). *H. rigidulum* DC. Prodr. ix. 540 (1845).—While at the British Museum of Natural History last year I made another search for Miller's type of *H. americanum* and eventually found it. It is specifically identical with *H. procumbens* as is also *H. brasilianum*, the type of which I found in Roth's herbarium at the Botanical Museum in Berlin. I have also examined the type-material of *H. rigidulum* at Geneva and can now definitely place this obscure species in the synonymy of *H. procumbens* Mill. also.

**HELIOTROPIUM LEIOCARPUM** Morong, Ann. N. Y. Acad. Sci. vii.

168 (1892). *H. minarum* Glaz. Bull. Soc. Bot. France lvii. Mem. 3e, 479 (1910).—I have examined the authentic material of *H. minarum* found in the Delessert Herbarium at Geneva. This species, scarcely more than a nomen nudum, falls into the synonymy of *H. leiocarpum*. It is rather slender, loosely branched and has rather thinnish leaves but seems to be clearly referable to *H. leiocarpum*. The plant is most interesting since it represents a conspicuous range-extension. No previous collections of *H. leiocarpum* have been reported from Brazil. The type of Glaziou's species came from southernmost Minas Geraes.

**Heliotropium** (§ *Orthostachys*) **cornutum**, sp. nov., annuum prostratum multicaule foliosum pilis rigidiusculis ca. 0.8 mm. longis adpressis pallidis sparse vestitum; caulibus gracilibus laxe ramosis 5–20 cm. longis ad 1 mm. crassis, internodiis usque ad 2 cm. longis; foliis alternis vel inferioribus rariter suboppositis ad apicem versus caulibus paullo reductis; lamina ovata vel oblongo-lanceolata 3–8 mm. longa 1.5–4 mm. lata concolori firmiter herbacea costata sed enervata integerrima apice acuta basi in petiolum gracilem 0.5–1 mm. longum plus minusve abrupte contracta; floribus distantibus inter euphylla secus ramulos extra-axillaribus; pedicello maturitate ascendenti ad apicem versus plus minusve incrassato 2–2.5 mm. longo imam ad basem tarde deciduis; corolla 5–6 mm. longitudine et diametro infundibuliformi extus faucibus et medio parte loborum sparse adpresse villosa; tubo ca. 1.5 mm. longo ad 1 mm. crasso intus supra insertionem staminum puberulento calyce conspicue breviori; faucibus gradatim ampliatis intus glabris tubo duplo longioribus; lobis ovatis ascendentibus 1.5 mm. longis distantibus, dentibus inter lobos late deltoideis plicatis ca. 0.3 mm. longis; staminibus tubo corollae inclusis medium versus tubi insertis; filamentis brevissimis; antheris ca. 1.2 mm. longis ovato-oblongis supra stigma fornicatis, apice truncatis cohaerentibus glanduloso-puberulentis; stylo ad 0.5 mm. longo gracili, disco stigmatoso angustissimo ad 1 mm. diametro, columna stigmatis gracili stylo subaequilonga; ovario villosissimo; fructibus conspicue rostratis et ad basem versus quadri-cornutis quadrangulatis maturitate 2–2.5 mm. crassis 3–4 mm. longis in nucula 4 uniovulatas disruptis lobis calycis paullo brevioribus; nuculis dorso leviter concavis adpresse villosis, ventre cum faciebus duabus planis arcte contiguis.—BRITISH INDIA: in a rice-field near Mangalor, Canara, March, *Pl. Indiae Or.* Ed. Hohenacker, 1851, no. 82 (TYPE, Brit. Mus.).—This is a very interesting and very distinct new member of the Subsection *Axillaria*. Johnston, *Contr. Gray Herb.* lxxxi. 48 (1928), a group heretofore thought to be endemic to America. The species is characterized by its very villous fruit which is not only drawn up into a very well



developed beak but is also provided with evident blunt cornute processes that develop above the base on each of its four angles. These processes are duplex in structure being composed of prolongations of adjacent portions of the margins of the closely contiguous nutlets. I know of no other species in the entire genus that has similar outgrowths on the fruit. The type has been determined as *H. marifolium* Retz, a species which it somewhat simulates in habit but from which it differs widely in inflorescence and fruit. *Heliotropium cornutum* must be very rare or local for otherwise it would be very difficult to understand how such a very striking species could go so long unrecognized.

It should be noted that *H. cornutum* is not the only representative of the Subsection *Axillaria* in the Old World. This very characteristic group also has thoroughly typical members in Africa and Madagascar. As with the Indian species these have also been confounded with *H. marifolium*. I take this opportunity, therefore, to give their synonymy and to cite such specimens of them as I have seen. They are as follows,—

***Heliotropium madagascariense*** (Vatke), comb. nov. *Evolvulus madagascariensis* Vatke, *Linnaea* xliii. 522 (1882); Hallier, *Bot. Jahrb.* xvi. 536 (1893) and *Bull. Herb. Boiss.* vi. 723 (1898).—MADAGASCAR: flowers white, in locis sterilibus, Mojangá, lat. 15° 43', June 1879, Hildebrandt 3035 (Berlin).—Of the three species of the *Axillaria* in the Old World this one seems to be closest to the American species, especially to *H. antillanum* Urban. From that species, however, it is readily separated by its coarser habit and larger leaves, more conspicuous pubescence and more elongate calyx-lobes. *Heliotropium madagascariense* is very closely related to the typical form of the African *H. Baclei* differing in its looser more evident pubescence, more slender habit and much smaller fruit.

**HELIOTROPIUM BACLEI** DC. *Prodr.* ix. 546 (1845); Baker in Thiselton-Dyer, *Fl. Trop. Africa* iv. pt. 2, 34 (1905). *H. marifolium* of Baker, l. c. 40, in pt.—AFRICA: Quoja, West Africa, *Bacle* (DC, TYPE); Gambia, 1928, *Hayes* 543 (Kew); Sierra Leone, 1915, *Thomas* 8836 (Kew); dry sandy places, Makunde, Limba, Sierra Leone, April 1892, *Scott-Elliott* 5717 (Kew, Brit. Mus.).

***Heliotropium Baclei*** DC., var. **rostratum**, nom. nov. *H. katan-gense* Gürke in De Wild. *Études Fl. Katanga* iii. 223 (1903); Baker, *Fl. Trop. Africa* iv. pt. 2, 43 (1905). *H. nigerinum* A. Chev. *Explor. Bot. Afr. Occid. Fr.* i. 450 (1920), nomen. *H. marifolium* of Baker, l. c. 40, in pt.—AFRICA: near water, flowers bright yellow, Sesheke Dist., Rhodesia, *Gairdner* 186 (Kew); wet sands near river, flowers

yellow, Victoria Falls, Zambesi, Feb. 1906, *Allen 289* (Kew); flowers bright yellow, Elephant Marsh, North Nyasaland, Dec. 1887, *Scott* (Kew); flowers yellow, dry sandbank of the Ugala River, Tanganyika Terr., March 29, 1882, *Böhm 123* (Berlin); Lukafu, Katanga, *Verdick 174* (Berlin); Mokele, Belg. Congo, Sept. 1914, *Vanderyst 4591* (Brit. Mus.); Kasai, Belg. Congo, Sept. 1914, *Vanderyst 4629* (Brit. Mus.); dunes along streams in the marigots of Sudan, 1880, *Lécard 42* (Berlin; Delessert); dunes along the Niger near Sebi, Sudan, July 11, 1899, *Chevalier 1168* (Kew).—The African material of the *Axillaria* seems to represent a single species. In its typical form it is confined to west Africa and is characterized by having its fruit broadly conical and not long-beaked. The forms of the species in central Africa, however, have the fruit drawn up into a very long and conspicuous beak. Because of the geographical correlation of this fruit variation I have thought it worthy of varietal recognition. The forms with beaked fruit have been published upon as *H. katangense* and *H. nigerinum*. In treating them for the first time as a variety, however, I have taken the opportunity of applying to them a really descriptive name. The varietal name may be considered as having the same type as *H. katangense* Gürke.

**Sericostoma calcarea** (Vatke), comb. nov. *Heliotropium calcareum* Vatke, *Linnaea* xliii. 318 (1882). *S. albidum* Franchet in *Révoil, Fauna et Fl. Pays Comalis (Sert. Somal.)* 46 (1882). *S. verrucosum* Beck. in *Paulits. Harar* 457, fig. 3–6 (1888). *H. albo-hispidum* Baker, *Kew Bull.* 220 (1895). *S. strigosa* Defflers, *Bull. Soc. Bot. France* xliii. 120 (1896). *H. Vatkei* Baker in *Thiselton-Dyer, Fl. Trop. Africa* iv. pt. 2, 39 (1905).—This species is known only from Somaliland and southwestern Arabia. It is very closely related to *S. Kotschyi* (Boiss. & Hohen.) B. & H. ex Jackson, *Index Kew*, iv. 885 (1895), from the head of the Persian Gulf and may be no more than a variety of that species distinguished by its coarsely tuberculate rather than smoothish nutlets. *Sericostoma calcarea* varies in the size of its leaves, and somewhat also in the size of the slightly irregular corollas, though by no means sufficiently to justify the recognition of the species that I have listed above in synonymy. The synonyms that were described as species of *Heliotropium* have been universally accepted in that latter genus, despite the fact that even a most hasty dissection would have revealed their true generic affinities. It perhaps should be mentioned here that although *H. calcareum* Vatke and *S. albidum* Franch. were both published in 1882 the former name has indubitable priority since Franchet, l. c. 8, cites Vatke's paper in his bibliography.

**Sericostoma arenaria** (Vatke), comb. nov. *Heliotropium arenarium*

Vatke, *Linnaea* xliii. 319 (1882).—This remarkable species is known only from the type collected on the coastal hills near Baraua, Somaliland. It is characterized by its congested inflorescence, shallowly lobed calyx, oblanceolate leaves and its firm oddly shaped corollas. The corolla is coarse and herbaceous in texture and is pustulate outside. The tube is cylindrical but the faux is globular.

MACROMERIA LONGIFLORA Don, *Edinb. New Philos. Jour.* xiii. 239 (1832) *Onosmodium longiflorum* Macbr. *Contr. Gray Herb.* xlix. 21 (1917). *M. discolor* Benth. *Pl. Hartw.* 49 (1840). *O. discolor* Macbr. l. c. 20.—I have examined the type of Don's *M. longiflora*, which is now preserved in the British Museum. It is unquestionably the same species as that which was subsequently described as *M. discolor* Benth. Don's type, which was a part of the Ruiz Herbarium formerly owned by Lambert, bears the manuscript name, *Lithospermum longiflorum*. Another old specimen of this very same species, also bearing the name *L. longiflorum*, is to be found among the Pavon collections in the Boissier Herbarium. Number 905 of Sesse & Mociño's plates in the library of the Delessert Herbarium apparently also represents the species. Although the old specimens from the collections of Ruiz and of Pavon bear the name *Lithospermum longifolium* I rather doubt that they are the same as the plant described under that name in Sesse & Mociño's posthumous work, the *Flora Mexicana* 29 (1894). It seems scarcely likely that *M. discolor*, i. e. *M. longiflora*, which is characterized by its closely appressed, almost strigose, pubescence would be described as having hirsute stems and leaves.

In my treatment of *Macromeria*, *Contr. Gray Herb.* lxx. 14 (1924), I identified *M. viridiflora* DC. with *M. Thurberi* (Gray) Mack. This disposition I am now inclined to doubt. *Macromeria viridiflora* is based entirely upon number 904 of the De Candolle set of copies from Sesse & Mociño's plates. Until last year I had seen only a tracing of this plate. Since then, however, I have seen the original at Geneva. I regret to say that this opportunity did not assist me in definitely placing *M. viridiflora*. I can only suggest that plate no. 904 may represent *M. Thurberi* or an otherwise unknown species or one poorly drawn and hence unrecognizable. With more data at hand regarding the distribution of *M. Thurberi* and with more information as to the itinerary of Sesse and Mociño I am inclined to believe now that they could scarcely have collected the northern species, *M. Thurberi*. Consequently until authentic material of *M. viridiflora* is seen or until collections made in central Mexico are found which agree with plate 904 I believe that the name *M. viridiflora* had best be treated as too obscure and doubtful for recognition.

**Cryptantha mendocina**, sp. nov., annua ca. 15 cm. alta ascendenter ramosa hispida; foliis linearibus vel lineari-spathulatis 1.5–3 cm. longis 1–3 mm. latis ad apicem versus latioribus abundanter minuteque pustulatis apice obtusis vel subrotundis superioribus paullo reductis; spicis solitariis vel rariter geminatis breviter pedunculatis 3–4 cm. longis evidenter foliaceo-bracteatis, bracteis calycibus plus minusve duplo longioribus; corolla inconspicua 2–2.5 mm. longa alba, lobis ca. 0.5 mm. longis ascendentibus; calycibus fructiferis laxè dispositis ascendentibus 5–6 mm. longis ad basem versus 2–2.5 mm. crassis paullo asymmetricis tarde vel vix deciduis basi rotundis; pedicellis evidentibus rigidis 1.5–2 mm. longis, lobis subulatis vel subulato-linearibus conniventibus sed ad apicem versus recurvatis imam ad basem connatis marginibus breviter hispido-villosis, costa lobi valde prominenti crassa indurata setis 1–1.5 mm. longis rigidis pallidis horrida; ovulis 4; nuculis 4 evidenter heteromorphis; nucula axillari maxima persistenti pallida 2–2.3 mm. longa ca. 1.1 mm. lata lanceolata ovata vel anguste ovata abundanter minuteque tuberculato-granulata et evidenter tuberculata papillatave, basi obtusa, lateribus rotundis, apice acuta, ventre ca.  $\frac{3}{4}$  longitudinis ad gynobasem quadrangulicolumnarem 1–1.2 mm. longam affixa, sulco paullo asymmetrico ad apicem versus nuculae clauso ad medium versus in areolam latam vix excavatam abrupte expanso; nuculis 3 homomorphis deciduis crassis 1.8–1.9 mm. longis paullo lucentibus ovato-oblongis inconspicue minuteque tuberculato-granulatis et evidenter papillatis, dorso rotundis, marginibus rotundis, lateribus subplanis, ventre ca.  $\frac{3}{4}$  longitudinis ad gynobasem affixis, sulcis asymmetricis apice nuculae clausis paullo infra apicem in areolam cuneatam vel lanceolatam evidenter excavatam ampliatis; stylo ca. 0.8 mm. longo nuculis 3 homomorphis superanti nuculae axillari aequanti vel rariter paullo superanti.—

ARGENTINA: dry place, Potrerillos, Prov. Mendoza, 1400 m. alt., Oct. 20, 1907, *Corn. Osten 5129* (TYPE, Herb. Boissier; fragments, Gray Herb.).—This species, while very distinct from any of the known South American members of the genus, is very closely related to and perhaps no more than varietally distinct from the North American *C. minima* Rydb., a plant which ranges almost exclusively east of the Rocky Mountains and extends from northern Texas northward into Canada. The Argentine plant differs from its northern relative in being a more slender plant, having slightly smaller less conspicuously thickened fruiting calyces and in having evidently tuberculate or papillate odd-nutlets. In *C. minima* the odd nutlet, i. e. the axial one, is minutely and finely tuberculate- or papillate-granulate as in *C. mendocina* but lacks the large coarse tuberculations present in the

southern species. Among the species of South America *C. mendocina* may be quickly distinguished by the very evident heteromorphy of its nutlets, the axial one of each fruit differing from the remaining ones not only in persistence but in size, shape, color and roughenings. It is of particular interest being clearly a member of the *Texanae*, Johnston, Contr. Gray Herb. lxxiv. 54-60 (1925), a group heretofore thought to be confined to North America.



CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCIII.

SPECIFIC SEGREGATIONS AND IDENTITIES IN SOME  
FLORAS OF EASTERN NORTH AMERICA  
AND THE OLD WORLD.

BY M. L. FERNALD.

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HARVARD UNIVERSITY.—NO. XCIII

SPECIFIC SEGREGATIONS AND IDENTITIES IN SOME  
FLORAS OF EASTERN NORTH AMERICA  
AND THE OLD WORLD<sup>1</sup>

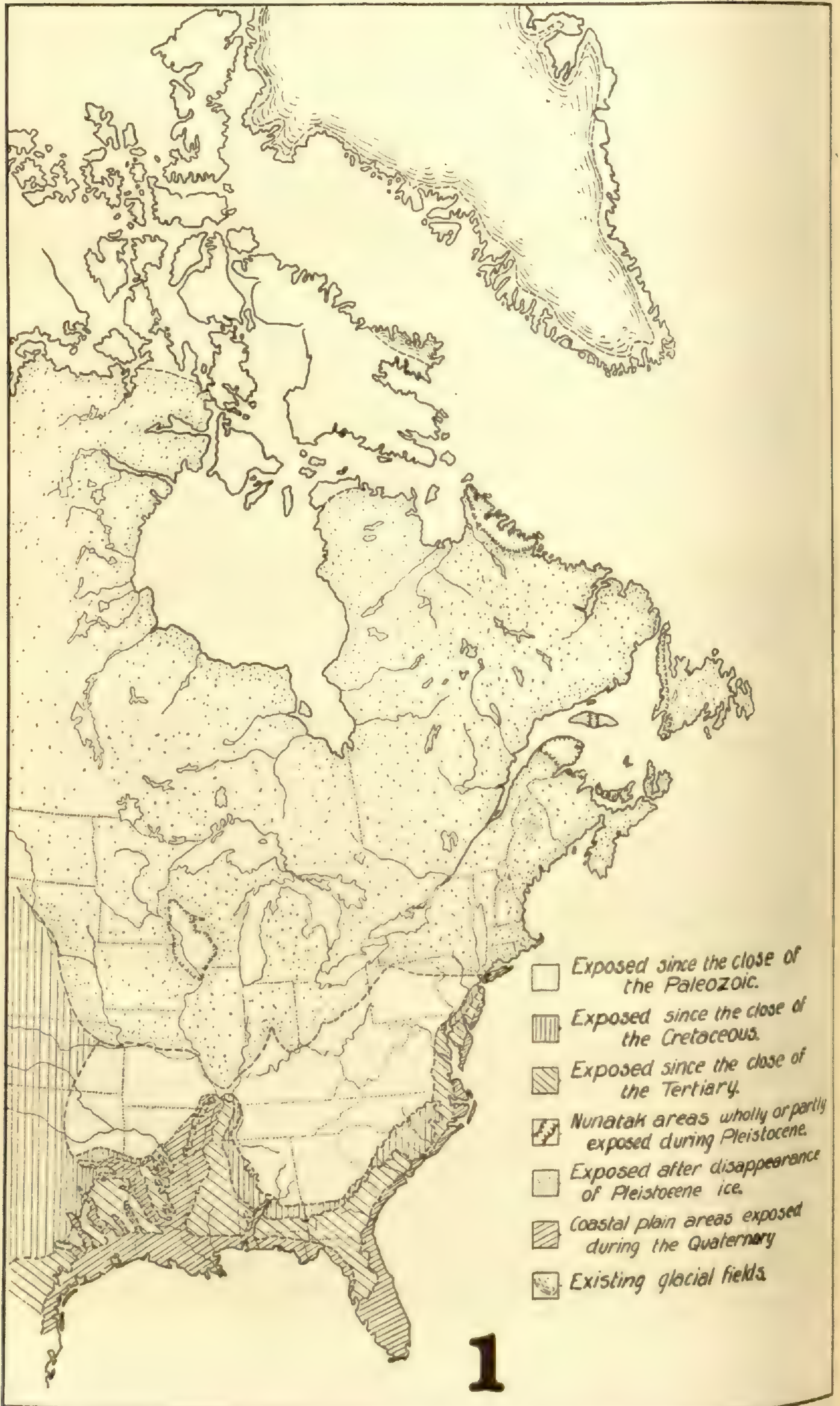
M. L. FERNALD

(Plate 204)

I HAVE assumed that I am expected to base my discussion primarily on some features of phytogeography which I have personally examined, rather than to attempt extensive generalizations concerning floras with which I am absolutely unfamiliar. Granted this assumption, I must start with a consideration of problems centering on a limited area of eastern North America, the region of the Atlantic slope extending from the Labrador Peninsula to the Atlantic States and the Mississippi Valley (MAP 1). This district, however, is sufficiently extensive clearly to exhibit large areas which, since the dawn of Angiosperms, have had quite different physiographic and floristic histories.

Viewed from the standpoint of availability for occupation by flowering plants, the oldest large section of the region is the southern half of the Appalachian Upland, extending from central New York to northern Georgia and northern Alabama, and west of the Mississippi represented by the Ozark Plateau. Never, since it was first occupied

<sup>1</sup> Originally announced under the above title for the joint Discussion on *Geographical Distribution and its Relation to the Concept of Species* of Sections E (Phytogeography and Ecology) and T (Taxonomy and Nomenclature) but, at the invitation of the Executive Committee, expanded and presented (under an abbreviated title) in the General Programme of the Fifth International Botanical Congress at Cambridge, England, Thursday evening, August 21, 1930.



Map 1, Periods of Availability for Plant-Occupation of Eastern North America since the Paleozoic.

by Angiosperms, has the Appalachian Upland of the United States (and Canada) been invaded by seas; and, except for its northern extension, it lies wholly south of the limits of the Pleistocene glaciation. During the Cretaceous, while this southern half of the Appalachian region was covered by land-vegetation, the lower marginal country, east, south and far to the west and northwest, was submerged under the Cretaceous seas. In the Tertiary, likewise, much of the low-lying Coastal Plain was again covered by shallow seas; and, furthermore, the outer margin of the Coastal Plain is often of very modern or Quaternary origin.

North of the southern Appalachians and extending north to northern Labrador and the subarctic and arctic continental coast is the area which was covered by Pleistocene ice, the last advance of which, the Wisconsin, is estimated to have begun its frontal decay only 25,000-30,000 years ago, while the northern limit of this advance in eastern America is represented by the living glacial field of eastern Baffin Island and the almost continental ice-cap of Greenland. Although the Wisconsin or most recent continental ice-sheet in the median latitudes of North America and its confluent valley-glaciers together denuded or modified a vast area, there are several nunatak areas known, where the last glaciers did not develop or where their work was so restricted as to leave essentially undisturbed some regions of mountains, high plateaus and precipitous headlands and, in the famous "driftless area" of Wisconsin, Illinois, Iowa and Minnesota, even of prairie. In the area we are specially considering the most notable of these nunataks<sup>1</sup> or regions unglaciated or only slightly denuded by the last continental ice-sheet are the Torngat Mountains, just south of the eastern entrance to Hudson Strait, large areas of Newfoundland, especially centering on the Long Range near the West Coast, the eastern half of the Gaspé Peninsula of Quebec, and some other smaller and isolated spots about the Gulf of St. Lawrence.

Temperate eastern North America has, then, an extensive area (the southern Appalachian Upland) in which land-plants have had an opportunity to spread since the advent of Angiosperms; others (limited portions of the inner Coastal Plain and much of the central plain of the United States) where living floras could have taken possession only after the withdrawal of the Cretaceous seas; others (much of the

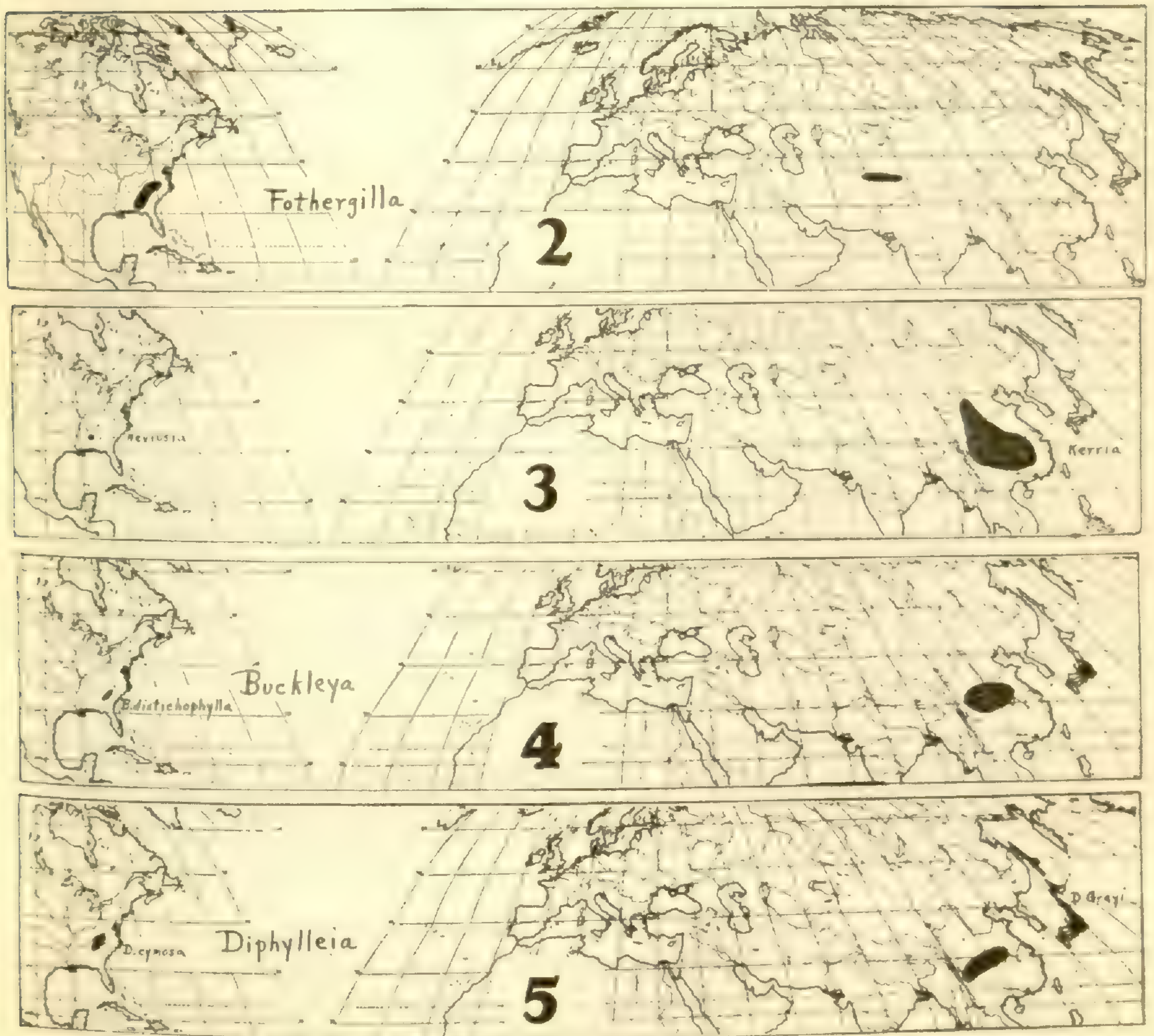
<sup>1</sup> For enumeration and discussion of these areas see Fernald, *Persistence of Plants in Unglaciated Areas of Boreal America*, Mem Amer. Acad. xv. No. III. (Mem. Gray Herb. II.) 295-317 (1925).

Atlantic and Gulf Coastal Plains) unavailable to land-plants until the tipping off of the Eocene and the Miocene waters; others (the nunatak areas) which apparently retained their present distinctive floras through at least the last glaciation; still another, the largest of all, the vast region of Canada and the Northern States which has become available for wholesale occupation by plants only since the decay of the Wisconsin ice, within the last few thousand years; almost as young or in some regions even younger, scattered areas at the outer margin of the Coastal Plain, of very recent or Quaternary origin; and, youngest of all, the million or more square miles cleared and fundamentally altered by the white man during the last three centuries.

These strongly contrasted periods of availability to plant-populations of different eastern American areas are, of course, closely paralleled in other regions: for instance, in Europe, with the western third of the Iberian tableland uninvaded by the Cretaceous and the Tertiary seas which drowned much of the continent; others, like much of the Mediterranean basin, largely unavailable until the withdrawal of the Tertiary seas; and still others, such as southern Scandinavia, only a few thousand years removed from submergence under the Great Baltic Glacier. The distinctive floras which characterize the different physiographic areas of temperate eastern North America are very definite, and it is my purpose, in so far as time will allow, to direct attention to the different degrees of specific segregation shown, especially by the amphigean or the world-wide genera in these different floras.

In the ancient Appalachian Upland of the United States the outstanding phytogeographic feature is, of course, the great mesophytic forest of Mesozoic or early Cenozoic genera, many of them formerly found likewise in Europe, western America and the Arctic but now restricted to one or more areas of eastern North America, eastern, central or southwestern Asia<sup>1</sup> or the geologically ancient peninsulas of

<sup>1</sup> The identity or close similarity of angiospermous genera of eastern Asia and eastern North America was recognized as early as 1750 by Halen, a student of Linnaeus, who, in his thesis, *Plantae Camschatcenses Rariores*, pointed out (in § V) several such cases—see L. Amoen. Acad. ii. 336 (1751). This relationship has subsequently been frequently emphasized and many typical examples are well known. Consequently, only a few illustrations, perhaps less generally familiar, are here enumerated. Other cases are discussed in the following papers by myself: *The Geographic Affinities of the Vascular Floras of New England, the Maritime Provinces and Newfoundland*, Am. Journ. Bot. v. 228 (1918); *Isolation and Endemism in Northeastern American and their Relation to the Age-and-Area Hypothesis*, Am. Journ. Bot. xi. 570 (1924); *The Antiquity and Dispersal of Vascular Plants*, Quart. Rev. Biol. i. 222, 227, 229 (1926); *Some Relationships of the Floras of the Northern Hemisphere*, Proc. Intern. Congr. Pl. Sci. ii. 1489 (1929).



Map 2, Geographic Range of FOTHERGILLA; 3, of KERRIA, and its American Representative, NEVIUSIA; 4, of BUCKLEYA; 5, of DIPHYLLEIA.

southeastern Europe: *Fothergilla* (MAP 2)<sup>1</sup> with a few excessively rare species in the southern Appalachians and one on the wooded slopes of Kashmir and adjacent Afghanistan; *Hamamelis*, with wide-ranging eastern American species and localized Asiatic representatives; *Magnolia*, highly developed in both southeastern North America and southeastern Asia; *Neviusia* (MAP 3), like an apetalous representative of the local Chinese *Kerria*<sup>2</sup> and known only from a very restricted station in the foothills of Alabama; *Pachystima*, *Stewartia*, *Symplocarpus*, *Panax*, *Shortia*, *Phryma*, *Triosteum* and scores and scores of others. It was this vast assemblage in the southern Appalachian

<sup>1</sup> The world-maps used to show ranges of plants in this paper are made on Goode's Homolographic Projection, published and copyrighted by the University of Chicago.

<sup>2</sup> *Kerria japonica* DC., in spite of its specific name, is endemic in China.

region as well as the remarkable relics on the Coastal Plain of the United States which stimulated Guppy, congratulating American students upon the superabundance of these ancient types still living and picturing the emotions of a student appreciative of his opportunity, to write:

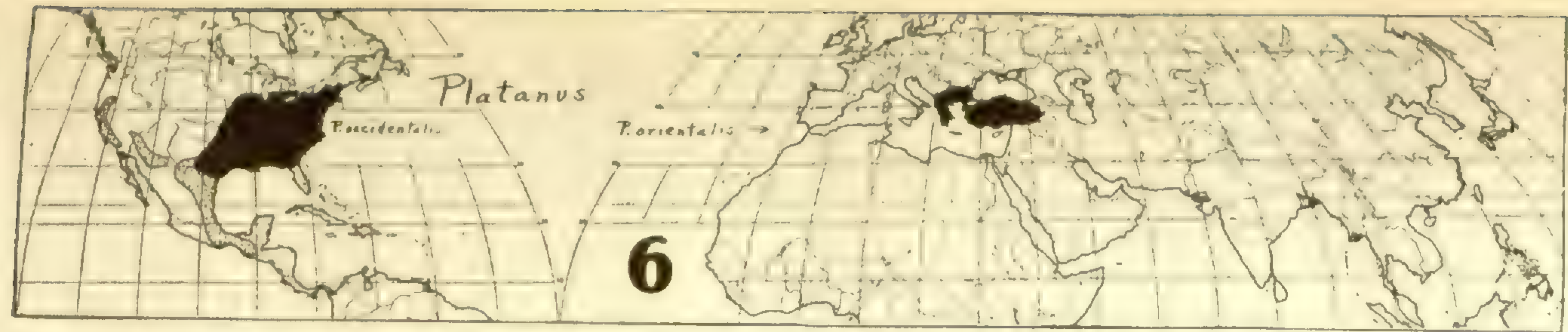
“In the woods around him were growing the Liquidambar, the Sassafras, and other shrubs and trees that had flourished in the Mesozoic ages in the spot where he was standing. Their remains crowded the Cretaceous deposits exhibited in the cliffs near by. Specimens of the past and of the present were in his hands. Though the difference in kind was very slight . . . the difference in time, measured in human lives, amounted to eternity. It is a story of perpetuity rather than of change . . . He begins with the cosmopolitanism of such types in the Cretaceous age and he ends with their more restricted distribution and somewhat greater specialization now. . . . Those old genera become the genera of today; and the genera of today, though the genera of a thousand ages, are ‘but as yesterday’ in the history of flowering plants.”<sup>1</sup>

Not only, as Guppy so vividly stated, are these Appalachian genera of today the genera of a thousand ages; their species are also ancient and usually sharply differentiated. No one with good material would fail to distinguish the two or three local Japanese and Chinese species of *Buckleya*<sup>2</sup> from the famously rare American *B. distichophylla* Torr. (MAP 4), the latter American shrub parasitic on the roots of *Tsuga*, the American *Menispermum canadense* L. from the Asiatic *M. dauricum* DC., the extremely local American *Cladrastis lutea* (Michx.) K. Koch from the Japanese *C. platycarpa* Mak. and the other Asiatic species; nor such herbs as the highly localized Appalachian *Diphylleia cymosa* Michx. (MAP 5) from the less localized Asiatic *D. Grayi* F. Schmidt, or the American *Podophyllum peltatum* L. from the Asiatic *P. emodi* Wall. Such illustrations of this eastern Asiatic-eastern American generic similarity but specific differentiation could be increased by hundreds but these must now suffice.

Turning to genera, subgenera or sections shared by Appalachian America and eastern or southeastern continental Europe, we again get sharp specific differentiations: the Old World *Platanus orientalis*

<sup>1</sup> Guppy, *Fossil Botany in the Western World: an Appreciation*, Am. Journ. Sci. ser. 4, xlix. 372 (1920).

<sup>2</sup> For memoranda on the Asiatic ranges of *Buckleya* and some other genera I am indebted to the kindness of Dr. Handel-Mazzetti.



Map 6, Geographic Range of PLATANUS; 7, of CERCIS; 8, of COMANDRA.

HERBARIUM  
MICHIGAN

L. (MAP 6) and the American *P. occidentalis* L. (with some related trees farther west); the Appalachian *Anemone lancifolia* Pursh, which has generally been confused with the European *A. trifolia* L. but which differs<sup>1</sup> in constant details of the flowers; the Eurasian *Cercis Siliquastrum* L. (MAP 7) and the American *C. canadensis* L., with other species in western North America and in central China; the common American genus *Comandra* (MAP 8) with a single Eurasian representative, the comparatively localized *C. elegans* (Rochel) Reichenb.; and so on through dozens of groups, the southeastern European and the eastern American species usually having western North American representatives as well. In the cases just cited the Appalachian and the Old World species are sharply distinguished, but there are a few (perhaps a dozen) cases of Angiosperms (and still more in the Pteridophytes) where the differentiation of species is not so complete, the eastern American and the Asiatic plants being considered by some systematists as recognizable species, by others as merely geographic varieties: such cases as *Tovara virginiana* (L.) Raf., *Polygonum sagittatum* L., *Liriodendron Tulipifera* L.,<sup>2</sup> *Phryma Leptostachya* L. and *Aruncus sylvester* Kosteletz.; while in a few cases, such as *Symplocarpus foetidus* (L.) Nutt. and *Monotropa uniflora* L., search has failed to reveal even significant varietal differences. Admitting these very few exceptions (which will become significant when we have examined the historical relation of the mesophytic Alleghenian flora to the prevailing xerophytic and hydrophytic Coastal Plain groups), however, when the hundreds of species of Appalachian angiospermous genera are compared with their Old World representatives the general conclusion is

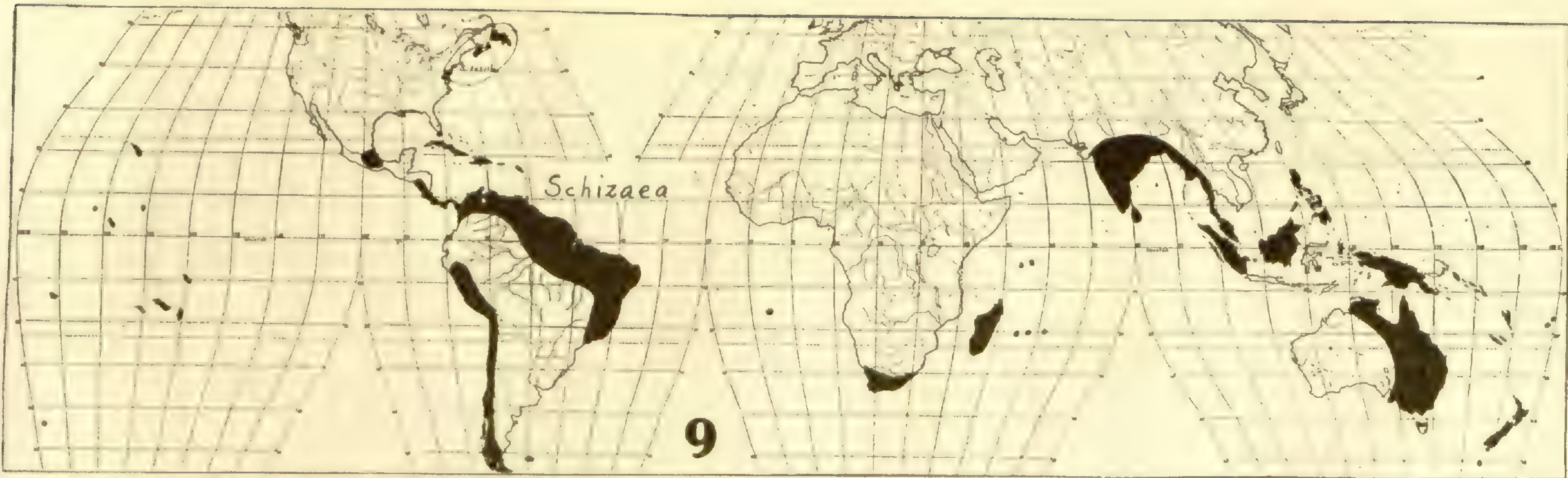
<sup>1</sup> See Fernald, RHODORA, xxx. 184 (1928).

<sup>2</sup> There is a very general impression that *Liriodendron* is one of the most ancient of Dicotyledons and that its antiquity is demonstrated by its having occurred in Greenland during the Cretaceous. The error involved has been well summarized by Seward: "Among the numerous species of Dicotyledons are some which it has been customary to refer to the genus *Liriodendron*, now represented by the Tulip-tree of North America and China. A recent examination of specimens [from Greenland] of these simple, emarginate 'leaves' has convinced me that they are the leaflets of a compound leaf, a conclusion which had previously been reached by some other palaeobotanists who have examined specimens from North American and European Cretaceous rocks. In a recently published book on 'Tree Ancestors,' the American palaeobotanist, MR. E. W. BERRY, speaks of the occurrence of *Liriodendron* in Greenland, but I venture to think that there is no satisfactory evidence in support of this statement. Though it is not possible from the available material to refer the leaflets to any one recent genus with complete confidence, the probability is that they belong to compound leaves of a plant closely allied to some existing species of *Dalbergia* or possibly *Pterocarpus*, genera with a wide geographical distribution in the tropics and both occupying a similar position in the Leguminosae."—Seward, *Arctic Vegetation Past and Present*. Journ. Royal Hort. Soc. 1. pt. 1: 15 (1925).

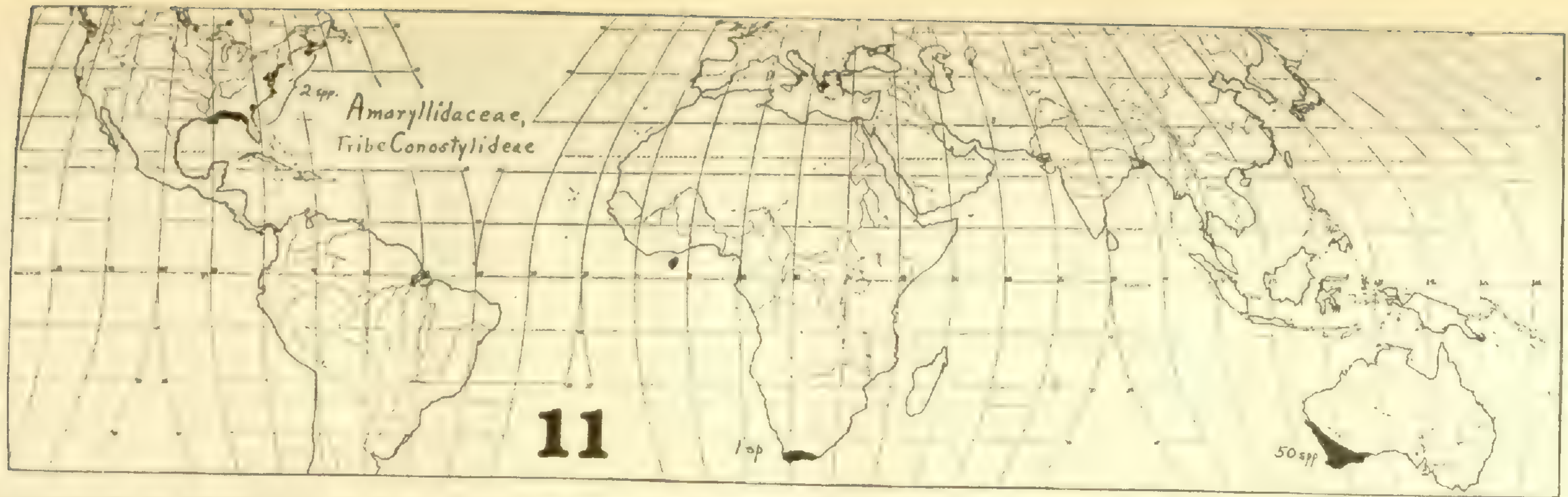


apparent: that in nearly all groups the species of the Western Hemisphere are completely segregated from those of the Eastern; that we here have stable or essentially stable specific entities.

Descending to the broad outer Coastal Plain of Atlantic North America, the region of silicious and acid peaty soils of Tertiary or later origin, we come to a change in the flora so striking as immediately to challenge attention; for, whereas the distinctive non-endemic genera of the southern Appalachian region are those shared with temperate eastern and central Asia or with southern or eastern Europe, the Old World elements in the indigenous Coastal Plain flora of Atlantic North America are prevailingly the groups with wide tropical and subtropical range, the families, tribes, genera and sections shared by the Americas with tropical and subtropical Africa, tropical and subtropical Asia, and Australia but for the most part unknown in temperate Europe and largely unrepresented in temperate Asia. For instance, if I may be permitted to leave for a moment the Angiosperms and to draw an illustration from the Pteridophytes, the ancient genus *Schizaea* (MAP 9), with 20–25 species confined to the Southern Hemisphere and the Tropics, in the Old World unknown north of Madagascar, the Seychelles, India and the Philippines; in the New World wanting north of tropical Mexico and subtropical Florida, but with the single famous exception, *Schizaea pusilla* Pursh. This solitary northern species was long supposed to be restricted to a limited area of the northern Coastal Plain, in New Jersey, but we now know that the regions of its wide-spread abundance are the peats of more northern Nova Scotia and still more northern Newfoundland; *S. pusilla* on the latter island being a typical species both of the highest unglaciated tablelands and of the lower regions recently covered by Wisconsin ice. Very similar tropical or austral relationships are shown by the majority of non-endemic genera and tribes of Angiosperms (and especially of Monocotyledons) on the Atlantic Coastal Plain: the *Haemadoraceae* (MAP 10) restricted to Australia, South Africa, tropical America and the Atlantic Coastal Plain north to Massachusetts; the tribe *Conostylideae* (MAP 11) of the *Amaryllidaceae* with 50 species in southwestern Australia, 1 in South Africa and 2 in eastern North America, the American species both excessively local but one of them extending north to Nova Scotia; the *Xyridaceae* (MAP 12) confined to the Southern Hemisphere and the Tropics except for an extension northward along the eastern margin of North



Map 9. Geographic Range of SCHIZAEA, S. PUSILLA in ellipse; 10, of the HAEMADORACEAE.



Map 11, Geographic Range of the AMARYLLIDACEAE, Tribe CONOSTYLIDEAE; 12, of the XYRIDACEAE.

America quite to latitude 50° in Newfoundland, with a slight isolation inland in the north about the Great Lakes and an area of disrupted colonies (of *X. torta* Sm.) on the 4000-foot silicious tablelands of the southern Appalachians; and so on with prevailingly tropical or austral groups like *Lophotocarpus*, *Eriocaulon*, *Hypoxis*, *Drosera* (MAP 28), *Galactia*, *Lilaeopsis*, the *Pontederiaceae*, *Burmanniaceae*, *Podostemaceae* and hundreds of other groups.

Although the eastern American representatives of the tropical and austral groups are there now concentrated on the soils of Tertiary, Quaternary or even Pleistocene origin, they are by no means restricted to the comparatively youthful areas. Here and there along the ancient tableland-crests of the Appalachian system, wherever the primitive, open xerophytic or hydrophytic conditions prevail and where the denuding action of the Pleistocene ice was not too severe, we are learning to expect rare and highly localized members of the so-called Coastal Plain flora, like *Xyris torta* (MAP 31) just referred to. Through Mesozoic time the Appalachian Mountains of the present day did not exist as mountains but, as Berkey succinctly puts it, "The continent stood much lower than now. Portions that are now mountain tops and the crests of ridges were then constituent parts of the rock floor of the peneplain not much above sea level. . . . Such conditions prevailed over a very large region—certainly all of the eastern portion of the United States."<sup>1</sup> The following, from among the very numerous corroborative statements, are representative of the consensus of geological opinion. "Jurassic time throughout the greater part of North America was one of erosion. . . . This erosion cycle brought about the final transformation from the old topographic expression of high Appalachian . . . mountains to a nearly base-leveled land."<sup>2</sup> "Once more there was prolonged quiet. The fault-block mountains were persistently attacked by the erosive agents and were reduced [in early Cretaceous], like their Appalachian predecessors, to an almost plane surface, close to sea-level."<sup>3</sup> "It is known as the 'Cretaceous Peneplain,' because of its best development during the Cretaceous period. This vast plain extended over the areas of the Appalachian Mountains, Piedmont Plateau, all of New York state, the Berkshire Hills, and the Green and [the] White Mountains. . . . The Cretaceous period was closed in eastern North America

<sup>1</sup> Berkey, N. Y. State Mus. Bull. no. 146: 67 (1911).

<sup>2</sup> Schuchert, Historical Geol. 846 (1915).

<sup>3</sup> Daly, Our Mobile Earth, 297 (1926).

by a disturbance which produced an upwarp of this vast Cretaceous peneplain with maximum uplift of from 2000 to 3000 feet . . . to produce a broad dome sloping eastward and westward, and northward to the Gulf of St. Lawrence and southward to the Gulf of Mexico."<sup>1</sup>

And studies by the geologists farther north clearly indicate that the peneplained or baseleveled condition of the ancient mountain-axes extended at least to Newfoundland and apparently to northern Labrador, if not beyond. For example, Alcock, reporting on the Shickshock Mountains of Gaspé, famous, like the tablelands of western Newfoundland, for having stood undisturbed above the local ice-sheets of the Pleistocene,<sup>2</sup> says: "Gaspé peninsula . . . is a region of Appalachian structure, . . . The interior of the peninsula is a plateau dissected by deep valleys . . . The most striking feature is, probably, the mature character of the upland topography . . . the skyline is comparatively even in all directions. . . . Gaspé peninsula, therefore, is a region which must have been base-leveled and, later, uplifted and dissected. . . . A youthful topography, represented by these steep-walled valleys, is superimposed upon the old age topography of the upland surface."<sup>3</sup> Similarly, Twenhofel, whose intimate knowledge of the physiography of the region is unequalled, says: "To one approaching Newfoundland from Sidney [Cape Breton] . . . , the most impressive feature is the high flat-topped upland, here rising almost vertically from the sea. . . . If Newfoundland be observed from the Labrador side, one feature will attract and maintain the attention: the flat-topped upland, standing boldly and prominently in view. . . . The sky line of the Long Range is strikingly horizontal and the appearance of an equal height in all its parts is not a fiction resulting from a distant view, for it remains the same near as well as far. . . . The accordance of the summit levels of the highlands, . . . the presence of well preserved flat-topped mountains at many localities with the projected plane of their summits

<sup>1</sup> Miller, *Historical Geol.* ed. 3: 278, 279 (1928).

<sup>2</sup> "There is no evidence that glaciers worked on the highest parts of the Shickshock mountains"—Coleman, *Physiography and Glacial Geology of Gaspé Peninsula, Quebec*, Can. Dept. Mines, Geol. Surv. Bull. 34 (1922); "The Shickshock Mountains, though occupied by local glaciers during the Pleistocene, escaped the erosion of the continental ice sheets."—Alcock, *Across Gaspé*, Geogr. Rev. xiv. 208 (1924); "the southern part of the Long Range . . . seems to have remained as an area free from ice on which pre-glacial plants could survive."—Coleman, *The Pleistocene of Newfoundland*, Journ. Geol. xxxiv. 220 (1926).

<sup>3</sup> Alcock, *Geology of Lemieux Township, Gaspé County, Quebec*, Geol. Surv. Can. Summ. Rep. 1921, Pt. D, 76, 77 (1922).

truncating all kinds of structure and rock, . . . : these are considered evidence of the present dissection, but one time perfection of a peneplain, a plain of erosion of remarkable perfection extending over the whole of Newfoundland. . . . On this ancient plain the rivers were free to wander where they would, . . . They probably crossed the site of the present mountain ranges and, when the land arose, each stream struggled to maintain its position. . . . In the eastern United States throughout the Appalachians, the existence of an extensive peneplain, completed before the end of Cretaceous time, is now universally admitted and with this base level that of Newfoundland is tentatively correlated, and the period of development and close of the cycle assumed to be the same."<sup>1</sup> Beginning with the close of the Cretaceous and continuing, with minor interruptions, through Tertiary time this floor of ancient Appalachian rock, only slightly above sea-level, was gradually uplifted and deeply weathered and sculptured to produce the Appalachian Upland of today; and as the upwarping of the older land progressed the marginal region, which had been overlapped by the shallow Tertiary seas, was also elevated, tipping off the Tertiary waters and extending the emerging continent a full 100 miles (160 kilometers) eastward to the margin of the now submerged continental shelf. The American geologist, Miller, thus puts the matter: "The uplift of the great Cretaceous peneplain was an event of prime importance for the eastern United States, because it literally furnishes us with the beginning of the history of most of the existing relief features of the Appalachian district as well as New York and much of New England. Hence we assert, with emphasis, that all the principal topographic features of this region as we see them today date from the uplift of the Cretaceous peneplain, because they have been produced by the dissection of that upraised surface. This dissection was largely the work of erosion. . . . All the valleys, great and small, such as the Champlain, Connecticut, Mohawk, Hudson, the Great Lakes valleys, and the valleys of the Appalachians, have been produced since the uplift of the peneplain."<sup>2</sup>

In view of this well attested physiographic and ecological change of the Appalachian Upland, from a baseleveled or coastal-plain status, with sluggish drainage and innumerable shallow pools and boggy de-

<sup>1</sup> Twenhofel, *Physiography of Newfoundland*, Am. Journ. Sci. ser. 4, xxxiii. 7, 18, and 19 (1912).

<sup>2</sup> Miller, *Hist. Geol.* ed. 3: 326-329 (1928).

pressions through much of the Cretaceous, to its present elevated and deeply dissected condition, it is certainly significant that in favorable habitats at different points on the now uplifted ancient peneplain we find relic-colonies of such tropical or austral genera as *Schizaea*, *Lygodium*, *Stenophyllum*, *Eriocaulon*, *Xyris*, *Lobelia* and that peculiar terrestrial group of *Utricularia*, sometimes treated as a genus, *Stomoisia*, with 50 species in tropical Asia, Africa, Australia, eastern South America and eastern North America; and mingled with the typical lowland plants of tropical or austral affinity on the high Appalachian crests and tablelands we sometimes find similar relic-colonies of characteristic endemic American genera of the Atlantic Coastal Plain: *Orontium*, *Xerophyllum*, *Helonias*, *Calopogon*, *Cleistes*, *Sarracenia*, *Hudsonia*, *Rhexia*, *Leiophyllum*, *Bartonia* and numerous others. *Schizaea pusilla* of the Pine Barrens of New Jersey and of the peaty barrens of Nova Scotia and Newfoundland occurs, likewise, on the highest unglaciated tablelands (the uplifted Cretaceous peneplain so much emphasized above) of Newfoundland. My first experience with it was on the diorite tableland of the Blomidon Range, my published note reading: "Among the tufts of *Scirpus caespitosus* . . . was the famous little fern of the New Jersey Pine Barrens, *Schizaea pusilla*. . . . Here at 2000 feet altitude it abounded over many acres, nestling in the bases of the *Scirpus* tussocks."<sup>1</sup> Fifteen years later the great student of Pleistocene geology, Coleman, visiting Blomidon, wrote: "From this [1,560 feet] to the highest point reached (1,700 feet) . . . there was no evidence of glaciation."<sup>2</sup> *Lygodium palmatum* (Bernh.) Sw., the only living member of this tropical genus now found on the Appalachian tablelands, has upland stations scattered from western New England to Tennessee; *Eriocaulon septangulare* With., *Xyris montana* Ries, *Lobelia Dortmanna* L. and *Utricularia* (*Stomoisia*) *cornuta* Michx. abound in pools on the tablelands of Newfoundland, there often associated with *Schizaea pusilla*; the *Eriocaulon*, *Xyris*, *Utricularia* and *Lobelia* also occurring, along with the Coastal Plain *Lygodium palmatum*, *Orontium aquaticum* L., *Amianthium muscaetoxicum* (Walt.) Gray, *Aletris farinosa* L. and *Rhexia virginica* L. on the tablelands of Pennsylvania.<sup>3</sup> *Xerophyllum asphodeloides* (L.) Nutt. and *Zigadenus leimanthoides* Gray, ordinarily Coastal Plain plants, have long been known from the high tablelands of North

<sup>1</sup>Fernald, RHODORA, xiii. 133 (1911).

<sup>2</sup>Coleman, Journ. Geol. xxxiv. 210 (1926).

<sup>3</sup>Porter, Flora of the Pocono Plateau, RHODORA, i. 183-185 (1899).

Carolina; *Leiophyllum prostratum* Loudon and *L. Hugerii* (Small) K. Sch. are the Appalachian crest representatives of the Coastal Plain *L. buxifolium* (Berg.) Ell. *Helonias bullata* L., for nearly two centuries supposed to be endemic on the Coastal plain, was found<sup>1</sup> in 1909 on the mountains of western North Carolina; and *Cleistes divaricata* (L.) Ames (*Pogonia divaricata* R. Br.), also considered a typical species of the Coastal Plain, is well known from high tablelands of the southern Appalachians.<sup>2</sup> In fact, this relationship of the Coastal Plain and the Appalachian tablelands has long been known. Thus, in 1879, Redfield, describing the Carolina mountain trip with Canby, Gray, Hyams and Sargent, wrote: "on the 12th was made the ascent of Table Rock, a most remarkable summit, belonging to the Blue Ridge system, presenting in one direction the tabular profile which gives it its name, and from another a sharp conical outline not unlike that of the Matterhorn. The botanists returned from it laden with plants, and it was curious to see among them so many of the species which are associated with the sandy barrens and swamps of southern New Jersey."<sup>3</sup>

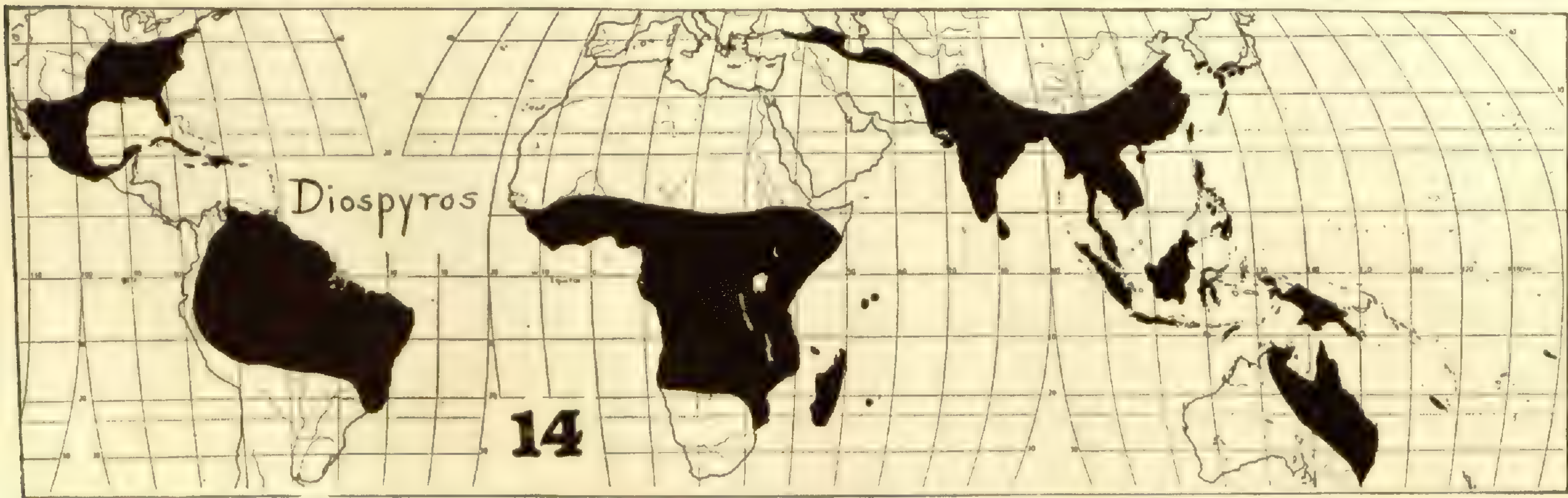
In some cases plants of Australian, Malayan and African affinity are now found in America almost wholly in the North, in the region which was largely under the Pleistocene ice. This most unlooked-for disruption of range is well illustrated by *Potamogeton*, sub § *Javanici* (MAP 13), the group of dimorphic plants which Hagström considered the most primitive of pondweeds with floating leaves. The members of this primitive subsection occur locally in Australia, more generally from Java to Japan and Burma, on Madagascar and across southern and central Africa; but outside these tropical and subtropical areas of the Old World the *Javanici* are known only as two extremely rare species, so rare that each new station is heralded as a notable range-extension, *Potamogeton Vaseyi* Robbins and *P. lateralis* Morong, confined to a limited region of the northeastern United States and adjacent Canada. A very similar disruption is displayed by *Myriophyllum*, § *Tessaronia*, the plants of *Eumyriophyllum* with four, instead of eight, stamens, plants of tropical and subtropical India, Madagascar and eastern North America, but with a slight representation also in Pacific North America.

<sup>1</sup> House, *Muhlenbergia*, vi. 73 (1910).

<sup>2</sup> Gattinger, *Tenn. Fl.* 84 (1887); Small & Heller, *Mem. Torr. Bot. Cl.* iii. no. 1: 10 (1892); Kearney, *Plant World*, i. 35 (1897); Wherry, *Journ. Wash. Acad. Sci.* xviii. 213 (1928).

<sup>3</sup> Redfield, *Bull. Torr. Bot. Cl.* vi. 335 (1879).



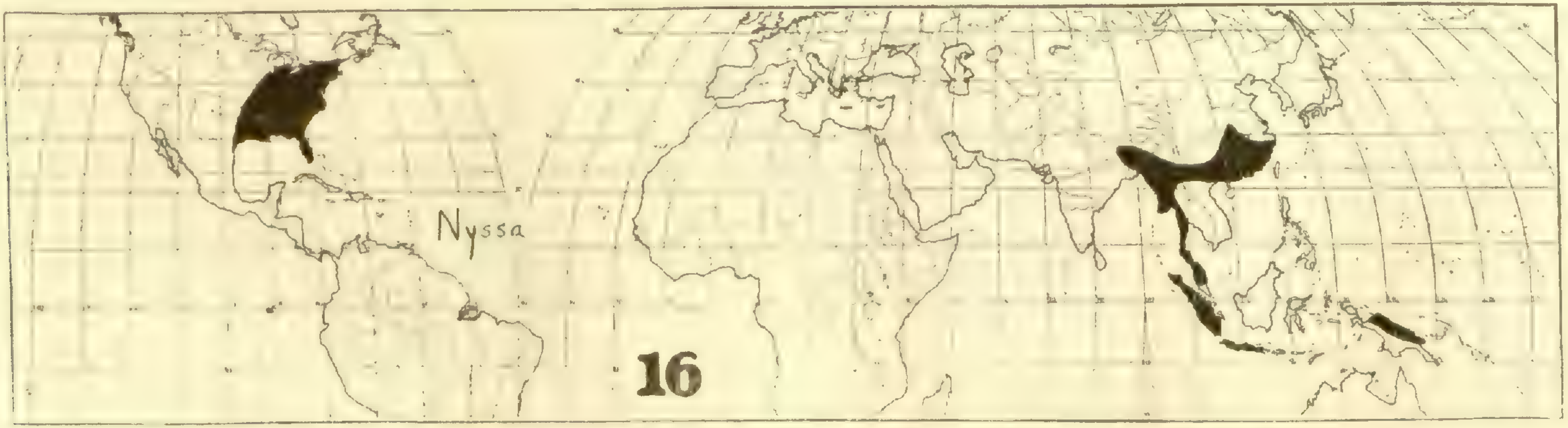
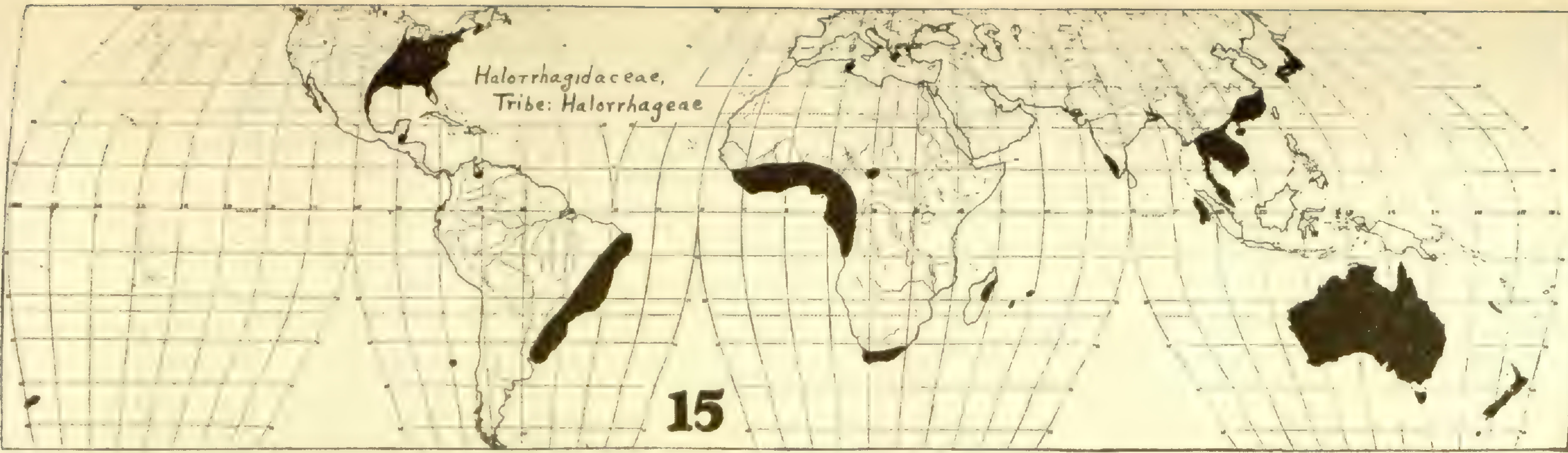


Map 13, Geographic Range of POTAMOGETON, sub § JAVANICI; 14, of DIOSPYROS.

Whether the wide-ranging herbaceous angiospermous groups of the Atlantic region of North America were Mesozoic or early Cenozoic genera of the whole Northern Hemisphere, which have subsequently restricted their ranges principally to the Tropics, we cannot now absolutely demonstrate. As herbs they have left few if any fossils; but Carboniferous, Jurassic and Cretaceous members of the *Schizaeaceae* occurred in Europe and northern Asia, even in arctic Spitzbergen;<sup>1</sup> and the ligneous and consequently easily fossilized genus *Diospyros* (MAP 14), which today has an essentially tropical distribution quite comparable with the present ranges of *Schizaea*, *Lygodium*, *Potamogeton*, sub § *Javanici*, *Lophotocarpus*, *Xyris*, *Eriocaulon*, the *Burmanniaceae* (MAP 18), the *Droseraceae* (MAP 28), the *Halorrhagidaceae*, tribe *Halorrhageae* (MAP 15) and hundreds of other groups (except that, unlike them, *Diospyros* is considered indigenous also from northern India to the Caucasus and the Black Sea), in mid-Cretaceous covered practically the whole Northern Hemisphere, quite to the Arctic. Berry's vivid account is to the point: "In that grand display of dicotyledonous genera which during the mid-Cretaceous replaced the old Mesozoic flora of ferns, cycads, and conifers and which appeared with such apparent suddenness at a number of points in the Northern Hemisphere, we find unmistakable evidence of the abundance and wide distribution of species of *Diospyros*. No less than 17 different forms have been described from the rocks of this age, and the localities where they have been found are scattered from Australia to Bohemia, Greenland, and Vancouver Island . . . they seem to have been especially at home along the Cretaceous coast of the Atlantic and along the border of the Mediterranean Sea which extended northwestward from the Gulf of Mexico over much of our present Great Plains area."<sup>2</sup> In other words, their greatest display of Cretaceous fossils is in the margin of the area covered by the Cretaceous seas, which then bordered the baseleveled land which in the Tertiary became uplifted and dissected to form the present Appalachian Upland with its characteristic climax mesophytic forest. Very similarly, ligneous *Nyssa* (MAP 16), today with a disrupted range somewhat similar to that of *Myriophyllum*, § *Tessaronia*, formerly had a broad range across Eurasia and North America, reaching Spitzbergen and

<sup>1</sup> See Potonié in Engl. & Prantl. *Naturl. Pflanzenfam.* 1. 372 (1900); also Seward. *A Study in Contrasts: The Present and Past Distribution of certain Ferns*, Journ. Linn. Soc. xlv. 233, 234 (1922).

<sup>2</sup> Berry, *Tree Ancestors*, 257 (1923).



Map 15, Geographic Range of the HALORRHAGIDACEAE, Tribe HALORRHAGEAE; 16, of NYSSA.

Greenland. Again drawing upon Berry's *Tree Ancestors*: "A large number of fossil forms of gums have been described . . . found in Upper Cretaceous deposits in Wyoming, Nebraska, Kansas, and Alabama. During the early Tertiary gums are extraordinarily abundant. . . . It is worthy of comment that all of the Upper Cretaceous and Eocene gums are North American or Arctic, . . . In the far north they occurred at that time in Alaska, Greenland and Spitzbergen."<sup>1</sup>

This present restriction primarily to the Tropics of groups formerly wide-spread in the Arctic has been summarized by our President in a single sentence: "A study of ancient floras reveals the capacity of plants as travelers; many flowering plants, conifers, and ferns that are now confined, or almost confined, to the tropics of the southern hemisphere were in the Cretaceous and Tertiary periods represented by species widely spread over the northern hemisphere, passing far within the Arctic Circle."<sup>2</sup> And all of us will call to mind groups, pre-vaillingly tropical today, which are also characteristic of temperate Atlantic North America and which have a few northern representatives in Europe as well: *Eriocaulon*, *Echinodorus*, *Fuirena*, *Fimbristylis*, *Mariscus* (*Cladium*), *Smilax*, the *Dioscoreaceae*, *Hibiscus* and *Ammania*.

A few species in eastern North America have today ranges quite comparable, except for minor details, with that of *Schizaea pusilla*, admittedly a relic from the boreal Cretaceous or earlier dispersal of its progenitors. This parallelism of range (on some of the Appalachian plateaus, uplifted from their sea-level position of the Cretaceous, and on the Atlantic Coastal Plain or its margin, with few if any intermediate stations) is well shown by one of the most distinct and rarest of pondweeds, *Potamogeton confervoides* Reichenb. (PLATE 204; also MAP 33). This remarkable species has the free ligules and continuous spike of the comparatively advanced subgenus *Eupotamogeton*; it constitutes Hagström's subsection *Monticoli* of *Eupotamogeton*, but, as he has stated, it exhibits such primitive anatomical characters as to form a "transition to the [primitive] *Coleogeton* species";<sup>3</sup> and in its delicate foliage, its branching, its creeping rhizome with subterranean tubers, and its long, terminal peduncle it so strongly simulates *P. pectinatus* L. (PLATE 204), *P. filiformis* Pers. and other species of the most primitive subgenus *Coleogeton* that only by the closest examin-

<sup>1</sup> Berry, l. c. 244.

<sup>2</sup> Seward, Journ. Royal Hort. Soc. l. pt. 1: 17 (1925).

<sup>3</sup> Hagström, *Critical Researches on the Potamogetons*, Kungl. Svenska Vetenskapsakad. Handl. lv. No. 5: 86 (1916).



Map 17, Geographic Range of LYCOPODIUM CAROLINIANUM and Allies; 18, of the BURMANNIACEAE.

ation can it be distinguished from them. It certainly is not a mere accident that today the obvious relic-species, *Schizaea pusilla*, on the uplifted Cretaceous peneplain of Newfoundland (and apparently also of Cape Breton) should there border the shallow pools in which the rare and demonstrably primitive *Potamogeton confervoides* is found; nor that these two, along with the equally rare and ancient *Lycopodium carolinianum* L., should be close neighbors in that haven of relic-species, the Pine Barrens of New Jersey, for, surely, the amazingly disrupted austral occurrence (MAP 17)<sup>1</sup> of restricted colonies of *L. carolinianum* and its immediate allies<sup>2</sup> is good evidence, if evidence were needed, that that species (in the broad sense) is of great antiquity. It is also not a mere accident that, except for rare stations in the silicious Coastal area, *P. confervoides* should be known in Pennsylvania, New York and New England only in pools on or among the highest mountains ("Alleghany Mountains," sent by Schweinitz to Reichenbach; Pocono Plateau, Pennsylvania, where associated with the relic colonies of Coastal Plain types enumerated on p. 39; Adirondack Mts., New York; Taconic and Green Mts., Massachusetts and Vermont; White Mts., New Hampshire; Mt. Katahdin, Maine).

The present-day ranges of the tropical groups which are represented in temperate eastern North America closely coincide with the existing continental and insular remnants of hypothetical Gondwana, the great equatorial land which, in the Permian, is supposed by some to have stretched from Australia and peninsular India to Africa and South America. But those who have reconstructed Gondwana Land (MAP 19)<sup>3</sup> tell us that, in Lower Cretaceous time Gondwana had become much disrupted and that by mid-Cretaceous (MAP 20) it had broken into remote Australia, Lemuria, Ethiopia, and Amazonia. Furthermore, during the supposed existence of Gondwana that equatorial land has been pictured as having had no direct connection with the Atlantic United States, and subsequently (MAPS 22-27)<sup>4</sup> the gap between the southeastern United States and Brazil is said to have been

<sup>1</sup> Doubtless a few tropical and austral stations have been overlooked, since most "Floras" omit the Pteridophyta.

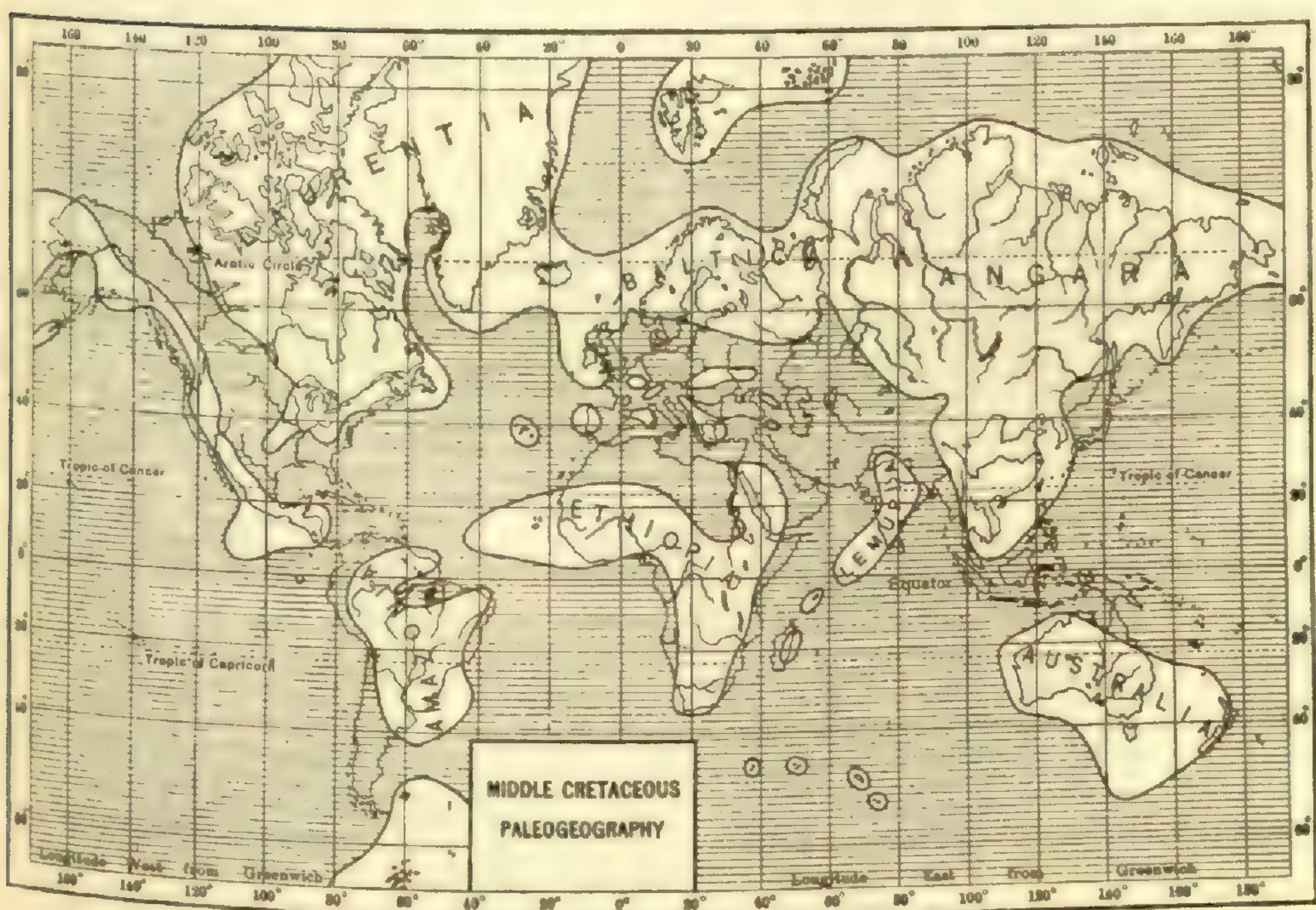
<sup>2</sup> Including *L. drepanoides* Blume, *L. Drummondii* Spring, *L. goyozense* and *L. meridionale* Underw. & Lloyd, *L. paradoxum* Spring, *L. sarcocaulon* Welw. and *L. tuberosum* A. Br.

<sup>3</sup> Map 19 is copied, with permission, from Schuchert, Hist. Geol. fig. 434 (New York. John Wiley & Sons, Inc.); map 20 from Schuchert's fig. 488.

<sup>4</sup> Maps 22-27 are from Schuchert, *Geological History of the Antillean Region*, Bull. Geol. Soc. Am. xl. 337-360 (1929).

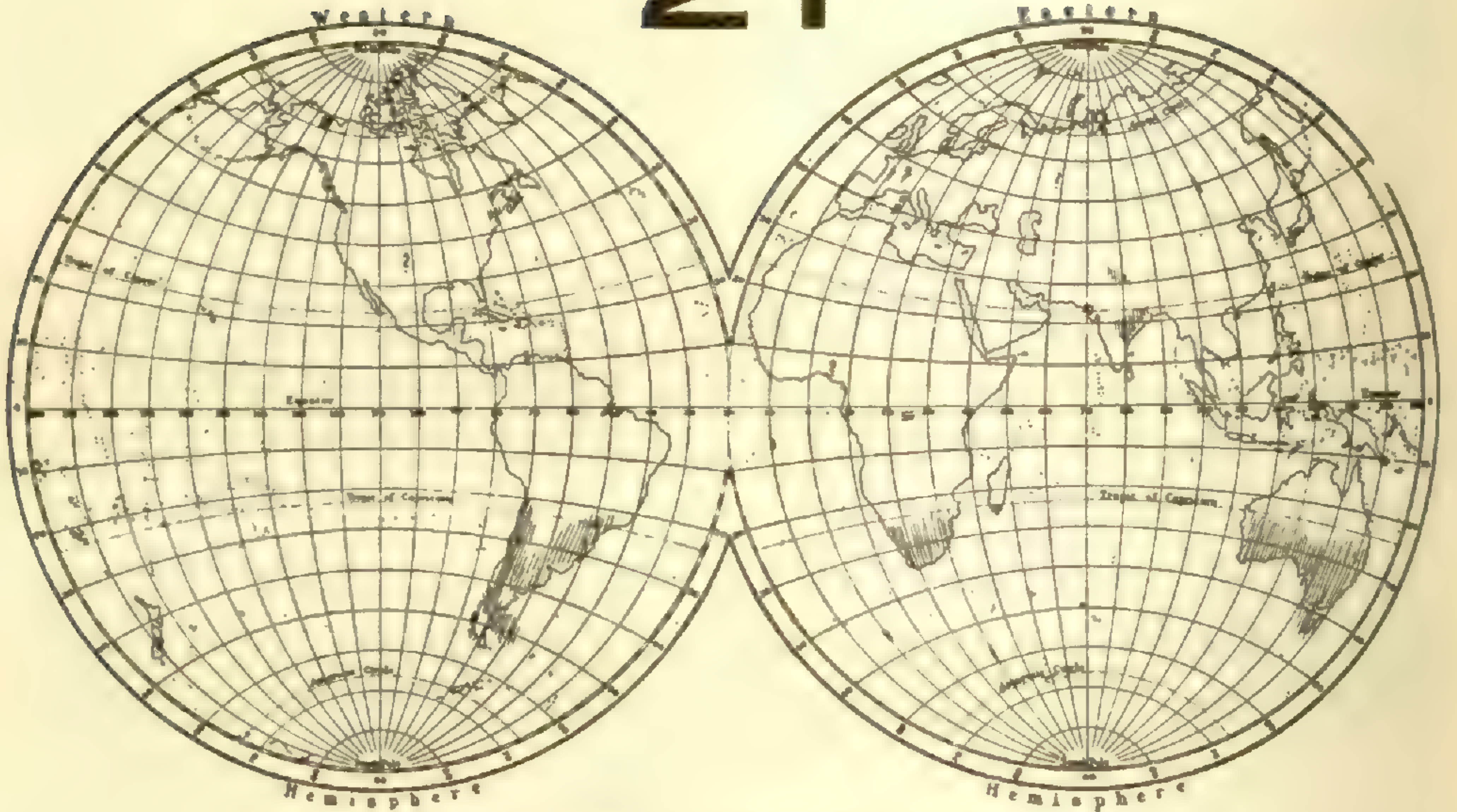


Map 19, the World in PERMIAN time (after Schuchert).

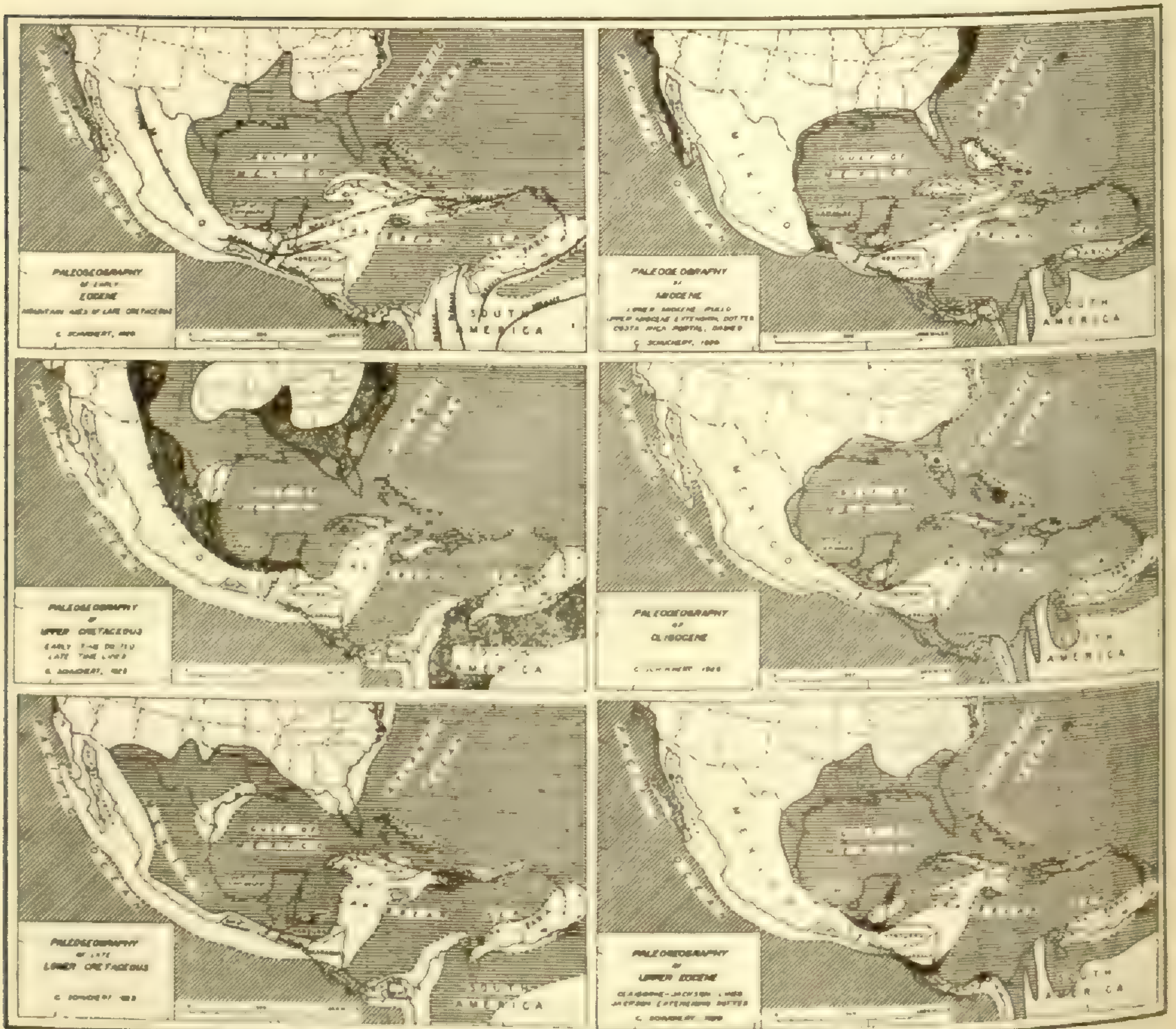


Map 20, the World in MID-CRETACEOUS time (after Schuchert).

## 21



Map 21, the PERMIAN GLACIATION (after Coleman)!



Map 22 (lower left), Geographic Connections of the Antilles in the LOWER CRETACEOUS; 23 (middle left), in the UPPER CRETACEOUS; 24 (upper left), in the early EOCENE; 25 (lower right), in the UPPER EOCENE; 26 (middle right), in the OLIGOCENE; 27 (upper right), in the MIOCENE (all after Schuchert).



continuously maintained and often broadened. Consequently, Gondwana, as usually defined and whether a hypothetical or a demonstrated Permian land, need not necessarily concern our immediate problem. If, however, with Alphonse De Candolle and many other thoughtful students, we conceive the angiospermous groups of today as having lived in Jurassic time<sup>1</sup> or if, with Velenovský, Mrs. Arber<sup>2</sup> and numerous others, we push the ancestral Angiosperms (the Pro-angiosperms of Engler<sup>3</sup>) back beyond the Cretaceous, and also greatly extend the area of Gondwana in the Western Hemisphere to reach the southeastern United States, then that hypothetical equatorial land will immediately come into the picture. In this connection it is worth noting that my associate, Dr. Hugh M. Raup, calls attention to the very striking fact, that hundreds of tropical and austral groups of today have restricted ranges almost coincident with the known areas of Permian or Permo-Carboniferous glaciation (see MAPS 21 and 19; also MAPS 9-18). If, indeed, Angiosperms existed at that time and if youthful and aggressive groups then spread into newly available territory as do virile and dominating groups today, it would seem only natural that, with the decay of the Permian glaciers, the most aggressive plants of the adjacent territory should quickly have taken possession and that their descendents should still linger about their ancestral centers. By some the herbaceous habit is associated with cold climates, and many herbs (as well as shrubs and trees) undoubtedly originated during the Pleistocene, while many others seem to be even more youthful; but, surely, many of the herbaceous species of today are as ancient as their living ligneous associates. And it is certainly significant that the greatest glaciation in the history of the world was the Permo-Carboniferous (MAP 21).<sup>4</sup> If it be true that the development of herbs has been largely a response to refrigerating climates, it must be apparent that, given the progenitor-stocks, herbs would <sup>have</sup> had a phenomenal epoch of development during the Permo-Carboniferous glaciation.

<sup>1</sup> "De nos jours, les Smilacées sont mêlées aux Cycadées dans l'Afrique australe, la Nouvelle-Hollande et l'Inde. Existaient-elles déjà dans l'hémisphère austral, au Japon, au Mexique, etc., quand les terrains jurassiques se formaient en Europe? C'est extrêmement probable; malheureusement on connaît peu de fossiles de ces pays lointains, et les géologues ne sont guère en état de certifier ce qui se passait dans une même période d'années à des distances aussi grandes."—A. DC. Mon. Phan 1. 35 (1878).

<sup>2</sup> For summary of literature and pertinent discussion see Arber, Agnes, *The Tree Habit in Angiosperms: its Origin and Meaning*, New Phyt. xxvii. 71-84 (1929).

<sup>3</sup> Engler, *Natürl. Pflanzenf.* ed 2, xiv<sup>a</sup>. 138-145 (1926).

<sup>4</sup> Map 21 reproduced, with permission, from p. 91 of Coleman, *Ice Ages Recent and Ancient* (New York, Macmillan).

Gondwana was, after all, only a hypothetical land. Originally reconstructed and subsequently greatly extended to account for the disrupted localities of now fossil species, it furnishes a sort of explanation of early tropical dispersal. But, at this very day, hundreds of living groups of Angiosperms (as well as many groups of Pteridophytes) have a "Gondwana" or relic pantropical range. Nevertheless, there is now no circum-tropical connection, such as is generally assumed for Permian time, between these areas of living plants; consequently, the hypothetical status of Gondwana becomes strikingly accentuated.

Leaving these purely theoretical realms and returning to better demonstrated and, consequently, firmer geological and paleontological grounds, we are at least justified in looking upon the present Atlantic North American representatives of prevailing tropical groups as lineal descendents of plants which reached eastern North America out of the North at a time, during the Mesozoic and perhaps early Cenozoic, when the ancient rock-floor which now constitutes the Appalachian Upland was peneplained or near sea-level. With the Cretaceous seas (see MAP 20) occupying the north-and-south center of the present continent and its southern and southeastern margin and the Tertiary seas later invading much of the southern and eastern portion of the same area, the only section of present eastern continental North America then continuously accessible to these plants was the ancient baseleveled Appalachian region with the Laurentian shield to the north and northwest.<sup>1</sup> Then, as the later uplifting of the once peneplained Appalachian region progressed, making halts at intervals through Tertiary time, with the consequent deep dissection of the extensive plateau and its inevitable conversion from a low Cretaceous plain with retarded drainage into a vast upland mesophytic area, ready for occupation by the abundant mesophytic types of the climax forest which could now freely mingle between Asia, northwestern America, eastern North America and Europe, the members of the tropical and subtropical groups (and with them many endemic groups) represented in eastern North America were largely forced (by drainage of the area and by invasion by the hoard of actively colonizing mesophytic types) to abandon their once congenial but now un-

<sup>1</sup> In this connection, the absence from Pacific North America of the hundreds of tropical and subtropical groups which linger on the Atlantic Coastal Plain is significant; during the Cretaceous eastern and western North America were completely isolated from each other (see MAP 20).

congenial haunts on the Appalachian area and to move out to the newly available xerophytic and hydrophytic habitats, chiefly on the Coastal Plain (though in some instances west and northwest of the Appalachian axis), where the acid savannahs, bogs, shallow pools and dry sands supply the ecological conditions in which these descendents of Cretaceous and early Tertiary hydrophytes and xerophytes can still survive.

In 1897, Dr. T. H. Kearney, directing attention to "*The Pine-barren Flora in the East Tennessee Mountains*,"<sup>1</sup> said: "One would hardly expect to find a large proportion of this flat country flora hidden among the high ridges of the Alleghanies; yet this is unmistakably the case. Especially along the picturesque French Broad river, . . . there is a notable incursion of plants usually considered typical of the coastal plain," and, after enumerating several such species, Kearney continued: "What are we to infer from the presence of these austro-riparian plants among the flora of northern origin that chiefly covers these mountains? Possibly they are the advance-guard of an invading army. Much more probably, however, they are the lingering survivals of a more southern flora, once widely distributed over the southern Appalachian region." Three years later, developing the subject more fully and interpreting the migration to the Coastal Plain as a response to Pleistocene cold, Kearney<sup>2</sup> suggested that "it may be conceived that while some individuals of each hypothetical Pliocene ancestral species maintained themselves in well-sheltered situations and were not forced [by Pleistocene cold] to a change of abode,<sup>3</sup> others escaped the changing environment by a gradual retreat into the warmer lowlands. The individuals which remained in the mountains were the direct ancestors of the present Appalachian species; while those which migrated and later accustomed themselves

<sup>1</sup> Kearney, *Plant World*, i. 33-35 (1897).

<sup>2</sup> Kearney, *The Lower Austral Element in the Flora of the Southern Appalachian Region*, *Science*, ser. 2, xii. 830-842 (1900), especially p. 839.

<sup>3</sup> The effect upon vegetation of ice-sheets hundreds of miles away was probably not so great as was formerly supposed. Witness the occurrence today of splendid forests on the glaciers of Alaska; and the occurrence at the ice-free margin of otherwise ice-capped Greenland of such plants of sea-level in the eastern United States as *Woodsia ilvensis*, *Cystopteris fragilis*, *Equisetum sylvaticum*, *E. hiemale*, *Deschampsia flexuosa*, *Carex brunnescens*, *Streptopus amplexifolius*, *Corallorrhiza trifida*, *Stellaria borealis*, *Ranunculus cymbalaria*, *R. reptans*, *Coptis groenlandica*, *Potentilla palustris*, *Viola Selkirkii*, *Epilobium angustifolium*, *Cornus canadensis*, *Pyrola secunda*, *Andromeda glaucophylla*, *Vaccinium Oxycoccus*, *Menyanthes trifoliata*, *Utricularia intermedia* and *Linnaea borealis*, var. *americana*; or the occurrence on tablelands of Newfoundland or Gaspé of members of chiefly tropical groups almost side-by-side with typical plants of Ellesmereland and Melville Island.

in the Coastal Plain . . . gave rise to the Austro-riparian species that attract our attention today because of their close resemblance to Appalachian forms." In 1904 the late Professor Harshberger<sup>1</sup> suggested a similar derivation of some of the endemic North American plants of the Coastal Plain from the crests of the Alleghenies. Somewhat later, Dr. Witmer Stone stated that "The flora at the top of Meadow Mountain, the summit of the Alleghenies [in Garrett County, Maryland], . . . was very much as in the pine barrens of New Jersey, and is quite likely a remnant of an early primitive flora such as we have there."<sup>2</sup> In 1924 Dr. John K. Small expressed the same view. The relic-genus *Nartheccium* (or *Abama*) has one wide-ranging species in Europe, one or two highly localized species in the eastern Mediterranean region, one in Japan, one in California and Oregon; and it has long been of great local interest in eastern America through *N. americanum* Ker., a famously rare plant of the very heart of the New Jersey Pine Barrens. But in 1919 a species closely related to *N. americanum* was discovered at a single station in the mountains of North Carolina. In describing the mountain plant as *Abama montana*, Small said: "It is not surprising that a bog-asphodel should come to light in the mountains of North Carolina, as several kinds of plants otherwise known only in the pine-barrens of the middle Atlantic Coastal Plain also grow in the Appalachians. . . . It is scarce, evidently rare, and may be on the verge of extinction. It may be that in this species we have one of the progenitors of the *Abama* of the Coastal Plain, for the high mountain region was the reservoir whence many of our Coastal Plain plants were derived."<sup>3</sup>

The derivation of much of the flora of the youthful Coastal Plain of the United States from the ancient Appalachian Upland, which in the Cretaceous itself had a coastal-plain status, is strongly supported by the very striking condition in the Antillean and Mexican regions. As shown by Schuchert<sup>4</sup> (MAPS 22-27), portions of the Greater Antilles (Cuba, Haiti, Jamaica, Porto Rico, etc.) have been in continuous existence at least since the Lower Cretaceous and much of the time connected with the Central American and Mexican tablelands; but the Bahama Islands did not rise above the sea until the Miocene,

<sup>1</sup> Harshberger, Proc. Acad. Nat. Sci. Phila. 1904: 607.

<sup>2</sup> Stone, as reported in *Bartonia*, No. 5: 16 (1912).

<sup>3</sup> Small, *Torreya*, xxiv. 86 (1924).

<sup>4</sup> Schuchert, *Geological History of the Antillean Region*, Bull. Geol. Soc. Am. xl. 337-360 (1929), from which my maps 22-27 are photographed.

while all but the base of the Peninsula of Yucatan is even younger. It is, therefore, significant, when we check the living floras of the Bahamas<sup>1</sup> and of Yucatan,<sup>2</sup> to find that on these very youthful areas, which are far isolated from more ancient upland centers, there are no species of *Schizaea* (MAP 9), the *Haemadoraceae* (MAP 10), the *Xyridaceae* (MAP 12) and *Lycopodiaceae* (see MAP 17); but that on the older Greater Antilles and the old Mexican or Central American Plateaus or their margins these groups of the young Coastal Plain of the United States are all represented. Ancient *Diospyros* (MAP 14), also, is on the Greater Antilles but, although locally present in Yucatan, it is absent, as a native, from the Bahamas. Many other tropical or austral groups which today have a northern remnant persisting on the young Atlantic Coastal Plain of the United States and on the ancient Greater Antilles and the equally ancient Mexican or Central American Plateaus or at their margins, are absent, likewise, from the young Bahamas and from still younger Yucatan (except occasionally as cultivated species or as relics of cultivation): such groups as the *Eriocaulaceae*, in Mexico up to 3355 m. (11,000 ft.), the *Marantaceae*, up to 915 m. (3000 ft.), the *Burmanniaceae* (MAP 18), up to 1675 m. (5500 ft.), *Boehmeria*, up to 1585 m. (5200 ft.), *Clitoria*, up to 2135 m. (7000 ft.), *Rotala*, up to 1525 m. (5000 ft.), *Myriophyllum* § *Tessaronia*, up to 1740 m. (5700 ft.) and *Dyschoriste*, up to 2400 m. (8000 ft.); while *Psilocarya* occurs on the Greater Antilles but not in Mexico and *Litsea* in Mexico ascends to 3050 m. (10,000 ft.). Similarly, on the Mexican Plateau we find representatives of *Xyris* at 1830 m. (6000 ft.) and of *Schizaea* at 1200 m. (3925 ft.).

The always interesting genus *Drosera* (MAP 28),<sup>3</sup> with three circum-boreal species and another (*D. linearis* Goldie) confined to boreal America, has most of its living species concentrated in the Southern Hemisphere and in southern Asia, with a few related species on the Greater Antilles, on the Coastal Plain of the United States and in Central America; but the genus is unknown from either Yucatan or the Bahamas. The unique *D. filiformis* Raf., however, differs from all other American species in its hardened bulbiform woolly base, its linear-filiform and very prolonged (up to 6 dm.) leaves without elon-

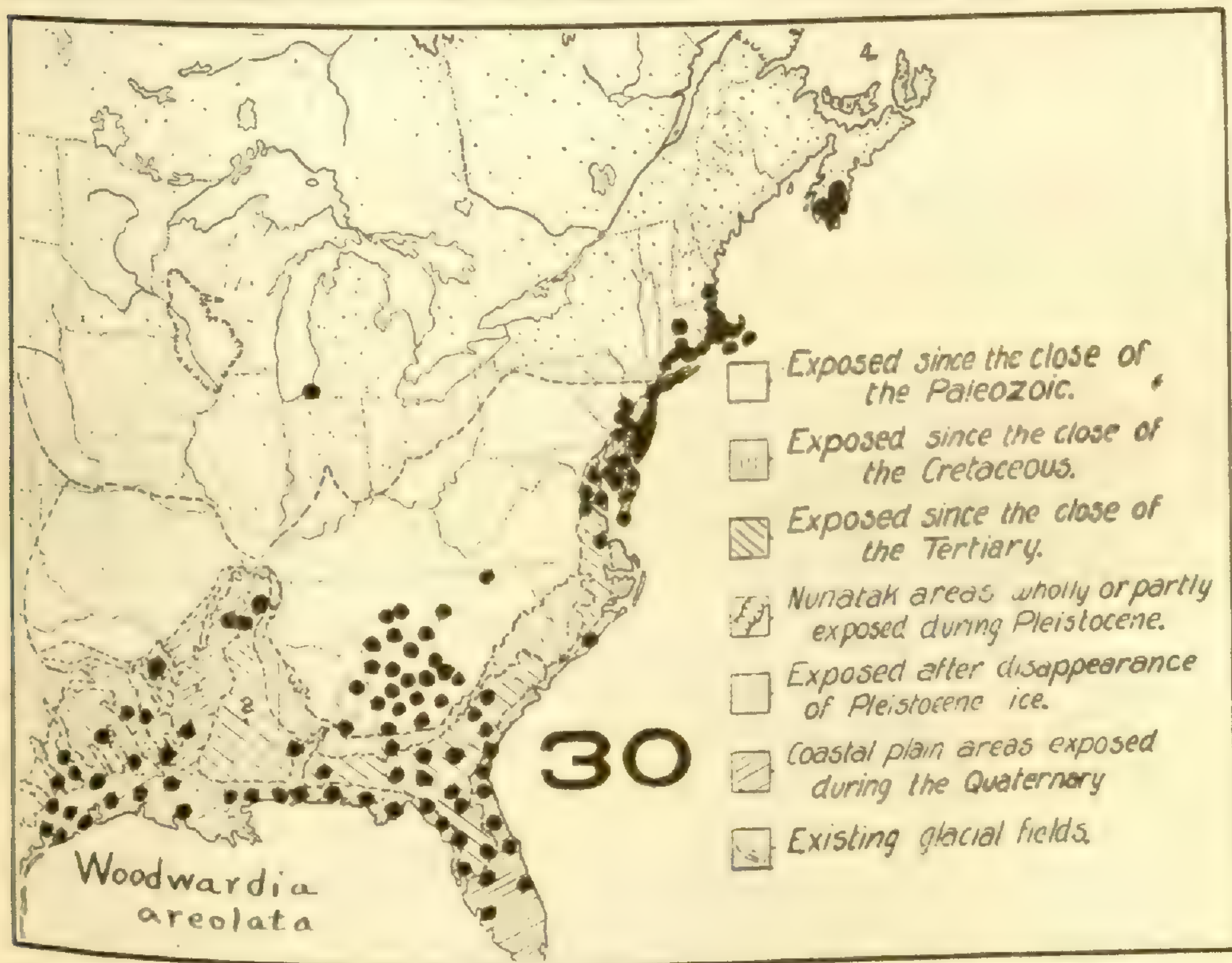
<sup>1</sup> See Britton & Millspaugh, *The Bahama Flora* (1920).

<sup>2</sup> See Standley, *Flora of Yucatan*, Field Mus. Publ. 279—Bot. Ser. iii. no. 3 (1930), which has come to hand while this paper is going to press.

<sup>3</sup> The map is largely copied from that of Diels in Engler, *Pflanzenr.* iv <sup>112</sup>, supplemented by material in the Gray Herbarium. The North American range is altered to accord with the specimens and citations covering this area.



Map 28. Geographic Range of *DROSERA*, the boreal Species indicated by Stippling, and of *DROSOPHYLLUM* (in ellipse).



Map 29, Geographic Range of *DROSERA FILIFORMIS* (upper and lower black areas) and of *DIONAEA* (middle black area): 30, of *WOODWARDIA AREOLATA* (an additional station should be recorded, at the southwestern end of Lake Erie).

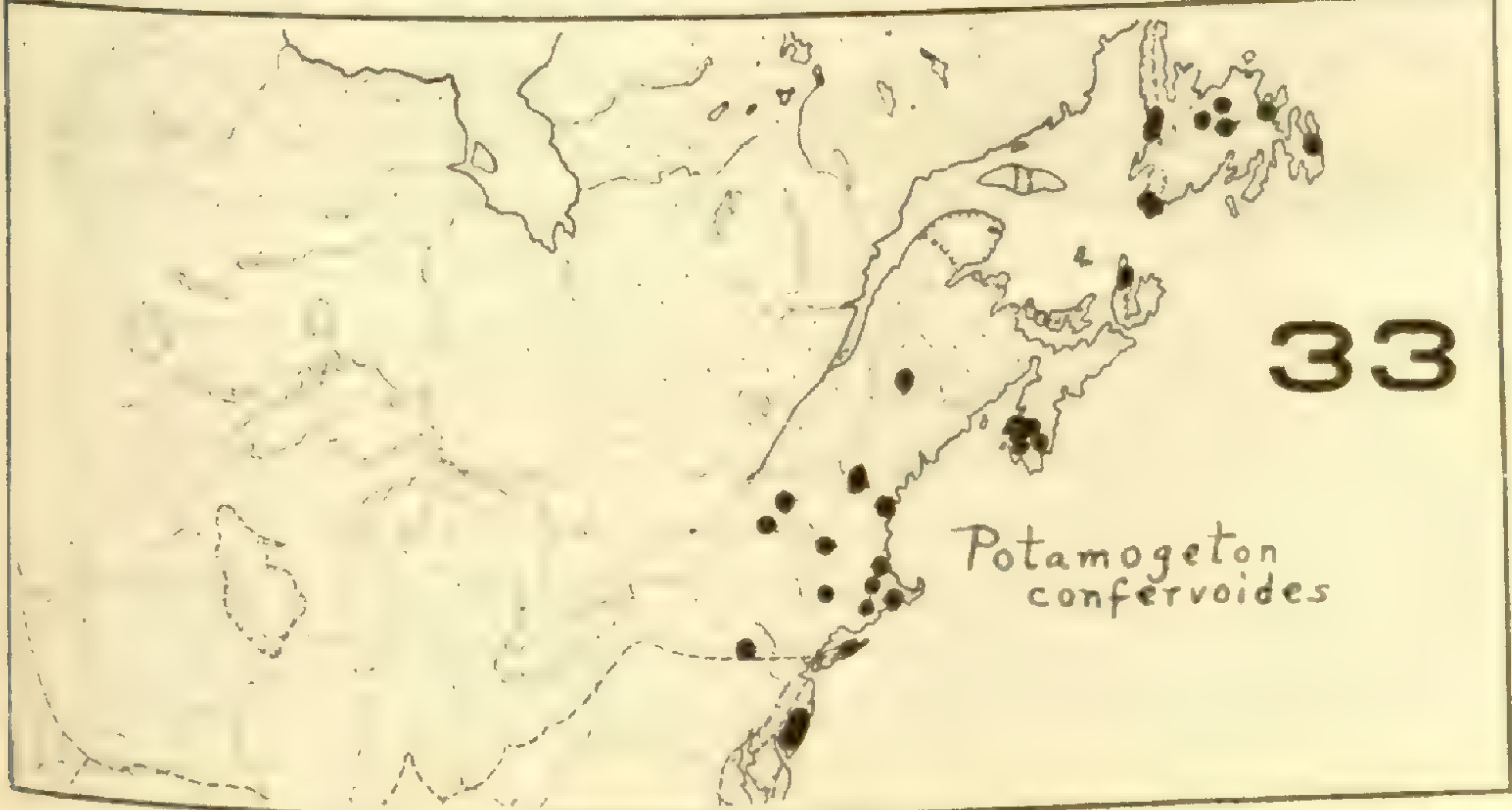
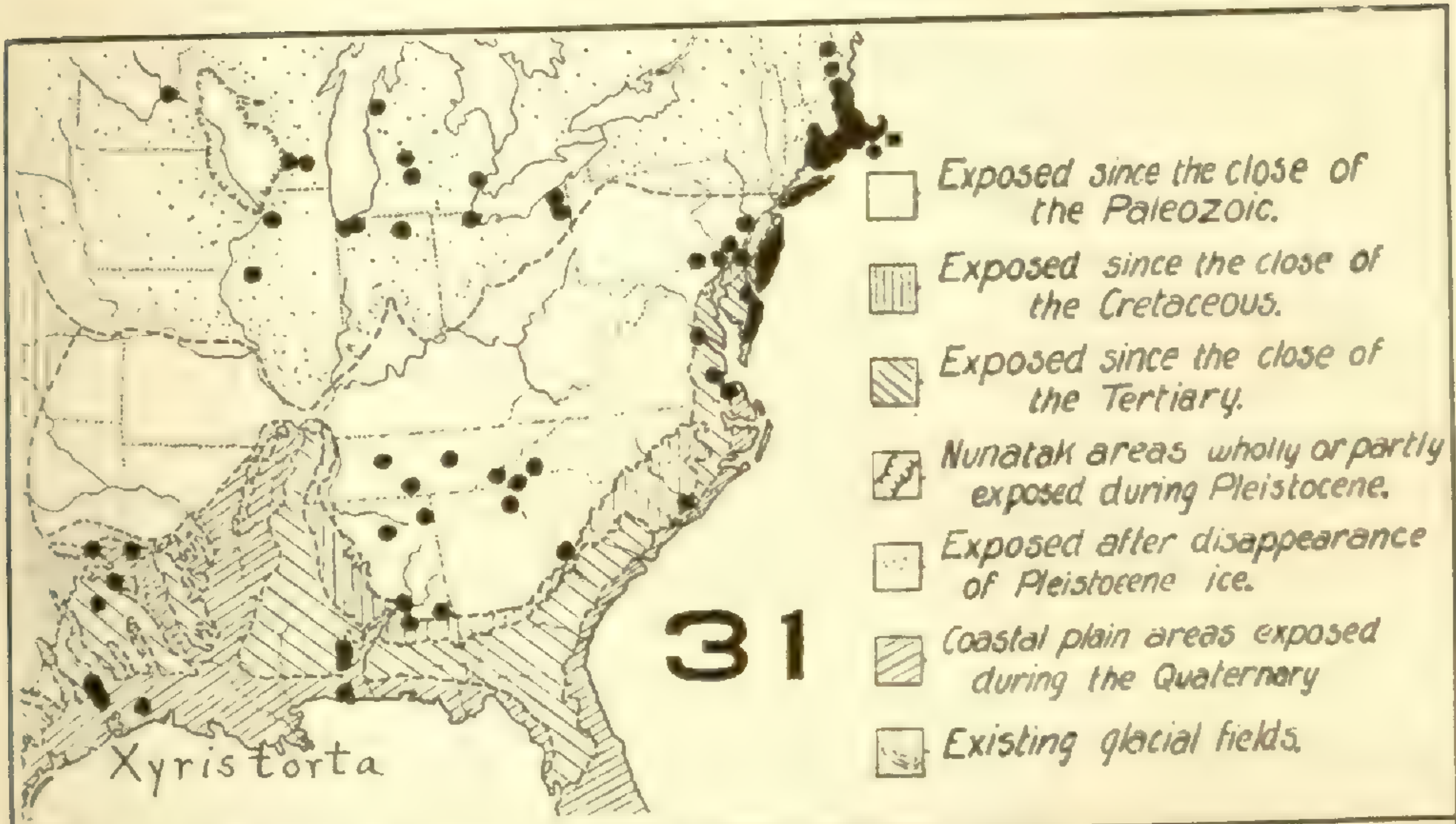
gate petiole, its large purple petals and its seeds; it is far more closely related to some of the Indian, Malayan and Australian species than to any of the broad-leaved, long-petioled and white-flowered species (of § *Rossolis*) with which it grows. It is restricted to two wholly disrupted areas of the Coastal Plain (see MAP 29) and its present distribution is best explained as a result of migration in two directions off the now uplifted Appalachian Upland. Outside the now essentially austral and tropical genus *Drosera* the family has two monotypes: *Drosophyllum lusitanicum* L. (see MAP 28) of the ancient Iberian Tableland and adjacent Morocco and *Dionaea muscipula* Ellis (see MAP 29) of the Cretaceous (hardly Tertiary or Quaternary) Coastal Plain of the Carolinas.<sup>1</sup> The antiquity of the insectivorous *Droseraceae*, therefore, can scarcely be doubted.

Not only, as we have seen, do the tropical groups represented on the Atlantic Coastal Plain of the United States have representatives on the high tablelands of the Appalachian Mountains, on the older of the Antilles and on the high plateaus of Mexico or of Central America; they are also well represented at low levels west and northwest of the Appalachian axis, particularly in the upper Mississippi Valley, and about the Great Lakes where the sands and peats of Pleistocene or later origin offer them peculiarly attractive habitats. Their migration out from the now elevated Appalachian area to the Coastal Plain on one side, to the region of the Great Lakes on the other, is clearly indicated by *Woodwardia areolata* (L.) Moore (MAP 30), a characteristic fern of the Coastal Plain but also found on the tablelands of the southern Appalachians at 3000 ft. (915 m.), and otherwise known only in northwestern Ohio and in southwestern Michigan.

This movement out from the Appalachian center is even better displayed by the very distinct, bulbous *Xyris torta* Sm. (MAP 31), a common species of the Coastal Plain sands, also at 2000-4000 ft. (610-1220 m.) on the high silicious tablelands from North Carolina and Tennessee southward, and with a rather extensive area about the Great Lakes. In these cases (and scores of others which might be cited) migration from the ancient Appalachian region is a reasonable explanation of the present segregations. In some other cases we do not now (or yet) know any existing stations high on the Appalachians but it is fair to assume that during the baseleveled Cretaceous stage of this area they must have there existed; and it is reasonable to be-

<sup>1</sup> For all known stations see Coker, *The Distribution of Venus's Fly Trap (Dionaea muscipula)*, Journ. Elisha Mitchell Sci. Soc. xliii. 221 (1928).





Map 31, Geographic Range of Xyris torta; 32, of Fuirena squarrosa; 33, of Potamogeton confervoides.

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lieve that, to the already surprisingly large number of relic-colonies of tropical types known on the mountains of the Carolinas and Tennessee, stations of members of these other groups may soon be added. *Potamogeton*, sub § *Javanici* (MAP 13), not yet known either on the Appalachian Upland or on the true Coastal Plain, is decidedly an exception. Much more typical is *Fuirena squarrosa* Michx. (MAP 32), characteristic of Coastal Plain sands, with a slight overlap on the ancient Piedmont area, but unknown from the high tablelands, and isolated on the sands of southern Michigan and northern Indiana. The *Burmanniaceae* (MAP 18) yield an even more striking instance. The family is widespread in tropical and subtropical regions but, like many other groups, it has a slight extension northward in eastern Asia and another around the Gulf and Atlantic Coastal Plains of the United States. North of Virginia the family is unknown, save for the extraordinary little species of prairies at Chicago, *Thismia americana* N. E. Pfeiffer.<sup>1</sup> This, as noteworthy a plant as is known in the Great Lake area, is the more remarkable since it belongs to a small subfamily otherwise confined to the Tropics, chiefly of the Old World.

The cases I have presented are merely a few illustrations but, without further enumeration or further analysis, enough have been presented to make it clear that, to a large extent the tropical groups which today have a representation on the Atlantic Coastal Plain of the United States or about the Great Lakes are also found persisting (often as rare relics) on the high tablelands of the Mexican Plateau as well as on the tablelands of the Appalachian Mountains or at other spots back of and older than the outer Coastal Plain. I am aware that, in looking upon the members of these and other primitive groups which now occur upon or among the mountains of north-eastern Pennsylvania, northern New York and western and northern New England as preglacial relics there, I am not in full accord with orthodox Pleistocene geology, which asks us to believe that the late ice-sheets so vigorously overrode these mountains as to denude them of all life. The parallelism is so definite, however, between these Coastal Plain species having representatives on the elevated tablelands of the more southern and quite unglaciated Appalachians, as well as on the Central American, Mexican and Antillean tablelands, and their occurrence on the supposedly denuded mountains farther north, that the botanist, at least, is forced to believe that the Pleistocene de-

<sup>1</sup> Pfeiffer, *Morphology of Thismia americana*, Bot. Gaz. lvii. 122-134 (1914)

struction of plants on the high mountains of New England, New York and northeastern Pennsylvania has been vastly overestimated. It is far more logical to look upon the very primitive *Potamogeton confervoides* (MAP 33), an aquatic with plump fruits not adapted for flying, as a preglacial relic on the high mountains of northern and western New England, on the Adirondacks and on the Pocono Plateau (as well as on the unglaciated or but slightly glaciated tablelands of Newfoundland and of Cape Breton), than to picture it as making a post-Wisconsin leap from the coastal pools to the highest mountain-masses far to the northwest and north and successfully finding welcoming pools on them all, but not landing in the thousands of intermediate lowland ponds. *P. confervoides*, one of the most primitive members of the worldwide subgenus *Eupotamogeton*, is so rare that only a few botanists have ever seen it growing. If any lowland pondweed were in post-Wisconsin time to do the improbable and invade the elevated mountain-pools from sea-level, it would less unreasonably be a common or, in the region, essentially ubiquitous and less primitive species (also of peaty depressions and pools), such as *P. pusillus* L., *P. Spirillus* Tuckerm., *P. epihydrus* Raf.<sup>1</sup> and *P. gramineus* L.; but these almost weed-like species of all pools at low levels, north, south, east and west, have not invaded the mountain-ponds of New England, New York and Pennsylvania, where the primitive and excessively rare Coastal Plain *P. confervoides* and its Coastal Plain congener, *P. Oakesianus* Robbins, alone represent the genus. Near the White Mountain stations of *P. confervoides* occur two endemic alpine xerophytes: *Potentilla Robbinsiana* Oakes, nearest related to the Siberian *P. elegans* C. & S.; and *Geum Peckii* Pursh, the isolated representative of *G. calthifolium* Mertens of the North Pacific and Bering Sea region. Obviously these two endemic neighbors of the Coastal Plain *Potamogeton confervoides* on the White Mountains have not originated there in post-Wisconsin time.

If this general reasoning is correct, that the Coastal Plain plants of the eastern United States before occupying the youthful Coastal Plain had had direct progenitors on the Cretaceous peneplain which, through Tertiary uplifts, has again become the Appalachian Moun-

<sup>1</sup> Although not found in the high subalpine ponds of New England and New York, *Potamogeton epihydrus* is, surely, to be sought there. On the great tableland of the Table-top Range in Gaspé, which Coleman and Alcock independently conclude "escaped the erosion of the continental ice sheets," it occurs in the pools along with *Myriophyllum Farwellii* Morong, the most northern representative of the tropical and Coastal Plain *Myriophyllum* § *Tessaronia*.

tains, it follows that these Coastal Plain groups are of as ancient ancestry as any angiosperms now living in eastern North America. It is, therefore, particularly noteworthy that in world-wide groups their representatives are invariably regarded by monographers as wholly differentiated specifically from their relatives now living in Africa, tropical India and Australia.

When we turn northward to the physiographically very youthful soils (or lack of soils) which have resulted from the Pleistocene glaciation, much of the vast area of eastern Canada and the northernmost States, a region in which the plant-population is, in some places, just moving in to occupy the newly available territory, we find a great assemblage of dominantly boreal (or extreme austral) genera: *Sparganium*, *Festuca*, *Glyceria*, *Agropyron*, *Calamagrostis*, *Eriophorum*, *Carex*, *Juncus*, *Salix*, *Alnus*, *Betula*, *Sorbus*, *Rubus*, *Fragaria*, *Potentilla*, *Rosa*, *Lathyrus*, *Epilobium*, *Pyrola* and hundreds of others. Although many stable species in this flora, like *Sparganium minimum* Fries, *Potamogeton filiformis* Pers., *P. obtusifolius* Mert. & Koch, *P. praelongus* Wulfen, *Triglochin palustris* L. and *maritima* L., *Cinna latifolia* (Trev.) Griseb., *Eriophorum gracile* Koch, *Caltha palustris* L., *Pyrola minor* L. and *Lysimachia thyrsiflora* L., are regularly regarded as identical with plants of Eurasia, others, like *Scheuchzeria palustris* L.<sup>1</sup> and *Menyanthes trifoliata* L.,<sup>2</sup> in eastern America are sufficiently different from the Eurasian plants in size of flower or fruit as to receive varietal designations; but no one has seriously proposed to treat them as different species. And when we get into heteromorphic tangles like *Festuca rubra*, the *Poa pratensis* jumble, *Agropyron repens*, *Calamagrostis canadensis* (including *Langsdorfi*), the *Carex vesicaria* morass, *Juncus effusus*, the *Salix glauca* complex, *Alnus incana*, the *Betula alba* forest, *Cerastium arvense*, *Sorbus*, *Rubus idaeus*, and a full hundred other always perplexing mazes, common experience on both sides of the Atlantic is sufficient to indicate the utter lack in these groups of the clear specific differentiations which every systematist looks for but in these plants fails to find.

The key-note in this youthful flora of the vast Canadian region, mostly available for plant-occupation only during the last few thousand years, is, then, the essential lack of fundamental specific segregation from the European representatives of these plants. This is in marked contrast with the condition shown in the amphigean

<sup>1</sup> See Fernald, RHODORA, XXV. 178 (1923).

<sup>2</sup> See Fernald, RHODORA, XXXI. 195 (1929).

genera now characteristic of the ancient Appalachian Upland and with the sharp specific differentiation of the Coastal Plain species from their allies in Africa, tropical Asia and Australia. Whether we derive the disrupted colonies of the tropical groups out of the widespread boreal flora of the Cretaceous and early Tertiary, which seems to me the logical deduction, or whether we prefer to picture them as having spread across a hypothetical trans-Atlantic land, it is clear that long after the tropical floras had become geographically separated the northern lands still maintained a broad connection. Many geologists have postulated a late Tertiary and Pleistocene uplift of the Arctic lands. Thus, Mecking,<sup>1</sup> following Suess, says of the Arctic: "At the end of the Tertiary began an uplift which continued into the Glacial Period. At the climax of the latter there followed a general sinking, which, by filling the valleys and troughs, created the sounds and then gave way to a newer uplift which still continues"; and Simmons, summarizing the various studies of former continuity of Arctic lands, concludes: "That the northern parts [of North America] . . . were lifted considerably above their previous level, cannot be doubted . . . most authors are inclined to refer the beginning of the rise . . . to the last part of the tertiary era."<sup>2</sup> The amount of this late Tertiary and early Pleistocene uplift has generally been estimated at 2000–3000 feet (600–900 meters); and study of Dr. Nansen's bathymetric map<sup>3</sup> of the Arctic Basin shows that an elevation of 2000 feet (600 meters) would today unite northwestern America and Asia and would connect northeastern America by two routes with Greenland, thence via Iceland with Scotland and Scandinavia. It is, then, quite clear that in late Tertiary, and probably in early Pleistocene time, the northern plants had essentially free routes for interchange between Eurasia and North America. Consequently, sharp specific differentiation in the comparatively youthful plants of amphigean relationship which are chiefly restricted to recently glaciated northern Europe and recently glaciated northern America is the exception rather than the rule.

Time does not permit my now specially discussing the outstanding

<sup>1</sup> Mecking, *The Polar Regions: a Regional Geography*, Geogr. Polar Reg., Am. Geogr. Soc., Sp. Pub. no. 8: 220 (1928).

<sup>2</sup> Simmons, *A Survey of the Phytogeography of the Arctic American Archipelago*, Lunds Univ. Årsskrift. n. f. Afd. 2, Bd. 9, Nr. 19: 152 (1913).

<sup>3</sup> Bathymetric Map of the Arctic Basin in Nansen, *The Oceanographic Problems of the still unknown Arctic Regions*, in Problems of Polar Research, Am. Geogr. Soc., Sp. Publ. no. 7, t. 1 (1928).

features of certain other floras in eastern America, like the high degree of relic-endemism on the nunatak areas, a topic already discussed by me in other papers<sup>1</sup> (190 rare and localized endemics already known, and 160 others with relic-colonies isolated by 1500–4500 miles from other colonies of the species), or the multiplicity of intergradient forms<sup>2</sup> of *Panicum*, *Salix*, *Amelanchier*, *Crataegus*, *Rubus*, *Vaccinium* (§ *Cyanococcus*) and *Aster* and the dominance of more than 1000 aggressive species introduced from Europe during the last three centuries on the clearings made by the white man, the youngest spots of all. From what I have been able to present, however, certain deductions, by way of summary, seem justified:

1. The characteristic flora of the present southern Appalachian Upland, made up largely of groups which were cosmopolitan in the Mesozoic or early Cenozoic but now reduced to geographically segregated remnants in the Northern Hemisphere, is obviously ancient and its species are usually (but not always) clearly differentiated from those of the same genera in eastern and central Asia or in southeastern Europe.

2. The Coastal Plain flora of Atlantic North America is distinguished by the abundance of tropical groups represented. Although these plants now chiefly occupy open silicious, peaty and aquatic habitats in comparatively youthful regions of eastern North America, it is probable that they or their progenitors formerly existed on the area of the ancient Appalachian Upland, especially in the Cretaceous, when that primitive region of the continent was baseleveled and reduced essentially to sea-level and at the time when the tropical groups of today were widespread in the North. Then, with the Tertiary uplift of the Appalachian region and its final conversion into a vast well-drained mesophytic area available to the groups which now constitute the climax forests of the Appalachian Upland, the Cretaceous xerophytes and hydrophytes which had previously occupied the ground gradually moved out to the newly available and for them more congenial Coastal Plain and similar habitats to the west and northwest. These species of the Coastal Plain, whose direct progenitors were probably segregated geographically from their

<sup>1</sup> For discussion see Fernald, *Isolation and Endemism in Northeastern America*, *Am. Journ. Bot.* xi. 564 (1924); *Persistence of Plants in Unglaciated Areas of Boreal America*, *Mem. Am. Acad.* xv. 242–244 (1925); *Some Relationships of the Floras of the Northern Hemisphere*, *Proc. Internat. Congr. Pl. Sci.* ii. 1493, 1494 (1929).

<sup>2</sup> For discussion see Fernald, *The Antiquity and Dispersal of Vascular Plants*, *Quart. Rev. Biol.* i. 236–238 (1926).

African, Indian and Australian allies during the Cretaceous or the early Tertiary, are thoroughly differentiated from the Old World species.

3. The nunatak areas, the scattered unglaciated or only slightly glaciated spots within the region of more widespread glaciation, are distinguished by a high degree of relic-endemism.

4. The dominant groups of the region of northeastern America only lately freed from Pleistocene ice are largely those of recently glaciated northern Europe. These northern lands have been so recently segregated geographically that until geologically recent time there has been free interchange in the floras; and in the ecologically youthful Canadian and northern European regions identity of species in the amphigean genera is so general as to become the rule.

5. The recently cleared lands, like the recently glaciated areas and the Quaternary sands, are also characterized by a multiplicity of variable and often intricately intergrading and hybridizing forms, as well as by the aggressive dominance of unchanged species introduced within three centuries from the youthful flora of Europe.

Some of the points I have discussed are possibly new, though many of them are familiar and very old-fashioned doctrines; but since familiarity so often breeds contempt and the latest doctrines are so frequently supposed to be the best, it may not be amiss to call attention anew to the overwhelming evidence of the soundness of some of the older deductions.



FLORA OF NEWFOUNDLAND  
 REGION OF CAPE RAY  
 26225  
*Potamogeton confervoides* Hitchcock  
 Fresh plants red dish  
 (The stem grows in praty barren among the grass)

FLORA OF NEWFOUNDLAND  
 REGION OF CAPE RAY  
 2562 *Potamogeton pectinatus* L.  
 Fresh plants

Photo. by H. M. Raup.

POTAMOGETON CONFERVOIDES (left) and P. PECTINATUS (right)  $\times 1\frac{1}{2}$ .



CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCIV.

THE VASCULAR FLORA OF ST. PAUL ISLAND,  
NOVA SCOTIA.

BY LILY M. PERRY.

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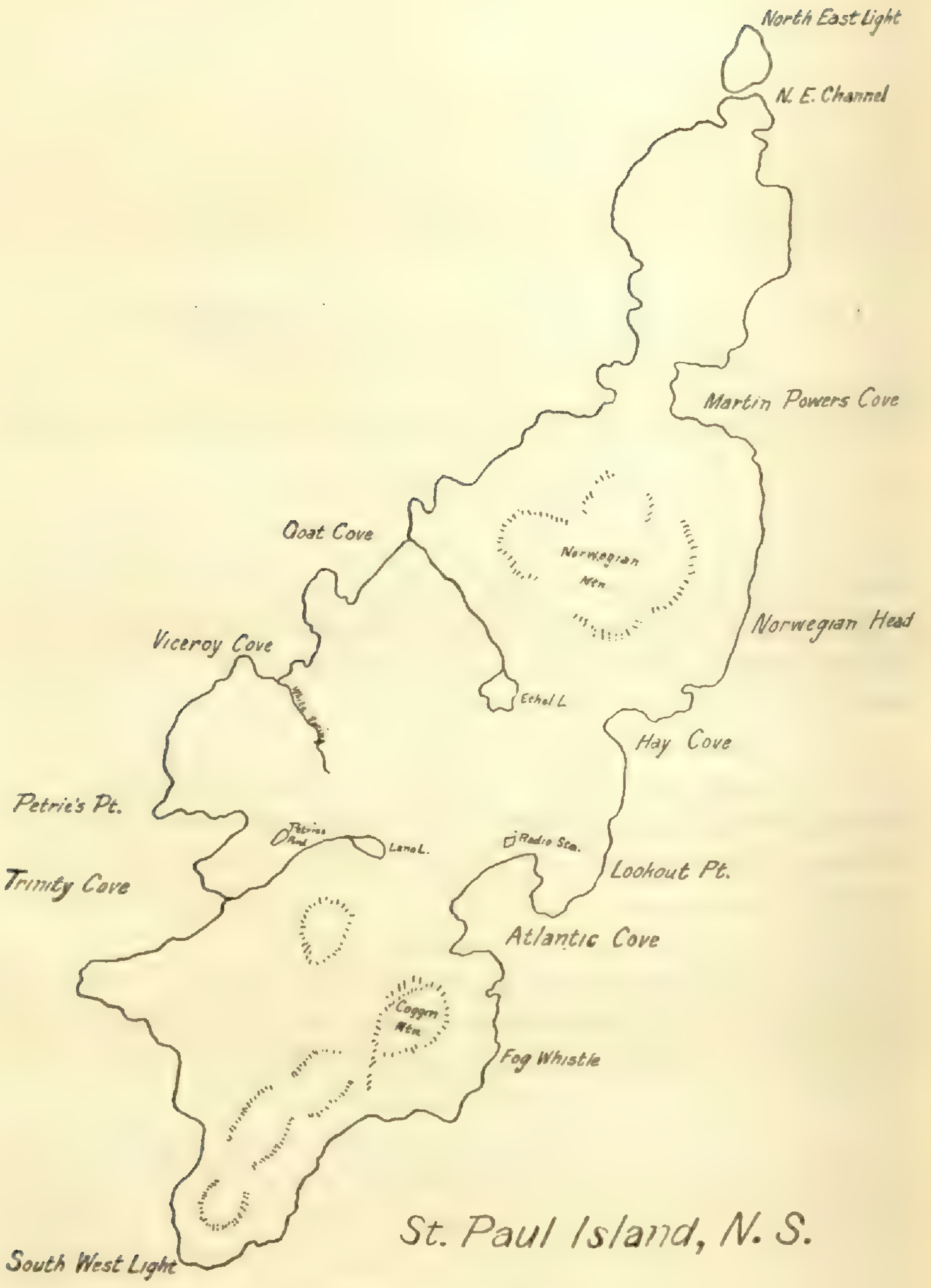
THE VASCULAR FLORA OF ST. PAUL ISLAND, NOVA SCOTIA

LILY M. PERRY

ST. PAUL, one of the smaller islands in the Gulf of St. Lawrence, lies about twelve miles northeast of Cape North, Nova Scotia. It is well-known that at least portions of the Magdalens, Anticosti and the Mingan Islands in the Gulf at some distance from the mainland escaped the Pleistocene denudation and consequently have been of particular interest phytogeographically. Presumably St. Paul also was far enough from the mainland to continue unglaciated, except perhaps locally; if so, its flora too might offer some interesting relics. This possibility and the smallness of the island induced Dr. Muriel V. Roscoe and me to spend a month's vacation there during the summer of 1929 collecting botanical specimens.

It was exceedingly difficult to obtain in advance much information concerning St. Paul. Apart from wireless and the government boats which carry supplies, equipment and employees, there is no regular means of communication with the mainland; no geological survey of the island has been made and consequently no topographic maps are available. Finally, however, Miss Roscoe discovered Miss Campbell, a former resident, who gave us many concrete facts about the place and supplied us with a map which, although drawn with the details of shipwrecks and currents especially for mariners, was invaluable to us in our work.

The island in outline is elliptical-oval, at best not more than a mile wide and approximately four miles long. About a quarter of a mile from the northeast end the sea runs through a narrow channel



MAP OF ST. PAUL ISLAND

so that, in fact, there are really two islands. The part cut off is perhaps a fifth of a mile wide and lacks trees or shrubs of any kind. On it are located the northeast light and the foghorn. A sliding cable with chairlike attachment serves as a means of transportation across the "Tittle" and here one receives as much of a thrill as if riding over the Niagara whirlpool. The island rises rather abruptly from the sea, although the surface is only moderately rolling with two slight elevations, Norwegian and Coggin mountains. On the summit of Coggin Mountain is a small bronze tablet set in concrete and stamped "for information write the Geodetic Survey of Canada." From Mr. Ogilvie, the Director of the Survey, I learned that this tablet is a triangulation station mark of the Geodetic Survey of Canada and its position is as follows: latitude  $47^{\circ} 11' 40.2''$  N., longitude  $60^{\circ} 09' 06.2''$  W., elevation 550 feet above the sea level. This particular station was used not only for the purpose of accurately locating the island and the lighthouses at either end, but also to aid in connecting points in Newfoundland to those in Nova Scotia.

From the economic point of view St. Paul Island is of little value since for the most part it is covered with a somewhat stunted forest of balsam fir and white spruce. It is really a government station managed by the Department of Marine and Fisheries; and no person, unless shipwrecked, is permitted to land without the consent of the Canadian government. Last summer eight government employees with their families were living there. Although the history of the island will not be considered here, one thing should not be overlooked. Hitherto St. Paul has been a menace to seafaring people on the Gulf of St. Lawrence. The coast is rugged, rocky, irregular and without harbors. There are three or four coves where a stranger might expect to find shelter, but experience has proved them to be more dangerous during a storm than the open sea and the lee side of the island affords the only possible haven. Not only have storms played havoc with vessels but also bewildering fogs and unusually treacherous currents. Practically every little headland has received its name from some ship destroyed thereon. So numerous were the wrecks that, until the year 1924, a life-saving station was maintained on the island under the direction of a governor; and a crew of eight men patrolled the coast every day on the lookout for wrecks or ships in distress. Since that time, however, the Canadian government has established a radio direction-finding station and the operation of this practically elimin-

ates the probability of any large wreck. The operator of any boat or vessel carrying a wireless outfit may ask for and receive his bearing at any time of the day or night.

As early as 1883 we find the island-flora already studied by Dr. A. H. MacKay and his manuscript-list incorporated in Macoun's "Catalogue of Canadian Plants." Nevertheless, so great has been the progress in the field of systematic botany that earlier determinations are often obscure and many times characters have been misinterpreted; for this reason a restudy of the specimens in the light of present knowledge is necessary to establish their identities. For instance, Professor Fernald, while revising the genus *Oxytropis* in eastern North America, found that it had been reported from St. Paul island. Through inquiry, he learned that Dr. MacKay's record had been made on tentative field identification, hence the specimens were unavailable for further study. Since "no *Oxytropis* is known about the Gulf of St. Lawrence except in the Gaspé region and in western Newfoundland (four species)," Professor Fernald emphasized the fact that it was highly desirable to obtain specimens from St. Paul. He also suggested that the flora there would probably reveal significant geographic relationships. Now the scope of the island is too limited to attract outstanding field-botanists; but Miss Roscoe and I believed that here was a somewhat isolated unit whereby we might contribute something to the knowledge of the flora of Nova Scotia and at the same time profit by some valuable field-experience.

It seemed a relatively simple problem to get a boat to transfer us from the mainland to the island; nevertheless, after seeing people there wait ten days for favoring wind, tide and weather in order to go safely ashore, we realized how fortunate we had been to spend only one day at Bay of St. Lawrence. The weather was ideal for tenting and collecting specimens; yet, in spite of almost no fog nor rain, so great was the humidity that it was impossible to dry either specimens or driers out-doors.

In the vicinity of the Radio Station at Atlantic Cove were miniature gardens; and the few fields, at least in part, had been cultivated although not many genera have been introduced. The vegetation of the fields was various. The predominant grasses, *Anthoxanthum*, *Agrostis* and *Phleum*, were associated with a profusion of *Rumex Acetosella*, *Stellaria graminea*, *Ranunculus repens*, *R. acris*, *Euphrasia canadensis*, *E. americana*, *Rhinanthus Crista-galli* var. *fallax*, *Chrysan-*

themum *Leucanthemum* var., *Leontodon autumnalis* var. *pratensis*, *Cirsium arvense* and occasional patches of *Trifolium*, *Prunella*, *Galeopsis Tetrahit* var., *Plantago major* and *Centaurea nigra*. In the moister or more meadowy portions *Viola cucullata* and *Arenaria lateriflora* were the showy members of the plant-association. Near the base of one hill *Potentilla canadensis* var. *simplex* was growing with scattering bits of sphagnum. Invariably the dry rocky places were covered with *Sisyrinchium angustifolium*, *Potentilla tridentata*, *Vaccinium Vitis-Idaea* var. *minus* and clumps of *Iris versicolor*. Instead of *Spiraea* on the open slopes, *Sanguisorba canadensis* var. *latifolia* grew in abundance. This Alaskan variety has been collected in Quebec at Natashquan and Pontchartrain, and on the island of Anticosti, but apparently has not been known south of Anticosti.

Bordering the swamp of this region was a somewhat solid turf of *Glyceria canadensis*, *Scirpus rubrotinctus*, *S. atrocinctus*, *Eriophorum virginicum*, *Carex scoparia*, *Juncus filiformis* and *Luzula campestris* var. *multiflora*. Beyond this the ground was spongy. Usually *Carex stellulata* var. *cephalantha* and *C. paupercula* filled the margins of little "bog-holes." The larger part of the swamp was covered with tussocks of *Scirpus cespitosus* var. *callosus* supplemented in open spots by *Rynchospora alba* and *Epilobium palustre* var. *monticola*. The whole area was interspersed with *Eriophorum angustifolium*, *Habenaria dilatata*, *H. fimbriata*, *Sarracenia purpurea* and a few clumps of *Iris versicolor*. Just beyond in a typical sphagnum bog the inconspicuous *Malaxis unifolia* was growing with an abundance of *Habenaria clavellata* and *Equisetum arvense*, and nearby a scrubby fir concealed a meagre specimen of *Kalmia polifolia*, a species not noted elsewhere on the island.

Owing to zones of dense undergrowth of brushwood, travelling in the forest was exceedingly difficult and in many places well-nigh impossible. Sometimes the scrub was sufficiently compact to carry our weight, but oftener it swallowed us and we had to hunt for a way through. The flora of the woods varied scarcely at all in the different regions. *Athyrium angustum*, var. *rubellum*, *Thelypteris Phegopteris*, *T. spinulosa* vars., *Clintonia*, *Maianthemum*, *Streptopus*, *Habenaria obtusata*, *Coptis*, *Ribes glandulosum*, *Aralia nudicaulis*, *Cornus canadensis*, *Moneses*, *Pyrola*, *Monotropa*, *Trientalis*, *Linnaea*, *Solidago macrophylla*, *Aster acuminatus* and *Prenanthes trifoliolata* were everywhere. *Empetrum nigrum* or *Chiogenes hispidula* covered the

exposed knolls and *Carex trisperma* carpeted the little swales and glades. Southeast of Lena Lake, *Polypodium virginianum*, *Taxus canadensis*, *Lycopodium lucidulum*, *Mitella nuda*, *Oxalis montana* and *Viola incognita* were frequent. The forest flora, however, was not entirely uninteresting. *Carex crinita* var. *simulans* collected in a swale on the east slope of Coggin Mountain, although known from Newfoundland to Massachusetts chiefly in the mountains, is reported for the first time from Nova Scotia; also *Solidago uniligulata* var. *neglecta* not definitely reported east of Yarmouth county was fairly abundant here. The prevailing tree was *Abies balsamea* although *Picea canadensis* was generally distributed throughout. Possibly an occasional "bog" spruce grew there, but we failed to find any in our cruising. The chief deciduous elements were *Alnus*, *Betula*, *Acer*, *Pyrus*, *Amelanchier*, *Lonicera*, *Viburnum*, and *Sambucus*. These were not plentiful nor were they much larger than undershrubs. *Lonicera canadensis* reaches its northeastern range-limit on St. Paul, and *Amelanchier Fernaldii*, a native of the region about the Gulf of St. Lawrence, is an addition to the Nova Scotian flora.

On account of the high winds and salt spray the border of the forest was greatly dwarfed. Often the firs were simply flattened dense mats which grew to the very edge of the sea-cliffs; but, between the woods and the cliffs were also stretches of barren which yielded a variety of interesting things. The barrens were nearly always on headlands and similar in character, although usually each was marked by some species lacking in the others. Here and there in slightly protected places stunted trees weathered the gales, but *Empetrum nigrum* flourished regardless of shelter. Occasionally sprawled with it were *Juniperus horizontalis* and *J. communis* var. *megistocarpa* similar in habit to var. *montana* yet distinguished by larger berries with larger seeds. This variety was described from Sable Island, but it also occurs on the Magdalen Islands and in western Newfoundland. On the broad barren, *Agrostis*, *Ammophila*, *Deschampsia flexuosa*, *Smilacina stellata*, *Iris setosa* var. *canadensis*, *Euphrasia*, *Solidago bicolor* and *Aster novi-belgii* were the general vegetative elements. *Equisetum*, *Agropyron*, *Carex hormathodes*, *C. silicea*, *C. maritima* or *Juncus balticus* var. *littoralis* filled the damp or sphagnous depressions. At the southwest end of the island some two hundred feet above the sea level, *Vaccinium uliginosum* var. *alpinum*, much cropped by the goats, maintained a struggle for existence. Near West Point the boreal

species *Cornus suecica* grew in abundance and close by a colony of *Anaphalis margaritacea* f. *anochlora* prospered. The barren at Trinity Cove was by far the largest, yet its vegetation contained only three particularly interesting things: *Deschampsia flexuosa* var. *montana*, *Rhinanthus groenlandicus* and *Campanula rotundifolia* var. *alaskana*. These natives of Newfoundland and Gaspé are here noted for the first time from Nova Scotia. To this enumeration of boreal species should be added *Silene acaulis* var. *exscapa* (abundant also at the southwest of the island), *Salix Uva-ursi*, *S. cordifolia* var. *callicarpaea* and *Solidago multiradiata*, all collected on a little slope south of the "Tittle" (North East Channel), the two latter the first from south of Newfoundland, Anticosti and Gaspé.

Near the sea cliffs, *Plantago juncoides* var. *decipiens* replaced the *Gramineae*. Along the upper edges of the bluffs were mats of *Cerastium arvense* or *Lathyrus maritimus* and clumps of *Sedum roseum*. At the northeast *Oxytropis johannensis* grew in profusion. This, the only member of the genus known from Nova Scotia, has not been found farther south in Newfoundland than Cape St. George, although it occurs in Quebec, Maine and east along the upper St. John river in New Brunswick. The chief crevice plants were *Puccinellia paupercula* var. *alaskana*, *Festuca rubra* var., *Sagina procumbens*, *Plantago juncoides* var. *decipiens* and *Solidago sempervirens*.

St. Paul rises so abruptly from the sea that it is unsafe to try to reach the water from more than three or four points on the island. Logically enough there is a characteristic lack of beaches. Nevertheless, on the west coast a small sand beach has developed, and in other places below the cliffs sandy margins are appearing. The beach below West Landing maintained a few beach-types: *Mertensia maritima* growing in mats from 6 inches to 2 feet in diameter, *Atriplex maritima* var. *hastata*, *Cakile edentula*, *Polygonum Raii* and *Arenaria peploides* var. *robusta* (a single specimen of each of the last two).

While scouting to obtain the lay of the land, we discovered apparently a low open stretch in the forest northeast of Petrie's Pond. We were eager to explore it, but, since the vegetation of the barren was more mature owing to its exposed location, we bent our efforts in that direction. We started at West Landing and, after following the Trinity Cove barren almost to Petrie's Point, we came to a slight ridge marking a definite change in the plant-association. On the other side of the elevation, a little stream was trickling from a series of



shallow pools and sunken spots of ooze or slimy mud. The locality was too fascinating to resist. From the pools we took *Equisetum arvense* f. *decumbens* and *Triglochin palustre*. We were puzzled by a network of delicate strands on the ooze; however, thinking they were probably indeterminable, we passed them by for species manifestly not yet represented in our collection: *Selaginella selaginoides* nestling under sedge tussocks and tiny banks, *Panicum boreale*, *Danthonia spicata*, *Carex gynocrates* (rare on the island and new to Nova Scotia), *C. Oederi* var. *pumila*, *Thalictrum polygamum*, *Potentilla fruticosa*, *Primula mistassinica* and *Pinguicula vulgaris*. It was impossible to pick up everything that day so we planned to return the following Monday. A heavy rain on Sunday swelled the brooklet and filled the oozy hollows with water. Imagine our surprise to find some pools almost choked with submersed masses of *Utricularia minor*. The specimens were coarser than those of the typical form, the bladders larger and the leaves flattened rather than capillary. There is a form *platyloba* which occurs wherever the plant creeps from the water into a muddy habitat, and I am inclined to believe that our slightly abnormal specimens may be the result of ecological conditions under which they live.

The stream drained a boggy meadow in which grasses and sedges were predominant. Here we gathered *Agrostis hyemalis*, *Calamagrostis canadensis*, *Scirpus cespitosus* var. *callosus*, *S. hudsonianus*, *Eriophorum viridi-carinatum*, *Carex pauciflora*, *C. rostrata* and var. *utriculata*, *Epilobium palustre* var. *monticola*, *Andromeda glaucophylla* and, curiously enough, *Gaultheria procumbens*. Bordering the expanse was a thicket of *Betula pumila*, *Pyrus dumosa*, *Rubus recurvicaulis*, *Rosa nitida*, *Acer rubrum*, *Lonicera villosa* var. *Solonis* and other common types. The swampy and boggy area in one direction was lying adjacent to Petrie's Pond and proved to be the section we had wished to explore. At the opposite end, it opened into a larger bog dotted with a number of small ponds often individual as to floral specialty, usually one of the following: *Sparganium angustifolium*, *Potamogeton epihydrus*, *Lycopodium Selago*, *L. inundatum* or *Juncus canadensis*. Here *Carex Howei*, a coastal plain species, reaches its present northern limit. Just beyond the immediate source of White Spring (the stream draining the bog) a beautiful patch of *Pogonia ophioglossoides* flourished and scattering specimens of *Solidago uniligulata* var. *neglecta* were beginning to blossom.

Apart from the brooklet already mentioned, the streams and their banks were disappointing botanically. This was probably owing to their smallness and the rapidity of the flow of water as well as to the wetness of the land in general. The lakes, Ethel and Lena, were more attractive. In Ethel Lake the wading was good and we added to our list *Isoetes macrospora*, *Eriocaulon septangulare*, *Nymphozanthus variegatus*, *Lysimachia terrestris* and *Lobelia Dortmanna*. The latter is slightly aberrant in that the lip of the corolla is somewhat more coarsely and profusely pubescent than that of the typical form and the protrusion of the pubescence causes the sinuses between the lobes to appear ciliate. Lena Lake was a different proposition. We had been warned to keep away from the lower end if we valued our lives. The muddy bottom, although seemingly solid, had several times given way suddenly, so that it was impossible to ascertain the real depth of water. But alas, here if anywhere ought to be good collecting. The vegetation grew from the margin nearly to the middle of the lake. We visited the place soon after landing and noted that the plants were too immature to collect; incidentally, we discovered by stepping into the water, that good-sized leeches were there in abundance. Just before leaving the island, we went back again to pick up whatever we could without venturing too far from the bank. In three weeks' interval a huge colony of *Scirpus acutus* had grown from a narrow strip along the margin almost to the centre of the lake. We obtained *Potamogeton Oakesianus*, *Scirpus subterminalis*, *Carex rostrata* var. *utriculata*, *Juncus militaris*, *Utricularia geminiscapa*, *U. ochroleuca*, *Aster nemoralis* and var. *major*. *U. ochroleuca* has been reported in North America only from Greenland; and while this may appear to be a long range-extension, both Professor Fernald and I believe that the specimens (which unfortunately are sterile) compare favorably with authentic material of this species of Hartman in the Gray Herbarium. Petrie's Pond was very small and had a quaking margin from which grew a profusion of *Carex limosa*.

It was our aim to make a complete collection of the vascular flora of St. Paul. Unfortunately, we did not reach a small part of the island, reserved for a last venture since we had been assured that it was almost inaccessible. Four days in advance, we knew that a boat was coming from the mainland for a government official and that we might return with him. By working into the wee small hours of the morning, we had hoped to clear our presses and yet to have left an entire day in

which to pick up at least one specimen of each of the desirable plants of Mica Head, the unexplored region. We had not one day but four so filled with heavy fog that this last field-trip faded into an impossibility. In spite of the lacuna, our collection is fairly representative of the flora of St. Paul. It includes about 2360 sheets of specimens, in all 418 numbers embracing 160 genera and approximately 300 species and varieties. In large part, these are common to the flora of Nova Scotia; some are found only in Cape Breton and St. Paul, while others, 20 in all, were collected in the province for the first time last summer and most of them illustrate definite range-extensions from the north. It is significant that these northern plants are characteristic of slightly or not at all glaciated regions in Newfoundland, Quebec, Anticosti or the Magdalen Islands; hence, if I may draw a parallel conclusion, it seems not unreasonable to infer that St. Paul also escaped denudation by the Wisconsin ice-sheet.

I am under obligation to many people who have aided me throughout my work on the flora of St. Paul Island. First of all, I wish to express my appreciation to Professor Fernald both for suggesting the trip and for the expert assistance and criticism which he has kindly and promptly given from the beginning of our preparation. To Dr. B. L. Robinson, I am deeply grateful for the generous support which made this trip possible, as well as for the personal interest he has shown in the work. I am greatly indebted to all the Canadian government officials and employees who contributed to the success and pleasure of our little expedition. I wish particularly to thank Mr. E. W. Hawken, Assistant Deputy Minister of the Marine Department, and Mr. C. H. Harvey, Agent of Marine and Fisheries at Halifax, for permission to visit the island; Major J. J. McLean, Superintendent of Lighthouses, for shipping our equipment on the "Lady Laurier" and also for many other courtesies; and Mr. H. M. Sutherland, Division Superintendent of Radio, for the special favor of permitting us to board at the Wireless Station. I take much pleasure in thanking Miss Campbell for a map of the island which greatly facilitated our work; and, I am highly appreciative of the helpful and courteous assistance of the government employees during our sojourn on the island. Their spirit of friendliness added much to the enjoyment of our work there.

## VASCULAR PLANTS COLLECTED ON ST. PAUL ISLAND, 1929

In the following list, the names of the species marked \* are recorded for the first time, apparently, from Nova Scotia. The introduced species are in italics.

*POLYPODIUM VIRGINIANUM* L. Between Atlantic Cove and Lena Lake. Fairly common on the southern half of the island.

*PTERIDIUM LATIUSCULUM* (Desv.) Hieron. Common.

*ATHYRIUM ANGUSTUM* (Willd.) Presl. var. *RUBELLUM* (Gilbert) Butters. Frequent throughout the woods.

*THELYPTERIS PHEGOPTERIS* (L.) Slosson. Abundant everywhere.

*T. NOVEBORACENSIS* (L.) Nieuwl. General in the open woods.

*T. SPINULOSA* (O. F. Muell.) Nieuwl., var. *INTERMEDIA* (Muhl.) Nieuwl. Common.

*T. SPINULOSA* (O. F. Muell.) Nieuwl., var. *AMERICANA* (Fisch.) Weatherby. Common.

Almost as abundant as the two varieties just mentioned was a form transitional between the two.

*OSMUNDA REGALIS* L., var. *SPECTABILIS* (Willd.) Gray. Margin of Petrie's Pond and Lena Lake.

*O. CLAYTONIANA* L. Occasional on the southeast side of the island.

*O. CINNAMOMEA* L. Frequent in the swampy region of Atlantic Cove.

*EQUISETUM ARVENSE* L. Common.

*E. ARVENSE* L., f. *DECUMBENS* (Meyer) Klinge. Muddy bottom of stream between Petrie's Pond and White Spring.

*E. SYLVATICUM* L., var. *PAUCIRAMOSUM* Milde. Woods near the Radio Station. Rare in Nova Scotia.

*LYCOPODIUM SELAGO* L. By margin of a water-hole in a bog above Petrie's Pond. Rare.

Previously collected in Nova Scotia on the Barrasois River, Cape Breton.

*L. LUCIDULUM* Michx. General southeast of Lena Lake.

*L. INUNDATUM* L. Muddy margin of water-hole, bog at head of White Spring.

*L. CLAVATUM* L. Dry hillock near the path to the North East Light.

Neither this nor the following species were seen elsewhere on the island.

*L. OBSCURUM* L. Dry hillock near the path to the North East Light.

*SELAGINELLA SELAGINOIDES* (L.) Link. Borders of tussocks; overhanging margins of sluggish stream; between Petrie's Pond and White Spring. Rare.

*ISOETES MACROSPORA* Dur. Abundant in Ethel Lake.

Not frequent in the province.

*TAXUS CANADENSIS* Willd. General on the southern part of the island.

*PICEA CANADENSIS* (Mill.) BSP. Commonly distributed throughout the forest.

*ABIES BALSAMEA* (L.) Mill., var. *PHANEROLEPIS* Fernald. Everywhere. This rather than the typical form is the predominant tree on the island.

*JUNIPERUS COMMUNIS* L., var. *MEGISTOCARPA* Fernald & St. John. Border of forest, Trinity Cove.

Known also on Sable Island, Nova Scotia.

*J. COMMUNIS* L., var. *MONTANA* Ait. Trinity Cove barren. Not plentiful.

*J. HORIZONTALIS* Moench. Common along the west side of St. Paul.

*SPARGANIUM CHLOROCARPUM* Rydb., var. *ACAULE* (Beeby) Fernald. Mud-hole by dam near Atlantic Cove.

*S. ANGUSTIFOLIUM* Michx. Miry pond in bog at head of White Spring.

*POTAMOGETON OAKESIANUS* Robbins. Shallow water, Lena Lake.

*P. EPIHYDRUS* Raf. Pond in bog above Petrie's Pond.

*ZOSTERA MARINA* L. In wash of tide.

*TRIGLOCHIN MARITIMA* L. Stagnant pool in rocks, North East Light.

*T. PALUSTRIS* L. Sluggish stream between Petrie's Pond and White Spring.

*PANICUM BOREALE* Nash. Banks of stream just mentioned.

*Anthoxanthum odoratum* L. Abundant in all the open places.

*MILIUM EFFUSUM* L. Woodland, southeast slope of Coggin Mountain.

*ORYZOPSIS ASPERIFOLIA* Michx. Wooded hillsides near Trinity Cove.

*Phleum pratense* L. Common in abandoned fields.

*AGROSTIS STOLONIFERA* L., var. *COMPACTA* Hartm. Barren slopes.

*A. HYEMALIS* (Walt.) BSP. Bog at head of White Spring. The awned form.

*A. TENUIS* × *A. STOLONIFERA*. [Det. *Dr. M. O. Malte*]. Atlantic Cove.

*CALAMAGROSTIS PICKERINGII* Gray. Bog above Petrie's Pond. This grass is rare on the island.

*C. CANADENSIS* (Michx.) Nutt. Abundant in exposed places. The predominant grass on St. Paul.

*AMMOPHILA BREVILIGULATA* Fernald. Wind-swept barren, Trinity Cove. Not noted elsewhere.

*CINNA LATIFOLIA* (Trev.) Griseb. Woodland between Whistle Point and South West Light.

*DESCHAMPSIA FLEXUOSA* (L.) Trin. General on the barren and in the woods on the west side of the island.

\**D. FLEXUOSA* (L.) Trin., var. *MONTANA* (L.) Ledeb. Barren, Trinity Cove.

Var. *montana* is essentially a plant of the northern regions. It is known from Greenland, Labrador, Newfoundland and Quebec (Gaspé and Matane Counties). This is the first collection south of Quebec.

*Avena sativa* L. Waste places, Atlantic Cove.

*DANTHONIA SPICATA* (L.) Beauv. Occasional in rocky places.

*SPARTINA MICHAUXIANA* Hitchcock. Near edge of sea-cliffs, slope southwest of N. E. Channel.

We were very much surprised to find this plant of river banks and other wet habitats growing with *Carex silicea* in a sheltered spot at least fifty feet above the sea level, but evidently it derived sufficient moisture from the drainage of the land above it to thrive.

*Poa pratensis* L. Occasional, Atlantic Cove.

*P. trivialis* L. Waste places, Atlantic Cove.

*GLYCERIA CANADENSIS* (Michx.) Trin. Border of swamp, Atlantic Cove.

*PUCCINELLIA PAUPERCUA* (Holm) Fernald & Weatherby, var. *ALASKANA* (Scribn. & Merr.) Fernald & Weatherby. Crevices of rocks, North East Light.

*FESTUCA RUBRA* L. Rocky slopes, North East Light.

\**FESTUCA RUBRA* L., var. *ARENARIA* (Osbeck) Fries. With *F. rubra*.

Var. *arenaria* is another native of northern lands; it has been collected previously in Greenland, Newfoundland and Quebec (Matane and Gaspé Counties).

*F. RUBRA* L., var. *JUNCEA* (Hack.) Richter. Crevices of cliffs, Trinity Cove.

*Agropyron repens* (L.) Beauv. Waste places.

\**A. CANINUM* (L.) Beauv., var. *HORNEMANNI* (Koch) Pease & Moore. Barren, Trinity Cove.

Var. *Hornemanni* has been reported as far south as the alpine region of New Hampshire, but I have not found anything to indicate that it has been collected previously in Nova Scotia.

*ELEOCHARIS PALUSTRIS* (L.) R. & S., var. *MAJOR* Sonder. Near the margin of Lena Lake. Scarce.

*SCIRPUS CESPITOSUS* L., var. *CALLOSUS* Bigel. Common in bogs.

*S. HUDSONIANUS* (Michx.) Fernald. Peat bog between Petrie's Pond and White Spring. Only a few patches seen.

*S. SUBTERMINALIS* Torr. Shallow water, Lena Lake.

*S. ACUTUS* Muhl. Petrie's Pond and Lena Lake.

*S. RUBROINCTUS* Fernald. General in swampy land.

*S. ATROCINCTUS* Fernald. Swamp, Atlantic Cove.

*ERIOPHORUM ANGUSTIFOLIUM* Roth. General in bogs and swamps.

*E. VIRIDI-CARINATUM* (Engelm.) Fernald. Occasional in bogs.

*E. VIRGINICUM* L. Abundant in swamp, Atlantic Cove.

*RYNCHOSPORA ALBA* (L.) Vahl. Bogs.

*CAREX HORMATHODES* Fernald. Wet hollow in barren, Trinity Cove.

*C. HOWEI* Mackenzie. Peat bog at head of White Spring.

This is a southern species which as yet has not been found farther north.

*C. SCOPARIA* Schkuhr. Common.

*C. SILICEA* Olney. Barren near the edge of the sea cliffs.

\**C. GYNOCRATES* Wormsk. Bog between Petrie's Pond and White Spring. Rare.

*C. EXILIS* Dewey. Sphagnous margin of Petrie's Pond.

*C. STELLULATA* Good., var. *CEPHALANTHA* (Bailey) Fernald. Common.

*C. INTERIOR* Bailey. Peat bog at head of White Spring.

*C. BRUNNESCENS* Poir., var. *SPHAEROSTACHYA* (Tuckerm.) Kükenth. Frequent in the open woods.

*C. TRISPERMA* Dewey. Wet mossy fir woods near Lena Lake.

*C. STIPATA* Muhl. Occasional in swales.

*C. MARITIMA* O. F. Muell. Swales on barren, also in muddy pockets in rocks.

*C. CRINITA* Lam., var. *GYNANDRA* (Schwein.) Schwein. & Torr. Swamp in woods near the Radio Station.

\**C. CRINITA* Lam., var. *SIMULANS* Fernald. Woodland, Coggin Mountain.

*C. GOODENOWII* Gay. Profuse everywhere.

*C. PAUCIFLORA* Lightf. Bog above Petrie's Pond.

*C. BUXBAUMII* Wahlenb. Swamp near Petrie's Pond.

*C. NOVAE-ANGLIAE* Schwein. Norwegian Head.

*C. PAUPERCUA* Michx. Common in swampy regions.

*C. LIMOSA* L. Floating out from the margin of Petrie's Pond.

*C. OEDERI* Retz., var. *PUMILA* (Coss. & Germ.) Fernald. Occasional in hollows on the barren or near the sea cliffs.

*C. ARCTATA* Boott. Occurring casually in the open woodland.

*C. DEBILIS* Michx., var. *RUDGEI* Bailey. Swampy woods near the Radio Station.

*C. INTUMESCENS* Rudge. By streamlet from the dam near the Radio Station.

*C. ROSTRATA* Stokes. Swamp near Petrie's Pond.

*C. ROSTRATA* Stokes, var. *UTRICULATA* (Boott) Bailey. Shallow water, Lena Lake.

*ERIOCAULON SEPTANGULARE* With. Ethel Lake.

*JUNCUS BUFONIUS* L. Abundant everywhere on open spots.

*J. TENUIS* Willd. Common along paths.

*J. BALTICUS* Willd., var. *LITTORALIS* Engelm. Windswept barren, Trinity Cove southwest.

*J. FILIFORMIS* L. Swale, Atlantic Cove.

*J. EFFUSUS* L., var. *SOLUTUS* Fernald & Wiegand. Margin of Lena Lake.

*J. EFFUSUS* L., var. *COMPACTUS* Lej. & Court. Frequent.

*J. BREVICAUDATUS* (Engelm.) Fernald. Abundant between Lena Lake and Petrie's Pond.

*J. CANADENSIS* J. Gay. Peat bog at head of White Spring. Rare.

*J. MILITARIS* Bigel. Shallow water, Lena Lake.

*J. ARTICULATUS* L. Common in open places.

*J. ARTICULATUS* L., var. *OBTUSATUS* Engelm. Wet path toward the North East Light.

*LUZULA SALTUENSIS* Fernald. Norwegian Head.

*L. CAMPESTRIS* (L.) DC., var. *MULTIFLORA* (Ehrh.) Čelak. Common in fields.

\**L. CAMPESTRIS* (L.) DC. var. *COMOSA* (Meyer) Fernald & Wiegand. Woodland path near Lena Lake.

This variety, generally distributed from Montana west and northwest, has been collected in eastern America, in western Newfoundland and at one station in Gaspé County, Quebec.

*CLINTONIA BOREALIS* (Ait.) Raf. Abundant throughout the woods.

*SMILACINA STELLATA* (L.) Desf. Common on the barrens.

*MAIANTHEMUM CANADENSE* Desf. General in the forest.

*STREPTOPUS AMPLEXIFOLIUS* (L.) DC. Frequent at the southwest end of the island.

*S. ROSEUS* Michx. Fairly well distributed throughout the woodland.

*IRIS VERSICOLOR* L. In swamps and on dry rocky places.

*I. SETOSA* Pall., var. *CANADENSIS* Foster. Near the cliffs on headlands and barrens.

*SISYRINCHIUM ANGUSTIFOLIUM* Mill. Common.

*HABENARIA DILATATA* (Pursh) Gray. Usual in bogs.

*H. CLAVELLATA* (Michx.) Spreng. Sphagnum bog, Atlantic Cove.

*H. OBTUSATA* (Pursh) Richardson. Everywhere in the woods.

*H. FIMBRIATA* (Ait.) R. Br. Fields bordering the woodland.

*POGONIA OPHIOGLOSSOIDES* (L.) Ker. Growing in profusion, peat bog at head of White Spring.

*CALOPOGON PULCHELLUS* (Sw.) R. Br. Occasional in bogs and swamps.

*LISTERA CORDATA* (L.) R. Br. Damp woods near Lena Lake.

*MALAXIS UNIFOLIA* Michx. Sphagnum bog, Atlantic Cove.

\**SALIX UVA-URSI* Pursh. Wind-swept barren southwest of N. E. Channel.

Although this species ranges farther south on the alpine summits of New England and New York, probably this locality is the southern limit of its growth near the sea-level.

\**S. CORDIFOLIA* Pursh, var. *CALLICARPAEA* (Trautv.) Fernald. (Prostrate). Barren at the north end of the main island.



"Var. *callicarpaea* is common from northern Labrador to north-western Newfoundland and the Shickshock Mountains, Quebec".

MYRICA CAROLINIENSIS Mill. Bogs. Scarce.

BETULA PAPYRIFERA Marsh. Infrequent, but general.

B. PUMILA L. Bogs. Casual.

This species has been collected by Nichols in Cape Breton but it is not commonly distributed through the province.

ALNUS CRISPA (Ait.) Pursh, var. MOLLIS Fernald. Fairly common.

\*GEOCAULON LIVIDUM (Richardson) Fernald. Barren near Petrie's Pond.

*Rumex crispus* L. Abundant in old fields.

*R. obtusifolius* L. Interspersed with the last named species.

*R. Acetosella* L. Apparently profuse in the fields and occasional on the barrens.

POLYGONUM AVICULARE L. Atlantic Cove. Weed.

*P. Persicaria* L. Atlantic Cove. Weed.

*P. scabrum* Moench. Atlantic Cove. Weed.

*P. RAI* Babington. Sand beach beyond West Landing. Only one plant seen.

*Chenopodium album* L. Occasional on hillsides.

ATRIPLEX PATULA L., var. HASTATA (L.) Gray. Sand beach beyond West Landing. Scarce.

SPERGULARIA LEIOSPERMA (Kindberg) F. Schmidt. Grassy slope, North East Light.

SAGINA PROCUMBENS L. The characteristic plant of rock crevices.

ARENARIA LATERIFLORA L. Wet grass-land, Atlantic Cove.

STELLARIA BOREALIS Bigel., var. FLORIBUNDA Fernald. Between West Landing and South West Light. Rare.

*S. graminea* L. Common in fields.

*S. media* (L.) Cyrill. Waste places.

CERASTIUM ARVENSE L. Edge of cliffs, Trinity Cove.

*C. vulgatum* L. Old cellar, Trinity Cove.

\*SILENE ACAULIS L., var. EXSCAPA (All.) DC. Abundant at the southwest end of the island, also south of N. E. Channel practically at sea level.

This is the first record near sea level southwest of Newfoundland.

NYMPHOZANTHUS VARIEGATUS (Engelm.) Fernald. Ethel Lake.

NYMPHAEA ODORATA Ait., var. ROSEA Pursh. Petrie's Pond and Lena Lake.

RANUNCULUS CYMBALARIA Pursh. Grassy slope, North East Light.

*R. acris* L. Abundant in fields.

*R. repens* L. Vying with the last named species in profusion.

THALICTRUM POLYGAMUM Muhl. General, variable; on rolling slopes up to 1 m. high, in bogs as small as 3 dm. in height.

- COPTIS GROENLANDICA (Oed.) Fernald. Common in the forest.
- ACTAEA RUBRA (Ait.) Willd. Open woods at the foot of Coggin Mountain. Not seen elsewhere on the island.
- Thlaspi arvense* L. Between West Landing and South West Light.
- Capsella Bursa-pastoris* (L.) Medic. Weed, Atlantic Cove.
- CAKILE EDENTULA (Bigel.) Hook. On cliffs and sand beach.
- Brassica juncea* (L.) Cosson. Weed near the Radio Station.
- B. arvensis* (L.) Ktze. Waste places.
- SARRACENIA PURPUREA L. Plentiful in bogs.
- DROSERA ROTUNDIFOLIA L. Abundant in open spots.
- SEDUM ROSEUM (L.) Scop. Common on cliffs and rocky knolls.
- MITELLA NUDA L. Deep woods south east of Lena Lake. General.
- RIBES GLANDULOSUM Grauer. Frequent on the southern part of the island.
- R. HIRTELLUM Michx. Generally distributed but casual.
- PYRUS ARBUTIFOLIA (L.) L. f., var. ATROPURPUREA (Britt.) Robinson. Rocky margins of the lakes.
- \*X *P. ARSENI* (Britton) Arsène. (*P. arbutifolia* var. *atropurpurea* X *P. dumosa*). Frequent.
- P. DUMOSA* (Greene) Fernald. Thicket bordering bog above Petrie's Pond.
- \*AMELANCHIER FERNALDII Wiegand. Margin of Ethel Lake.
- The species thus far is restricted in its distribution to the Gulf of St. Lawrence region. It has been collected on the Magdalens, Anticosti, Quebec (along the lower St. Lawrence), Newfoundland and now, St. Paul.
- A. BARTRAMIANA (Tausch.) Roemer. Between Ethel Lake and Atlantic Cove.
- FRAGARIA VIRGINIANA Duchesne, var. TERRAE-NOVAE (Rydb.) Fernald & Wiegand. By the dam near the Radio Station. General.
- POTENTILLA NORVEGICA L., var. HIRSUTA (Michx.) Lehm. Near the Radio Station. Not noted elsewhere.
- P. CANADENSIS* L. var. SIMPLEX (Michx.) T. & G. Wet slope, Atlantic Cove.
- P. PACIFICA* Howell. Rocky slopes and near margins of cliffs.
- P. TRIDENTATA* Ait. Rocky places. Common.
- P. FRUTICOSA* L. Bogs.
- RUBUS IDAEUS L., var. CANADENSIS Richardson. Occasional in the woods.
- R. CHAMAEMORUS L. Fairly general in bogs.
- R. PUBESCENS Raf. Abundant in the open places.
- R. RECURVICAULIS Blanchard. Peat bog at head of White Spring. Rare.
- \*SANGUISORBA CANADENSIS L., var. LATIFOLIA Hook. Frequent on grassy slopes.
- An Alaskan variety heretofore known in the east only from the

north shore of the St. Lawrence River (two stations), Quebec and the island of Anticosti.

*ROSA NITIDA* Willd. Casual in boggy places.

*PRUNUS PENNSYLVANICA* L. f. Top of Coggin Mountain, also between Lena Lake and Petrie's Pond. Rare on the island.

*Trifolium pratense* L. Fields.

*T. repens* L. Near edge of cliffs, Money Rocks.

\**OXYTROPIS JOHANNENSIS* Fernald. Abundant at the northeast end of St. Paul.

Although this species has not been collected in Newfoundland south of Cape St. George, its range extends south from Quebec into Maine and east along the upper St. John River in New Brunswick. This is undoubtedly the plant reported in Macoun's Catalogue (i. 115) from St. Paul as *O. uralensis*, var. *pumila*, and later (i. 509) as *O. arctica*.

*Vicia angustifolia* (L.) Reichard, var. *segetalis* (Thuillier) Koch. Weed, Atlantic Cove.

*LATHYRUS MARITIMUS* (L.) Bigel. Border of cliffs, Trinity Cove.

*L. PALUSTRIS* L., var. *MACRANTHUS* (T. G. White) Fernald. Grassy slope, North East Light.

Although found in Nova Scotia, it is more plentiful farther north.

*OXALIS MONTANA* Raf. Common in the forest of the southern half of the island.

*EMPETRUM NIGRUM* L. Very abundant in all the open habitats.

*ILEX VERTICILLATA* (L.) Gray. Occasional in bogs.

*NEMOPANTHUS MUCRONATA* (L.) Trel. Bog south east of Lena Lake.

*ACER SPICATUM* Lam. Woodland between Lena Lake and West Landing.

*A. RUBRUM* L. Thicket bordering the bog above Petrie's Pond. None of the specimens seen were larger than shrubs.

*HYPERICUM CANADENSE* L. Path, near Lena Lake. Scarce.

*VIOLA CUCULLATA* Ait., f. *PRIONOSEPALA* (Greene) Brainerd. Fields.

*V. PALLENS* (Banks) Brainerd. Sphagnous depressions on barren, also in the forest. General.

*V. INCOGNITA* Brainerd. Deep woods southeast of Lena Lake.

*EPILOBIUM ANGUSTIFOLIUM* L. Atlantic Cove.

*E. GLANDULOSUM* Lehm., var. *ADENOCAULON* (Hauskn.) Fernald. Open woods, Atlantic Cove.

*E. PALUSTRE* L., var. *MONTICOLA* Hauskn. Common in bogs.

*OENOTHERA PERENNIS* L. Waste places, Atlantic Cove.

*CIRCAEA ALPINA* L. Dripping slope of open woods, Coggin Mountain.

*ARALIA NUDICAULIS* L. A characteristic woodland species.

*Carum Carvi* L. Weed, Atlantic Cove.

*LIGUSTICUM SCOTHICUM* L. Rocky slopes usually near the cliffs.

*HERACLEUM LANATUM* Michx. Swale, Coggin Mountain.

CONIOSELINUM CHINENSE (L.) BSP. Fairly general on the island, but apparently not so in the province.

\*CORNUS SUECICA L. Sphagnous depression in barren, Trinity Cove southwest.

This boreal species occurs in Greenland, Newfoundland, Quebec, Anticosti, the Magdalens, St. Paul and Alaska. After collecting several sheets of the material at Trinity Cove, Miss Roscoe and I noticed near Martin Power's Cove an abundance of *Cornus*, the berries of which were very like this species but the leaves were much larger. In passing we thought it *C. suecica*, but I now believe it was rather *C. canadensis* var. *intermedia* Farr. However, since we took no specimens, I cannot make this statement with surety.

C. CANADENSIS L. Common.

MONESSES UNIFLORA (L.) Gray. Common in the woods.

PYROLA CHLORANTHA Sw. Woodland near Lena Lake.

P. SECUNDA L. Casual in the woods.

MONOTROPA UNIFLORA L. Frequent.

LEDUM GROENLANDICUM Oeder. Well distributed but not anywhere abundant.

KALMIA ANGUSTIFOLIA L. Chiefly at Atlantic Cove.

K. POLIFOLIA Wang. Sphagnum bog, Atlantic Cove. Not seen elsewhere.

ANDROMEDA GLAUCOPHYLLA Link. Bog above Petrie's Pond. Scarce.

CHAMAEDAPHNE CALYCVLATA (L.) Moench. Bog on the left of the path to North East Light.

GAULTHERIA PROCUMBENS L. Bog above Petrie's Pond.

CHIOGENES HISPIDULA (L.) T. & G. Abundant on knolls in open woodland.

GAYLUSSACIA DUMOSA (Andr.) T. & G., var. BIGELOVIANA Fernald. Bog on the left of the path to North East Light.

VACCINIUM VITIS-IDAEA L., var. MINUS Lodd. Frequent.

\*V. OXYCOCCUS L., var. INTERMEDIUM Gray. Near cliffs, Lookout Point.

V. PENNSYLVANICUM Lam. Woods, Atlantic Cove. Rare.

V. ULIGINOSUM L., var. ALPINUM Bigel. Upper slope of headland, West Point; South West Light.

Previously collected by Nichols on the mountains west of Ingonish, but not generally distributed in Nova Scotia.

PRIMULA MISTASSINICA Michx. Banks of streamlet between Petrie's Pond and White Spring.

LYSIMACHIA TERRESTRIS (L.) BSP. Shallow water, Ethel Lake.

TRIENTALIS BOREALIS Raf. Common in the forest.

GLAUX MARITIMA L., var. OBTUSIFOLIA Fernald. Rocky slope, North East Light.

HALENIA DEFLEXA (Sm.) Griseb. Hillside, Martin Power's Cove.

This species is listed by Nichols (Vegetation of Northern Cape Breton, 324, 1918) as common on bleak exposed headlands. I do not find any other record of its occurrence in the province.

MENYANTHES TRIFOLIATA L., var. MINOR Michx. Stagnant pools and bogs.

CONVOLVULUS SEPIUM L., var. PUBESCENS (Gray) Fernald. Atlantic Cove.

MERTENSIA MARITIMA (L.) S. F. Gray. Sand beach beyond West Landing.

PRUNELLA VULGARIS L., var. LANCEOLATA (Barton) Fernald. Fields, Atlantic Cove.

*Galeopsis Tetrahit* L., var. *bifida* (Boenn.) Lej. & Court. Waste places, Atlantic Cove.

LYCOPUS UNIFLORUS Michx. Open places. Infrequent.

VERONICA SERPYLLIFOLIA L. By streamlet, Hay Cove.

EUPHRASIA PURPUREA Reeks, var. RANDII (Rob.) Fernald & Wiegand. Hillside, Martin Power's Cove. Abundant.

E. PURPUREA Reeks, var. RANDII (Rob.) Fernald & Wiegand, f. ALBIFLORA Fernald & Wiegand. Hillside, Martin Power's Cove.

E. PURPUREA Reeks, var. FARLOWII (Rob.) Fernald & Wiegand. Barrens.

E. AMERICANA Wettst. Field, Atlantic Cove. Frequent.

E. CANADENSIS Townsend. Field, Atlantic Cove. Abundant.

\*RHINANTHUS GROENLANDICUS Chabert. Near ruins of an old house, Trinity Cove. Not noted elsewhere on the barren.

This boreal species is represented in the Gray Herbarium by specimens from Greenland, Labrador, western Newfoundland, Quebec (Saguenay Co.), Anticosti, the Mingan Islands and Alaska.

R. CRISTA-GALLI L., var. FALLAX (Wimmer & Grab.) Druce. Abundant in fields, Atlantic Cove.

UTRICULARIA GEMINISCAPA Benj. Lena Lake.

U. MINOR L. Pools of streamlet between Petrie's Pond and White Spring.

The specimens differ from those of the typical form in having bladders somewhat larger than usual and flattened rather than terete leaves. Possibly they correspond to f. *platyloba* Meister, which is merely the result of an ecological reaction to creeping out on the mud.

\*U. OCHROLEUCA R. Hartm. Lena Lake.

This dainty little plant is most closely related to *U. intermedia*, which ordinarily may be identified by the fact that the bladders are borne on separate leafless branches. *U. ochroleuca*, too, has separate

bladder-bearing leafless branches, but it differs from its relative in bearing bladders also on the leaves of the immersed stems; moreover, the teeth along the margins of the leaves are larger than those characteristic of *U. intermedia*. Unfortunately our specimens are sterile, but Glück intimates that sterility is not an unusual occurrence in this species. *U. ochroleuca* is fairly common in the northern countries of Europe. It has been reported from two localities in Greenland, but this is the first record south of there; hence, it is not only an addition to the flora of Nova Scotia but also to that of Canada.

*PINGUICULA VULGARIS* L. Banks of streamlet between Petrie's Pond and White Spring.

Found also on Cape Breton, but not elsewhere in the province.

*PLANTAGO JUNCOIDES* Lam. toward var. *LAURENTIANA* Fernald. Rocks, North East Light.

*P. JUNCOIDES* Lam., var. *GLAUCA* (Hornem.) Fernald. Hillside, Martin Power's Cove.

*P. JUNCOIDES* Lam., var. *DECIPIENS* (Barneoud) Fernald. Barrens. Common.

*P. MAJOR* L. Field, Atlantic Cove.

*GALIUM TRIFLORUM* Michx. Woods near the Radio Station.

*G. CLAYTONI* Michx. Common in swamps and wet open places.

*MITCHELLA REPENS* L. Near the outlet of Lena Lake.

*LONICERA VILLOSA* (Michx.) R. & S., var. *SOLONIS* (Eaton) Fernald. Margin of peat bog at head of White Spring.

*L. CANADENSIS* Marsh. Woods near Ethel Lake.

This is the northeastern limit of its range.

*LINNAEA BOREALIS* L., var. *AMERICANA* (Forbes) Rehder. Abundant in the forest.

*VIBURNUM CASSINOIDES* L. Casual on the southern part of the island.

*SAMBUCUS RACEMOSA* L. Open places in the woodland.

*CAMPANULA ROTUNDIFOLIA* L. Hillside, Martin Power's Cove. In this locality we found one white-flowered form. The typical was abundant near cliffs.

\**C. ROTUNDIFOLIA* L., var. *ALASKANA* Gray. Rocky slopes.

This Alaskan variety has been collected east of British Columbia only in western Newfoundland and Gaspé (one collection), and, now, St. Paul (Nova Scotia).

*LOBELIA DORTMANNIA* L. Ethel Lake.

The specimens differ slightly from the typical in the more pubescent lip of the corolla.

*SOLIDAGO BICOLOR* L. Rocky slope above South West Light.

*S. MACROPHYLLA* Pursh. Open forest. Fairly common.

*S. PUBERULA* Nutt. Woodland near Martin Power's Cove.

\**S. MULTIRADIATA* Ait. Barren southwest of N. E. Channel.

Distributed in the west from Manitoba to Alaska. In the east, reported from western Newfoundland and Quebec (Gaspé and Matane counties).

*S. SEMPERVIRENS* L. Both near and on cliffs.

*S. UNILIGULATA* (DC.) Porter, var. *NEGLECTA* (T. & G.) Fernald. Peat bog at the head of White Spring.

*S. RUGOSA* Mill., var. *SPHAGNOPHILA* Graves. Wet gulch, Norwegian Mountain.

*ASTER LATERIFLORUS* (L.) Britton. Woods, Atlantic Cove.

*A. RADULA* Ait. Swamp, Atlantic Cove. Part of the specimens collected approach var. *STRICTUS*.

*A. NOVI-BELGII* L. Casual on the barren.

*A. UMBELLATUS* Mill. General in open places.

*A. ACUMINATUS* Michx. Open woodland.

*A. NEMORALIS* Ait. Margin of Lena Lake.

*A. NEMORALIS* Ait., var. *MAJOR* Peck. Margin of Lena Lake, growing with the typical form.

*ANAPHALIS MARGARITACEA* (L.) B. & H. Hillside, Atlantic Cove.

*A. MARGARITACEA* (L.) B. & H., f. *ANOCHLORA* Fernald. Barren, Trinity Cove southwest.

*Gnaphalium uliginosum* L. Waste places, Atlantic Cove.

*Achillea Millefolium* L. Clearing near South West Light.

*Matricaria suaveolens* (Pursh) Buchenau. Hillside, Atlantic Cove.

*Chrysanthemum Leucanthemum* L., var. *pinnatifidum* Lecoq & Lamotte. Abundant in the fields, Atlantic Cove.

*CIRSIIUM MUTICUM* Michx. Casual. Only three or four specimens seen.

*C. arvense* (L.) Scop. Swale, base of Norwegian Mountain.

*Centaurea nigra* L. Field, Atlantic Cove.

*Leontodon autumnalis* L., var. *pratensis* (Link) Koch. Weed, Atlantic Cove.

*Taraxacum officinale* Weber. Atlantic Cove.

*PRENANTHES TRIFOLIOLATA* (Cass.) Fernald. In open forest and along borders. Common.

*P. TRIFOLIOLATA* (Cass.) Fernald, var. *NANA* (Bigel.) Fernald. Barren, Trinity Cove.

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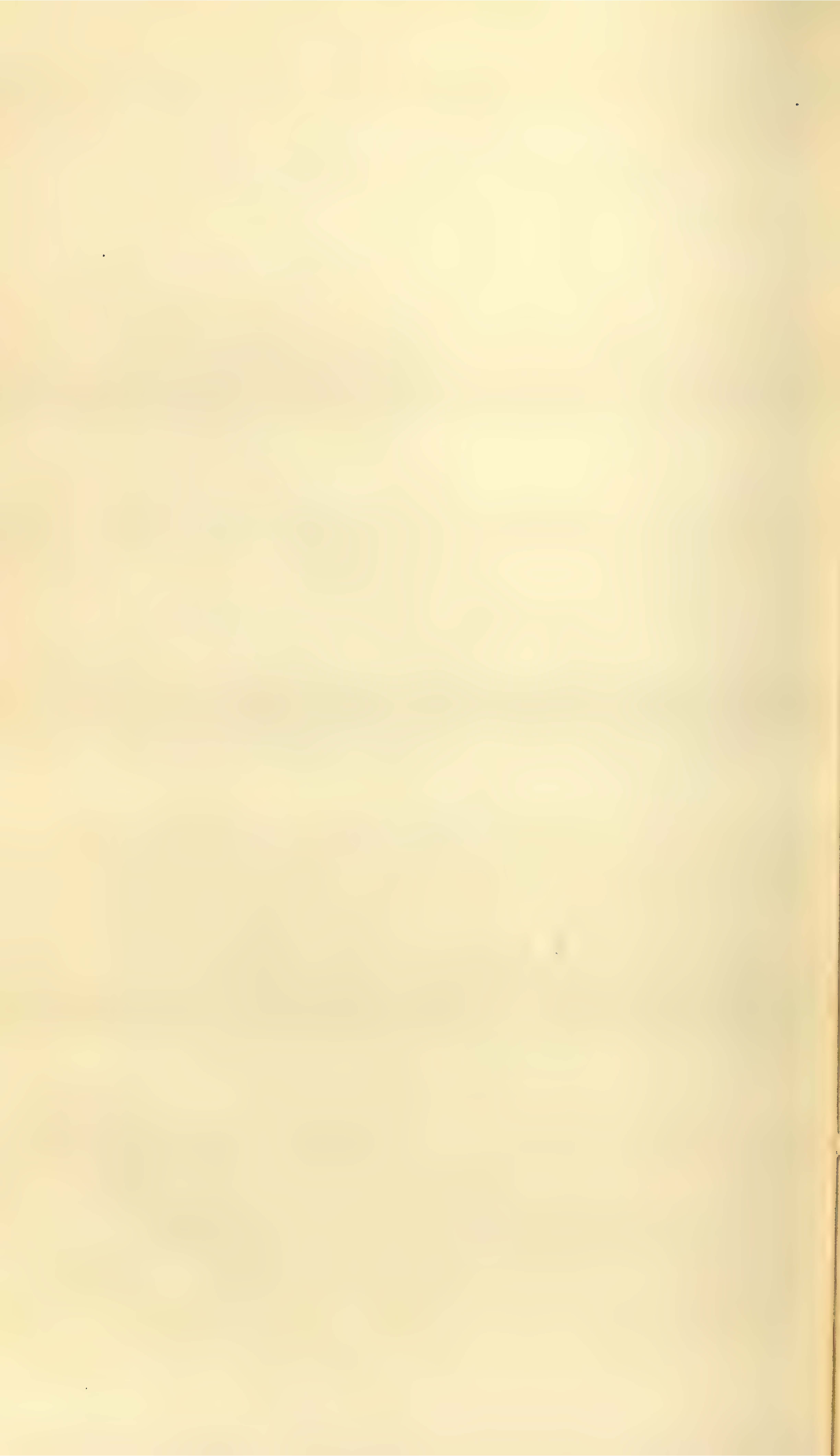
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# I. TAXONOMIC STUDIES IN CUPHEA.

BY RIMO BACIGALUPI.

(Plates I-V.)

THE large genus *Cuphea*, which already includes some 240 species and several score varieties, is one whose many technicalities render it particularly fitting that it be left in the hands of a specialist. By far the largest genus of the *Lythraceae*, it early attracted the attention of Emil Koehne of Berlin who, although known more generally, in Germany if not abroad, for his extended and distinguished dendrological researches, soon became established, in international taxonomic circles at least, as the world's foremost authority on this largely tropical American family. His contributions to the knowledge of this group, as indicated by the dates of his many publications among which are included two complete monographs of the *Lythraceae*, extended from 1873 to 1913, at which latter date began the series of ailments and disabilities which culminated in his death five years later.

Shortly after his death, the Gray Herbarium was fortunate enough to acquire, through purchase, Koehne's unpublished "Atlas *Lythracearum*," a set of original habital and diagnostic drawings in which every known species and variety of the *Lythraceae* published up to the time of his fatal illness had been delineated with consummate skill by this thorough scholar. Interest in *Cuphea* as a possible subject for taxonomic investigation was initiated by the availability of this valuable document; indeed, without such an exceptional aid, the writer would not have been encouraged to attempt detailed study of a genus so large and complex. Moreover, it soon became apparent that much interesting and novel material had been collected from Mexico, Central America and more especially from South America since Koehne published his last novelty in *Cuphea* (*C. bicolor*) in 1913. From these more recently collected specimens, many of them kindly forwarded to the Gray Herbarium for the writer's purposes by Professor Samuelsson of the Museum of Botany in Stockholm, most of the novelties here presented were described. Among these were found specimens of four of Koehne's still unpublished species of *Cuphea*, transcripts of the original diagnoses of two of which were very obligingly transmitted by Professor Diels and Dr. Melchior of the Botanical Museum at Berlin-Dahlem. During the summer of 1930, the writer enjoyed the privilege of

examining Koehne's collection, now permanently housed at the herbarium in Berlin-Dahlem, among which the many *Cuphea* types studied helped immeasurably to clear up dubious details. Other European herbaria visited in this connection are those of the Conservatoire de Botanique in Geneva, the Institut de Botanique of the University of Geneva, and the Muséum d'Histoire Naturelle in Paris. A loan of the *Cuphea* collection of the Dudley Herbarium of Stanford University, which included the very recent collections of Mrs. R. S. Ferris from the west coast of Mexico, yielded many interesting specimens from which one of the sixteen novelties presented in this paper materialized.

Koehne's lifelong studies on his chosen family of plants were brought together in his second monograph on the *Lythraceae* in "Das Pflanzenreich," issued in 1903. Later, he twice published, in Engler's serial "Botanische Jahrbücher," supplementary accounts embodying his subsequent work, consisting in large measure of novelties brought to his attention since the general treatment and, in lesser degree, of emendations to statements therein. The results of the present writer's investigations on *Cuphea*, which extended intermittently from 1928 to the present, submitted in the form of critical comments, supplementary keys and descriptions of novelties, are intended to form a third such supplement.

At the conclusion of an excellent biography of Koehne [Generalversammlungs-heft, Berichte Deutsche Bot. Gesellsch. xxxvi. (1919) (73)–(89)] by Professor Harms of Berlin may be found a complete list of Koehne's botanical writings. The following summary of the published accounts by Koehne and others on the genus *Cuphea* issued since its last general revision [Das Pflanzenreich IV. Fam. 216 (1903) 80–179] will, it is hoped, prove helpful.

The results of Koehne's own work on *Cuphea* published after the above cited revision are to be found in Engler's Bot. Jahrb. xli. (1907) 74–110, xlii. Beibl. (1908) 47–53, Fedde's Rep. Spec. Nov. viii. (1910) 16, 165–167, 196–199, and in Verhandl. Bot. Vereins Prov. Brandenb. lv. (1913) 174. With few exceptions, the new species of *Cuphea* published between 1903 and 1913 were described by Koehne himself and in the various issues of the three publications just cited. The exceptions are *Cuphea delicatula* T. S. Brandege, Zoe v. (1905) 213, *C. humayana* T. S. Brandege, loc. cit. 214, *C. pannoso-cortica* Rusby, Bull. N. Y. Bot. Gard. iv. (1907) 361, *C. Goldmanii* Rose, Contrib. U. S. Nat. Herb. xii. (1909) 287, fig. 28, *C. trichandra* Brandege, Univ. Calif. Publ. Bot. iv. (1910) 89, and *C. Purpusii* Brandege, loc. cit. (1913) 378. Several species described

by and attributed to Rose were published by Koehne and subsequently republished by their author, loc. cit. 287-290.

Since 1913, various workers have published new species of *Cuphea*. These are *C. chiapensis* Brandegee, Univ. Calif. Publ. Bot. vi. (1915) 187, *C. chiquitensis* Herzog, Mededeel. Rijks Herb. xxvii (1915) 16, *C. petalosa* Herzog, loc. cit. 17, *Parsonsia blepharophylla* Blake, Proc. Biol. Soc. Wash. xxxii (1919) 190 [*C. blepharophylla* (Blake) Riley, Kew Bull. (1924) 211], *C. scelopetala* Riley, loc. cit. 212, *Parsonsia salvadorensis* Standl. Journ. Wash. Acad. Sci. xiv. (1924) 240 [*C. salvadorensis* Standl. Field Mus. Publ. Bot. iv. (1929) 238], *C. Eckmanii* O. C. Schmidt, Arkiv Bot. 20A, no. 15 (1926) 82, *C. pergracilis* O. C. Schmidt, Fedde Rep. Spec. Nov. xxiv. (1927) 77, and *C. riparia* Eck. & O. C. Schmidt, Fedde Rep. Spec. Nov. xxvii. (1929) 106. *C. tuberosiformis* Koehne ex Dusén & Neger, Beihefte Bot. Centralbl. xxxviii, Abt. 2 (1921) 295, is virtually a nomen nudum. It was published in a descriptive account of the woody anatomy of "Xylopodien," Lindman's name for the irregularly thickened, often rounded, very hard woody enlargements of the root or of the basal underground portion of the stem characteristic of the § *Oidemation* in *Cuphea*. Only the anatomical peculiarities of the wood-structure of the xylopodium of *C. tuberosiformis* are here described. The characterization of this species is therefore included among the following diagnoses and comments.

The writer wishes here to express his appreciation of the friendly encouragement and scholarly advice so unstintingly given by Professor B. L. Robinson under whose guidance the work here presented was carried out. Both he and Mr. C. A. Weatherby of the Gray Herbarium staff have aided in giving some semblance of botanical style to the Latin diagnoses characterizing the novelties. Professor Briquet of the Conservatoire de Botanique in Geneva authorized the transmittal of specimens which proved of invaluable aid. For help in the matter of photographing types, I am indebted to Drs. L. B. Smith and A. N. Steward.

## § 2. ENANTIOCUPHEA.

***Cuphea obtusifolia*** Koehne in MS., spec. nov. "Herba perennis videtur rhizomate repente; caulis erectus simplex vel superne pauciramis, infra racemum glaberrimus; internodia foliis paulo vel  $\frac{1}{3}$  longiora. Folia in petiolum subnullum vel ad 3 mm. longum cuneato-decurrentia, anguste oblonga vel oblongo-lanceolata, 20-50 mm. longa et 5-12 mm. lata, obtusa, glaberrima, nervis utrinsecus 5. Racemi distinctissimi, axi minutim puberulo parceque breviter

setuloso, bracteis infimis 5–7 mm. longis, supremis minimis, omnibus herbaceis, setis glanduliferis parce ciliatis. Pedicelli 5–9 mm. longi, tenuiter filiformes, violaceo-setulosi. Calyx basi gibbus, 11 mm. longus, laxe breviter violaceo-setulosus, setulis glanduliferis, intus supra stamina lanatus, intus fundo glabro excepto dense villosus; lobus dorsalis maximus productus. Petala 6, dorsalia 2 rosea nervo medio saturate purpureo, 5 x 2.5 mm., ventralia 4 lilacina, 4.5 x 2 mm., omnia cuneato-oblonga. Stamina lobos aequantia, lanata. Pistillum 10 mm. longum, ovarium apice breviter villosum, stylus ovario ca.  $\frac{1}{4}$  brevior, dense villosus; discus magnus horizontalis, supra concavus, subtus convexus; ovula ca. 34–38. Semina rotundata, 1.5 mm. longa, tuberculata, pallide crenato-marginata."—Plate I.

BRAZIL: PARANÁ: on marshy ground, Piraguara, Jan. 1, 1909, P. Dusén, no. 7782 (TYPE, in Herb. Mus. Botan. Stockholm).

This species is to be distinguished from *C. longiflora* Koehne and *C. racemosa* var. *divergens* Koehne, its closest relatives, by its unusually produced large dorsal calyx-lobe and its obtuse glaucescent glabrous leaves and its likewise glaucescent, absolutely glabrous stems.

**Cuphea Lindmaniana** Koehne in herb., hucusque ined. Annuæ ex basi ramosa magis minusve hirsutula. Caules ad apices foliati 10–15 cm. longi dense hirsutuli praesertim insuper simul sparsius crispo-puberuli. Petioli foliorum inferiorum saepe 1–3 mm. longi vel subnulli, ei superiorum nulli vel subnulli. Folia ovato-oblonga vel oblongo-lanceolata basi subrotundata vel saepius subattenuata apice acuta ambis paginis ut caules hirsutula margine scabrida 12–18 mm. longa, 4–6 mm. lata. Pedicelli ebracteolati oppositi in axillis foliorum superiorum ut caulis puberuli sed minus hispiduli 4–6, demum 7–8 mm. longi. Calyx parum gibbosus 4–5 mm. longus purpurascens purpureo-vel albido-hirsutus, lobo dorsuali flavo margine puniceo cum lobis obtusis juxtapostis producto, lobis ventralibus 3 angustis acutis, intus ventre infra stamina magis minusve villosus costulis infra petala dorsualia villosis sub staminibus ventralibus subaequalibus inclusis lanatus. Petala alba, 2 dorsualia 3 mm. longa, 1.3 mm. lata, 4 ventralia 4 mm. longa, 1.7 mm. lata. Pistillum villosum stylo ovarii tertiam partem aequante. Ovula 28–29. Semina minuta valde alata glabra, 1 x 0.8 mm. Discus angustiusculus adscendens.

BRAZIL: PARANÁ, Itapirusú, "in campo," Nov. 11, 1908, P. Dusén, no. 7156 (TYPE, Herb. Mus. Botan. Stockholm).

This species of the *series 1* of the subsection *Gastrodynamia* (§

*Enantiocuphea*) is most closely related to *C. ramosissima* Koehne. It may be distinguished from that species by its hirsutulous leaves and calyx, its villose ovary and calyx interior, its shorter petioles and winged seeds.

**Cuphea varia** Koehne in herb., hucusque ined. Annuā basi interdum procumbens internodiis infimis saepe radices emittens. Caules parce ramosi dense glanduloso-hirsutuli simul pilis crispis parum puberuli basi glabrescentes 12–30 cm. longi. Petioli 1–5 mm. longi vel foliorum superiorum saepe subnulli, ut caules vestiti. Folia ovata vel ovato-oblonga basi subrotundata vel late attenuata apice obtusa, 11–22 mm. longa, 7–13 mm. lata, nervis utrinsecus 4–5 nervo medioque paginarum inferiorum saepe prominulis margine scabra ambis paginis eorundem minorum ad basem caulis versus glabra vel glabrata paginis superioribus eorundem majorum ad apicem caulis versus plerumque setulis adpressis conspersa simul saepe paene scabrida paginis inferioribus nervis interdum hirsutula. Pedicelli ebracteolati quam caules conspicuius crispo-puberuli sparsiusque glanduloso-hirsutuli 4–11 mm. longi. Calyx sub anthesi atroviolaceo suffultus fauce adscendens lobo dorsuali majore flavo margine violaceo costis uniformiter hirsutulus parum gibbosus 5–6 mm. longus fructifer fere campanulatus intus ventre sub staminibus lanatus infra eadem dorso villosus ventre glabratus costis infra petala dorsualia villosus. Stamina 9 ventralia inclusa subaequalia villosa. Petala 2 dorsualia minora atroviolacea subcuneato-oblonga, 2–2.5 mm. longa, 4 ventralia alba oblonga vel cuneato-oblonga, 3–3.5 mm. longa. Ovarium ad basem versus glabrum insuper villosum stylo villoso ovarii  $\frac{1}{3}$  aequante demum exserto. Ovula ca. 50. Semina valde alata villosa 1 mm. vel minus longa. Discus tenuis adscendens.

BRAZIL: PARANÁ: Calmon, "in subpaludosis," March 15, 1910, *P. Dusén*, no. 9266 (TYPE, in Herb. Mus. Botan. Stockholm); Guarapuava, "in paludosis," Jan. 8, 1911, *P. Dusén*, without number.

This species, together with *C. Lindmaniana* Koehne, likewise described in these studies, is related to *C. ramosissima* Koehne. The subsection *Gastrodynamia* (§ *Enantiocuphea*), of which all three species are members, is characterized by having the two dorsal petals, singularly enough for *Cuphea*, shorter than the four ventral ones.

*Cuphea varia* Koehne is at once set apart by its dark violet dorsal petals and villose seeds. These latter are so small that only with a lens is their villose character clearly discernible.

CUPHEA ORIGANIFOLIA Cham. & Schlecht. Among the recent collections of E. P. Killip and Albert C. Smith from the eastern

Cordillera of Colombia appear specimens referable to *Cuphea organifolia* Cham. & Schlecht. This species had not heretofore been noted north or west of Minas Geraes, Brazil. Hence these specimens prove a very interesting extension of range. If they had not had the erect or semi-erect gland at the base of the ovary characteristic of this species, these specimens might easily have passed for forms of *C. racemosa* (L. f.) Spreng. These Killip & Smith numbers of plants from the department of Santander, Colombia are 15542, 16012, 17734, and 18276.

**Cuphea flavisetula**, spec. nov. Herba perennis ramosa basi fruticulosa circ. 20 cm. alta. Rami puberulenti ac praesertim insuper remote hispidi, petioli subnulli summum 0.5 mm. longi flavescens. Folia lanceolato-elliptica utroque acuta utrinque glabra remote perspicueque flavescens hispido-ciliata, 10–22 mm. longa, 3–8 mm. lata. Racemi 2.5–6 cm. longi; bracteae 1–3 mm. longae; pedicelli oppositi ebracteolati ut caulis puberulenti insuper dense breviterque glanduloso-hispiduli, 4–6 mm. longi. Calyx basi tantum paullo gibbosus remote flavescens hispido-basi interdum glanduloso-hispidulus ceterum glaber intus infra stamina uniformiter pilosus 7–8 mm. longus, lobis ventralibus productis anguste triangularibus leviter acuminatis quam dorsales multo angustioribus. Petala oblanceolata basi attenuata apice rotundata duo dorsualia retrorsa 2.5 mm. longa, 4 ventralibus dimidio breviora. Stamina 9 ventralia alterne subinaequalia quorum 5 inter lobos calycis subexserta filamentis lanatis, filamenta staminum 2 dorsualium multo breviora glabra. Stylus villosus calycem aequans. Ovula 12–18.

MEXICO: TEPIC TERRITORY (NOW NAYARIT): Acaponeta, June, 1897, J. N. Rose, no. 1421 (TYPE, in Gray Herb.).

This species falls into Koehne's subsection *Gastrodynamia*. It is related to *C. decandra* Ait. The differences between these two species may perhaps best be set down in tabular form.

#### C. DECANDRA.

Species of West Indies and Colombia.

*Leaves* broadly oblanceolate to oblong-oblanceolate, pubescent, often densely so, minutely, more or less densely, and often glandularly short-ciliate.

*Calyx* densely glandular-hirtellous, not at all hispid.

*Ventral sepals* obtuse, broadly triangular.

#### C. FLAVISETULA.

Species of Mexican West Coast.

*Leaves* lance-elliptic, perfectly glabrous on both surfaces, remotely but conspicuously hispidulous-ciliate with straw-colored hairs.

*Calyx* remotely short-hispid (the basal hairs sometimes gland-tipped), otherwise glabrous.

*Ventral sepals* acute, narrowly triangular and somewhat acuminate.

CUPHEA PURPUSII Brandegee, Univ. Calif. Publ. Bot. iv. (1913) 378. This species is based on *Purpus*, no. 6147, collected at Baños de Carrizal, Rio de los Pescados, Vera Cruz, Mexico. It agrees with *C. decandra* Ait. in all its characters save one, the marked reduction of the two dorsal petals. These are subulate-filiform, 1.5 mm. in length (*Purpus*, no. 7650) and early deciduous so that in mature flowers they appear to be lacking. Of the lower four petals, the outer two are 3.5–4 mm., the inner 4.5–5.5 mm. long.

It may be recalled that *C. decandra*, along with several other species, differs from many of the members of the subgenus *Lythrocuphea* in having the two dorsal petals smaller, rather than larger, than the lower four, but in this species, the difference in size is not such a striking one.

*C. Purpusii* was originally described as a four-petaled species, "disco erecto, ovarii adpresso," but an examination of isotype material at the Gray Herbarium revealed a disc almost surrounding the base of the ovary, interrupted ventrally and greatly thickened dorsally, as in typical *C. decandra*.

Koehne (Pflanzenreich IV, Fam. 216, p. 110. 1903) gives Vera Cruz, Mexico, Haiti, eastern Cuba and Colombia as the geographic range of *C. decandra*, but all the Vera Cruz material at the Gray Herbarium has the dorsal petals, in the rare instances when they are still present, minute and linear-subulate, and coincides in all other particulars with typical material of *C. Purpusii*. It is probable, therefore, that all Mexican (Vera Cruz) specimens, heretofore referred to *C. decandra*, are more properly referable to *C. Purpusii*. In addition to the two *Purpus* specimens mentioned above, *Purpus*, no. 1493 and *Pringle*, no. 7825 are referred here.

It seems better, in the light of the facts presented, to consider *C. Purpusii* a geographic variety of *C. decandra*. The following combination is therefore proposed. **Cuphea decandra** Ait. var. **Purpusii** (Brandegee), comb. nov.

According to Koehne's drawings (loc. cit. and Atlas Lythracearum in MS.), the inside of the calyx of *C. decandra* is never more than merely biseriately pilose, but in specimens from Cuba (*Wright*, no. 334) and Colombia (*Lehmann*, no. 5612; *Rusby & Pennell*, no. 174), as well as in all Vera Cruz material referable to *C. decandra* var. *Purpusii*, each of the ribs on the inside of the calyx bears a series of minute hairs from below the stamens to almost the very base, so that the whole inside of the calyx appears uniformly pilose. In *Wright*, no. 334, this pilosity is not so uniform as in the others, but still the inside of the calyx is not nearly so glabrous as Koehne indicates.



## § 5. BRACHYANDRA.

CUPHEA MICRANTHA H. B. K. *Pittier*, no. 9011 and no. 9749, from Venezuela, were erroneously distributed as *Cuphea strigulosa* H. B. K.

CUPHEA CARTHAGENENSIS (Jacq.) Macbride, *Field Mus. Pub. Bot.* viii. (1930) 124 (*C. balsamona* Cham. & Schlecht.; *C. hyssopifolia* Griseb., in part, *Fl. West Ind. Ids.* (1860) 270, not H. B. K., the latter taken up by Hillebrand, *Flora of the Hawaiian Islands* (1888) 131, and followed by many Hawaiian authors since; *Parsonsia pinto* Heller, *Minn. Bot. Stud.* ii. 862. 1897). Among specimens of *C. carthagenensis* erroneously labelled *C. hyssopifolia* H. B. K. are *Joseph F. Rock*, no. 3137 and *Heller*, no. 2004.

*Cuphea patula*, as misapplied by Stewart, *Proc. Calif. Acad. Sci.* ser. 4, i. (1911) 116, not St. Hil. Stewart's specimens from the Galapagos Islands, which were named and distributed as *C. patula*, proved upon examination to be *C. carthagenensis* (Jacq.) Macbride (*C. balsamona* Cham. & Schlecht.), a species of somewhat weedlike ability to spread but not previously reported from this island group.

**Cuphea Ferrisiae**, spec. nov. Herba annua erecta vel semi-prostrata fere a basi divergente ramosa. Caules hispidi pilis arcuato-adscendentibus simul crispe pubescentes, 1.5–2.5 dm. alti. Rami ut caulis vestiti, 7–14 cm. longi. Folia elliptica ad apicem basemque versus attenuata utrinque margineque scabrida supra in nervo medio ad basem versus ut in petiolo crispo-pilosiuscula subtus in nervis interdum sparsissime adscendenter hirsuta basi et in parte in petiolum decurrente ciliata ceterum glabra, 2.5–4 cm. longa, 1.4–2.2 cm. lata. Inflorescentiae terminales spiciformes bracteatae rachibus biserialiter crispo-pilosis ad basem versus ut caules hispidis. Bracteae inferiores euphyллоideae lanceolatae acuminato-apiculatae superiores multo angustiores, 2–2.5 mm. longae. Pedicelli aliquantum verticellati ut rachis vestiti vel glabrati, 1–3.5 mm. longi, prope apicem bracteolas in setulas albas 3 reductas gerentes. Calyx cylindraceus mox scariosus anguste calcaratus calcare interdum parum incurvato parce hispidus ceterum glaber intus glaberrimus. 4–5.5 mm. longus, lobis viridibus brevissimis dorsali producto demum os claudentibus, appendicibus 1–2-aristulatis quam lobi longioribus. Petala 2 dorsalia rotundato-elliptica unguiculata (unguiculo tertiam partem petali aequante), 2 mm. longa, 4 ventralia brevius unguiculata breviora pallidiora cuneato-elliptica. Stamina 11 glabra inaequalia inaequalissime disposita 4 ex eis lobos aequantia. Ovarium

glabrum fructiferum calycem  $\frac{2}{3}$  aequans, stylo lobos ventrales calycis aequante, stigmatate late capitato. Discus tenuis valde retrorsus apice subglobosus. Semina 3 exalata leviter retusa minute scrobiculata, 1.5 mm. longa.

MEXICO: NAYARIT: in dense forest, vicinity of San Blas, *R. S. Ferris*, no. 5363 (TYPE, in Dudley Herb., Stanford University).

This species shows relationship to the *Cuphea Wrightii* group of the subsection *Lophostomum* (§ *Heterodon*) on the one hand, and to *Cuphea Scleri* of the somewhat anomalous subsection *Lophostomopsis* (§ *Brachyandra*) on the other. Koehne (Pflanzenreich IV, Fam. 216, p. 121) admits the relationship of this latter group to *C. Wrightii* and *C. secundiflora*. Indeed, in general habit this species is not unlike *C. secundiflora*.

If, because of its slightly produced dorsal lobe, it be, in spite of its short calyx, included in the section *Heterodon*, its slender deflexed disc indicates its relationship to *C. Wrightii*, a species the calyx of which is often not more than 5 mm. in length, and to its close relatives, *C. lutea* Rose and *C. viscosa* Rose. In addition to striking habital differences, it may be separated from these by its scarious calyx, its strict spiciform inflorescence and in having the dorsal calyx lobe not so strikingly produced as in these.

In addition to the gland character, this species differs from *C. secundiflora* in its scarious and merely hispid calyx, in the very shortly produced dorsal calyx lobe, in having only three ovules and absolutely glabrous filaments and style.

If, on the other hand, this species be included, because of its short calyx, within the section *Brachyandra*, it falls, as suggested above, into the subsection *Lophostomopsis*. Here, it may be distinguished from *C. Scleri*, its closest relative in this grouping, by its shorter calyx (7–8 mm. long in *C. Scleri*), by its longer, more slender and often slightly incurved spur, by its longer ovary and correspondingly shorter style, this latter equaling or slightly exceeding the short lower calyx lobes, in its more slender and decidedly deflexed disc, subglobose at the tip, and in having the calyx within and the stamens absolutely glabrous. As in *C. Scleri*, however, the dorsal calyx lobe is longer, even if not markedly, and larger than the others, and is deflexed finally, helping with the other lobes to close the mouth of the calyx, as in many species of the section *Heterodon*.

Owing to the short calyx, it may be considered more expedient, for keying purposes at least, to place this species in the subsection *Lophostomopsis*.

This species is dedicated to Mrs. Roxana S. Ferris, assistant curator

of the Dudley Herbarium of Stanford University, whose recent collections on the west coast of Mexico have disclosed more than a few interesting novelties.

### § 6. EUANDRA.

**Cuphea laeviuscula**, spec. nov. Herba maximam partem glabra basi suffrutescens. Caules plures ramosi adscendentes saepe 2-3 ex basi emanantes hinc tantum mox decorticati insuper flavescentes interdum rubescentes ad apicem versus magis magisque pilis albidis brevissimisque tantum uniseriatim minutimque crispo-pubescentes ceterum glaberrimi, 25-38 cm. alti. Petioli glabri foliorum inferiorum ad 1.5 mm. longi ei superiorum subnulli. Folia decussata lineari-lanceolata interdum leviter subfalcata (nonnulla ad basem caulis versus oblongo-lanceolata) laevissima margine tantum scabrida lutescenti-viridia juniora rubescentia nervis utrinsecus 5-6 subtus prominulis basi subattenuata vel subrotundata interdum obliqua apice leviter attenuata vel acuta vel obtusissima, 20-25 mm. longa, 5-6 et rarius ad 8 mm. lata. Pedicelli 1-3 mm. longi glabri ad apicem versus bracteolas minutas rotundato-ovatas setulis stipularibus instructas gerentes. Calyx glaberrimus apud florem juniorem graciliter rotundato-calcaratus dorso lateribusque rubescens ad os versus purpurascens, 7-8 mm. longus, apicibus loborum subaequalium leviter recurvatis hinc minutim albido-pubescentibus appendicibus obtusis minutissimis intus sat conferte biseriatim villosus ore sub staminibus ventralibus leviter floccoso-lanatus ceterum glaber. Petala calyce vix  $\frac{1}{4}$  breviora 2 dorsalia intense purpurea ovali-elliptica 4 ventralia lilacina spathulato-oblonga. Filamenta 2 breviora dorsualia pilosissima ex 9 ventralibus paria duo exteriora anata 5 interiora longiora glabrescentia sinus sed non lobos calycis superantia. Ovarium glabrum stylo villosiusculo apud florem juniorem ovarium longitudine aequante et incluso. Ovula 16-18. Semina ala angustiuscula cincta. Discus latus haud crassus dorso convexus.

ARGENTINA: MISIONES: Loreto, in the region about Posadas, moist situations along the Rio Yabebiry, Jan. 14, 1908, *E. L. Ekman*, no. 1929 (TYPE, in Herb. Mus. Bot. Stockholm).

The slightly winged margins of the ecarunculate seeds of this species indicate its affinity to the various species of *series 2* of the subsection *Platypterus* (§ *Euandra*). Those species within *series 2* to which it is allied are in the group comprising *C. glutinosa*, *C. phoenix*, *C. acinifolia*, *C. concinna* and *C. thymoides*. *Cuphea laeviuscula* may be distinguished from any of these by its absolutely glabrous calyx (outside, at least) and by the minute uniseriate pubes-

cence of the younger stems, which, unlike any of the other species of its group, are otherwise quite glabrous.

§ **Euandra**, subsection PLATYPTERUS, series 2. Since the last general treatment of the *Lythraceae* by Koehne in Das Pflanzenreich (1903), five new species, all members of this series, were subsequently described by the monographer. These are *C. phoenix*, *C. concinna*, *C. grata*, *C. corisperma* and *C. hexasperma*. In addition, *C. laeviuscula*, described in this paper, has been added by the present writer. These may be more readily distinguished from each other and from the other species relegated to this series by the following key, adapted from the original Latin key in Koehne's Atlas Lythracearum (ined.).

- A. Spur obtuse, not incurved B.
- B. Branches glabrous save for a minute uniseriate white pubescence towards the tips; calyx glabrous.....*C. laeviuscula*
- BB. Branches not glabrous, variously pubescent, below as well as above C.
- C. Branches usually more or less hispid above with reddish-brown hairs; calyx 7-12(-13) mm. long, glabrous or often sparingly hispidulous; ovules 8-17.....*C. ingrata*.
- CC. Branches not reddish-brown-hispid; plants more or less viscid; calyx never glabrous, 6-9 mm. long; leaves small, 4-17 (or rarely -24) mm. long; ovules 4-20.
- D. Stems, branches and the surfaces of at least the younger leaves uniformly and densely glandular-hirtellous and pubescent; leaves commonly attenuate at the base.....*C. glutinosa*.
- DD. Only the branches and stems pubescent or subhirtellous; leaves often ciliate, but not uniformly pubescent on their surfaces.
- E. Leaves finely but conspicuously pinnate-veined, 6-17 mm. long, 2-8 mm. wide.
- F. Stems and branches minutely puberulent; leaves 6-13 x 2-5 mm., abruptly narrowed or somewhat rounded at the base, glabrous; calyx 9 mm. long, covered with short gland-tipped hairs, glabrous below the stamens within; the two dorsal petals almost twice as wide as the others; seeds 2 mm. long, scarcely narrower; ovules 13-16.....*C. phoenix*.
- FF. Stems and branches hirtellous; leaves 6-17 x 3-8 mm., commonly attenuate at the base, glandular-ciliate on the margins and nerves of the lower surface; calyx 6-8 mm. long, fairly densely setulose, biserially villous below the stamens within; the two dorsal petals hardly  $\frac{1}{4}$  wider than the others; seeds 2 mm. long and slightly wider; ovules 6-9.....*C. acinifolia*.
- EE. Leaves 1-nerved or the lateral veins quite inconspicuous, at least the lower leaves obtuse at the base G.
- G. Leaves commonly crowded, longer than the internodes, 5-15 x 2-7 mm.; the two dorsal petals more than  $\frac{1}{3}$  wider than the others, rotund-ovate; ovules 5-6.....*C. concinna*.

- GG. Leaves more remote, the longest 14 mm. long, oblong-ovate to linear; the two dorsal petals hardly, if at all, wider than the others, widely cuneate-oblong; ovules 4-12.....*C. thymoides*.
- AA. Spur quite slender, more or less incurved; calyx 10-13 mm. long H.
- H. Ovules 21-32; seeds orbicular or suborbicular; spur decidedly incurved; leaves 10-35 mm. long; plants not at all or only very slightly viscid J.
- J. Branches pilose with light hairs 2-3 mm. long, especially above; leaves commonly lanceolate, bright green, acutish to obtusish at the base; calyx 13 mm. long; petals 9.5 mm. long.....*C. grata*.
- JJ. Branches not pilose with long hairs; leaves commonly oblanceolate, more or less hoary, cuneate at the base; calyx 10-12 mm. long; petals 6-7 mm. long (perhaps longer).....*C. campylocentra*.
- HH. Ovules 10-12; seeds quite widely ellipsoid; spur only slightly incurved; leaves cuneate at the base, the lower 10-17 mm. long.....*C. corisperma*.
- HHH. Ovules 6; leaves rounded at the base, commonly 8-13 mm. long.....*C. hexasperma*.

**Cuphea obliqua**, spec. nov. Suffrutex verisimiliter alt. ignota. Caules irregulariter ramosi inferne decorticati superne pilis atropurpureis glanduloso-hispidi simul sat dense pilis articulatis pubescentes apud specimen visum 50 cm. longi. Petioli 0.5-2 mm. longi, ut caules vestiti. Folia obliqua lanceolata vel oblongo-lanceolata subcoriacea apice acuta vel subito acuminata, 6-25 mm. longa, 2.5-11 mm. lata, minora subfalcata, supra rugulosa scabrida glabra, subtus praesertim in nervis prominulis hispidula. Pedicelli pilis articulatis uniseriatim crispo-pubescentes, 1-2 mm. longi, bracteolas rotundatas apiculatas prope apicem gerentes. Calyx parce glanduloso-hispidulus ceterum glaber vel plerumque tantum minutissime sparseque hirsutulus dorso purpureo suffultus calcare graciuscule rectoque 7.5-8 mm. longus, intus infra stamina ventralia biseriatim villosus ceterum hinc glaber ore sub eis lanatus nervis duobus lobi dorsalis sub petalis dorsualibus dilatatis inspissatisque; vesiculae infrastaminales sub-10 vel 1-2 vel 0; appendices breves obtusae quam lobi breves calycis breviores setulis 1-2 munitae. Petala lilacina, 2 dorsualia oblongo-oblanceolata, 3.5 mm. longa, 4 ventralia cuneato-oblanceolata, 3 mm. longa. Ex filamentis 9 ventralibus exteriora duo lobos calycis superantia, interiora 7 quam lobi breviora, 3 brevissima, 4 cum eis alternantia exteriorum  $\frac{2}{3}$  aequantia. Ovarium glabrum stylo villosiusculo calycis  $\frac{3}{4}$  aequante. Ovula 10-12. Semina margine obtusa, 1.5 mm. longa. Discus latus crassiusculus reflexus.—Plate II.

ARGENTINA: MISIONES: region about Posadas, along the Alto-Paraná River, near the ranch known as "La Granja," Nov. 18, 1907, *E. L. Ekman*, no. 1914 (TYPE, in Herb. Mus. Botan. Stockholm).

This species is one of the subsection *Hyssopocuphea* (§ *Euandra*). It differs from *C. rubescens* Koehne, its closest relative, in its glandular-hispidulous and somewhat longer calyx, its slightly villose style, in having the leaves distinctly petioled by as much as 2 mm. in the larger leaves, in the articulate pubescence of the younger stems and in its much wider leaves strigulose beneath, particularly on the nerves. The leaves of *C. rubescens* range from lanceolate to sub-linear (those of *C. obliqua*, from lanceolate to oblong-lanceolate) and are often so oblique at the base as to make the leaf appear falcate. The specific name has reference, of course, to these oblique leaves.

**Cuphea paranensis**, spec. nov. Suffrutex (an frutex?) viscidus insuper adscendenter denseque ramosus alt. ignota. Rami inferne decorticati dense glanduloso-hispiduli insuper simul sparse crispo-puberuli folia pauca sessilia rotundato-ovata uninervia (interdum 3 nervis ex basi) ut ea ramulorum vestita 12 x 8-9 mm. in quorum axillis ramuli gerentes, 30-40 cm. longi. Ramuli virgati ut rami juniores vestiti 5-13 cm. longi. Folia conferta sessilia decussata subcoriacea aut cordato-ovata internodiis paullo breviora vel ea aequantia, 5 mm. longa, 4 mm. lata, aut elliptica-oblonga internodiis longiora, 3-4 mm. longa, 1.5-2 mm. lata, omnia adscendentia caulibus adpressa eos obtectentia uninervia conspicue glanduloso-ciliata utrinque atroviridia sparsius pilis adpressis glanduloso-hispidula. Inflorescentiae compositae foliatae confertae 3-10 cm. longae. Pedicelli interpetiolares vel interdum paullo infrapetiolares ut caules vestiti prope apicem bracteolas ovato-cordatas basi late sessiles gerentes. Calyx subcoriaceus stramineus dorso lateribusque purpureo suffultus dense uniformiterque glanduloso-hirsutulus 9-10 mm. longus, calcare rotundato obtuso, fauce valde adscendente, lobis brevibus latisque, intus infra stamina ventralia biseriatim villosiusculus ceterum hinc glaber, fauce intus atropurpureus sub staminibus ventralibus ac infra petala 2 dorsualia lanatus. Vesiculae infrastaminales nullae. Petala rosea vena media purpurea, 2 dorsualia cuneato-oblancoolata 4.5 mm. longa, 4 ventralia lineari-oblancoolata 5 mm. longa. Filamenta ventralia longiora lobos calycis paullo superantia. Ovarium sub anthesi breve, glabrum, 2 mm. longum, stylo villosiusculo 3 mm. longo calycem demum 2 mm. superante. Ovula 8-10. Semina atropurpurea nigrescentia ecarunculata margine obtusa. Discus latus horizontalis.—Plate III.

BRAZIL: PARANÁ: Marungava, "in campo cerrado rupestri," Dec. 7, 1915, P. Dusén, no. 17381 and (TYPE, in Herb. Mus. Botan. Stockholm).

The obtuse margins of the seeds of this species are those characteristic of the subsection *Hilariella* (§ *Euandra*). The rounded obtuse spur of the calyx places it in *series 1* of this subsection.

This novelty seems to be not very closely related to any hitherto described species in this subsection, though it is closer to *C. acinos* St. Hil. of Minas Geraes and S. Paulo than to any of the others. It may easily be distinguished from any species of the section *Hilariella*, series 1, by its larger number of ovules (no other species in this series has more than 6), and by its crowded, glandular-ciliate, sessile, dimorphic (larger cordate-ovate and smaller elliptic-oblong) leaves thickly clothing the branchlets.

**Cuphea tuberosiformis** Koehne in MS., spec. nov. "Suffrutex vel herba perennis" rhizomate suborbiculari crasso tuberoso 2-3 cm. diam. (*Ekman*, no. 1928); "caules 14-32 cm. longi, tenues, simplices, internodia foliis pro parte breviora pro parte longiora, pubescentia ac breviter violaceo-hirtella. Folia petiolis 1-4 mm. longis insidentia, e basi obtusa vel late acuta ad oblonga, vel infima orbicularia, 12-50 mm. longa, et 8-25 mm. lata, acuta, supra albido-punctulata vel strigosa setulisque saepe conspersa, subtus scabra vel scabro-hirtella, nervis utrinsecus 6 supra interdum impressis subtus prominentibus. Racemi distincti, bracteis infimis tantum ad 20-25 mm. longis ceteris a 5 ad 1.5 mm. longis, decurrentibus,  $\pm$  compositi ramulis saepe pedicellum axillarem juxta pedicellum interpetiolarem insertum, ad 17 mm. longum, foliis 1-3 minimis, 1-1.5 mm. longis obsitum imitantibus; pedicelli 2-12 mm. longi ut caules vestiti prope apicem bracteolas minimas virides rotundatas gerentes. Calyx calcare brevi obtuso adjecto" (10-) "13-14 mm. longus, puberulus ac breviter violaceo-setulosus viscosus, intus supra stamina ventre lanatus infra eadem villosus; lobi aequilongi. Petala 6, purpureo-lilacina, 7 mm. longa, dorsalia 2 cuneato-obovata 5 mm., ventralia cuneato-oblonga 3 mm. lata. Stamina episepala lobos aequantia vel vix superantia, 2 lanata, 3 glabra, episepala" [epipetala] "tubum vix aequantia lanata, 2 dorsalibus brevibus glabris exceptis; vesiculae infrastaminales 0. Pistillum ca. 9-10 mm. longum, ovarium glabrum, stylus ovario aequilongus parce pilosus vel subglaber, demum breviter exsertus; discus deflexus, supra concavus, subtus  $\pm$  trilobus. Ovula 8 vel 9. Semina orbicularia, ca. 2.2 mm. longa, margine obtusa."—Plate IV.

BRAZIL: PARANÁ: Tamanduá, "in campo," Feb. 24, 1910, *P. Dusén*, without number (type, in Herb. Mus. Bot. Stockholm); Capão Grande "in campo," Nov. 27, 1908, *P. Dusén*, no. 7281; Turma N. 23, "in campo," Jan. 25, 1910, *P. Dusén*, no. 9142; same loc., "in campo graminoso," Oct. 24, 1914, *G. Jonsson*, no. 1201a; Ponta Grossa, "in campo," Jan. 10, 1915, *P. Dusén*, no. 16316.

PARAGUAY: "in viciniis Caaguazú," Feb. 1905, *Hassler*, no. 8969.

ARGENTINA: MISIONES: Bonpland, vicinity of Posadas, Dec. 23, 1907, *Ekman*, no. 1928.

The striking tuberous underground portions of this species place

it at once with the others of the subsection *Oidemation* (§ *Euandra*). Its dorsal stamens have normal pollen-bearing anthers, a character confining the species to *series 1* of this subsection. It may be distinguished from its closest relatives, *C. tuberosa* Cham. & Schlecht. and *C. confertiflora* St. Hil. by its larger ovate-oblong to orbicular-ovate leaves and by having its flowers borne in racemosely branched cymes. Its petioles are much shorter than those of *C. tuberosa*, while its calyx differs from that of *C. confertiflora* in not having longer, though sparser, hispidulous hairs in addition to its uniform glandular puberulence.

**Cuphea myrtifolia**, spec. nov. Suffrutex verisimiliter. Rami basi lignescentes ex rhizomate cir. 1 cm. diam. vere lignoso inferne pilis rufis hirsuti hinc insuperque canescenti-strigulosi ac pruinoso-glandulosi fusco-ferruginei insuper pallidiores apud exempla visa simplices, 15–22 cm. alti. Petioli 0–1 mm. longi ut caulis vestiti. Folia adscendentia anguste oblongo-elliptica ad basin versus acute vel obtuse angustata sursum angustata vel acuminata adscendentia sat conferta internodiis longiora utrinque albido-strigulosa scabridaque praesertim subtus aeneo-viridia nervo medio tantum hinc prominente ac cinnamomeo margine plerumque sparse ciliata nervis utrinsecus paginae superioris 6–7 adscendentibus ad marginem versus arcuatis confluentibusque medio sulcato omnibus singulari modo incrassato-exstantibus, 12–35 mm. longa, 6–14 mm. lata. Pedicelli interpetiolares ut caulis dense albido-strigulosi apice bracteolas sat magnas ut pedicellus vestitas gerentes, 1–3 mm. longi. Inflorescentia vere foliata calycibus partim foliis obtectis. Calyx fuscus ad os versus et interdum dorso atropurpureus subcoriaceus prominente obtuseque costatus ut caulis uniformiter albido-strigulosus interdum dorso lateribusque pilis bruneis vel purpureis sparsis 1.5–2 mm. longis obsitus calcare rotundato appendicibus quam lobi calycis dimidio longioribus setis 2 duplo longioribus auctis, 6–9 mm. longus, intus sub staminibus 9 ventralibus barbatus infra ea tantum densissime biseriatim pilosus ceterum glaber. Stamina 2 dorsalia dense pilosa 9 ventralia bases sinuum calycis vix aequantia exteriora magis minusve barbata interiora pilis mollibus sat prolixè pilosa. Petala subaequalia rosea cuneato-oblonga 3 mm. longa. Vesiculae infrastaminales 0. Ovarium glabrum stylo demum calycem 0.5–1 mm. superante. Ovula 3. Semina turgida exalata. Discus horizontalis latus insuper inferneque convexus.

BRAZIL: MATTO GROSSO: Santa Anna da Chapada, May 12, 1903, *Gustav Malme* (TYPE, in Herb. Mus. Bot. Stockholm); same locality, Oct. 13, 1902, *Malme*.

This novelty belongs to the subsection *Oidemation* (§ *Euandra*).



It is most closely related to *C. ferruginea* Koehne, having among other characters in common with that species its dark reddish pubescence. It differs in having strictly decussate, sparsely long-ciliate and not hirsute leaves, much shorter pedicels, in its much more sparsely hirsute calyx, in having the two dorsal filament-bearing ribs of the inside of the calyx very densely instead of only slightly pilose, and more especially in the peculiar character of the leaf venation. On the lower surface, the lateral veins are hardly visible, while on the upper, they are very conspicuously raised, none ending freely at the edge of the leaf but running into the similarly raised marginal nerve. The wider dorsal midrib appears to be a double one, owing to the longitudinal groove which runs its entire length.

In Das Pflanzenreich IV, Fam. 216, only one species (*C. Urbaniana*) appears in series 3 of the subsection *Platypterus* (§ *Fuandra*). Since that publication, Koehne described three additional species having the carunculate seeds characteristic of this series. The distinctions between these and *C. Urbaniana* are set down in the following key, largely adapted from Koehne's manuscript.

- Caruncle not appearing as an apical protuberance (merely as a raised area on the seed surface). Ovules 4. Stem not hirsute. Leaves sparingly setose-ciliate. Uniformly strigulose calyx sparsely long-setose, biserially villose below the stamens within.....*C. Fiebrigi.*
- Caruncle appearing as an apical protuberance. Ovules 8-12.
- Calyx strigose, often with a few setose hairs, or even quite densely hirsute, as well.
- Calyces and stems often violet-hirsute. Seeds suborbicular.
- Calyx within glabrous below the stamens.....*C. Urbaniana.*
- Plant not all hirsute. Seeds obovate-ellipsoid. Calyx within biserially villose below the stamens.....*C. Dusenii.*
- Calyx very densely viscoso-hirtellous and, in addition, hirsute with hairs longer than those forming the more or less uniform covering. Seeds obovate-orbicular. Calyx within biserially villose below the stamens.....*C. carunculata.*

### § 7. TRISPERMUM.

**Cuphea callosa**, spec. nov. Herba annua depressa basi aliquantum lignea. Caulis simplex vel ramosus, incano-strigosus simul dense glanduloso-hirsutulus, circ. 10 cm. altus. Folia decussata, internodiis longiora anguste subcordato-ovata vel -oblonga, acuta rigida utrinque valde sed non densissime glanduloso-hirsuta sub-revoluta strigoso-ciliolata, 10-14 mm. longa, 3-6 mm. lata. Petioli subnulli-1 mm. longi. Pedicelli interpetiolares, 1.5-2 mm. longi, apice bracteolas ovatas ciliatas gerentes. Calyx breviter hirsutus breviter sed gracillime calcaratus ad os versus purpurascens, 5 mm. longus, intus supra stamina ventre lanatus infra eadem villosiusculus

costis duabus dorsualibus infra petala dorsualia pallide purpureis dilatatis claviformibus appendicibus inconspicuis breviter hirsutulis. Vesiculae infrastaminales nullae. Petala subaequalia ovato-oblonga caeruleo-purpurea calyci dimidio (circ.) aequilonga. Filamenta ventralia longiora tubum fere aequantia omnia pilis crispis pubescentia duo dorsualia multo breviora inferius inserta glabra. Ovarium glabrum. Stylus ovarium aequans glaber calice multo brevior. Discus valde incurvato-deflexus. Ovula 3-4.

COLOMBIA: DEPT. SANTANDER: marshy soil on the northern slope of the Mesa de los Santos, alt. 1000-1500 meters, eastern Cordillera, Dec. 11-15, 1926, *E. P. Killip & Albert C. Smith*, no. 15032 (TYPE, in Gray Herb.). One of the more robust specimens collected under this number appeared to have been badly cropped.

This species belongs to the section *Trispermum*. Its closest relative is *C. impeza* Koehne from Piauhý, Brazil. It may be distinguished from this species by the presence of a petiole, however short, by its less densely and more shortly hirsute calyx, by having the external appendages which alternate with calyx-lobes only inconspicuously and shortly setulose, by the two purplish dorsal ribs of the calyx which are widened and thickened, ending as free callosities just below the insertion of the dorsal petals (whence the name), by its glabrous style, and by its less densely, though still conspicuously hirsute, subrevolute and strigose-ciliolate leaves.

#### § 8. PSEUDOCIRCAEA.

In his key to the species of the § *Pseudocircaea* (Pflanzenreich IV, Fam. 216, p. 95. 1903), Koehne divided the species into two main groups, basing this separation on the presence or absence of hairs on the thickened midrib of the lower side of the persistent petals. Later, he found this condition far more general in this section than he had at first supposed. From Fed. Rep. viii. (1910) 199, Koehne may be quoted as follows: "Die Blumenblätter scheinen stets, was sonst bei *Cuphea* nicht vorkommt, unterseits an der Mittelrippe zottig zu sein, eine Erscheinung, die ich anfangs bei einer Anzahl von Arten, von denen mir nur geringfügige Proben vorlagen, übersehen habe." He thereupon revised his key to the section, and included therein two species described since the general revision, *C. talaverensis* and *C. Rojasi*, both of Koehne. This revised key was still in manuscript at the time of Koehne's death in 1918, nor has it since been published. It is here reproduced verbatim from Koehne's manuscript.

## Sect. 8. PSEUDOCIRCAEA.

- A. Petioli 1-3 mm. longi. Folia nulla cordata, 5-33 mm. longa.
- a. Discus semierectus, ovario sursum adpressus. Folia 12-32 mm. longa, floralia in quovis pari maxime inaequalia. Petala angusta vix inaequalia.
- α. Folia basi attenuata oblongo-lanceolata. Ovula 5. . . . . 117. *C. Chodatiana*.
- β. Folia basi rotundata vel vix acuta rotundato-ovata vel ovata vel ovato-oblonga. Ovula 5-10. . . . . 118. *C. ovalifolia*.
- b. Discus horizontalis vel subhorizontalis. Folia 5-33 mm. longa. Petala dorsalia plerumque ventralibus manifeste latiora.
- α. Ovula 5-13. Calyx 8-15 mm. longus.
- I. Ovula 5-6. Calyx 8-10 mm. longus, glanduloso-hirtellus. Folia e basi obtusiusculo oblanceolata, 10-20 mm. longa, floralia subaequalia. . . . . 119. *C. trichopetala*.
- II. Ovula 9-13. Calyx 10-15 mm. longus, longissime hirsutus. Folia basi attenuata late lanceolata vel fere oblonga, 18-33 mm. longa, floralia valde inaequalia. . . . . 120. *C. persistens*.
- β. Ovula 3-5. Calyx 7-7.5 mm. longus, violaceo-hirsutus. Folia basi rotundata, ovata vel ovato-oblonga, 5-25 mm. longa, floralia subaequalia. Pedicelli vix 1 mm. longi. . . . . 121. *C. sessiliflora*.
- B. Petioli saltem inferiores longiores, aut folia plerumque cordata. Folia saltem inferiora 20-45-70 mm. longa, nervis subtus prominulis.
- a. Folia basi attenuata vel acuta.
- α. Annua. Ovula 3. Petioli 10-20 mm. longi; folia ovata vel ovato-oblonga, 10-70 mm. longa. Calyx 5-7.5 mm. longus. . . . . 122. *C. prunellifolia*.
- β. Suffruticuli vel fruticuli (an etiam n. 123?).
- I. Ovula 5-8. Calyx 8-9 mm. longus.
1. Ovula 5. Petioli 8-12 mm. longi; folia ovato-oblonga, 25-45 mm. longa, floralia inaequalia altero  $\frac{1}{3}$ - $\frac{2}{3}$  breviora nec lineari nec longe ciliato. Calyx 9 mm. longus. . . . . 122b. *C. talaverensis*.
2. Ovula 6-8. Petioli 3-9 mm. longi; folia oblongo-lanceolata, 45-50 mm. longa, floralia maxime inaequalia altero 3 mm. longo lineari longe ciliato. Calyx 8 mm. longus. . . . . 123. *C. impatientifolia*.
- II. Ovula 3. Petioli 3-9 mm. longi; folia lanceolata vel lanceolata-linearia, 20-60 mm. longa, floralia inaequalia. Calyx 6-7 mm. longus. . . . . 124. *C. parietarioides*.
- b. Folia basi rotundata vel subcordata vel cordata, nervis subtus plerumque valide prominentibus.
- α. Folia basi rotundata oblonga vel oblongo-lanceolata apice obtusiuscula, 25-55 mm. longa. Calyx (7-)10-15 mm. longus. Ovula 3-8. Discus horizontalis. . . . . 125. *C. lutescens*.
- β. Folia multa basi subcordata vel cordata apice acuta.
- I. Ovula 3. Discus semierectus. Folia ovato-oblonga vel ovata, 20-43 mm. longa, nervis utrinsecus 6-12; petioli inferiores 4-10 mm. longi. Calyx 10 mm. longus. . . . . 125b. *C. Rojasi*.
- II. Ovula 5(-7). Discus horizontalis. Folia rugosa late ovata vel ovato-oblonga, 20-45 mm. longa, nervis utrinsecus 11-14; petioli 2-5 mm. longi. Calyx 8-9 mm. longus. . . . . 126. *C. costata*.

## § 9. HETERODON.

**CUPHEA WRIGHTII** Gray. This species has a geographical range extending from Costa Rica northward to the mountains of southeastern Arizona. In the extreme northern portion of its range, growing with the typical form, is found one with uniformly much reduced linear petals less than 1 mm. in length. Owing to the presence of very short slightly crisped hairs, the petals, though actually pale violet, appear grayish in hue. This plant may be designated as *Cuphea Wrightii* var. *nematopetala*. The distinctions may be thus set forth:—

Var. *a. typica*, var. nov. Petala violacea glabra 2 dorsalia obovata vel fere rotundata, 2–3 mm. longa, 4 ventralia 1.5–2 mm. longa, cuneato-obovata.

Var. *β. nematopetala*, var. nov. Petala pallide violacea sed propter pilos brevissimos primo aspectu cineracea omnia linearia, 0.5–0.8 mm. longa.

ARIZONA: Bowie, Sept. 21, 1884, *Marcus E. Jones* (TYPE, in Gray Herb.); Bowie, Sept. 10 (18?), 1884, *M. E. Jones*, no. 35; Ramsey Cañon, Huachuca Mountains, Sept. 28, 1929, *M. E. Jones*, no. 24989, at least in part, distributed as *C. Palmeri* Wats.

Related to *Cuphea lophostoma* Koehne are *C. cuernavacana* Rose and *C. Lozani* Rose, both described since the general treatment in *Das Pflanzenreich*. The distinctions among these three species were outlined in key form by Koehne in manuscript. A translation from this Latin key follows:—

- Pedicels bearing normal bractlets; dorsal calyx-lobe glabrous within, the edge not turned back like a hood (not cucullate).  
 Calyx densely long-hirsute.....*C. cuernavacana*.  
 Calyx much more shortly viscous-hirtellous.....*C. lophostoma*.  
 Pedicels without normal bractlets, these replaced by a row of bulbose-subulate black stipular structures; dorsal calyx-lobe velvety-pubescent, the edge turned back like a hood (cucullate).....*C. Lozani*.

**Cuphea tenuipes**, spec. nov. Herba annua simplex vel insuper demum ramosa. Caulis stramineus pilis brevibus crispis leviter albido-pubescentibus simul conspicue longe purpureo-hirsutus ad basem versus retrorso-hispidus, 25–60 cm. altus. Petioli subnulli–6 mm. longi. Folia anguste lanceolata basi saepe cuneata in petiolos decurrentia utrinque scabra strigosaque, 30–70 mm. longa, 9–15 mm. lata, floralia linearia setis purpureis ciliata. Inflorescentiae confertae demum aperte paniculatae. Pedicelli 1–2 mm. longi prope apicem bracteolati. Bracteolae ovatae longe ciliatae pilis brevibus albidis

basi bulbosis in axillis instructae. Calyx basi stramineus dorso purpureus ad os versus viridis dense breviterque albido-strigosus simul dense longeque purpureo-hirsutus, lobo dorsuali producto, intus sub staminibus ventralibus crispo-pilosus infra stamina duo dorsualia biseriatim villosus, 10–12 mm. longus, calli duo infra petala dorsualia conspicui; appendices calycis minutae setosae, duae dorsuales multo majores setas 3 vel 4 quam lobus dorsualis longiores gerentes. Petala duo dorsualia cyanea lamina suborbiculari basi cuneata, 5–6 mm. longa, unguiculo tenuissimo 3–4 mm. longo, 4 ventralia lutea oblongo-ob lanceolata breviter lateque unguiculata, 3–4 mm. longa. Filamenta ventralia 9 subexserta inaequalia, extimis duobus barbatis, aliorum 4 leviter crispo-pilosis, 3 cum eis alternantibus omnino glabris. Vesiculae infrastaminales 8. Stylus glaber apicé bifidus demum os calycis 2.5 mm. superans. Discus brevis crassus deflexus. Ovula 5.—Plate V.

MEXICO: GUERRERO: hills near Iguala, alt. 3500 feet, July 30, 1907, Pringle, no. 13942 (TYPE, in Gray Herb.); same loc., Aug., 1905, J. N. Rose, nos. 9304 and 9304a.

This species falls into Koehne's section *Heterodon* (subsection *Lophostomum*, series 1). Its closest relative is *C. viscosa* Rose, from which it may be distinguished by its more slender, less branching and more truly herbaceous habit, by its longer and more narrowly lanceolate, scabrous leaves, its purplish setose pubescence, especially above, its much larger ovate and ciliate bractlets, its larger and longer dorsal petals with much longer and more strikingly slender claws, its oblong-ob lanceolate, bright yellow instead of linear-subulate whitish ventral petals, its five instead of three ovules, and finally by the presence of eight vesicular outgrowths inside the calyx just below the nine ventral stamens. These vesicles as well as the shape and color of the ventral petals seem to indicate, too, a relationship with *C. lutea* Rose, a species considered by Koehne as closely allied to and intermediate between *C. Wrightii* and *C. viscosa*. In like manner, *C. tenuipes* may be considered intermediate between *C. viscosa* and *C. lutea*.

The specific name of this novelty has reference to the long slender claws of the two dorsal petals.

**Cuphea quaternata**, spec. nov. Caulis circ. 40 cm. altus ad basem versus dense crispo-pubescens simul glanduloso-hirsutulus. Petioli subnulli–1.5 mm. longi. Folia quaternaria subcoriacea lanceolata leviter revoluta basi rotundata supra rugulosa scabra atroviridia subtus pallidiora scabrida nervis exstantibus nervo medio hispidulo. 18–32 mm. longa, 5–10 mm. lata. Inflorescentia terminalis racemi-

formis bracteata. Pedicelli vix graciles parte superiore bracteolati, 5-6 mm. longi. Bracteolae apice rotundatae ciliatae. Calyx crassus fulvus insuper basique purpurascens viridi-costatus rotundato-calcaratus glanduloso-hirsutulus circ. 16 mm. longus lobo dorsuali leviter producto intus sub staminibus ventralibus pilosiusculus infra stamina glaber. Petala 6, duo dorsualia retrorso-erecta ovato-elliptica 5 mm. longa eorundem unguiculi vix tenui 1.5 mm. longi, 4 ventralia oblongo-spathulata sessilia 3-3.5 mm. longa. Filamenta duo dorsualia breviora glabra, 9 ventralia irregulariter incrassata floccoso-lanata praecipue exteriora quorum tria subexserta. Ovarium glabrum stylo glabro incluso. Ovula 5-7. Discus crassus apice deflexo.

MEXICO: TEPIC TERRITORY (NOW NAYARIT): between Santa Gertrudis and Santa Teresa, August, 1897, *J. N. Rose*, no. 2066 (TYPE, in Gray Herb.).

This species belongs to the subsection *Lophostomum*. Its closest relative is *C. Karwinskii* Koehne from Oaxaca, from which it may be distinguished by its quaternate leaves and its much thicker and glandular-hirsutulous rather than strigose-puberulent calyx.

**Cuphea purpurascens**, spec. nov. Herba annua radice recta simpliceque. Caulis simplex vel in exemplaribus majoribus ascendenter ramosus purpurascens leviter pubescens praecipue insuper simul glanduloso-hirsutulus pilis purpureis, 15-35 cm. altus. Petioli foliorum inferiorum ut caulis vestiti, 2.5 mm. longi, ei foliorum superiorum nulli vel subnulli. Folia oblanceolata vel lineari-oblanceolata supra strigulosa interdum sparse adpresso-hirsutula subtus item strigulosa saepe in nervo medio remote purpureo-hirsuta undulata minute revoluta ciliolata in petiolos attenuata 10-20 mm. longa, 2-5 mm. lata, floralia lanceolato-lineariter purpurascens ciliata purpureo-hispida valde inaequalia, ad 5 mm. longa. Inflorescentia spiciformis floribus saepe secundis. Pedicelli subnulli prope apicem bracteolati; bracteolae vere purpureae acuminatae. Calyx conspicue purpureo-nervatus sparse purpureo-hispidus pilis basi bulbosis lobo dorsuali maximo producto post anthesin deflexo calycem demum claudente intus usque ad partem infra mediam pilosiusculus sub staminibus ventralibus dense villosus 5-7 mm. longus, 1.5-2.5 mm. latus, squamulis infra petala nullis. Petala 2 dorsualia oblanceolato-obovata semi-erecta 2 mm. longa, 4 ventralia spathulata vel anguste oblanceolata 1 mm. longa. Stamina inclusa. Filamenta longiora dense barbata apice glabra. Stylus calyce brevior glabratus. Discus minutus oblique erectus ovario adpressus. Ovula 3-4.

MEXICO: PUEBLA: Tehuacan, Sept., 1911, *C. A. Purpus*, no 5711, distributed as *C. Palmeri* Wats. (TYPE, in Gray Herb.); at same locality, Sept. 6, 1905, *J. N. Rose*, no. 10136.

This species belongs in the subsection *Lophostomum* (§ *Heterodon*). In Koehne's key (Pflanzenreich IV, Fam. 216, p. 95), it would be placed next to *C. secundiflora* Sesse & Moc. Related to both these species is *C. humayana* Brandegee (Zoe V. 214. 1905) from Sinaloa. The distinctions among them may be set forth in the following amendment to Koehne's key (loc. cit.).

B. 2 dorsal petals larger than the lower or sometimes the lower 4 lacking.

a. Disc obliquely erect.

I. Claws of the 2 dorsal petals never more than  $\frac{1}{3}$  the length of the blade. Ovules 3-6.

II. Calyx 8-12 mm. long,  $1-1\frac{1}{2}$  mm. wide, in fruit narrowly ampullaceous, greenish, pilose, slightly 2-ribbed within, the throat slender, the mouth strikingly oblique; ventral petals inconspicuous or lacking; style as long as the dorsal (longer) side of the calyx, hispidulous, especially below; leaves ovate to ovate-lanceolate,  $3\frac{1}{2}-7$  cm. long; petioles of lower leaves often 10-35 mm. long. . . . . *C. secundiflora*.

II. Calyx 5-7 mm. long,  $1\frac{1}{2}-2\frac{1}{2}$  mm. wide, in fruit broadly ampullaceous, purplish-nerved and suffused purplish on the back, sparsely purple-hispid, not at all 2-ribbed within, the throat only slightly narrower than the base, the mouth only slightly oblique; ventral petals present,  $1\frac{1}{2}$  mm. long; style shorter than the ventral (shorter) side of the calyx, glabrate; leaves oblong-lanceolate to narrowly oblanceolate, to  $2\frac{1}{2}$  cm. long; petioles mostly none to 5 mm. in length. . . . . *C. purpurascens*.

I. Claws of the 2 dorsal petals  $\frac{1}{2}$  as long as to equaling the blade. Ovules 3. Calyx 8-10 mm. long, in fruit broadly ampullaceous. Petals 6. Leaves lance-ovate, 25-40 mm. long. . . . . *C. humayana*.

**CUPHEA HUMAYANA** Brandegee. This species was originally described from Culiacan, Sinaloa. Subsequent collections have more definitely established its range. It is now known to occur in Morelos and Nayarit as well. The following specimens may be cited:—Yuatepec, Morelos, *Rose et al.*, no. 8537 (distributed under a manuscript name by Rose); same loc., *Rose & Painter*, no. 6581 (distributed as *C. lanceolata* Ait.); foothills back of Jalisco, Nayarit, *R. S. Ferris*, no. 5838.

### § 10. MELVILLA.

**Cuphea Loefgrenii**, spec. nov. Fruticulus mox decorticatus altitudine ignota. Caules juniores pilis purpurascensibus dense glanduloso-hispidi simul interdum sparse crispo-pubescentes. Petioli 0.5-2 mm. longi, inferiores ad 4 mm. longi, ut caulis vestiti. Folia oblongo-elliptica plerumque ad basem versus subcuneata apice acuta vel plerumque breviter attenuata supra atroviridia scabra parce

hispidula subtus pallidiora hispidula praesertim in nervis prominentibus et in margine scaberrima, 20–40 mm. longa, 13–26 mm. lata. Inflorescentia foliata. Pedicelli interpetiolares ut caulis vestiti, 5–8 mm. longi, prope apicem bracteolati. Bracteolae ovato-lanceolatae hispido-ciliatae. Calyx crassus cylindraceus, 20–40 mm. longus, 4–5 mm. latus, sulfureus dorso convexus hinc et ad os versus coccineus valde rotundato-calcaratus dense breviterque albido-hirtellus dorso lateribusque coccineo-hirsutus intus sub staminibus 9 ventralibus barbatus infra ea uniformiter pilis mollibus sparsisque pilosus, lobis brevibus eciliatis apicibus recurvatis appendicibus fere obsoletis 4–6 aristulas lobos paene aequantes gerentibus. Petala 6 sessilia pallide sanguinea duo dorsalia ovata basi subcordata 4 ventralia elliptico-oblonga omnia 2–2.5 mm. longa lobos calycis 0.5 mm. superantia. Filamenta duo dorsalia glabra, ex ventralibus medium glabrum aliis conspicue longius, ea utroque adjacentia et paria duo exteriora villosa lobos calycis bene vel vix aequantia cetera duo glabra longitudine intermedia. Ovarium glabrum, 5 mm. longum, stylo glabro, 13 mm. longo, filamento longissimo 1 mm. brevior. Discus latus brevis deflexus. Ovula 10 valde convexo-concava apice late retusa.

BRAZIL: CEARÁ: Alta da Serra in "caapuerão," March 16, 1910, *Albert Löfgren*, no. 256 (TYPE, in herb. Mus. Botan. Stockholm); San Felix, in "carrascal," March 18, 1910, *Albert Löfgren*, no. 332.

This species fits into Koehne's *series 2* of the subsection *Pachycalyx* (§ *Melvilla*). The nine ventral stamens, as usual, are alternately long and short, but the middle of these is conspicuously longer than any of the others, exceeding the long exerted style by 1 mm. This condition is very rare in *Cuphea*. In no other species of the section *Melvilla* hitherto described is any one of the ventral stamens longer than the others, a character at once separating *C. Loefgrenii* from the other Brazilian species of *series 2* of the subsection *Pachycalyx*. Moreover, *C. Loefgrenii* differs from these (*C. grandiflora*, *C. Gardneri* and *C. annulata*) in the character and uniform distribution of the pubescence of the interior of the calyx, in having at least the two dorsal petals slightly cordate at the base and in the number of ovules.

**Cuphea Mexiae**, spec. nov. Suffruticulus erectus rhizomate 12–16 mm. incrassato. Caulis simplex cortice chartaceo cinnamomeo ad 1.5 m. altus praesertim insuper dense glanduloso-pilosus. Petioli subnulli ad 1 mm. longi in axillis pilos minutos incrassatos purpureos stipulares gerentes. Folia decussata oblongo-elliptica utroque sensim angustata apice leviter acuminata basi abrupte rotundata supra stigulosa ac sat dense hispidula subtus densissime glanduloso-pilosa



nervo medio venisque stramineis prominentibus nervis utrinsecus 8-11 margine strigulosa interdum revoluta, 30-55 mm. longa, 5-15 mm. lata. Folia juniora floralia pilis longis intense coccineis obsita. Inflorescentia terminalis. Pedicelli ad 7 mm. longi prope apicem bracteolati. Calyx coccineus sat dense pilis coccineis glanduliferis pilosus simul sparsius pilis albidis hirsutulus dorso convexus, 26 mm. longus, ad 4 mm. latus, intus fauce sub staminibus pilis mollibus pilosus infra stamina glaberrimus, calcare brevissimo 1 mm. longo haud orbiculare; lobi calycis brevissimi leviter acuminati minutim hirsuto-ciliolati; appendices duae dorsuales lobis longiores crassiusculae setis validis coccineis basi bulbosis margine vel interdum dorso obsitae, ceterae minores lobis subbreviores setis similibus ciliatae. Petala ignota an nulla (?). Stamina 11 ventralia pilosa alterne inaequalia quorum 3 mediana ceteris longiora inclusa. Ovarium gibbum glaberrimum styli glabri demum subexserti tertiam partem aequans. Ovula 6. Discus dorsualis brevis crasse ovato-cordatus leviter deflexus.

MEXICO: JALISCO: East of San Sebastian, Hacienda del Ototal, Arroyo de los Hornos, Sierra Madre, alt. 1500 m., woods, on slopes, abundant, March 6, 1927, *Ynez Mexia*, no. 1820 (TYPE, in Gray Herb.).

This novelty finds its closest affinity in *Cuphea Watsoniana* Koehne. It may be distinguished from the latter by its copious glandular pubescence, very short petioles, mostly narrower leaves densely glandular-pilose beneath, strictly terminal inflorescence, uniformly scarlet calyx (that of *C. Watsoniana* having a green throat), much more striking appendages, included pilose stamens and by the disparity in the number of ovules (*C. Watsoniana* has 20-26 ovules).

Upon examination, *Pringle*, no. 2792, distributed as *C. Liebmannii* Koehne ?, proves conspecific with *C. Watsoniana* Koehne. Both this and the type (same collector's no. 4355) are from the same general region.

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## II. THE VASCULAR FLORA OF THE GUANO ISLANDS OF PERU.

BY IVAN M. JOHNSTON.

(Plates VI-VII.)

WERE it not for the myriads of sea-fowls that frequent them the islands off the coast of Peru would be known only as local features and of concern only to fishermen and navigators. They are small bits of land. A few of the several score of them have a length of from

five to ten kilometers, but the great majority are very much smaller. Practically all are found strewn close in along the Peruvian coast ten kilometers or less off shore. The most isolated one is less than sixty kilometers from the mainland. In themselves they are forbidding and merit only passing attention of Man. Under the rainless sky which prevails over them, however, the excreta of their enormous bird populations have accumulated, forming vast quantities of that valued and hence much sought-after fertilizer—guano. The islands, consequently, have achieved a fame and importance which their small size, coastal position and general aridity and inhospitality alone would never have given them.

To the naturalist the Peruvian islands have been known only for their bird populations. The truly astonishing size of these and their great economic importance early attracted attention. Concerning the flora and the other than avian fauna of the islands, however, scarcely anything has been recorded. The most successful attempt to remedy this surprising dearth of information regarding the strictly land flora and fauna of the Peruvian islands has come through the collections and studies made on them between Sept. 1919 and Feb. 1920 by Dr. Robert Cushman Murphy, then connected with the Brooklyn Museum and now on the staff of the American Museum of Natural History. Although his primary objects were ornithological, Dr. Murphy, taking full advantage of excellent facilities for visiting the important Peruvian islands, collected and observed all the land plants and animals he could find on them. His collections, with the exception only of the plants, have been reported upon technically ten years ago. The results of their study may be found summarized in Dr. Murphy's delightful book, "The Bird Islands of Peru" which was published (Putnam, New York) in 1925.

The collection of plants made by Dr. Murphy has, through a variety of circumstances, remained until now unrecorded in print. It represents the first ever made of the land flora of the guano islands. Dr. Murphy collected upon all the important Peruvian islands except San Lorenzo, off Callao, and visited all the islands on which any of the higher plants might be expected to occur. His collections, hence, indicate rather well the distribution of such plants among the islands and the probable extent of the flora involved. As a result we can now say with fair confidence that the higher plants are present on only four of the Peruvian islands, namely Lobos de Tierra, San Lorenzo, San Gallan and Viejas. The total flora probably consists of about two dozen species.

The most northern of the islands mentioned, Lobos de Tierra,

which has the smallest flora as to number of both species and individuals, apparently owes its pitifully small flora in some part to the occasional visits of equatorial storms. On the remaining three islands, however, the flora is dependent upon and directly correlated with the clouds that bathe their rather lofty crests. These fogs, brought about by the cooling of moisture-laden sea-winds which have been upwardly deflected by obstructing headlands or coastal hills, are characteristic features of the littoral of Peru and northern Chile. Forming at between 300 and 400 meters altitude over the islands, and somewhat higher, at about 1000 meters, over the coastal hills on the mainland, they bathe the favored peaks and slopes in wet clouds. On the coastal hills the localized effects of the protection they give from the sun and the moisture brought by them to the soil results in a rather sharply defined zone of lush green vegetation on otherwise barren seaward slopes. This winter and spring fog-correlated vegetation, so conspicuous on the coastal hills of Peru and northern Chile, has been called the Loma Formation. It is one of the most distinctive plant associations in South America. Belonging with it, both ecologically and phytogeographically, are the floras of San Lorenzo, San Gallan and Viejas.

The Peruvian islands have a flora that is merely an impoverished fragment of that of the adjacent mainland. The flora of Lobos de Tierra is the only one uncorrelated with fog. The most common of its two species, *Sesuvium*, is a sea-dispersed halophyte widely distributed in tropical America. Its other species, represented by a single struggling tree of *Prosopis*, may possibly be a relic of a climatically more favorable past. Whatever may be the case, whether its presence is the result of natural dispersal or the agency of man, the colonization of the island by *Prosopis* is scarcely a successful one. The remarkable thing about Lobos de Tierra is that of all the Peruvian islands it alone has developed a flora at low altitudes. On the islands south of Lobos de Tierra a flora is developed only on those which reach an altitude of 350 meters or more and which thereby achieve fog-bathed crests. There are only three of these; San Lorenzo, San Gallan and Viejas. The other Peruvian islands are much lower, most of them being less than 100 meters high and only four reaching up to between 100 and 200 meters in altitude. In their alignment with topographic features on the mainland the islands all clearly reveal their connections with the continent. An elevation of the Peruvian coast by some score of meters would connect most of the islands with adjacent promontories and headlands. A subsidence of similar amount would make islands out of various headlands now part of the mainland.

Under such conditions an endemic insular flora is scarcely to be expected. I am consequently of the opinion that eventual exploration of the headlands on the mainland adjacent to San Gallan and Viejas will reveal there the presence of the species now found on the foggy summits of those islands. It is known that the foggy crests of San Lorenzo have a flora composed of species found in the Loma Formation on the adjacent mainland. While the *Periloba* and *Polyachyrus* that are described from San Gallan seem to have affinities that are Chilean rather than Peruvian, I believe that they represent simply further Chilean elements in the Peruvian flora belonging with the many others that are recognizable in the coastal regions of Peru, particularly in the southern departments. That they have been discovered first on the islands is simply because the headlands of Ica and northern Arequipa have not yet been botanized.

Lobos de Tierra Island, lat.  $6^{\circ} 26' S.$ , one of the largest and most northern of the Peruvian islands, is about 10 km. in length and lies over 16 km. from the nearest mainland. The island is rough in topography and reaches at the south end an altitude of almost 100 m. It is barren and quite arid, its only water coming from the equatorial storms, that through the course of the years, occasionally reach south to it. According to Murphy, l. c. 319, "Lobos de Tierra is unique among all the low islands of the Peruvian coast in that it has what may by courtesy be termed a terrestrial flora. Minute green algae color a few of the higher rocks along the western border; and a small, fleshy-leaved flowering plant [*Sesuvium*], which the fishermen call *lejuia*, grows sparingly on the beaches of the east coast. But the outstanding, almost startling, botanical feature of the island is a thorny, acacia-like tree [*Prosopis*], which stands in a sandy sink not far from the Caleta de Cherra and within sight of the light-house. Deriving its water presumably from ocean seepage, this anomalous plant—a single representative of a single species—has contrived to eke out a lengthy existence. According to the most venerable of the Indians, its twisted trunk and bent branches, which reach barely three feet above the ground, have had their present appearance as far back as memory and tradition go."

San Lorenzo Island, lat.  $12^{\circ} 06' S.$ , lies only a few kilometers to the southwest of Callao. About 8 km. long and nearly 3 km. wide it reaches an altitude of over 370 meters. Its slopes are dry and sandy, but its crests, reaching into the same atmospheric strata as San Gallan and Viejas, like these islands are bathed with fog. A similar fog-correlated vegetation is developed there. The only attempt to list the species of plant found on San Lorenzo is that by Ramondi,

El Peru iv. 405 (1902), whose specific determinations are probably mostly, if not all, incorrect. San Lorenzo not being a guano island, and Dr. Murphy not having collected there, its flora is not treated in detail in this paper.

San Gallan Island, lat.  $13^{\circ} 53'$  S., lies to the southwest of the port of Pisco and about 5.5 km. west of the Paracas Peninsula. The island is about 4 km. long. Prevailingly low at its north end, it slopes generally upward and culminates at the south end in cliffs and bold headlands that reach an altitude of about 400 meters. It is the most lofty of all the Peruvian islands. Mostly arid, it is only on and about the foggy crests of the island that its flora is developed (Plate vi). A quotation from Dr. Murphy's book, l. c. 187, gives some idea of the ecological conditions and plant distribution on the island. "We walked through the gently sloping, sandy valley, which was filled here and there with diving petrel burrows, and then turned up the steep, bone-dry hillside toward the rocky central summit. At a slight elevation we encountered the first straggling, stunted growths of the bayonet-leaved epiphyte, *Tillandsia purpurea* [rather *T. latifolia*!]; and, at a height of 1100 feet the desert, with its hot stones and resounding crust of alkaline salt, abruptly gave way to a rock garden such as a landscape architect might well take as an inimitable ideal. On this peak the crumbling granite was exposed in chaotic piles, and here, within a layer of cool, moist air, were fully a dozen species of plants with buds, flowers, and fruit all together. Three of them I had already seen on the crest of Isla Vieja, in Independencia Bay, but the others were all new. Butterflies, grasshoppers, land snails, and lizards dwelt among the rocks and the vegetation, while every crevice and small patch of soil had its aggregation of petrel tunnels. To one who had been living upon the bare low guano islands, the fresh, verdant scene and the smell of foggy air were a delight." Dr. Murphy collected seventeen species of ferns and flowering plants about the summit of San Gallan.

Viejas Island, lat.  $14^{\circ} 14'$  S., lies close in shore in line with the promontories forming the north and south ends of Independencia Bay, and separated from them by more than one and less than nine kilometers of water. It is about 6 km. long and nearly 2 km. wide, and reaches an altitude of about 366 meters. The crest is almost constantly bathed in fog. On this moistened area Dr. Murphy found three kinds of higher plants, all of them belonging to species present on San Gallan.

The collection of plants made by Dr. Murphy on the guano islands, which is the basis of the present paper, was presented to the Brooklyn

Botanic Garden and is now preserved in the herbarium of that institution. For the privilege of studying the collection I am indebted to Dr. C. Stuart Gager, Director of the Garden and to Dr. Henry K. Svenson, Assistant Curator in the herbarium. Dr. Murphy has most kindly supplied for publication some of his excellent photographs of San Gallan and its vegetation. I am also indebted to several of my friends for assistance in the identification of critical groups. The ferns have been named by Dr. W. R. Maxon, the grasses by Prof. A. S. Hitchcock and the bromeliads by Dr. Lyman B. Smith.

#### CATALOGUE OF THE SPECIES.

**Polypodium lanceolatum** L. Sp. Pl. ii. 1082 (1753).

San Gallan (M. 3475). A species widely distributed in the tropics.

**Trisetum spicatum** (L.) Rich. Pl. Eur. i. 59 (1890).

San Gallan (M. 3481). A form of this polymorphous species. Hitchcock, Contr. U. S. Nat. Herb. xxiv. 360 (1927), reports it elsewhere in Peru only from the Andean valleys of the interior. I have collected a similar plant in the Loma Formation in northern Chile.

**Koeleria trachyantha** Ph. Fl. Atac. 55 (1860).

San Gallan (M. 3477). A plant of the coastal hills which ranges from the Lima region south into northern Chile.

**Stipa disticha** Hitchc. Contr. U. S. Nat. Herb. xxiv. 288 (1925).

San Gallan (M. 3478, TYPE). A very distinct species known only from the Dr. Murphy's collection. Its relations seem to be southern.

**Tillandsia latifolia** Meyen, Reise ii. 45 (1835).

San Gallan (M. 3482). The most common and conspicuous plant on the island, growing luxuriantly over gravelly slopes and out-crops above 300 m. alt. and even staggling down below the cloud-zone in occasional stunted examples to about 10 m. alt. The best developments of the plants were towards the crests on lee exposures. The species is widely distributed along the Peruvian coast and has been reliably reported from San Lorenzo.

**Tillandsia recurvata** L. Sp. Pl. ed. 2, i. 410 (1762).

Viejas (M. 3221) and San Gallan (M. 3468). On Viejas it grows only on crumbling rocks about the summit. On San Gallan in the cloud belt it is not uncommon, and is usually found clinging to the lee side of rocks. According to Dr. Smith this island plant represents a phase of the variable and very widely distributed *T. recurvata* notable chiefly for its stout habit and long, trailing stems.

**Parietaria debilis** Forst. Prodr. 73 (1786).

San Gallan (M. 3471). A widely distributed herb frequent in moist, sheltered places in western Peru.

**Suaeda foliosa** Moq. in DC. Prodr. xiii. pt. 2, 156 (1849).

San Gallan (M. 3465). A spreading succulent shrub of the coastal hills of central and southern Peru and northern Chile.

**Sesuvium Portulacastrum** L. Syst. ed. 10, ii. 1058 (1759).

Lobos de Tierra (M. 3464). Growing sparingly along the beach on the east side of the island. A widely distributed halophyte in the American tropics.

**Prosopis chilensis** (Molina) Stuntz, U. S. Bur. Pl. Indust., Invent. Seeds xxxi. 85 (1914).

Lobos de Tierra (M. 3463). Represented on the islands by a single, stunted, wind-swept tree slightly back and above the shore. A photograph of this individual is to be found on the plate in Dr. Murphy's book opposite page 320. The species is a widely distributed one in well drained soils throughout most of the coastal area of Peru and Chile.

**Geranium limae** Kunth, Pflanzenr. [Heft 53] iv. Fam. 129, 74 (1912).

San Gallan (M. 3473, 3474). This is the only Peruvian species of a group that is prevailingy Chilean. The type and previously only known specimen is given as from "Lima und S. Lorenz." The San Gallan plant may be somewhat more densely hairy on the stems but otherwise appears to agree closely with the type.

**Oxalis carnososa** Molina Sagg. Chile ed. 2, 288 (1810).

Viejas (M. 3218) and San Gallan (M. 3469). A plant widely distributed along the coast of western South America.

**Palaua moschata** Cav. Monadelph. Class. Dissertat. i. 41 (1790).

San Gallan (M. 3466). Growing chiefly in sheltered hollows between rocks about the summit. The flowers are lavender or pale purplish. Otherwise known only from San Lorenzo Island and the hills near Lima.

**Daucus montanus** H. & B. ex Schultes, Syst. vi. 482 (1820).

San Gallan (M. 3476). Widely distributed in western South America.

**Apium ammi** (Jacq.) Urban in Mart. Fl. Bras. xi. pt. 1, 341 (1879).

San Gallan (M. 3480). A plant common in the coastal hills of Peru.

**Periloba insularis** Johnston, sp. nov., perennis; caulibus prostratis 5-15 cm. longis sparse divaricateque ramosis saepe 1.5-3 mm. crassis, dense villosulis (pilis simplicibus furcatisve), minute stipitoglanduliferis, tandem glabrescentibus, basibus prominentibus petiolorum cicatricosis, maturitate cortice pallido suberoso glabrato obtectis, e caudice prostrato laxissime divaricateque ramoso indurate crasseque fusco-corticoso lignoso usque ad 12 mm. crasso erumpentibus; foliis villosulis pilis furcatis simplicibusve dense vestitis minute

stipitato-glanduliferis integerrimis crassiusculis, lamina ovata vel obovata 10–15 mm. longa 6–8 mm. lata apice rotundata basi in petiolo 5–10 mm. longo gradatim attenuata; basi petioli indurata persistenti; foliis capitum caudicis rosulatis; foliis caulinis ramealibusque 1–15 mm. distantibus superioribus vix conspicue reductis; floribus in axillis foliorum superiorum solitariis; pedicellis gracilibus ca. 10 mm. longis maturitate deflexis; calycibus obconicis 1 cm. longis ultra medium in lobos duos acutos incisis, fructiferis ca. 8 mm. diametro 6–7 mm. altis, lobis incurvatis; corolla infundibuliformi caerulescenti 2 cm. longa extus villosula et glanduligera; tubo cylindrico 5 mm. longo per calycem occulto intus villosulo; faucibus gradatim ampliatis ca. 10 mm. longis ad 10 mm. diametro; filamentis inclusis 3 et 4 mm. longis ca. 5 mm. supra basem corollae affixis ad basem versus dilatatis, partibus inferioribus et decurrentibus dense villosis, aliter glaberrimis; antheris ellipticis ca. 1.8 mm. longis; stylo glaberrimo 10 mm. longo; receptaculo maturitate hemisphaerico 2–2.5 mm. diametro irregulariter profundeque lacunoso; nuculis 15–20 percongestis distinctis evidenter 2–3-seriatis basi affixis evidenter inaequalibus 1–2.5 mm. longis plus minusve angulatis polymorphis nigris sub lente minute delicateque alveolatis plus minusve opacis.—  
 PERU: fog-bathed crest of San Gallan Island, Nov. 27, 1919, *R. C. Murphy* 3472 (TYPE, Brooklyn Bot. Garden; ISOTYPE, Gray Herb.)

A very distinct species of a genus heretofore unknown in the Peruvian flora. All the congeners of *P. insularis* are Chilean. None of them, however, seems closely related to it. If it were necessary to indicate a particular affinity I should suggest *P. paradoxa* (Lindl.) Raf. of the coast of central Chile. The island plant can be distinguished from all other members of its genus by its very woody caudex and dense, forking or even dendritic pubescence. From most species it is further distinguished by having the corolla-tube villous within and in having conspicuously unequal nutlets. The calyx is not at all plicate and seems to be prevailingly two-lobed. In the nature of the pubescence on the herbage, in its villous corolla-tube and in the attachment of its small nutlets the plant rather suggests a species of *Bargemontia*. The elevated gynobase, the pluriseriate arrangement of the nutlets, and the broad leaves, however, are all indicative of its affinities in *Periloba*. Its fruit, clearly and unmistakably, removes it from *Nolana*, although the gross habit, though not pubescence, does suggest the well known species of the Peruvian coastal region, *N. prostrata* L. f.

***Solanum tuberiferum*** Dunal in DC. Prodr. xiii. pt. 1, 63 (1852).  
 San Gallan (M. 3470). The specimen is poor but represents,



almost certainly, this species. It is a plant of the coastal hills of Peru.

**Solanum Murphyi** Johnston, sp. nov., succulentum glaberrimum erectum; radice crassa palariramosa ut videtur annua; caulibus 8-12 mm. crassis purpureo-tinctis breviter subdichotome ramosis 15-30 cm. altis flexuosis ad basem versus aliquanto induratis ceterum herbaceis fistulosis; ramis 5-12 cm. longis ascendentibus saepissime simplicibus foliosis 4-8 mm. crassis confertis vel distantibus; foliis succosis 1.5-2.5 cm. longis 5-8 mm. latis 5-7-lobatis viridis, margine evidenter revolutis, supra minute papillatis, subtus leavibus cum costa lata conspicua ornatis; lamina ovata vel ovato-oblonga 7-13 mm. longa in petiolum alatum abrupte contracta, lobis 2-3-jugatis 1-2.5 mm. longis et latis obtusis sinibus saepissime apertis obtusis; inflorescentia cymosa 1-2-flora in ramis saepe terminali; pedicellis gracilibus sulcatis 5-9 mm. longis erectis, fructiferis deflexis; calyce 4-4.5 mm. longo, lobis 5 erectis oblongis 3-3.5 mm. longis 1-1.5 mm. latis, apice obtusis, extus glaberrimis minute papillatis, intus stipitato-glanduliferis; corolla purpureo-caerulea cupuliformi vel rotato-infundibuliformi 1.5-2 cm. diametro ca. 12 mm. longa quam calyce 3-4-plo longiori extus villosula intus glabra, lobis latis rotundis ca. 8 mm. latis ca. 1.5 mm. longis apiculatis, sinibus lobulis rotundis 2 mm. latis ca. 0.9 mm. altis ornatis; filamentis aequalibus ca. 1.5 mm. supra basem corollae affixis subulatis glaberrimis 4 mm. longis immam ad basem ca. 0.8 mm. latis; antheris distinctis oblongis aequalibus 2-2.5 mm. longis biporosis; stylo 5.5 mm. longo glaberrimo; stigmatate 1 mm. longo compresso; fructu globoso 5-7 mm. diametro.—PERU: growing about rocks on foggy summit of Viejas Island, Nov. 17, 1919, *R. C. Murphy* 3219 (TYPE, Brooklyn Bot. Garden; ISOTYPE, Gray Herb.).

An interesting member of *Solanum* subsection *Dulcamara*, characterized by its glabrous, very succulent herbage and its broadly and very shallowly lobed corollas. It seems to be related to the Chilean *S. Fewillei* Dunal. The corolla of *S. Murphyi* has five very broad short lobes that alternate with smaller but similarly proportioned lobes produced in the sinuses. Along with *Tillandsia* and *Oxalis* this plant formed the entire vascular flora of Viejas Island. A collection (no. 3479) and an excellent photograph (plate vii) obtained by Dr. Murphy near the crest of San Gallan evidently represent the same species. Except that the plants are distinctly shrubby below the middle and seem to be persistent, they differ in no evident way from those of Viejas Island which have furnished the basis of my description given above. I believe that they are conspecific.

**Polyachyrus nesites** Johnston, sp. nov., suffruticosus 2.5–3 dm. altus; caulibus vetustioribus caudicem laxe ramosus decumbens formantibus; ramis erectis vel ascendentibus numerosis 1–2.5 dm. longis evanescenter canescenterque arachnoideis vetustate plus minusve glabrescentibus 2.5–4 mm. crassis; foliis 4–7 cm. longis 13–26 mm. latis numerosis supra medium caulis abrupte reductis carnosulis pinnate lobatis, supra glabratis et sparse glandulosis, subtus incano-arachnoideis, margine evidenter revolutis, lobis elongatis divaricatis vel antrorse ascendentibus distantibus 4–6 integerrimis vel evidenter unidentatis 2–5 mm. latis basi confluentibus subtus prominente medio-costatis; alis petioli conspicuis infra basem petioli in caulem vix decurrentibus apud folia mediana auriculas 3–4 mm. latas amplexicaules formantibus; glomerulis capitulorum 14–18 mm. diametro 3–12 globosis in paniculam subcorymbosam vel racemum congestum dispositis; receptaculo lanuginoso, bracteis navicularibus 2–3 mm. longis glabratis; involucris flosculorum 1–2-floris 3.5–4 mm. longis glaberrimis; tegulo exteriori paullo brevissime ad basem versus callo prominenti notato; flosculis roseis 5–6.5 mm. longis, tubo (faucibus vix differentiatis) ca. 4 mm. longo, labia interiori in lobos 2 acutos ligulatos 2.5 mm. longos divisa, labia exteriori ovato-elliptica apice tridentata; antheris (partibus fertilibus) ca. 1.4 mm. longis linearibus apice appendicula oblongo-lanceolata ca. 1 mm. longa coronatis basi cum caudis subulatis laevibus ca. 1 mm. longis ornatis; setis pappi ca. 5 mm. longis albis.—PERU: in sheltered places near the crest of San Gallan Island, Nov. 27, 1919, *R. C. Murphy* 3467 (TYPE, Brooklyn Bot. Garden; photo and frag., Gray Herb.).

Among the Peruvian species probably closest to *P. echinopsoides* (Hook.) DC., but differing in habit of growth, in less copious arachnoid indument of the herbage, and in the smaller thicker leaves which are glabrate above and have narrow elongate more separated lobes. Its closest relative seems to be in *P. Poeppigii* Kunze, of central Chile. A photograph of the living plant is reproduced on Plate VII.

## EXPLANATION OF PLATES.

## PLATE VI.

Fig. 1. San Gallan Island from the southeast, showing the vegetation-supporting fogs that bathe the crests of the island.

Fig. 2. San Gallan Island. A view near the summit, showing the growths of *Tillandsia latifolia* that darken the lee-sides of the higher ridges.

## PLATE VII.

Fig. 3. *Solanum Murphyi* sp. nov. A living plant near the summit of San Gallan Island.

Fig. 4. *Polyachyrus nesites* sp. nov. A plant growing near the summit of San Gallan Island, the type station.

## III. NEW AMERICAN SPECIES OF TRICHOMANES.

By C. A. WEATHERBY.

*(Plate VIII.)*

**TRICHOMANES daguense**, spec. nov. Rhizoma breve erectum, pilis tenuibus brunneis onustum. Frondes plures caespitosae 5.5–16.5 cm. longae. Stipes viridis 2–4.5 cm. longus quam lamina  $\frac{1}{3}$  brevior usque ad basim alatus. Lamina lanceolata basi paullo angustata apice sensim attenuata 3.5(plerumque 5)–12 cm. longa 2–3.5 cm. lata ad alam 1–1.5 mm. latam secundum rachin pinnatifida nervis margineque pilis brunneis simplicibus rigidis sparse instructa. Lacinae plus minusve remotae sinibus rotundatis interstinctae 10–18-jugae lineari-oblongae medianae 1–2 cm. longae 3–4 mm. latae adscendenti-patulae, fertiles apice excepto subintegrae vel leviter undulatae truncato-obtusae apice 2–4 soros gerentes, steriles crenato-serratae ad apicem angustum obtusum angustatae. Nervi crassiusculi, nervilli catadromi 3–10-jugi plerumque simplices recti e costula angulo acuto exeuntes. Cellulae plerumque oblongae c. 0.2 mm. longae, parietibus crassis, luminibus parvis hyalinis. Indusia cylindrica basi angustata 1.6–1.8 mm. longa sub orificio 0.5–0.6 mm. lata in limbum angustissimum sed distinctum suberectum vel patulum 0.2 mm. latum dilatata, in dentibus apicalibus prominentibus laciniarum immersa sicut alata. Receptaculum aetate longe exsertum.—  
**COLOMBIA:** forest, alt. 80–100 m., Dagua Valley, Cordoba, Dept. El Valle, May 6–8, 1922, *Killip*, no. 5251, TYPE in U. S. Nat. Herb.; another sheet of the same number in Gray Herb.; same place and date, *Killip*, no. 5098.

Species *T. delicato* v. d. Bosch affinis, a quo differt laciniis longioribus angustioribus minus dentatis, cellulis latis, indusiis longioribus anguste cylindricis, venis simplicibus.

**TRICHOMANES Killipii**, spec. nov. Rhizoma c. 2 cm. longum erectum, apice pilis brevibus brunneis lucidis tenuibus onustum. Frondes plures caespitosae 8–13 cm. altae, stipitibus rachi nervis marginibusque pilis simplicibus rigidis brunneis sparse obsitae. Stipes 2–4 cm. longus lamina multo brevior fuscus superne alatus basim versus nudus. Lamina lanceolata basi paullo angustata apice gradatim attenuata 5–9 cm. longa 1.3–2.5 cm. lata ad alam 1–1.5 mm. latam secundum rachin pinnatifida, rachis plus minusve fusca. Lacinae 9–15-jugae approximatae vel subremotae sinibus rotundatis interstinctae oblongae vel fere quadratae obtusae leviter adscendentes integrae vel leviter undulatae vel apice paucidentatae medianae

0.7–1.3 cm. longae 3–5 mm. latae, fertiles apice 1–3 soros gerentes. Nervi tenues; nervilli catadromi 2–4-jugi 1–2-furcati imi e costula angulo lato exeuntes deinde arcuati superiores adscendentes recti angulo acutiore exeuntes. Cellulae laciniarum basi quadratae, apicem versus oblongae 0.1–0.2 mm. diametro vel longae, parietibus crassis, luminibus hyalinis majusculis. Indusia anguste cylindrica 1.8–2 mm. longa, orificio 0.4–0.5 mm. lato truncato vel in limbum angustissimum bilabiatum erectum producto, immersa vel si in dentibus solitaria sicut exserta alata. Receptaculum aetate longe exsertum. — COLOMBIA: epiphytic in coastal thickets, alt. 0–10 m., Buenaventura, Dept. El Valle, Oct. 5–10, 1922, Killip, no. 11727, TYPE in Gray Herb.

Species *T. holoptero* affinis, quod differt praecipue venis fertilibus simplicibus, indusiis in limbum conspicuum latum dilatatis. *T. Galeottii* etiam similis, quod tamen rhizomate vix erecto, lamina latiore, stipite longiore, laciniis crebris subimbricatis patulis, venulis crassioribus crebris differt.

*T. delicatum* v. d. Bosch appears to have been curiously misunderstood. It was based on a specimen of *Cuming* 21 from Quito in "H. Berol." and was explicitly described as having fasciculate fronds, once-pinnatifid lamina with undulate-toothed segments, simple hairs and very elongate, linear cells. Yet Baker (Syn. Fil. 79), followed in the Index Filicum and even by Domin (Mem. Czech Soc. Sci. n. s. no. 2. 51 (1929)), referred it to the mainly West Indian *T. alatum*, a species in which even dwarfed fronds are strongly bipinnatifid, with forked hairs and mostly quadrate cells. Hieronymus, who should have had access to the type specimen, after remarking that *T. delicatum* was "a Hooker et Baker perverse ut synonymum *T. alati* Swartz citatum" (Engler Bot. Jahr. xxxiv. 421 (1904)), himself disposes of it, even less convincingly, as a form of *T. Poeppigii* Presl. This last is closely related to and has been regarded by many authors as synonymous with, *T. polypodioides*; like that species, it has a filiform, repent rootstock, scattered fronds, branched hairs and quadrate cells.

There are no specimens of *Cuming* 21 in the Gray Herbarium; there are, however, two sheets of a plant from Quito (*Jameson* 104) remarkable for its greatly elongate cells and otherwise agreeing well with van den Bosch's description and with his drawings of details, published in Med. Rijks Herb. Leiden no. 38. 3 (1919). Here also the citation "Jameson (Herb. Hook.)" is added to the republished description. In all probability the collection above mentioned is meant; I am accordingly taking the Gray specimens of it as authentically representing the species.

The following key attempts to define the American species of *Trichomanes*, so far as known to me, which share the characters of low stature, cespitose, once-pinnatifid fronds, spreading-ascending subremote segments and unbranched hairs. *T. macilentum* and *T. ornatulum* are known to me only from v. d. Bosch's rather brief descriptions and his posthumously published, fragmentary drawings. They are included without entire confidence that they really belong here, but for the purpose of indicating wherein the two species above proposed as new differ from them, as described.

Indusium with subtruncate orifice or narrow spreading limb not over 0.2 mm. wide.

Veins mostly simple; segments linear to rather narrowly oblong; cells of the leaf-tissue oblong, not more than three times as long as wide, nor more than 0.2 mm. long.

Indusium with narrow spreading limb 0.2 mm. wide; veinlets making an acute angle with the costule; stipe winged to base. Colombia.....*T. daguense* Weatherby.

Indusium with subtruncate orifice; veins making a "rounded" angle with the costule; stipe naked at base. Brazil (Para).....*T. macilentum* v. d. B.

Veins mostly forked; segments broadly oblong or nearly quadrate.

Segments prominently undulate-toothed; cells of the leaf-tissue mostly elongate, 4-6 times as long as wide, up to 0.4 mm. long, thin-walled; indusium rather broadly cylindric-ventricose with narrow more or less spreading limb. Ecuador.....*T. delicatum* v. d. B.

Segments (except sometimes at apex) entire or very shallowly undulate; cells of the leaf-tissue quadrate at base of segments, crowded and oblong between the veins above, not over 0.2 mm. long; indusium narrowly cylindric with truncate orifice or narrow bilabiate erect limb. Colombia.....*T. Killipii* Weatherby.

Indusium with conspicuous spreading limb 0.5 mm. wide; cells thick-walled.

Segments oblong or broader, coarsely 3-4-undulate-dentate with often narrow but rounded sinuses; veins of fertile segments mostly simple; cells quadrate to oblong, 1-2 times as long as broad; indusium infundibuliform. West Indies.....*T. holopterum* Kze.

Segments "suboblong," entire or 1-2-dentate, with acute sinuses; cells 3-6 times as long as broad; indusium cylindric. Brazil (Rio).....*T. ornatulum* v. d. B.

**TRICHOMANES crassipilis**, spec. nov. Rhizoma repens gracile (indumento excluso diametro c. 0.75 mm.) trichomatibus flavo-brunneis crassis submoniliformibus ex cellulis pluribus oblongis ad 0.4 mm. longis valde compressis cujusque plano planis proximarum angulum rectum formante cellulaque terminali ensiformi decidua compositis onustum. Frondes distantes 4-11 cm. altae. Stipes 1.5-4 cm. longus, lamina paullo brevior ala viride superne 0.5-1 mm.

lata basim versus gradatim angustata marginatus. Lamina deltoidea vel late ovata vel rite ovata 2.5–6 cm. longa 2–3.5 cm. lata ad alam 1–2 mm. latam secundum rachin pinnatifida nervis margineque pilis simplicibus rigidis brunneis ensiformibus prope basim articulatis sparse obsita. Lacinae 3–6-jugae adscendentes oblongae late obtusae basim versus integrae ad apicem grosse sparseque crenato-dentatae subremotae sinibus rotundatis interstinctae, medianae 1–2 cm. longae, c. 5 mm. latae. Venae crassae, venulae catadromae c. 5-jugae simplices vel saepius 1–2-furcatae angulo acuto e costula exeuntes. Cellulae plerumque oblongae ad nervos marginemque irregulariter quadratae ad 0.2 mm. longae, parietibus crassis, luminibus parvis hyalinis. Sori 1–3 in apice laciniarum superiorum immersi; indusia subcylindrica basi angustata 2–2.4 mm. longa sub orificio 0.8–1 mm. lata in limbum angustum patulum dilatata; receptaculum aetate longius exsertum.—SANTO DOMINGO: alt. 400–1000 m. Quita Espuela, vicinity of San Francisco de Macoris, Prov. Pacificador, April 5–17, 1922, *W. L. Abbott*, no. 2114a, TYPE in U. S. Nat. Herb., sheet no. 1,145,256; high ridges, c. 1100 m. alt., rare, Loma la Campaña, Cordillera Central, Prov. Sto. Domingo, Feb. 2, 1929, *E. L. Ekman*, no. H 11507, U. S. Nat. Herb.

Species rhizomate longe repente, trichomatibus singularibus, lamina pinnatifida, laciniis paucis, nervis crassis distinctissima, ut videtur in *Hispaniola* endemica. Fortasse ad gregem *T. trigoni* adducenda, cujus species trichomata similia sed minus evoluta habent, caetera tamen totae diversae sunt.

**TRICHOMANES Curranii**, spec. nov. Rhizoma breviter repens tortuoso-ramosum trichomatibus crassis compressis articulatis pallide brunneis onustum. Frondes subdistantes 14–18 cm. altae omnibus partibus pilis rigidis e basi tuberculosa 2–4-ramosis deciduis plus minusve obsitae. Stipes 5–7 cm. longus lamina brevior usque vel fere ad basim alatus. Lamina ovata 9–11 cm. longa 5–6 cm. lata bipinnatifida basi vix angustata apice pinnatifido acuta, ala secundum rachin 1.5–2 mm. lata. Lacinae c. 10-jugae lineari-oblongae medianae 3–4 cm. longae 0.8–1.2 cm. latae obtusae subremotae sinibus latis rotundatis interstinctae profunde pinnatifidae; lacinulae oblongae linearesve sparse crenato-denticulatae obtusae. Venae crassiusculae ultimae in lacinulis valde adscendentes simplices vel 1-furcatae. Sori in lacinulis singulis plerumque singuli; indusia (post maturitatem tantum visa) late cylindrica subventricosa 1–1.4 mm. longa 0.6–0.8 mm. lata sub orificio ut videtur subtruncato vel leviter bicorni; receptaculum breviter exsertum. Cellulae minimae quadratae vel oblongae, parietibus crassis, luminibus plerumque vix ultra 0.05 mm.

latis.—VENEZUELA: common at 300–600 m. alt., Cerro Sta. Ana, Paraguana Peninsula, April 13, 1917, *Curran & Haman*, no. 672, TYPE in Gray Herb.

*T. fimbriato* affinis a quo differt textura densiore, cellulis minoribus, lacinulis obtusis neque appendiculo capillari apicali ornatis.

The following key may serve to distinguish *T. Curranii* from the species which are apparently its nearest relatives, sharing with it the characters of erect or short-repent rootstock with coarse, articulate, pale-brown trichomes, bipinnatifid lamina and branched hairs.

Lamina lance-elliptic, 15–30 cm. long, attenuate at base, broadest at about the middle, segments often only shallowly toothed, if pinnatifid the lobes produced into capillary appendages; indusium with narrow spreading limb. West Indies.....*T. trigonum* Desv.

Lamina ovate, mostly less than 15 cm. long, broadest below the middle, only the lowest one or two pairs of segments reduced, deeply bipinnatifid.

Lobes of segments acute, the sterile usually produced into a capillary appendage; texture thin, the rather thin-walled cells with lumina 0.1 mm. in diameter; indusium with narrow spreading limb. Trinidad.....*T. fimbriatum* Backh.

Lobes obtuse, without capillary appendages; texture firm, the thick-walled cells with very small lumina (0.05 mm.); indusium apparently subtruncate. Venezuela...*T. Curranii* Weatherby.

I am indebted to Dr. William R. Maxon of the United States National Herbarium for the loan of indispensable material.

#### EXPLANATION OF PLATE VIII.

Fig. 1. TRICHOMANES CRASSIPILIS Weatherby, spec. nov. a. Habit  $\times 0.4$ ; b. sterile segment  $\times 0.8$ ; c. fertile segment  $\times 0.8$ ; d. indusium  $\times 6$ ; e. trichome  $\times 8$ .

Fig. 2. TRICHOMANES DAGUENSE Weatherby, spec. nov. a. Habit  $\times 0.4$ ; b. sterile segment  $\times 0.8$ ; c. fertile segment  $\times 0.8$ ; d. indusium  $\times 6$ .

Fig. 3. TRICHOMANES DELICATUM van den Bosch.  $\times 0.4$

Fig. 4. TRICHOMANES KILLIPII Weatherby, spec. nov. Habit  $\times 0.4$ ; b. sterile segment  $\times 0.8$ ; c. fertile segment  $\times 0.8$ ; d. indusium  $\times 6$ .

#### IV. STUDIES IN THE BROMELIACEAE,—II.

BY LYMAN B. SMITH.

(Plates IX–XI.)

DURING the past year many points of taxonomic significance have come to my attention in the course of further study on the *Bromeliaceae*, and since no immediate revision covering these matters is contemplated it seems best to put them on record here. I am indebted to the following institutions for the opportunity to examine valuable

specimens in their collections: the United States National Herbarium (US), the Field Museum of Natural History (FM), the Herbarium of the Royal Botanic Gardens at Kew (K), the Biological Institute of São Paulo (SP), the National Museum of Rio de Janeiro, and the Botanical Section of the Riks Museum at Stockholm (S). To Mr. W. E. Broadway of Trinidad I owe much for critical observations in the field, helpful correspondence, and frequent gifts of specimens.

The small lot of plants collected in the Rio Grongogy Basin in eastern Brazil by Mr. H. M. Curran deserves special notice since it includes three new species, *Ronnbergia marantoides*, *Streptocalyx Curranii*, and *S. lanatus*. In two cases these species are so unusual as to present difficulty in placing them generically. Evidently this region in extreme southern Bahia is little known botanically and should amply repay further investigation.

For convenience of reference genera and species are arranged in alphabetical order.

**Aechmea Bernoulliana** Wittm. The following record is of interest as being the first known instance of this species occurring south of Costa Rica:

ECUADOR: MANABI: imprimis in sitio El Recreo dicto lecta,  $\frac{1}{2}^{\circ}$  S. Lat., Eggers 15489 (US, phot. G).

**Araecoccus pectinatus**, spec. nov., pergracilis, fere metralis, stolonibus procreans: foliis eis *Araecocci micranthi* valde similibus, ad 70 cm. longis, fasciculatis; vaginis anguste ovatis, tubum angustum formantibus; laminis grosse serratis, anguste ensiformibus, acuminatis, interioribus canaliculatis, ad 20 mm. latis et 50 cm. longis, exterioribus valde reductis, vaginis multo brevioribus: scapo gracili, perelongato; scapi vaginis membranaceis, angustis, infimis internodia bene superantibus: inflorescentia glabra, pauciramosa, pulchre rubra, 15–22 cm. longa; bracteis primariis parvis, ovato-acuminatis, membranaceis, patulis: spicis elongatis, multifloris, 1 cm. latis, erectis; rhachi flexuosa, sulcata; bracteis florigeris ovatis, acutis vel mucronulatis, valde pectinatis, 7 mm. longis, flores subobscurantibus, auriculatis, reflexis: floribus sessilibus, fructiferis solis cognitis: bacca late ovoidea, 5 mm. longa; seminis in bacca paucis, ovoideis, curvatis. Pl. XI, fig. 6.

COSTA RICA: Pozo Azul de Pirris, Pacific foot-hills on upper edge of coastal plain, alt. 95 m., 1927, C. H. Lankester 1164 (US, phot. G).

Although no good flowers were to be found on the above specimen the open paniculate inflorescence, inferior ovary, and small few-seeded berries prove it to be an *Araecoccus* beyond any reasonable



doubt. Its sessile flowers would ally it with *A. micranthus*, for which its leaves are an almost exact match (see Fl. Bras. iii. pt. 3, t. 56, fig. 1 (1891)). But it differs from all previously described species of the genus in its relatively large and strongly pectinate floral bracts.

**Glomeropitcairnia erectiflora** Mez. Thanks to the efforts of Mr. W. E. Broadway it is now possible to extend the known range of this interesting species to Trinidad where he collected it on the summit of Mt. Tucuche as early as 1893. Until the present, the species has not been noted outside its type locality, the Island of Margarita, Venezuela. At the same time the original description may be enlarged as follows on the basis of fresh flowering material sent recently by Mr. Broadway:

Petalis fulgide citrinis, quam sepalas paulo brevioribus, basi biligulatis; staminibus inclusis, antheris angustis, 6 mm. longis; stylo gracili, stamina subaequant. Pl. X, figs. 6-7.

The presence of two scales at the base of each petal is of particular interest, since the only other species in the genus, *G. penduliflora* is characterized by a single scale on each petal (see Mez in Bull. Herb. Boiss. ser. 2, v. 232 (1905)).

**Hohenbergia Sellowiana** Mez. Until now this species seems to have been known only from the type material, a collection of Sellow with no locality indicated except "Brasilia." The following citations serve to define its range more exactly:

BRAZIL: BAHIA: near Bahia (São Salvador), 1915, *Rose & Russell 19895* (US, phot. G); Bahia, in palmetis prope urbem, loco arido litori proxime, 1892, *Lindman A63* (S).

**Nidularium billbergioides** (Schult. f.), comb. nov. *Hohenbergia billbergioides* Schult. f. in R. & S. Syst. vii. 1253 (1830). *Tillandsia terminalis* Vell. Fl. Flum. 137 (1825), Icones iii. t. 143 (1827), not *Nidularium terminale* Ule.

This species is treated by Mez in De Candolle's Monographiae under the name, *Nidularium bracteatum* (Vell.) Mez. *Tillandsia bracteata* Vell. upon which the name is based is not a *Nidularium* as shown by the scales at the base of the petals, the free petals, and the free second series stamens (see Fl. Flum. Icones iii. t. 125). These characters with the serrate floral bracts (see Fl. Flum. 132) make it seem more probable that *Tillandsia bracteata* is the same as *Aechmea fasciata* (Lindl.) Bak.

The next name in question is *Tillandsia terminalis* Vell. and it is almost certainly the same as *Nidularium billbergioides*. Unfortunately, however, Ule has used the name *Nidularium terminale* for a large species with serrate floral bracts so that the combination is not usable.

The next name for this species is *Hohenbergia billbergioides* Schult. f. in R. & S. and this combination for *Nidularium* is made accordingly.

**Quesnelia** (§ **Wawraea**) **Hoehnei**, spec. nov., epiphyta, acaulis, stolonibus procreans, ca. 40 cm. alta: foliis paucis, anguste rosulatis, inflorescentiam subaequantibus vel ea distincte longioribus, cellulis sclerenchymaticis permanifeste auctis, subtus lepidibus minutis peradpressisque dense praeditis; vagina anguste elliptica, laminam longitudine fere aequanti, atro-violacea; lamina subligulata, apice rotundato-apiculata vel retusa, 3–4.5 cm. lata, minute remoteque denticulata, viridi: scapo erecto, gracili, albo-tomentoso; scapi bracteis membranaceis, integris, pulchre roseis, anguste ellipticis, apiculatis, infimis quam internodia brevioribus, summis sub inflorescentiam comatim cumulatis: inflorescentia breviter spicata, subcapitata, pauciflora, ad 8 cm. longa; axi albo-tomentoso; bracteis minutis, membranaceis, ovario bene brevioribus: floribus erectis, sessilibus, 5 cm. longis; sepalis oblongo-lanceolatis, minutissime asymmetricis, apice anguste rotundatis, glabris, bene nervatis, ca. 20 mm. longis, basi 2 mm. connatis; petalis atro-rubris, anguste lanceolatis, sepalis subduplo longioribus, basi ligulis binis fimbriatis acutis, paulo zygomorphe dispositis; staminibus inclusis; stylo gracili; ovario sulcato, glabro, tubo epigyno magno, ovulis excaudatis. Pl. X, figs. 3–5.

BRAZIL: SÃO PAULO: dense forest, Estação Biologica, Alto da Serra, alt. 800–900 m., lat. 23° 47' S., long. 46° 19' W., 1929, *L. B. Smith* 1968 (G, type); 1929, *L. B. Smith* 1887 (G); 1923, *F. C. Hoehne* in *Inst. Biol. S. P.* 8623, 8631 (G, SP), 8625 (SP), 1924, 12338 (SP); 1921, *A. Gehrt* in *Inst. Biol. S. P.* 5710 (G, SP); Capivary, 1895, *G. Edwall* in *Inst. Biol. S. P.* 12340 (G, SP); Riveirão Pires, *G. Edwall* in *Inst. Biol. S. P.* 12336 (SP).

This species is most nearly related to *B. indecora* Mez, from which it differs in its entire membranaceous scape-bracts and rounded sepals. It is a pleasure to name this handsome little Bromeliad after my good friend Dr. F. C. Hoehne, whose great experience and ready coöperation have been an invaluable aid in studying the plants of his country.

**Ronnbergia marantoides**, spec. nov., acaulis, ad 25 cm. alta: foliis rosulatis, utrinque minute lepidotis; vaginis late ellipticis; laminis lanceolatis, 35–40 mm. latis, super vaginam valde contractis, late acutis apiculatisque: scapo erecto, gracili, sulcato, foliis brevioribus; scapi bracteis peranguste triangularibus, membranaceis, reflexis: inflorescentia simplicissima, laxe spicata, glabra; bracteis florigeris ignotis, verisimiliter deciduis: floribus sessilibus, 25 mm. longis; sepalis inermibus, retusis, 10 mm. longis, ad 3 mm. connatis, asymmetricis, bicarinatis, carinis cum eis ovarii continuis; petalis liberis, (ex sicco) aureis, eligulatis, laminis anguste ellipticis; staminibus

inclusis, serie II cum petalis alte connatis, antheris mucronatis, granulis pollinis biporatis; ovario omnino infero, late 6-carinato, tubo epigyno breve sed manifesto, placentis apice loculorum affixis, ovulis longe caudatis. Pl. XI, figs. 1-3.

BRAZIL: BAHIA: forests of Rio Grongogy Basin, alt. 100-500 m., 1915, *H. M. Curran 142* (US, phot. G).

This plant does not fit exactly any of the genera of the *Bromeliaceae* as defined by either Mez or Harms. However, it does come very close to the Andean genus, *Ronnbergia*, from which it differs only in its long-caudate ovules. Since *Aechmea* is made to include both caudate and obtuse types of ovules it does not seem inconsistent to broaden the definition of *Ronnbergia* in the same way.

This species resembles the two species of the subgenus *Euronnbergia* in its entire subpetiolate leaves, but differs from them very strikingly in its broadly 6-winged ovary.

**Sodirola dissitiflora** André. Here is one more instance of a South American genus of *Bromeliaceae* turning up in Central America, *Greigia* and *Puya* having been so noted by Mr. P. C. Standley, and *Araecoccus* by the writer.

COSTA RICA: Cascajal, 1920, *Lankester K166* (K, phot. G); SAN JOSÉ: on tree, La Hondura, alt. 1300-1700 m., 1924, *Standley 37813* (US, phot. G).

**Streptocalyx Curranii**, spec. nov., acaulis, ca. 4 dm. altus: foliis rosulatis, subtus dense minuteque lepidotis, ad 6 dm. longis; vaginis ellipticis, pallide brunneis; laminis anguste ligulatis, late acutis apiculatisque, 20-25 mm. latis, remote denticulatis: scapo erecto, gracili, paulo furfuraceo; scapi bracteis lanceolatis, membranaceis, integris: inflorescentia pyramidata, bipinnatim paniculata, 11 cm. longa, paulo furfuracea, mox glabrescenti; bracteis primariis anguste lanceolatis, membranaceis, quam spicae axillares bene brevioribus; spicis sublaxe cylindricis, quaquaverse florigeris; bracteis florigeris ovato-acuminatis, membranaceis, ovario subaequantibus: floribus sessilibus, suberectis; sepalis liberis, asymmetricis, apiculatis, 8 mm. longis; petalis liberis, eligulatis, laminis anguste ellipticis; staminibus inclusis, serie II cum petalis alte connatis, granulis pollinis biporatis; ovario omnino infero, cylindrico, (ex sicco) valde sulcato, tubo epigyno manifesto, placentis prope apices loculorum affixis, ovulis multis, obtusis. Pl. XI, figs. 7-9.

BRAZIL: BAHIA: forests of Rio Grongogy Basin, alt. 100-500 m., 1915, *H. M. Curran 143* (US, phot. G).

This species is easily distinguished from the other members of the subgenus *Eustreptocalyx* by its combination of slender scape and polystichous-flowered spikes.

**Streptocalyx lanatus**, spec. nov., acaulis: foliis rosulatis, subtus minute peradpresseque lepidotis; vaginis maximis, ad 20 cm. longis, anguste ellipticis, atro-castaneis; laminis peranguste triangularibus, basi 3 cm. latis, apice involutis, grosse serratis, spinis ad 6 mm. longis: scapo erecto, dense lanato; scapi bracteis ligulatis, apice involutis, subtus lanatis, mox glabrescentibus, supra adpresse lepidotis: inflorescentia subtripinnatim paniculata, dense cylindrica, dense lanata; bracteis primariis eis scapalibus isomorphis; ramis inferioribus paulo divisis; spicis quaquaverse florigeris; bracteis florigeris aciculosis, pungentibus, ovario subaequantibus: floribus sessilibus, adscendente curvatis; sepalis 7 mm. longis (sine spina), alte connatis, asymmetricis, infra apicem retusum longe spinulatis, coriaceis; petalis liberis, eligulatis; staminibus inclusis; ovario clavato, placentis apice loculorum affixis. Pl. XI, figs. 4–5.

BRAZIL: BAHIA: forests of Rio Grongogy Basin, alt. 100–500 m., 1915, H. M. Curran 138 (US, phot. G).

The definition of the subgenus *Eustreptocalyx* as given by Mez must be broadened to include plants with tripinnate inflorescences in order to cover this species.

**Tillandsia argentea** Griseb. Formerly known only from the Greater Antilles.

MEXICO: OAXACA: between San Carlos and San Bartolo, alt. 1000–1600 m., 1895, E. W. Nelson 2561 (US, phot. G).

**Tillandsia Bakeri**, nom. nov., *Catopsis flexuosa* Bak. Journ. Bot. xxv. 175 (1887), *Tillandsia flexuosa* (Bak.) Mez in DC. Mon. ix. 744 (1896), not Swartz (1788).

**Tillandsia crispa** (Bak.) Mez. The following citation marks a westward extension of range for the species:

PANAMA: DARIEN: Cerro de Garagará, Sambú basin, alt. 500–974 m., 1912, H. Pittier 5653 (US, phot. G).

**Tillandsia Lorentziana** Griseb. It is not at all surprising that this species already known from Argentina, Paraguay, and Bolivia should appear in similar country in southern Brazil.

BRAZIL: PARANÁ: "in rupibus," Villa Velha, 1903, P. Dusén 2810 (Museu Nacional do Rio de Janeiro, phot. G); Dusén 2756 (Mus. Nac. Rio); 1909, Dusén 7624 (S); 1910, Dusén 9528 (S).

**Tillandsia micrantha** Bak. Until recently this species has been known only from fruiting material, but now through the kindness of Mr. W. E. Broadway, who has forwarded preserved flowering material from Trinidad, it is possible to complete the description as follows:

Petalis albis (ex cl. W. E. Broadway), quam sepalae minute longioribus; staminibus profunde inclusis, stylo superantibus, antheris ovoideis, apice minute mucronatis, filamentis validis, basi dilatatis. Pl. IX, figs. 5-9.

The general character of petals, stamens, and pistil agrees closely with that already known in other members of the Section *Pseudo-Catopsis*, but it is interesting to note that in *T. micrantha* the base of the filament is slightly broader than the anther.

**Tillandsia pruinosa** Sw. Not recorded south of Colombia on the Pacific coast heretofore.

ECUADOR: ORO: Portovelo (Gold Mine near Zaruma), alt. 600-1000 m., 1923, *Hitchcock 21259* (G).

**Tillandsia rubra** R. & P. Fl. Peruv. iii. 40, t. 266 (1802). *T. paniculata* Ch. & Schdl. in *Linnaea* vi. 54 (1831), not L. (1762). With the recent outlawing of homonyms by the International Rules the well-known *Tillandsia paniculata* of Chamisso and Schlechtendal becomes untenable despite the fact that the earlier *T. paniculata* of Linnaeus is definitely a *Vriesia*. However, a careful study of the original description of *Tillandsia rubra* and its accompanying plate, demonstrates with reasonable certainty that this and *T. paniculata* Ch. & Schdl. are one and the same thing.

Furthermore collections by Macbride and Featherstone show that there is one large common *Tillandsia* in the general region from which *T. rubra* was described. These collections agree closely with specimens such as *Wright 1522*, *Fendler 1516*, and *Bang 1283* which are cited by Mez under *T. paniculata*,<sup>1</sup> and in some cases, notably *Macbride & Featherstone 1255* from Yanahuanca, Dept. of Huanuco, the whole inflorescence is a brilliant red.

The stamens in this species are never really exerted as in true members of the section *Platystachys*, nor are the petals so tightly twisted. Consequently it seems best to place it in the section *Allardtia*, although its stamens are somewhat longer than is usual there.

**Tillandsia** (§ **Platystachys?**) **Standleyi**, spec. nov., ut videtur acaulis, metralis (si inflorescentia pendula erigitur): foliis erectis, rosulatis, 40 cm. longis, utrinque lepidibus minutis peradpressisque praeditis; vaginis ellipticis, 10 cm. longis, 4.5 cm. latis, atro-purpureis, minute pallido-maculatis; laminis anguste triangularibus, supra vaginam  $\pm$  15 mm. latis, pallidis: scapo decurvo, quam folia brevior, bracteis foliaceis omnino occulto: inflorescentia laxa bipinnatim paniculata, pendula (ex cl. P. C. Standley); axi gracili, leviter flexuoso.

<sup>1</sup> Mez in DC. Mon. Phan. ix. 703 (1896).

glabro; bracteis primariis maximis, patentibus, quam spicae axillares 3-4-plo longioribus, ad 26 cm. longis, 2 cm. latis, spicis involventibus, pulchre fulgideque rubris: spicis lanceolatis, bene complanatis, valde stipitatis, 6 cm. longis, 2 cm. latis, dense ad 8-floris, pallide viridibus; rhachi valde complanata, angulata; bracteis florigeris anguste lanceolatis, acuminatis, rhachin obtegentibus, sepalis aequantibus, ad 35 mm. longis sed saepe multo brevioribus, dorso valde impressis, laevibus vel apice paulo nervosis, glabris: sepalis anguste lanceolatis, acuminatis, valde carinatis, aequaliter liberis, laevibus, glabris; petalis et partibus genitalibus ignotis: capsulis acutis, quam sepala brevioribus. Pl. IX, figs. 1-4.

HONDURAS: COMAYAGUA: on oak tree in pine forest, El Achote, near Siguatepeque, alt. 1500 m., 1928, *Standley 56177* (FM, TYPE; phot. G).

This is distinguished at once from all other species of *Tillandsia* by its pendulous scalariform inflorescence and its exceedingly long primary bracts. In fact it is rather difficult to say to what it is most nearly related. Its occurrence in Central America would argue its probable inclusion in the section *Platystachys*, and on the basis of the key in Mez's Monograph it comes nearest to *T. Leiboldiana* in that section.

Unlike any other species of *Tillandsia* known to the writer, *T. Standleyi* has a peculiar growth at the base of each spike on the side toward the axis of the inflorescence (Pl. IX, figs. 1-2). Various facts would indicate that this growth functions as an aid to spreading the spikes at maturity. The deep groove left in the basal floral bract which is next the axis (Pl. IX, fig. 4) and the total absence of any groove in the one on the opposite side indicate that before maturity the spikes were erect and very closely appressed to the axis. The extremely shrunken condition of the growth indicates that it was formerly very turgid, and this with its spreading position evidently made it well adapted to pushing the spike away from the axis of the inflorescence. It is not possible to ascertain the morphological nature of this growth with any certainty until fresh material is obtainable.

The figure of the habit is in some slight degree a restoration, since the specimen was much folded over on the herbarium sheet.

I take pleasure in naming this remarkable species after Mr. P. C. Standley, whose name is written so large in Central American botany.

***Tillandsia triticea*** Burch. The discovery of *T. triticea* in central Peru by Messrs. Killip and Smith is particularly noteworthy, since it definitely extends the range of this species into the Andean region. The species is of very wide range in eastern South America, but

strangely enough has never before been recorded from the north-western part of the continent which is the center of distribution of almost all of its near relatives.

PERU: JUNIN: epiphytic in dense forest, Pichis Trail, San Nicolas, alt. ca. 1100 m., 1929, *E. P. Killip & A. C. Smith 26055* (G).

**Vriesia sparsiflora**, spec. nov., acaulis, pergracilis, semimetralis: foliis rosulatis, 20 cm. longis, subtus minute perobscureque lepidotis; vaginis late ellipticis, pulchre violaceis; laminis ligulatis, abrupte acutis, apiculatis, 5–20 mm. latis: scapo erecto, gracili, foliis bene longiore; scapi bracteis anguste ellipticis, acuminatis, supremis quam internodia distincte brevioribus: inflorescentia perlaxe bipinnatim paniculata, perpauciflora; axi gracili, flexuoso; bracteis primariis parvis: spicis erectis, perlonge stipitatis, bracteis sterilibus multis auctis, 2–3-floris sed flori apicali semper sterili abortivo; bracteis florigeris ovato-acutis, membranaceis, nervatis, sepalis subduplo brevioribus et cum eis secunde versis, haud carinatis: floribus patentibus, secundis, ad 35 mm. longis; sepalis anguste ellipticis, apice obtusis, nervatis, carinatis; petalis biligulatis, verisimiliter citrinis; staminibus petalis subaequantibus. Pl. X, figs. 1–2.

BRAZIL: SÃO PAULO: Estação Biologica, Alto da Serra, 1926, *Hoehne in Inst. Biol. 17928* (SP).

This graceful little species comes next to *Vriesia Philippo-Coburgi* in Mez's treatment, but differs from it in its much smaller size, its inconspicuous primary bracts, and the remarkably long sterile base of its spikes. Owing to the small number of fertile flowers on a spike (never more than 2), it is not obvious at first that the flowers are secund. But careful examination shows that in several cases the floral bracts are twisted so as to lie almost entirely above the flower, thus indicating that the flower also must have turned to allow such movement.

#### EXPLANATION OF PLATES.

##### PLATE IX.

- Fig. 1. *TILLANDSIA STANDLEYI* L. B. Smith (*Standley 56177*), habit  $\times \frac{1}{10}$ .  
 " 2. Same, spike and primary bract  $\times \frac{1}{2}$ .  
 " 3. Same, sepal  $\times 1$ .  
 " 4. Same, basal floral bract from side next the axis  $\times 1$ .  
 " 5. *TILLANDSIA MICRANTHA* Bak. (*W. E. Broadway*), flower  $\times 5$ .  
 " 6. Same, sepal  $\times 5$ .  
 " 7. Same, petal and stamen  $\times 5$ .  
 " 8. Same, pistil  $\times 5$ .  
 " 9. Same, branch  $\times 1$ .

## PLATE X.

- Fig. 1. *VRIESIA SPARSIFLORA* L. B. Smith (*F. C. Hoehne in Inst. Biol. S. P. 17982*), habit  $\times \frac{1}{4}$ .  
 Fig. 2. Same, petal and stamens  $\times 1$ .  
 " 3. *QUESNELIA HOEHNEI* L. B. Smith (*L. B. Smith 1968*), habit  $\times \frac{1}{4}$ .  
 " 4. Same, flower  $\times 1$ .  
 " 5. Same, petal and stamens  $\times 1$ .  
 " 6. *GLOMEROPITCAIRNIA ERECTIFLORA* Mez (*W. E. Broadway*), flower and floral bract  $\times 1$ .  
 Fig. 7. Same, petal and stamen  $\times 1$ .

## PLATE XI.

- Fig. 1. *RONNBERGIA MARANTOIDES* L. B. Smith (*H. M. Curran 142*), habit  $\times \frac{1}{4}$ .  
 Fig. 2. Same, flower  $\times 1$ .  
 " 3. Same, petal and stamen  $\times 2$ .  
 " 4. *STREPTOCALYX LANATUS* L. B. Smith (*H. M. Curran 138*), branch of panicle  $\times 1$ .  
 Fig. 5. Same, sepals  $\times 2$ .  
 " 6. *ARAEOCOCCUS PECTINATUS* L. B. Smith (*C. H. Lankester 1164*), section of the inflorescence  $\times 1$ .  
 Fig. 7. *STREPTOCALYX CURRANII* L. B. Smith (*H. M. Curran 143*), branch of panicle  $\times 1$ .  
 Fig. 8. Same, sepal  $\times 2$ .  
 " 9. Same, petal and stamens  $\times 2$ .

## V. THE GROUP OF ASPLENIUM FRAGILE IN SOUTH AMERICA.

BY C. A. WEATHERBY.

The group of *Asplenium fragile* consists, in South America, of three closely related and critical species. All three share the characters of habit, large number of pinnae, glandularity of frond, proliferation of the lower axils, and blackish-reticulate spores.<sup>1</sup> Probably in all, and almost certainly in the material of *A. fragile*, var. *lomense* studied, the stipes of the proliferous fronds frequently become greatly elongated, with the lamina poorly developed, or lacking altogether. After the lamina, or what there is of it, has withered, the stipe remains, apparently living, until the young plant which develops

<sup>1</sup> One can easily be misled as to the character of the spores in herbarium specimens. Apparently, in drying, sporangia which were still closed when collected open and release spores nearly but not quite matured, which have attained their full size but are quite different in appearance from the fully ripe spores. They are brownish in color and the anastomosing ridges, instead of being thick, black, and opaque, are thin and translucent, giving the effect of a winged spore when seen in profile—an effect which quite disappears when the spore is completely ripe.



from the gemma at its summit has become well rooted, giving quite the appearance of a flagelliform stolon.

Since the three species have been confused in herbaria, the following attempt to define them and the citation of specimens belonging to them, may be of service. I am much indebted to the authorities of the United States National Museum for the loan of specimens, and to those of the Royal Botanic Garden, Kew, for fragments of the type of *Asplenium Gilliesii*. These fragments, and photographs, in the Gray Herbarium, of the two plants cited by Hieronymus in the original publication of *A. Lorentzii*, have been used, in addition to the descriptions, in determining the application of the two names concerned. *A. fragile* is employed in the usually accepted sense, for the plant which seems most nearly to agree with Presl's description and figure.

- Margins of the broadly flabelliform-rhombic, pale green and (when mature) rather thick pinnae dentate with sharply acute or acuminate teeth; median cells of the scales elongate-oblong or linear-oblong, generally with small lumina; spores nearly spherical, 40–50  $\mu$  in diameter. . . . . 1. *A. Gilliesii*.
- Margins of pinnae entire, crenate, or with mostly blunt, short-mucronate teeth; median cells of the scales broadly oblong to square, usually with conspicuous lumina; spores chiefly ellipsoid, 30–50  $\times$  20–25  $\mu$ .
- Pinnae trapezoid-ovate or trapezoid-oblong, not at all or only slightly auriculate or lobed in well-developed fronds, membranaceous, deep green, truncate at the very inequilateral base, the lower margin nearly straight and entire almost to the obtuse or truncate apex, the upper margin dentate with mostly blunt teeth. . . . . 2. *A. Lorentzii*.
- Pinnae flabelliform-rhombic, in well developed fronds commonly auriculate or shallowly or sometimes deeply bi-lobed.
- Stipe and rachis beneath merely fuscous; pinnae pale green and somewhat coriaceous, their margins or those of their lobes crenate-dentate. . . . . 3. *A. fragile*.
- Stipe and rachis brown; pinnae bright green and rather thin, their margins or those of their lobes entire.
- 3a. *A. fragile*, var. *lomense*.

1. ASPLENIUM GILLIESII Hook. Exot. Fl. ad t. 208 (1827). *A. Gilliesianum* Hook. & Grev. Icon. Fil. t. 73 (1829). *A. debile* Fée 10 Mém. 28, t. 35, f. 2 (1865) (see Christensen Ark. Bot. xx, pt. 7. 14 (1926)).—PERU: Chicla, April 21–23, 1882, Ball (G); Oroya, July 14, 1914, Rose, no. 18,702 (U. S.); Ollantaytambo, 3000 m., April 26, 1915, Cook & Gilbert, nos. 340 and 342 (U. S.); among volcanic rocks near Tinta, 3500 m., April 15, 1915, Cook & Gilbert, no. 207 (U. S.); Tarata, Espinosa (G.). BOLIVIA: La Paz, 11,500 ft., Aug. 22, 1901, R. S. Williams, no. 2596 (mixed with *A. fragile*; U. S.); 1884,

*Bang*, no. 121 (G., U. S.); Jan. 25, 1906, *Buchtien*, no. 165 (U. S.); Pozna, 4200 m., May, 1908, *Buchtien*, no. 1138 (U. S.); Comancha, *Rose*, no. 18,878 (U. S.); Sorata, 7500 ft., Sept. 3, 1901, *R. S. Williams*, no. 2597 (U. S.).

Hooker and Greville describe this species as with "frondibus tenuissime membranaceis" and with oval spores. The discrepancy between their statements and the character here given for the species may perhaps be explained by the fact that the type material (so far, at least, as evidenced by the fragment seen by me) is young and has immature spores. Ball (*Journ. Linn. Soc.* xxii. 64 (1885)) and Christensen (*Ark. Bot.* xx, pt. 7. 14 (1926)) have pointed out that the characters of *A. Gillicsii* are not altogether constant and that forms seemingly intermediate between it and *A. fragile* are found. However, it is usually rather readily distinguishable by the ear-marks enumerated in the key and seems quite worth maintaining—as is done by both the authors referred to.

2. ASPLENIUM LORENTZII Hieron. *Engl. Bot. Jahrb.* xxii. 375 (1896).—BOLIVIA: Im Walde, Unduavi, Nord-Yungas, 3300 m., *Buchtien*, nos. 408 (G.), 901 and 2642 (U. S.); Oct., 1885, *Rusby*, no. 405 (G.); Pinos bei Tarija, 2300 m., March 12, 1904, *Fiebrig*, no. 2974 (U. S.), in part.

*A. Lorentzii* appears to vary toward *A. Gillicsii*, but differs from that species in the structure of its scales and the shape of its spores, and from both *A. Gillicsii* and *A. fragile* in the texture and shape of its pinnae, which, as Hieronymus remarks, resemble, when well developed, those of small specimens of the group of *A. lunulatum*. On these characters it is here kept up.

3. ASPLENIUM FRAGILE Presl, *Tent. Pterid.* 108 (1836). "*A. stoloniferum* Bory" Presl, *Rel. Haenk.* i. 44, t. 6, f. 4 (1825), not Bory (1804). *A. rhomboideum* Brack. *Wilkes Expl. Exp.* xvi. 156, t. 2, f. 2 (1854).—VENEZUELA: Páramo de Timoteo, Mérida, 3000 m., Jan. 21, 1922, *Jahn*, no. 865 (U. S.). COLOMBIA: without locality, *Moritz*, no. 326 (G.). ECUADOR: Cuenca, Sept. 16, 1918, *Rose & Rose*, no. 22,734 (U. S.); Sept. 17–24, 1918, *Rose, Pachano & Rose*, no. 22,839 (G., U. S.); in dumetis Cotocallas, *Mille*, no. 109 (fronds 3.5 dm. tall; G., U. S.); ravines at Chuquipollo, Dec. 8, 1855, *Couthouy*, no. 45 (G.). PERU: Panticalla Pass, 3000 m., July 14 and 17, 1915, *Cook & Gilbert* nos. 1825 and 1885 (U. S.); La Quinua, 12,000 ft., May 14, 1922, *Macbride & Featherstone*, no. 2025 (U. S.); [Baños] *Wilkes Expl.*, no. 44 (type or cotype of *A. rhomboideum* Brack. U. S.); on wall of reforested terrace, Ollantaytambo, 3000 m., May 11, 1915, *Cook & Gilbert*, no. 661 (U. S.). BOLIVIA: Sorata, 10,000 ft.,

Feb., 1886, *Rusby*, no. 404 (G., U. S.); Pelichuco, 10,000 ft., May 1, 1902, *R. S. Williams*, no. 2595 (U. S.).

I cannot understand what is meant by *A. fragile*, var. *stoloniferum* Rosenst. Meddel. Rijks Herb. Leyden no. 19, 11 (1913), said to be based on *A. stoloniferum* Presl. There is properly no *A. stoloniferum* Presl; that author, in the *Reliquiae Haenkeanae*, misapplied the name *A. stoloniferum* Bory to the plant which, recognizing his error, he later called *A. fragile*.

Dr. Winifred Robinson (Bull. Torr. Bot. Club xl. 209 (1913)) makes the surprising statement that the type locality of *A. rhomboideum* Brack. is the Hawaiian Islands. It is, of course, actually Baños, Peru, and no other collection is cited by Brackenridge. The identity of his plant is quite clear from his excellent figure and the Wilkes Expedition specimen in the National Herbarium. The Hawaiian plant in question (which is closely related to, but hardly conspecific with, the Andean) he seems to have referred to *A. Menziesii* Hook. Mettenius, Hooker, and Christensen were quite correct in referring *A. rhomboideum* to *A. fragile*. I cannot separate the two even varietally and believe that Hooker was right in supposing that Presl had described a dwarfed and Brackenridge a more luxuriant phase of the same species.

ASPLENIUM FRAGILE Presl, var. LOMENSE Weatherby, Contr. Gray Herb. lxxxv. 13 (1929).—CHILE: under rock in bottom of gulch above springs, in moist and sheltered situation, Aguada del Panul, Prov. Antofogasta, Dept. Taltal, Dec. 4, 1925, *Johnston*, no. 5421 (G.).

*Asplenium peruvianum* Desv. Mém. Soc. Linnéenne Paris vi. 271 (1827) was assigned to this group by Mettenius, probably correctly, but I cannot be sure of its identity. Desvaux's description is very brief and not very helpful. A photograph, in the Gray Herbarium, of his type specimen at the Paris Museum, shows a single small and seemingly depauperate frond, broken in the middle and at the tip, and bearing seven pairs of pinnae. The better developed of these exhibit a strong tendency toward the quadrilateral outline characteristic of *A. Lorentzii*, but are more coarsely toothed and more auriculate than in that species. Desvaux's binomial, based, as it is, on material insufficient in a critical group, had best remain in the limbo of *species dubiae*, at least until someone thoroughly familiar with the points involved can examine the actual type. With it may rest *A. tenue* Presl Rel. Haenk. i. 44, t. 6, f. 5 (1825), if, indeed, it is of this affinity.

VI. NEW SPERMATOPHYTES FROM MEXICO  
AND ARGENTINA.

BY IVAN M. JOHNSTON.

**Struthanthus Hunnewellii**, sp. nov., fruticosus erectus villosulus sparse ascendenterque ramosus 3–5 dm. altus; ramis juventate dense conspicueque villosulis canescentibus, maturitate glabrescentibus fuscescentibus 2–4 mm. crassis; foliis alternis lanceolatis vel lanceolato-ovatis vel ellipticis coriaceis laeto-viridibus integerrimis inconspicue villosulis concoloribus evidenter costatis sed obscurissime nervatis, maturitate plus minusve glabratis 8–15 mm. latis 2–4 cm. longis apice acutis vel rariter obtusis, basi obtusis vel latissime acutis in petiolum 1–2 mm. longum villosum contractis; floribus pluribus dioeciis (femineis tantum cognitis) ad apices pedunculorum congestis; pedunculis ex axillis foliorum maturorum erumpentibus 1–2.5 cm. longis villosulis ascendentibus tantum summum ad apicem bracteatis vel floriferis; bracteis conspicuis foliaceis villosulis 3–10 mm. longis 1–3 mm. latis lanceolatis tarde deciduis, exterioribus majoribus fructibus longioribus; corolla floris feminini 2.5 mm. longa extus hispidulo-villosula, lobis anguste lineari-lanceolatis ca. 0.7 mm. latis acutis; staminoideis supra medium corollae affixis ca. 0.8 mm. longis oblongo-linearibus; bacca oblongo-ellipsoidea vel obovoidea 6–8 mm. longa 3–5 mm. crassa rubra apice truncata plus minusve villosula.—MEXICO: on *Alnus* in woods north of Cuernavaca, State of Morelos, ca. 2100 m. alt., Feb. 28, 1931, *F. W. Hunnewell 11854* (TYPE, Gray Herb.); road between Juquila and Napala, State of Oaxaca, March 4, 1895, *E. W. Nelson 2421*.

An exceptionally well marked species that can be quickly distinguished by its canescent, densely villulose twigs and by its very long-pedunculate, conspicuously bracteose, capitate flower-clusters. Its closest relatives appear to be *S. alni* Bartlett, from Oaxaca, and *S. microphylla* (HBK.) Don, from Jalisco to Morelos. These species resemble *S. Hunnewellii* in having very shortly pedunculate (or even sessile) cymose-capitate inflorescences and also a tendency for leafy bracts. The former species is glabrous. The latter, although distinctly pubescent is much less obviously so than in the species here proposed. In *S. Hunnewellii* all the collar-like bracts, borne just below the flower-attachment, produce on their abaxial side an evident lanceolate herbaceous blade. In the two related species the collar-like bracts of only the outermost flowers of each cluster develop pronounced blades. The bracts of the inner flowers of the cluster

quite lack them. The blades of the bracts of the outermost flowers are leaf-like in size and form. In *S. Hunnewellii*, however, the bract-blades are all much smaller and proportionally more elongate than the cauline leaves.

It is a pleasure to associate with this highly interesting plant the name of Francis Welles Hunnewell, for many years the Curator of the Herbarium of the New England Botanical Club, who collected the species on a recent journey in Mexico. Mr. Hunnewell's material was obtained while he was motoring over the recently constructed highway between Mexico City and Cuernavaca. It was through a study of his collections that this well marked species was first brought to my attention.

**Hysterionica caurina**, sp. nov., herbacea erecta 1–4 dm. alta; caulibus striatis ascendenter ramosis pilosis; foliis viridibus plus minusve tenuibus vix congestis in nerviis costisque utrinque sparse setosis, margine integris vel obscurissime sinuatis paullo incrassatis ciliatis, juventate plus minusve evanescenter glanduliferis; inferioribus mox deciduis oblanceolatis sub apice late acuto usque ad basem versus gradatim attenuatis; mediis majoribus persistentibus lanceolatis vel oblongo-lanceolatis 3–4.5 cm. longis 5–10 mm. latis sessilibus basi rotundis vel obtusis apice late acutis a basi 3(–5)-costatis; superioribus mediis similibus sed aliquantum minoribus; pedunculis 8–30 mm. longis terminalibus vel ex axillis foliorum superiorum reductorum erumpentibus pilosis medium bracteolas duas subulatas 1–3 mm. longas saepe gerentibus; involucre capituli 7–10 mm. diametro; tegulis ca. 50 linearibus acutis ca. 5 mm. longis ca. 0.3 mm. latis minute glanduliferis lobos corollae disci vix superantibus in costa setosis 3–4 seriatis imbricatis subaequilongis, exterioribus viridibus ceteris stramineis; ligulis linearibus flavis ca. 100 pistiliferis, tubo (faucibus haud differentiatis) ca. 1.5 mm. longis, limbo ca. 5 mm. longo ca. 0.5 mm. lato; corollis disci 3–3.5 mm. longis hermaphroditis flavescentibus, lobis deltoideis ca. 0.3 mm. longis crasse marginatis, tubo ca. 1 mm. longo extus sub lente minute sparseque pubescentibus, faucibus cylindricis ca. 2 mm. longis quam tubo duplo crassioribus; antheris 1.3–1.5 mm. longis basi rotundis apice acutis; stigmato breviter lobato; pappo albo duplicato, parte interiore setis 15–20 antrorse barbellatis 3–3.5 mm. longis sistente, parte exteriori paleis anguste oblongis vel linearibus 0.3–0.5 mm. longis apice laceratis composita; achaeniis valde compressis ca. 1.2 mm. longis 0.5–0.6 mm. latis apice truncatis, lateribus antrorse appresseque sparsim pubescentibus—ARGENTINA: common along roads, Perico, Prov. Jujuy, Jan. 19, 1930, *L. R. Parodi* 9052 (TYPE, Gray Herb.);

common, El Suncho, Prov. Catamarca, Sept. 11, 1915, *P. Jørgensen* 1279 (G).

A very distinct species related to *H. jasionoides* Willd., differing in its smaller heads, very much more conspicuously heteromorphic pappus, branching stems, very short peduncles, and much larger broader greener and less firm leaves. The species is known only from northwestern Argentina.



Plantae Brasilienses e civitate Paraná reportatae.

1772 ...  
...

CUPHEA OBTUSIFOLIA Koehne.




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Plantæ in civitate argentina Misiones collectæ.

---

DETERMINED AT THE GRAY HERBARIUM

J. T. Egan

CUPHEA OBLIQUA Bacigalupi.





*CUPHEA PARANENSIS* Bacigalupi.



CUPHEA TUBEROSIFORMIS Koehne.



DETERMINED AT THE GRAY HERBARIUM  
*Cuphea tenuipes* n. sp.  
 Bacigalupi  
 R. C. B. (type specimen) 1897

C. G. SHINDEL.  
 PLANTÆ MEXICANÆ  
 1897.  
 18942 - STATE OF GUERRERO -  
*Cuphea*  
 Hills  
 near Tepic, Jalisco  
 30, July, 1907.

CUPHEA TENUIPES Bacigalupi.



Fig. 1 (upper). SAN GALLAN ISLAND FROM SOUTHEAST.  
Fig. 2 (lower). UPPER RIDGES OF SAN GALLAN ISLAND.

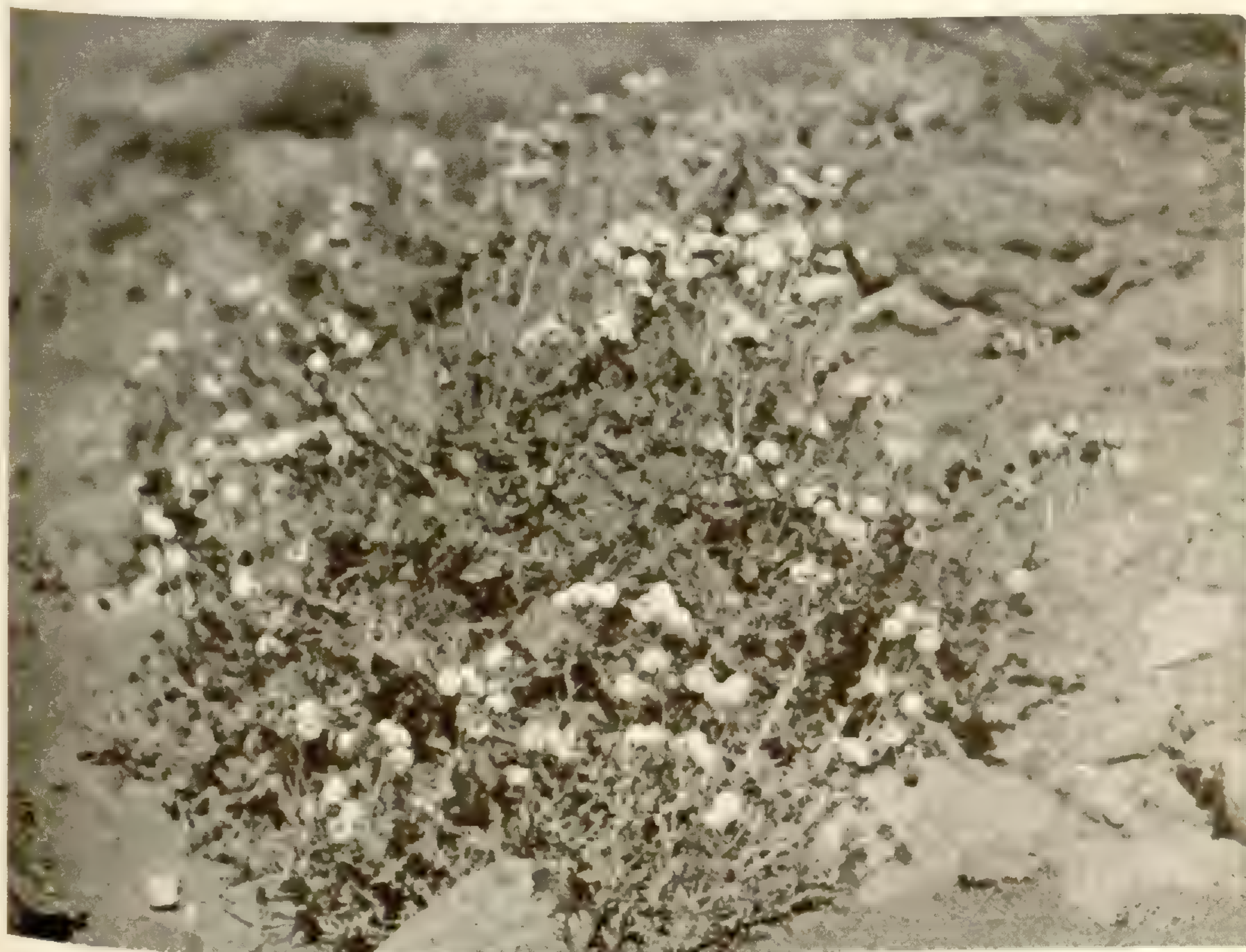
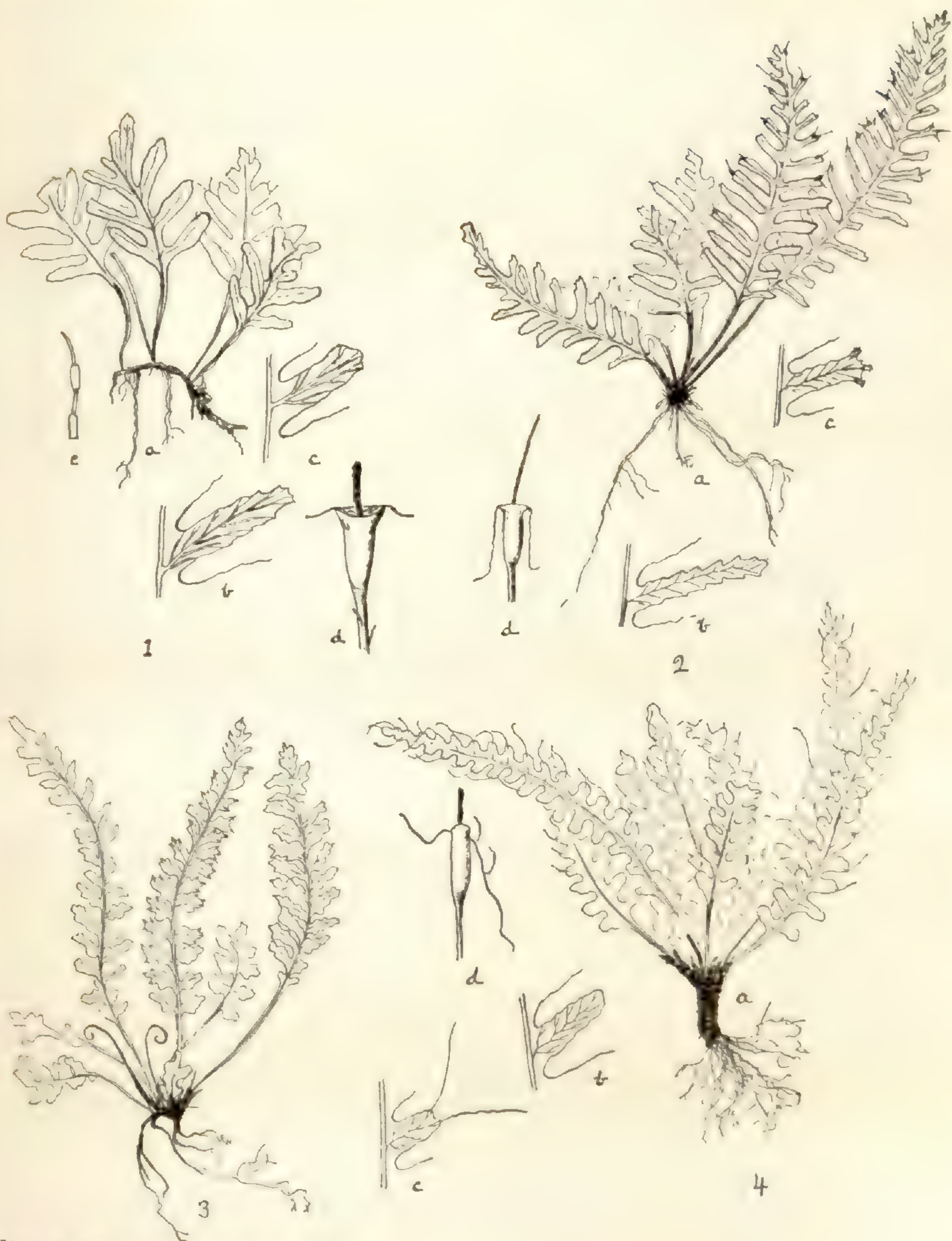


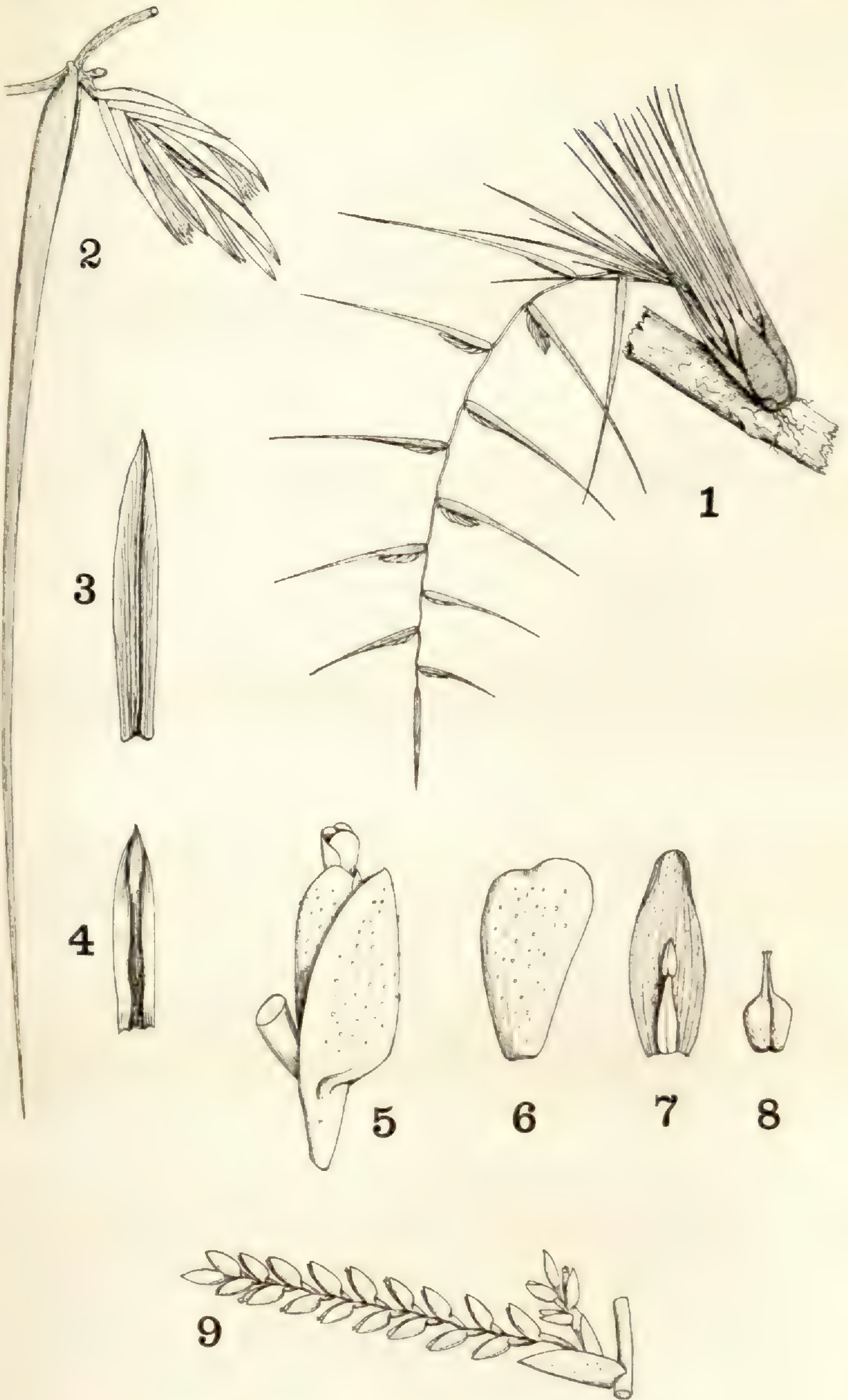
Fig. 3 (upper). *SOLANUM MURPHYI* sp. nov.

Fig. 4 (lower). *POLYACHYRUS NESITES* sp. nov.

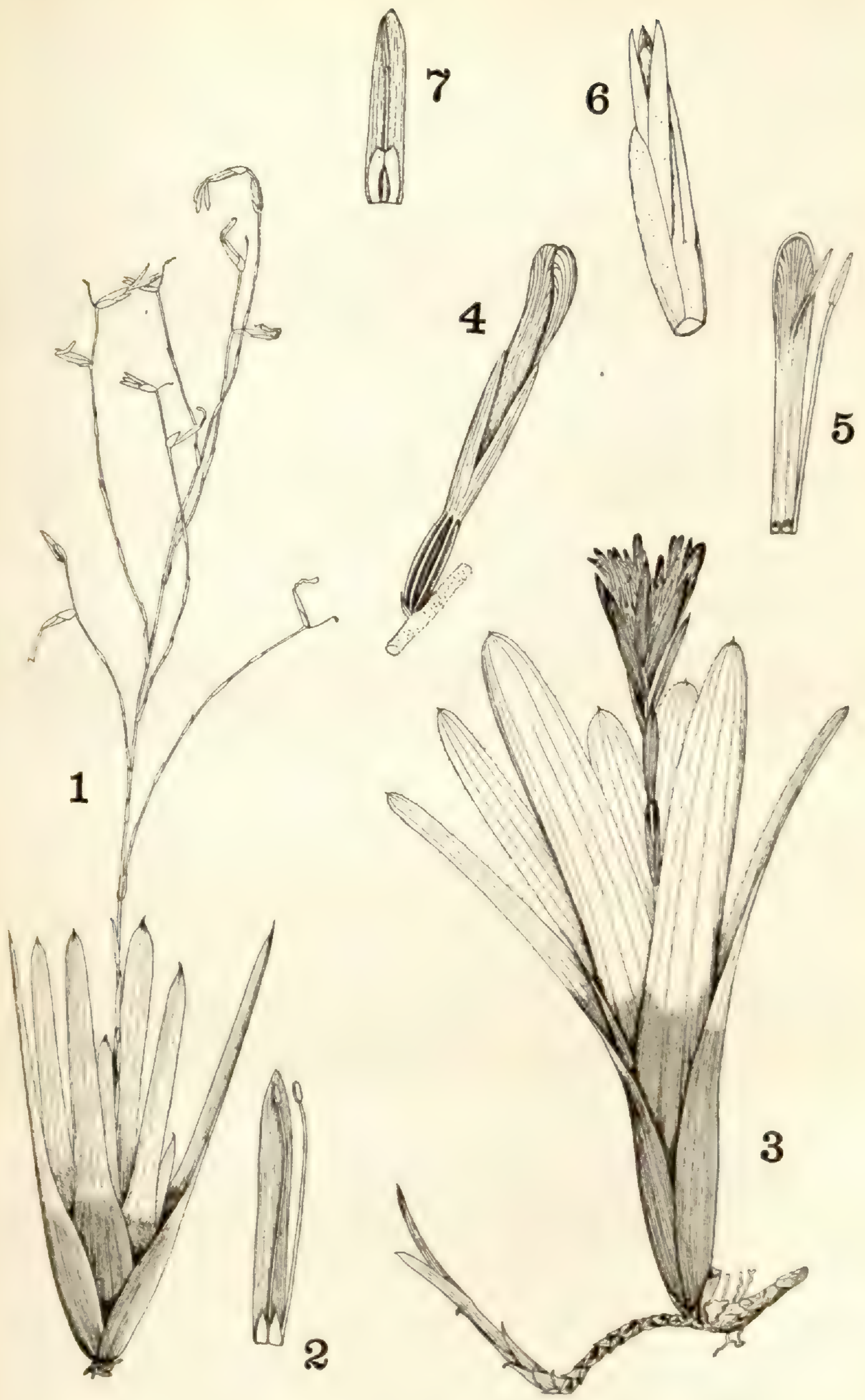


*Una F, Weatherby ad nat. del.*

- Fig. 1. *TRICHOMANES CRASSIPILIS* Weatherby, spec. nov.
- Fig. 2. *TRICHOMANES DAGUENSE* Weatherby, spec. nov.
- Fig. 3. *TRICHOMANES DELICATUM* van den Bosch.
- Fig. 4. *TRICHOMANES KILLIPPII* Weatherby, spec. nov.

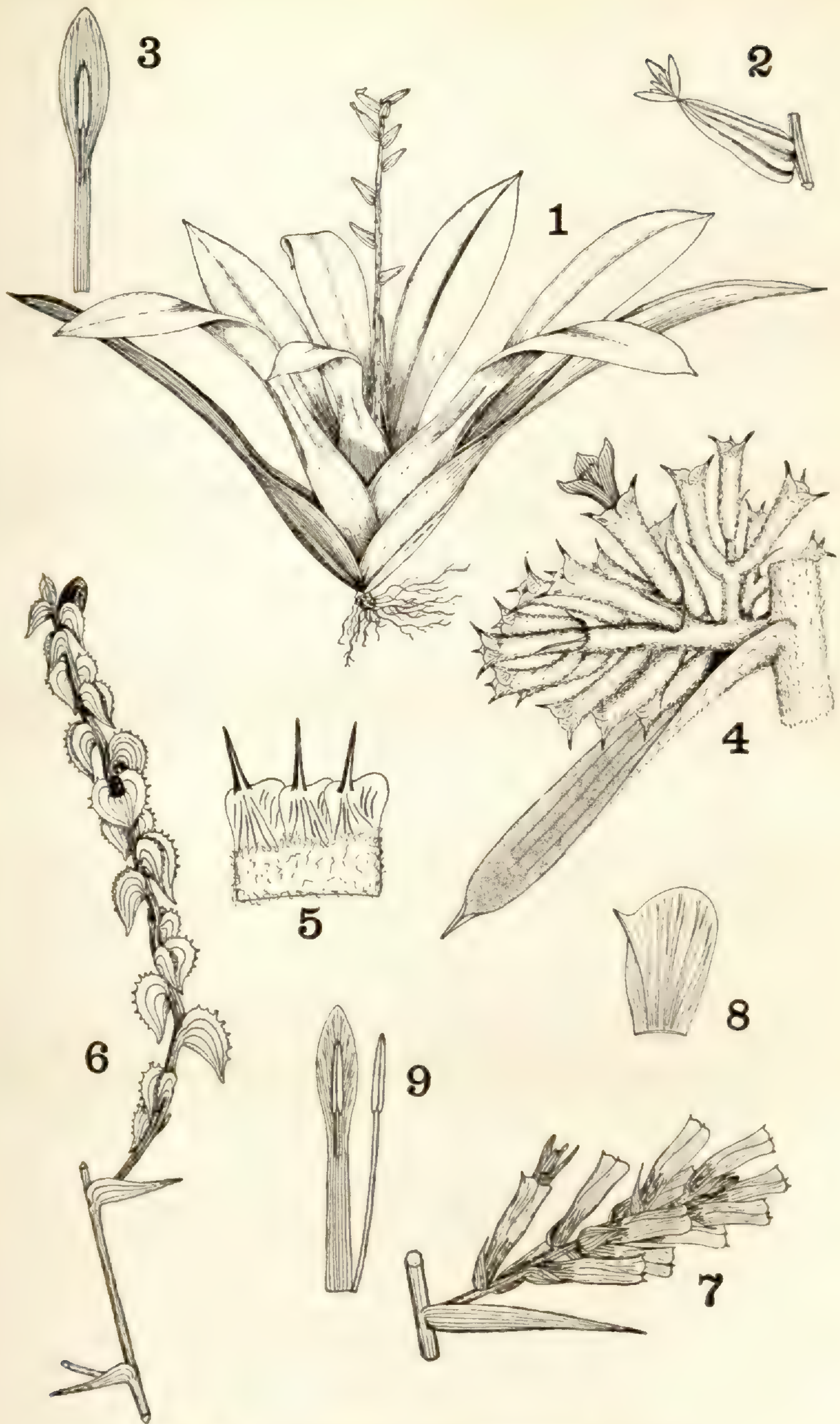


Figs. 1-4. *TILLANDSIA STANDLEYI* L. B. Sm.  
Figs. 5-9. *T. MICRANTHA* Bak.



Figs. 1-2. *VRIESIA SPARSIFLORA* L. B. Sm.  
Figs. 3-5. *QUESNELIA HOEHNEI* L. B. Sm.  
Figs. 6-7. *GLOMEROPITCAIRNIA ERECTIFLORA* Mez.





Figs. 1-3. RONNBERGIA MARANTOIDES L. B. Sm.  
Figs. 4-5. STREPTOCALYX LANATUS L. B. Sm.  
Fig. 6. ARAEOCOCCUS PECTINATUS L. B. Sm.  
Figs. 7-9. STREPTOCALYX CURRANII L. B. Sm.

CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCVI.

ISSUED AUG 15 1931

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BY B. L. ROBINSON.

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1931.



RECORDS PRELIMINARY TO A GENERAL TREATMENT  
OF THE EUPATORIEAE—IX.

SINCE the publication (in August 1930) of the preceding paper in this series, it has been possible for the author to study much additional material of the Eupatorium tribe from the American tropics. This has become available for examination through incoming collections received at the Gray Herbarium and through generous loans from other establishments or specimens kindly submitted for his study and identification. In this recently examined material it has been possible to find some thirty plants which appear to merit record as new species or varieties. These are characterized below, a few notes relating to the synonymy and ranges of previously known species being interspersed. The sources of the material examined are indicated in each case and the methods of citation, etc., are so closely similar to those of the earlier publications of the series as to require no explanation at this point.

**Stevia** (§ **Multiaristatae**) **andina**, spec. nov., erecta herbacea dense breviterque pilosa et superne glandulari-puberula 5 dm. vel ultra altitudine; caule tereti brevissime griseo-velutino usque ad inflorescentiam folioso; foliis oppositis late ovatis obtusis crenatis ad basin versus integris vel cuneatis et sessilibus vel subabrupte contractis et in petiolum distinctum ca. 5–7 mm. longum cuneatim angustatis; lamina 2.5–5 cm. longa 2.3–3.5 cm. lata membranacea supra puberula subtus pallidiori praecipue in nervis venisque dense griseo-pubescenti supra basin 3-nervata; inflorescentia terminali paniculata ampla diffusa vel subdiffusa adscendenter ramosa usque ad 3 dm. longa et 2.5 dm. diametro glandulari-puberula; pedicellis maturis plerumque involucri longioribus; capitulis 5-floris 1 cm. longis; involucri squamis lanceolato-linearibus acutis glandulari-puberulis 5–6 mm. longis; corollis extus cum glandulis subsessilibus ornatis; tubo proprio gracili 1.5 mm. longo; faucibus cylindratis 3 mm. longis rubro-purpureis; dentibus limbi oblongis albis puberulis 1 mm. longis; achaeniis gracilibus laeviusculis deorsum attenuatis ca. 3 mm. longis pappo heteromorphis; adelphocarpiis 4 quoque cum aristis 9–12 instructo; idiocarpio cum arista unica et squamis paucis brevibus ornato; aristis adelphocarpiorum basi in annulo pallido connatis 4.5 mm. longis.—ECUADOR: Province Loja: quebrada near Loja, *Poortmann*, no. 138 (Par.), inflorescence only; between Loja and San Lucas, alt. 2100–2600 m., *A. S. Hitchcock*, no. 21,475 (TYPE, in Gray Herb., isotype, N. Y.); near Tablon de Oña, *Rose, Pachano & Rose*, no. 23,091 (Gr.); near Las Juntas, *Rose, Pachano & Rose*, no. 23,230 (Gr.).

PERU: Chachapoyas, *Mathews*, no. 3033 (K.) and *Mathews* without number.

This plant has been associated with *S. crenata* Benth. and is without doubt a close relative of that species. However, the type material of *S. crenata*, namely Hartweg's no. 1089 from Guapulo near Quito has narrower, less pubescent and much less definitely petioled leaves, which are crenate only above the middle, while in *S. andina* the toothing begins distinctly below the middle. It is clear therefore that these are readily recognizable as different plants and unless some evidence of intergradation can be demonstrated they must be treated as separate species.

**S. Bertholdii**, spec. nov., herbacea perennis suberecta 4 dm. alta longe patenterque albo-pilosa; caule tereti brunneo curvato-adscendente folioso 2-3 mm. crasso; internodiis plerisque 2-4 cm. longis; foliis oppositis petiolatis vel supremis subsessilibus ovatis subacutis vel obtusis crenatis ad basin versus integris subrotundatis vel abrupte contractis et breviter in petiolum 2-3 mm. longum cuneatis membranaceis supra obscure viridibus albo-setulosis subtus paullo pallidioribus praecipue in nervis venisque pilosis 3-4 cm. longis 2-3 cm. latis, crenis utroque 6-9; inflorescentia paniculata ovoidea laxa foliaceo-bracteata dense glandulari-puberula 2.5 dm. longa et crassa; bracteis sessilibus anguste ovatis basi rotundatis subintegris; ramis plerisque oppositis vel suboppositis patenter adscendentibus superne fastigiato-ramulosis; pedicellis 3-8 mm. longis; inflorescentiis partialibus laxe fastigiatis; capitulis 5-floris ca. 12 mm. longis in ramulis ultimis inflorescentiae saepius false racemosis; involucri squamis lineari-oblongis breviter acutatis 8 mm. longis 1.4 mm. latis dorso glandulari-hispidis; corollae tubo proprio ca. 0.7 mm. longo; faucibus cylindratis 4.5 mm. longis ut videtur atrorubris vel purpureis glandulari-puberulis; dentibus limbi oblongis obtusis albis dorso hispidulis 2-3 mm. longis; achaeniis homomorphis 4 mm. longis in angulis paullo scabratis; pappo coroniformi e squamulis scariosis plus minusve connatis 0.4 mm. longis sistente omnino exaristatis.—ECUADOR: Village of Sacaranga, *Berthold Seemann*, no. 658 (K., phot. Gr.). Mixed with a habitally similar specimen of *S. andina* Robinson, which may be readily distinguished by its shorter involucre, much more exerted florets, much longer pedicels, and copious awns.

**S. Burkartii**, spec. nov., a basi plus minusve decumbente suberecta herbacea perennis 3-5 dm. alta; caule tereti flexuoso foliosissimo purpurascenti usque ad inflorescentiam simplici vel paucirameo ad basin versus ca. 3 mm. diametro glabrato in parte media obscurissime et brevissime griseo-puberulo (pilis minutis tenuissimis adpressis)

in parte superiori et inflorescentia minute cum glandulis brevissime stipitatis ornato; internodiis inferioribus 1–3 cm. longis, mediis et superioribus multo brevioribus; foliis (infirmis oppositis ceteris plerisque alternis) sessilibus lineari-lanceolatis acutis integerrimis vel ad apicem versus obscure crenulatis a basi 3-nerviis subconcoloribus utrinque subglabris et minute nigro-puncticulatis plerisque 2–3.5 cm. longis et 3–5 mm. latis dense imbricatis; inflorescentia terminali fastigiatis ramosa corymbosa planiuscula 3–6 cm. diametro multicapitulata brevissime et densissime glandulari-puberula; pedicellis inferioribus usque ad 2 cm. longis; capitulis ca. 10.5 mm. longis 5-floris; involucri squamis lineari-lanceolatis 1(–3)-nerviis acutis vel acutiusculis stramineo-viridibus dorso dense glandulari-puberulis ca. 7 mm. longis 1.4 mm. latis; corollae tubo ca. 1.5 mm. longo et faucibus paullo ampliatis 4 mm. longis purpureis; lobis limbi ca. 1.8 mm. longis ut videtur pallidis ad apicem versus paullo hispidulis; achaeniis homomorphis glaberrimis brunneo-stramineis 3–3.8 mm. longis quoque aristis 20–24 barbellatis ca. 7 mm. longis munito.—ARGENTINE REPUBLIC: Prov. Entre Ríos: Arroyo Yuquerí Chico near Concordia in moist earth at the side of railway track, 4 Feb. 1927, *Arturo Burkart*, no. 1149 (TYPE, in Gray Herb.). It is a pleasure to name this species for its discoverer, who is now engaged in scholarly floristic studies of the interesting and heretofore little recorded vegetation about the delta of the Paraná. Among the *Stevias* of the Argentine Republic included by the writer in his recent revision, *S. Burkartii* falls with *S. entleriensis* Hieron. and *S. multiaristata* Spreng. From the former it differs in its smaller, much smoother, lance-linear rather than oblanceolate leaves, which stand closer on the stem and quite lack the setose marginal hairs characteristic of *S. entleriensis*. From *S. multiaristata* it differs in its smaller heads and practically glabrous foliage.

***S. eclipses***, spec. nov., ut videtur herbacea perennis patenter villosa vel subsetulosa; caule subrobusto usque ad 4–5 mm. diametro fistuloso flexuoso subtereti post exsiccationem paullo angulato-costato viridi vel purpureo-tincto; internodiis plerisque 6–9 mm. longis; foliis oppositis bene petiolatis subdeltoideo-ovatis acutiusculis vel acuminatis grosse crenato-serratis basi subtruncatis pallide viridibus subconcoloribus utrinque cum setulis albis nodulosis ornatis supra basin 3(–7)-nervatis textura membranaceis vel fortasse subcarneis 5–7 cm. longis 4–5 cm. latis; petiolo 1.5–2.5 cm. longo sursum anguste cuneatim alato longe piloso; glomerulis ad apices ramorum aggregatis subsessilibus; capitulis sessilibus ca. 9 mm. longis; involucri squamis stramineo-viridibus anguste oblongis breviter acutatis, extimis sparse setuloso-hispidulis; corollis albis in tubo pubentibus; tubo proprio 1 mm.

longo; faucibus 3 mm. longis; adelphocarpiis coronula annulari brevissima ornatis et cum aristulis 1-2 brevissimis (vix 0.2 mm. longis) munitis; idiocarpio sine coronula sed aristulis 1-2 etiam plus reductis munito.—BOLIVIA: Dept. Tarija; Pinos near Tarija, alt. 2300 m., Mar. 10, 1904, K. Fiebrig, no. 3126 (TYPE in Gray Herb., isotype, Field Mus.).

This plant was distributed as "*Stevia* cf. *Schultzii* Hieron." *S. Schultzii* Hieron., it may here be explained, was founded on two elements, namely a plant of Tucumán coinciding with the much earlier *S. breviaristata* H. & A. and a specimen of Mandon's from the Sorata region which proves identical with the plant on which Rusby had already founded his *S. boliviensis*. To neither of these elements does the southern Bolivian plant here in question make any close approach.

*S. ELATIOR* HBK. The varieties of this species, as they occur north of the isthmus of Panama, have been already discussed (Contrib. Gray Herb. xc. 13, 97-98 (1930)), and consisted, as may be here recalled of (1) Var. *TYPICA*, with pauci-aristate adelphocarps and sessile leaves; (2) Var. *PODOPHYLLA*, with pauci-aristate adelphocarps and conspicuously petiolate leaves; and (3) Var. *DISSOLUTA*, with all its achenes exaristate.

The Colombian and Venezuelan forms of the species, so far as observed by the writer, are essentially of var. *typica*. Ecuadorian and Peruvian material referred by various writers to *S. elatior* has thus far all proved on investigation to be of multiaristate plants referable either to *S. crenata* Benth. or to a new species (*S. andina*) here described. On the other hand the plant reported from Bolivia as *S. elatior* by Dr. Otto Kuntze, Rev. Gen. iii. pt. 2, 180 (1898) on the basis of specimens collected by himself in Santa Cruz and determined by Hieronymus, is pretty certainly of this species. Nevertheless, although the material is neither satisfactorily mature nor available in sufficient quantity for detailed study, this plant of Bolivia exhibits differences fully justifying at least varietal distinction. It is weaker and more decumbent than is normally the case with the plant of the northern hemisphere. It is also more coarsely hirsute. The leaves are more decidedly petiolate than in var. *typica* and they are smaller and more hirsute than in var. *podophylla*. Finally the pubescence of the outer phyllaries instead of consisting of a very fine short and gland-tipped puberulence with perhaps a very few longer and glandless hairs, is far more hirsute, being made up chiefly of longish white jointed attenuate and (at least at full maturity) glandless hairs.

This most southern and so far as we now know quite isolated manifestation of the species may be put on record as follows:

Var. **austrina**, var. nov., laxe decumbens quam var. *typica* paullo gracilior et hirsutior; involucri squamis extimis dorso hirsutis, pilis plerisque longis albis articulatis attenuatis maturitate eglandulosis; achaeniis 4 (adelphocarpiis) quoque 5-aristatis; achaenio quinto (idiocarpio) exaristato.—*S. elatior* (as det. by Hieron.) in Ktze., Rev. Gen. iii. pt. 2, 180 (1898), not precisely HBK.—BOLIVIA: Dept. Santa Cruz: Sierra de Santa Cruz, 1600 m., May, 1892, Dr. O. Kuntze (TYPE, N. Y., isotype, U. S., phot. Gr.).

**S. Hilarii**, spec. nov., herbacea erecta gracilis perennis 3–4 dm. alta; caule tereti brunneo brevissime puberulo foliosissimo 2–2.5 mm. diametro; internodiis plerisque 5–12 mm. longis; foliis oppositis sessilibus patentibus lanceolatis vel anguste oblongis subacutis crenato-serratis basi integris cuneatis utrinque glabris (sed supra glandulis sessilibus adsparsis) subtus paullo pallidioribus nigro-punctatis fere a basi trinervatis; foliis caulinis 1.6–2 cm. longis 6–9 mm. latis plerisque in axillis proliferis; foliis rameis multo minoribus saepe integris aliquando alternis; inflorescentia terminali glandulari-puberula laxiuscula; pedicellis maturis gracillimis usque ad 1 cm. longis; capitulis 5-floris 1 cm. longis saepe nutantibus; involucri squamis oblongis acutis pilosiusculis et brevissime glandulari-puberulis ca. 6 mm. longis et 1.5 mm. latis saepius ad apicem versus purpureo-tinctis; corollis ut videtur rubro-purpureis; tubo proprio ca. 1.5 mm. longo in fauces ampliatas subaequilongas gradatim transienti; dentibus limbi ca. 2 mm. longis et 1 mm. latis apice rotundatis; achaeniis 3.6 mm. longis fere isomorphis quoque cum aristis 6–8 ca. 5 mm. longis et cum squamulis paucis brevissimis coronato.—BRAZIL: Minas Geraes, 1816–1821, A. de Saint-Hilaire, no. 1023 Cat. D. no. 275 (TYPE, Par., phot. and fragm. Gr.); also Cat. C<sup>1</sup> no. 367 (Par.).

This plant is attractive on account of its slender erect and evenly leafy stems which are virgate almost to the inflorescence. The leaves are mostly proliferous in the axils and at anthesis those on the undeveloped secondary axes are about half the length of the cauline, thus giving the plant somewhat the look of bearing leaves of alternating sizes. The species is manifestly close to the real *S. veronicae* DC., but differs in its greater stature, shorter internodes, proliferous axils, shorter pubescence and much more open inflorescence.

**S. kuhnioides** Rusby in herb., herbacea perennis gracilis suberecta ca. 4 dm. alta; caule tereti flexuoso vix 1.5 mm. diametro folioso atropurpureo breviter crispeque piloso; internodiis plerisque 1–2.5 cm. longis; foliis oppositis distincte petiolatis ovatis acutis crenato-serrulatis basi integris abrupte contractis deinde cuneatis utrinque pubescentibus subtus paullo pallidioribus, lamina 1.7–2.3 cm. longa



1–1.5 cm. lata, textura membranacea; petiolo 4–5 mm. longo sursum paullo alato; glomerulis 2–3 densis, terminali breviter, lateralibus longius pedunculatis; capitulis 7–10 mm. longis sessilibus; involucri squamis lanceolatis acutis vinaceis dorso subpatenter vel crispe pilosiusculis; pilis albis saltem maturitate eglandularibus; corollae tubo et faucibus purpureis, lobis limbi albidis pilosis; achaeniis heteromorphis; adelphocarpiis plerisque 2–3-aristatis et cum squamulis paucis coronatis; aristis inaequalibus, longioribus corollas subaequantibus; idiocarpio cum squamis solis coronato exaristato.—BOLIVIA: Cordillera Real, on the road from Okara to Ancoma, alt. about 3350 m., Apr. 29, 1926, *G. H. H. Tate*, no. 870 (TYPE, N. Y. Bot. Gard., phot. Gr.).

This plant, as yet known only from rather imperfect material, collected by the Ladew Expedition and presented to the New York Botanical Garden by the American Museum of Natural History, was most kindly placed at the disposal of the writer for inclusion in the present paper by Dr. H. H. Rusby who had already detected its novelty.

**S. leucosticta**, spec. nov., suffruticosa semierecta minute puberula; caulibus teretibus gracilibus brunnescentibus flexuosis 2–3 mm. diametro superne ramosis 1–1.2 m. longis; internodiis caulinis plerisque 3–5 cm. longis; foliis caulinis oppositis sessilibus ovato-lanceolatis acutis supra mediam partem obtuse serratis basi cuneatis integris utrinque glabris sed cum glandulis sessilibus maturitate albis sub lente punctatis 4–5 cm. longis 1–1.5 cm. latis chartaceo-membranaceis vel subcoriaceis; foliis rameis saepe alternis multo minoribus integriusculis; inflorescentiae ramis longis gracillimis saepe recurvantibus ad summum versus fastigiatim divisis et capituliferis; capitulis 5-floris ca. 12 mm. longis; involucri squamis lanceolato-linearibus acutis viridibus glandulari-granulatis et aliquando etiam pilosellis 5–5.5 mm. longis; corollis albis breviter sparseque glandulari-puberulis; tubo proprio gracili 1 mm. longo; faucibus sursum paullo ampliatis 4 mm. longis; dentibus limbi oblongis apice rotundatis 2–2.5 mm. longis; achaeniis 1–3-aristatis 3.6 mm. longis; aristis aliis corollam subaequantibus, aliis in aristulas multo breviores deminutis.—PERU: Dept. Huanuco: southwestern slope, alt. about 2750 m., July 8–22, 1922, *Macbride & Featherstone*, no. 1382 (TYPE, Field Mus., isotype Gr.).

In the heads examined this species showed a moderate and gradual heterocarpy, thus the awns on the different achenes of the same head were in number about as follows: 3–2–1½–1½–1¼. The plant is said to grow in dense masses and to be known by the vernacular name “utcuisha.” Its fine chalky-white sessile glands, if constant, should give a ready mark of recognition.

**S. Macbridei**, spec. nov., suffruticosa erecta usque ad 1.3 m. alta saltem aliquando ab caudice erecto lignoso ramoso pluricaulis; caulibus teretibus ad basin versus lignescentibus usque ad 6 mm. diametro glabrescentibus superne adscendenter ramosis atropurpureis foliosis puberulis; foliis oppositis et (praecipue supra mediam partem) alternis anguste ovatis acutiusculis vel obtusis crenatis vel crenato-serratis ad basin versus integris cuneatis breviter petiolatis vel (rameis) sessilibus chartaceo-subcoriaceis supra brevissime griseo-puberulis subtus multo pallidioribus subalbescens glaberrimis vel (juventate) obsolete in nervis puberulis fere a basi 3-nervatis 3–4 cm. longis 1–2 cm. latis; petiolo ca. 4 mm. longo; foliis rameis multo minoribus oblongo- vel lanceolato-linearibus; capitulis ca. 12 mm. longis sessilibus in glomerulos corymbosos aggregatis; inflorescentia densissime glandulari-puberula; involucri squamis linearibus subacutis ca. 7 mm. longis atrorubris dense glandulari-puberulis; corollae tubo proprio gracili 1.5 mm. longo glandulari-puberulo; faucibus rubris 4.5 mm. longis; dentibus limbi 1.5–2 mm. longis albis dorso paullo hispidulis; achaeniis vel homomorphis et pappo coronulato exaristato ornatis vel rarius heteromorphis et multiaristatis.

A Peruvian species with two sharply marked pappus-varieties, namely,

Var.  $\alpha$ . **typica**, homocarpa; achaeniis omnibus exaristatis solum cum pappo brevi squamuloso 0.2–0.4 mm. longo coronatis.—PERU: Dept. Huanuco: on "grass-shrub slope," Mito, alt. about 2750 m., July 8–22, 1922, *Macbride & Featherstone*, no. 1613 (TYPE, Field Mus., isotype Gr.); Dept. Lima: steep grassy northwestern slope, Rio Blanco, alt. about 3660 m., May 8–19, 1922, *Macbride & Featherstone*, no. 663 (Field Mus., Gr.); also in somewhat lower and more slender form (as if from somewhat less favorable environment) but without essential alteration of character, and unfortunately quite without record of locality, 1839–1840, *Gay*, no. 355 (Par., phot. and fragm. Gr.).

Var.  $\beta$ . **anomala**, var. nov., heterocarpa multiaristata; adelphocarpiis 4 quoque cum aristis 7–10 corollas subaequantibus munito; idiocarpio cum squamulis 0.2–0.4 mm. longis et cum aristulis 1–4 quam corolla multo brevioribus 1–3 mm. longis instructo.—PERU: without more exact locality, 1839–1840, *Gay*, no. 379 (Par., phot. and fragm. Gr.).

Awnless forms or varieties of the normally few-awned *Stevias* are rather numerous and have often been recorded. It is much less usual to find an awnless form of a normally multiaristate species. In this Peruvian species we seem to have a manifestation of reverse tendency, that is to say an occasional multiaristate development on the part of a species usually exaristate.

**S. ophiomaches**, spec. nov., suberecta vel curvato-adscendens subherbacea vel ad basin versus lignescens dense breviterque incurvo-pilosa infra mediam partem saepius simplex et delapsu foliorum mox denudata supra patenter ramosa et foliosa 4–6 dm. alta; radice fibrosa; caule tereti brunneo usque ad 4 mm. diametro; internodiis plerisque 1–2 cm. longis; foliis oppositis oblanceolatis utroque angustatis ad apicem verum rotundatis ad basin versus in petiolum paullo marginatum 4–7 mm. longum gradatim angustatis supra mediam partem obscure crenatis a basi 3-nervatis utrinque breviter pubescentibus textura membranaceis; lamina plerumque 1.5–3.5 cm. longa 5–8 mm. lata; corymbis compositis terminalibus et lateralibus convexis incurvo-puberulis; capitulis pro genere parvis plerisque 7–8 mm. longis 5-floris breviter pedicellatis; involucri squamis substramineis breviter acutatis 4–5 mm. longis dorso cum pilis brevibus incurvis eglandularibus et cum glandulis paucis sessilibus ornatis; corollis albis sublaevibus ex involucri bene exsertis; achaeniis heteromorphis ca. 2 mm. longis; adelphocarpiis 4, quoque cum aristis corollam aequantibus 3–5 et cum coronula vix 0.2 mm. alta munitis; idiocarpio coronulato exaristato.—COLOMBIA: Dept. Norte de Santander: Prov. of Ocaña: open space by roadside, Santa Maria Chica, 16 Nov. 1879, *Kalbreyer*, no. 1240 (TYPE, in herb. Royal Gard. Kew, phot. and small fragm. Gr., isotype Brl.); also in open sunny dry spaces, common and somewhat glutinous, alt. 2125–2750 m., Jan. 1878, *Kalbreyer*, no. 605 (K., phot. Gr., Brl.). Flowers said to be fragrant. Plant said to be employed medically as an antidote for snake-bite—hence the distinctive if somewhat fanciful specific name. The species is clearly related to the widely distributed *S. rhombifolia* HBK. and might at first sight be thought merely a stunted paramo form of that plant, but its relatively narrower as well as much smaller leaves and more stiffly spreading branches give the Colombian species here described a characteristic and individual habit and suggest that it is to be regarded as a separate specific entity.

*S. PALLIDA* (Sch.-Bip.) Hieron. and *S. PURPURASCENS* (Sch.-Bip.) Hieron. in Engl. Bot. Jahrb. xxi. 328 (1895). These binomials, so obscurely put forward as to escape the notice of the compilers of the Index Kewensis, resulted from an attempt on the part of Hieronymus to give specific status to two alleged plant-entities doubtfully attached by Schultz (*Linnaea* xxv. 275) to *S. elongata* HBK. Somewhat prolonged effort to check, compare, and differentiate more clearly the tangled elements here involved in the work respectively of Kunth, Schultz, and Hieronymus, has led the writer to the following conclusions.

*S. elongata* HBK. is duly shown by a somewhat fragmentary but happily still extant and convincingly authentic specimen in the Humboldt and Bonpland series at Paris. This specimen shows that the species was somewhat misleadingly characterized from the start, for its branches, while in some cases alternate, as stated in the original description, are at other nodes opposite, and the "flores" [doubtless used for heads], stated by Kunth to be "longe pedunculati," are in fact sessile or shortly pedicelled in rather dense glomerules. The latter, however, are in fact rather conspicuously stalked and it may have been this fact that suggested the "longe pedunculati," an expression perhaps inadvertently or by clerical error applied to the "flores."

When Schultz drew up his revision of *Stevia* he merely mentioned *S. elongata* and made no effort to characterize it. Indeed, he gave no evidence that he had been able to examine the typical form. However, he appended to the species a "*β. Moritziana* Schultz Bip. an nova species?" Close comparison of the described features of this var. *Moritziana* and of the original description of *S. elongata* discloses no differential trait of significance that was not founded upon some misapprehension or which does not break down when the material in question is critically examined.

Under this by no means satisfactorily separated "*β. Moritziana*" Schultz further indicated two minor phases, which he called "I. *Pallida*" and "II. *Purpurascens*" without assigning them to any precise taxonomic rank. Of these, the former was said to be less glanduliferous and to have the phyllaries and flowers pale, while the latter was described as strongly glandular and said to have the upper part of the phyllaries and the flowers "tantum ad tubi partem superiorem" purplish.

Though the original *S. elongata* HBK. is stated to have come from central Colombia, both forms of Schultz's "*β. Moritziana*" came from western Venezuela, having been collected by Moritz and by Linden in the mountains of Mérida. When Hieronymus in 1895 was describing the Bolivian *S. Stuebelii* he made incidental mention of Schultz's two forms of his "*β. Moritziana*" and though adding no clear or convincing differential traits raised them each to specific rank.

The writer has studied the pertinent material of this aggregate at Paris, Berlin, and Kew and is forced to conclude that the first cited part of Schultz's "I. *Pallida*" (namely Moritz no. 1376) and the first mentioned element in his "II. *Purpurascens*" (namely Moritz no. 1376b) do not differ in any essential point from the typical *S. elongata* HBK. In all three of these plants the inflorescence and dorsal sur-

face of the rather gradually pointed phyllaries are closely beset with stipitate glands.

Under his "*I. Pallida*," however, Schultz mentioned a second specimen—a plant cited thus "Venezuela, prov. Merida, Culata, 9000' Septbr. 1842 Linden (flores albi)." In the Schultz herbarium now at the Museum of Natural History in Paris there is a small specimen of Linden's no. 483, referred to his subcategory *pallida* and bearing precisely the data cited. This plant, however, differs from the Moritz specimens nos. 1376 and 1376b in having the inflorescence less glandular and the phyllaries relatively broader and more abruptly pointed and furthermore beset on their dorsal surface with a rather sparse incurved or subappressed pilosity, the individual hairs being delicate, jointed, attenuate and glandless but being interspersed with a few scattered sessile or subsessile glands. It is to be inferred that this plant of Linden's was the one which formed the basis of Schultz's brief description of his "*I. Pallida*" and which presumably suggested its name.

Thus it will be seen that the name *pallida* as here employed by Schultz cannot be maintained on the basis of its first-mentioned specimen, Moritz no. 1376, for that proves to be in fact the more glandular form and to have colored corollas and finally to be indistinguishable from the much earlier *S. elongata* HBK. Thus, if *pallida* is here to be maintained in any status it must be taken as resting upon the second-mentioned element, namely Linden's specimen bearing in Schultz's herbarium the identical data cited as follows "Venezuela, prov. Merida, Culata, 9000' Septbr. 1842, Linden (flores albi)" and further bearing at Paris the number 483. This conclusion is reached for the double reason that this plant of Linden's, being less glandular and having paler flowers, best agrees with Schultz's brief character and the name he selected, while furthermore it is the sole remaining element after the extraneous element, Moritz no. 1376, has been removed to an earlier named plant-entity.

Unhappily, the writer when examining (necessarily with some haste) the representation of *Stevia* in the Botanical Museum at Berlin-Dahlem in the summer of 1927 was unable to find any precise equivalent of the Linden plant numbered 483 at Paris. Thus it would appear probable that Hieronymus, when raising Schultz's *pallida* to specific rank did not have before him its typical element. This inference is strengthened by the fact that in the very brief descriptive phrases which Hieronymus applies to his *S. pallida* (Sch.-Bip.) Hieron. some do not apply to the plant shown by Linden's no. 483. Thus he speaks of the stems as being subsimple and the leaves

subentire or but remotely serrate, while the leaves of the Linden specimen at Paris are very clearly and by no means remotely serrate and the plant proves to be one which branches rather freely.

However, it is to be remembered that the name *pallida* of Schultz must be applied solely with reference to the identity of its own type and no confusion of extraneous material during the transfer of this name to new position or rank can be allowed to effect any change in the plant-identity covered by the name.

Though the plant represented by *Linden* no. 483 does not appear to have been subsequently collected in Venezuela, excellent and copious specimens of what seems to be identical material have been collected in recent years by Pennell, Killip and others in various parts of Colombia.

To summarize, it may be said that, so far as the author has been able to ascertain, *S. purpurascens* (Sch.-Bip.) Hieron. falls into the synonymy of *S. elongata* HBK., while *S. pallida* (Sch.-Bip.) Hieron. (as determined by its actual type and not by extraneous material studied at the time of its transfer to specific rank) may be appropriately used for the plant of both Venezuela and Colombia somewhat fully described under this name on page 34 of the present paper.

*S. PUBERULA* Hook. Bot. Misc. ii. 225 (1831). This Peruvian species, as originally described, was stated to have a pappus of about 11 awns. When last at Kew, the writer was most kindly permitted to dissect a head from the type material. This proved anisocarpic, four of the achenes being each 9–10-awned and the fifth being provided merely with a scale-pappus and two short awnlets not a quarter the length of the awns in the other florets. Through the kindness of the director of the Museum of Natural History at Paris the writer has been able to borrow and examine with greater care two sheets of this species collected by Martinet at Matucana, Peru. In these some of the heads proved essentially isocarpic while others, adjacent on the same inflorescence, were found to be strongly anisocarpic. It is therefore evident that heterocarpy is here a mere tendency, sometimes manifesting itself partially. No better proof is needed that as a differential trait heterocarpy should be employed in *Stevia* only with the greatest care.

**S. Purdiei**, spec. nov., herbacea perennis suberecta vel curvato-adscendens 4–6 dm. vel ultra altitudine breviter crispeque pilosa a media parte adscendentem ramosa; radice e fibris longis fuscis tenuibus sistente; caule gracili tereti rubro-brunneo ca. 2 mm. diametro; internodiis 1–3.5 cm. longis; ramis patenter adscendentibus plerisque simplicibus 1–1.5 dm. longis; foliis oppositis (supremis paucis alternis)

sessilibus lanceolatis vel anguste subovatis utroque acutis supra mediam partem inconspicue crenato-serratis supra pilis albis sparsis basi incrassatis instructis subtus paullo pallidioribus punctatis in nervis venisque crispe pilosis a basi 3-nervatis 2–2.5 cm. longis 5–8 mm. latis textura membranaceis; caulinis saepe in axillis proliferis; rameis minoribus subintegris; glomerulis densis 1–2.5 cm. diametro in caule ramisque terminalibus; capitulis subsessilibus 10–11 mm. longis 5-floris; involucri squamis lanceolato-linearibus attenuatis peracutis dorso cum glandulis breviter stipatatis numerosis et cum pilis longioribus albis crispis eglandulosis ornatis ca. 7.5 mm. longis 1.2 mm. latis; corollae tubo proprio ca. 1 mm. longo; faucibus cylindratis 3.5 mm. longis glabris ut videtur atropurpureis; dentibus limbi pallidis paullo hispidulis; achaeniis gracilibus ca. 4 mm. longis; pappo coroniformi ca. 0.8 mm. alto scarioso margine eroso-denticulato.—COLOMBIA: Dept. Magdalena: St. Miguel, Nevada de Santa Marta, Nov. 1844, *William Purdie* (TYPE, in herb. Royal Gard. Kew, phot. Gr.); identical material on a second sheet in the herbarium at Kew bears the data, *Purdie*, St. Martha, 1845, and a third sheet in the Gray Herbarium bears like material said to have been collected by *Purdie* at Santa Marta in 1849. Possibly all three are parts of the same collection, of which the date was somewhat obscurely written and may have been erroneously copied. One of the sheets in the Kew herbarium is annotated in hand of Bentham as "*Stevia* sp. nov.," but though thus correctly interpreted the plant does not appear to have received a name even in manuscript.

**S.** (§ **Multiaristatae**) **sabulonis**, spec. nov., herbacea vel fruticulosa (basi ignota) ramosa patenter villosa; caule tereti rubello 2–2.5 mm. diametro; ramis adscendentibus saepe paullo curvatis vel flexuosis gracilibus foliosis; internodiis plerisque 1–2 cm. longis; foliis oppositis (supremis paucis alternis) sessilibus anguste obovato-ellipticis acutis vel apice rotundatis supra mediam partem argute incurvo-serratis ad basin versus angustatis integerrimis supra prope marginem longe villosis aliter inconspicue puberulis subtus ubique sparse sed longe villosis 2.5–3 cm. longis 8–11 mm. latis membranaceis a basi 3-nervatis; villis gracillimis albis patentibus nodulosis; corymbis ramos terminantibus planiusculis vel rotundatis 3–5 cm. diametro; pedicellis 4–10 mm. longis; capitulis 5(–6!)-floris 12 mm. longis; involucri squamis lanceolato-linearibus 7.5 mm. longis 1.5 mm. latis acutis 1(–3)-nervatis dorso glandulari-puberulis ad apicem versus paullo patenterque villosis; corollis glabriusculis albis, tubo proprio gracili 1.5 mm. longo, faucibus 4 mm. longis gradatim superne ampliatis, dentibus limbi oblongo-ovatis 1.7 mm. longis; achaeniis

homomorphis 3.5 mm. longis laeviusculis; aristis pappi 19–22 albis vel ochroleucis paullulo barbellatis 6.5 mm. longis.—URUGUAY: sands of the Rio Negro opposite Mercedes, April 1867, *C. Fruchart*, no. 281.

Specimens of this number have long lain undetermined in the herbaria at Kew and Paris. Persistent efforts have failed to place them satisfactorily in any hitherto described species. Though the material available for study is of slight extent it is sufficient to permit adequate diagnosis and therefore seems to merit published record. The very sharply incurved-serrate obovate-elliptical leaves are quite distinctive. The sheet of this species at the herbarium of the Royal Botanic Gardens at Kew may be regarded as the type.

**S.** (§ **Multiaristatae**) **samaipatensis**, spec. nov., herbacea perennis erecta virgata habitu *S. serratae* similis 2–3 dm. alta; caule tereti 2 mm. diametro minute incurvo-puberulo brunnescenti; foliis oppositis et alternis sessilibus saepe ab axillo proliferis anguste oblanceolatis obtusis ad apicem versus crenato-serratis basi longe attenuatis integris textura subcoriaceis utrinque nigro-puncticulatis inconspicue puberulis 1.6–1.9 cm. longis 3–4 mm. latis; corymbo terminali fastigiatis ramoso denso planiusculo 4–5 cm. diametro; capitulis sessilibus vel brevissime pedicellatis 8–9 mm. longis 5-floris; involucri squamis anguste oblongis abrupte acutatis incurvo-puberulis saepe purpureo-tinctis ca. 4.5 mm. longis; corollis in tubo et faucibus atropurpureis puberulis; dentibus limbi albis vel albidis; achaeniis heteromorphis ca. 2.7 mm. longis; adelphocarpiis 9–11-aristatis; aristis ca. 5 mm. longis corollas subaequantibus ad basin versus scarioso-dilatatis; idiocarpio coronula e squamis ca. 0.7 mm. longis plus minusve connatis ornato exaristato.—BOLIVIA: Dept. Santa Cruz: Prov. Vallegrande: Samaipata, alt. 2000 m., 16 Mar. 1920, *J. Steinbach*, no. 3761 (TYPE in Bot. Mus., Berlin-Dahlem, phot. and small fragm. Gr.).

From the habitually similar *S. serrata* of more northern latitudes this plant may be readily distinguished by its thicker leaves and multiaristate adelphocarps. It is doubtless more nearly related to *S. mercedensis*, but is clearly distinct, having slightly smaller heads, shorter achenes, more virgate habit, thicker leaves and denser corymb.

**S. SORATENSIS** Hieron. var. **subeglandulosa** (Hieron.), comb. nov. *S. grandidentata* Sch.-Bip. var. *subeglandulosa* Hieron. in Engl. Bot. Jahrb. xxii. 798 (1897). Some years later, Hieronymus noticed that *S. grandidentata* as he had here employed it was a homonym untenable because of the earlier *S. grandidentata* Sch.-Bip. described by Klatt in 1884 for a plant of Mexico. Renaming the Bolivian plant as *S. soratensis*, Hieronymus (l. c. xxviii. 560) failed to transfer his



already indicated var. *subeglandulosa*. This is here given what is believed to be its correct nomenclatural status.

**S. totorensis**, spec. nov., herbacea erecta perennis 1.5–4 dm. alta; caule tereti gracili vix 2 mm. crasso folioso brunneo minute scabriusculo-puberulo; internodiis plerisque 1–2.5 cm. longis; foliis oppositis sessilibus conduplicatis recurvatis ovatis acutis serratis basi acutis utrinque glabriusculis exserto-reticulatis textura coriaceis 2.5–3.2 cm. longis 1.5–2 cm. latis, summis minoribus subintegris; glomerulis paucis subdensis in corymbo planiusculo dispositis; capitulis 5-floris ca. 1 cm. longis sessilibus vel subsessilibus; involucri squamis ad apicem versus violaceis acutis rigidiusculis minute granulatis (cum glandulis brevissime stipitatis dense ornatis); corollae tubo proprio gracili et faucibus 3.7 mm. longis subcylindratis rubro-violaceis glandulis minutis subsessilibus munitis; achaeniis heteromorphis 2.3–2.7 mm. longis; adelphocarpis 4 quoque 3–5-aristato et cum squamulis etiam coronato; aristis purpureis vel purpurascentibus corollas subaequantibus; idiocarpio cum squamulis et 2–3 aristulis multo brevioribus munito.—BOLIVIA: Dept. Cochabamba: Prov. Totora: Bucona, alt. 3000 m., Mar. 28, 1920, *J. Steinbach*, no. 3953 (TYPE in Bot. Mus. Berlin, phot. and small fragm. Gr.)

This Bolivian plant recalls in some respects *S. myriadenia* Sch.-Bip. of Brazil, but has more closely netted leaves, which are almost sessile instead of distinctly petioled, denser inflorescence, and some other differences rendering it pretty clearly a distinct species.

**S. URTICAEFOLIA** Billb. in Thunb. Pl. Bras. Dec. I. 13 (1817). In the Brazilian specimens of this species which have been examined and which may be presumed to represent the typical form of the plant, the corolla-throat is a fairly deep purple. A plant of the Bolivian uplands closely resembles this Brazilian form in habit, foliage, inflorescence and pappus, but differs decidedly in having the throat of the corollas much paler and of a yellowish or greenish color. This may be put on record as follows:

Var. **pallidiflora**, var. nov., corollae faucibus pallidis lutescentibus vel viridescentibus; aliter var. *typicae* simillima.—Listed by Rusby, Bull. N. Y. Bot. Gard. iv. 377, as *S. urticifolia* Thunb.—BOLIVIA: without stated locality, but probably from the Yungas region, *Bang*, no. 2877 (Gr., N. Y., U. S.).

**S. Weberbaueri**, spec. nov., suffruticosa ut videtur procumbens vel subprostrata; caulibus teretibus (ca. 2–3 mm. diametro) gracilibus copiose ramosis juventate glandulari-puberulis tardius glabratis; internodiis plerisque 2–5 cm. longis; ramis adscendentibus plerisque simplicibus 1–1.5 dm. longis foliosis; foliis oppositis (vel superne

subalternis) sessilibus utroque acutis basi integra cuneata excepta serratis utrinque parce pilosis subconcoloribus a basi trinervatis textura membranaceis 2–3 cm. longis 6–10 mm. latis; inflorescentia subirregulariter ramosis; glomerulis multi- vel pauci-capitulatis densis vel laxiusculis; capitulis 16 mm. longis 5-floris sessilibus vel breviter pedicellatis; involucri squamis anguste oblongis breviter acutatis 8–8.5 mm. longis 1.8 mm. latis, extimis dorsaliter glandulari-puberulis; glandulis minimis stipitatis; corollae tubo proprio ca. 1.5 mm. longo; faucibus cylindratis 4 mm. longis roseis; dentibus limbi albis vel pallide roseis oblongis 2.5 mm. longis; achaeniis heteromorphis, eorum quattuor (adelphocarpiis) cum aristis stramineis barbellatis 10–16 apice munitis; achaenio quinto (idiocarpio) solum squamis brevibus scariosis coronulato.—PERU: Carumas, Prov. Moquegua, alt. 3200 m., Feb. 21–Mar. 6, 1925, *Dr. A. Weberbauer*, no. 7293 (TYPE, Field Mus., isotype, Gr.).

From the mostly erect and essentially herbaceous *S. puberula* Hook. this species differs in its lanceolate rather than oval leaves, its somewhat trailing habit and distinctly woody though slender stem, also in its more irregular inflorescence. From *S. Bangii* Rusby and *S. tapacariensis* Hieron. the plant here described differs in its larger heads and glandular-puberulent phyllaries, as well as in its more woody stem.

FLEISCHMANNIA URENIFOLIA (Hook. & Arn.) Benth. & Hook. f. ex Hemsl. Biol. Cent.-Am. Bot. ii. 91 (1881) as *urenaefolia*. This Mexican species is found to vary remarkably in several ways. Its pubescence is singularly inconstant on different coördinate parts of the same individual. Even more striking differences are shown in the contour and lobing of the leaves. Even in the type specimen some of the leaves are but slightly lobed while others are trifoliolate to the rachis. In a notable collection of plants secured by Mrs. Ynes Mexia in little known parts of Jalisco two very unlike plants of this genus were distributed under nos. 1684 and 1684-a. At first these were taken to be distinct species but on closer study it seems best to treat them as follows:

Var.  $\alpha$ . **typica**, foliis paucis vel nullis indivisis ovatis vel ovato-oblongis paullo trilobatis et dentatis basi acutiusculis vel rotundatis sed plerisque ad rachin trifoliolatis cum foliolis dentatis et saepe lobatis.—*Phania* ? *urenifolia* Hook. & Arn. Bot. Beech. 297 (1840). *Hofmeisteria urenifolia* Walp. Rep. vi. 106 (1846–7). *Helogyne urenifolia* Walp. Rep. iv. 457 (1848) by typographical error. *Phania urenaefolia* Benth. & Hook. f. Gen. Pl. ii. 243 (1873). *Fleischmannia urenaefolia* Benth. & Hook. f. ex Hemsl. Biol. Cent.-Am. Bot. ii. 91

(1881). *F. Langlassei* Robinson, Proc. Am. Acad. xli. 273 (1905).—JALISCO: wet cliffs, Barranca of Beltran, *Pringle*, no. 5492 (Gr.); steep wooded slope, inclined to be prostrate, Hacienda del Ototal, east of San Sebastian, Sierra Madre Mountains, *Mexia*, no. 1684 (Gr.). MICHOACAN or GUERRERO: on moist rocks, Arroyo de Barabas, alt. 1000 m., *Langlassé*, no. 27 (Gr.). CHIAPAS: on rocks along creek east of Montserrate, *Purpus*, no. 218 (Gr.). STATE UNKNOWN: *Beechy* (K., phot. Gr.)

Var.  $\beta$ . **Mexiae**, var. nov., foliis omnibus late ovatis vel suborbicularibus indivisis inciso-lobulatis et dentatis basi rotundatis vel saepius cordatis. MEXICO: Jalisco: herb growing in crevices of rock near water, steep wooded slope of narrow cañon, Hacienda del Ototal, east of San Sebastian, alt. 1500 m., *Mrs. Ynes Mexia*, no. 1684-a (TYPE, in Gray Herb.).

No floral differences have been detected between these in foliage strikingly unlike plants. However, the outer phyllaries in var. *Mexiae* are a little narrower and more acute and the leaves generally more pubescent than in var. *typica*.

**Symphypappus leptophlebius**, spec. nov., fruticosus glaberrimus; caulibus ramisque plus minusve costato-angulatis brunneis flexuosis foliosis gracilibus; ligno duro; foliis oppositis petiolatis lanceolato-ovatis caudato-attenuatis serratis ad basin versus integris cuneatis fere a basi 3-nervatis supra viridibus minute reticulato-venulosis (venulis obscuris impressis) subtus distincte pallidioribus (venulis etiam impressis vel vix exsertis) 6–11 cm. longis 1.4–2.4 cm. latis textura submembranaceis; petiolo 7–10 mm. longo saepissime recurvato; inflorescentia (illae *Eupatorii crenulati* habitu simillima) dense paniculata subpyramidata, ramulis paniculae gracillimis flexuosis rubris minute granulatis; capitulis ca. 10-floris 8 mm. longis 2.5 mm. diametro graciliter pedicellatis subracemosis; involucri squamis ca. 15 substramineis valde inaequalibus leviter nervatis obscure dorso granulatis apice rotundatis ciliolatis; corollis tubulatis 4 mm. longis supra mediam partem paullo ampliatis, dentibus limbi brevissimis recurvatis; achaeniis glabris nigrescentibus; pappi setis ca. 25 stramineis basi distincte connatis ad apicem versus paullulo clavellatis vix barbellatis corollam subaequantibus.—BRAZIL: Minas Geraes: *A. de Saint-Hilaire*, no. 782 Cat. D, no. 571 (TYPE, Par., phot. and fragm. Gr.).

This plant, which since its collection by Saint-Hilaire has lain more than a century undescribed, has foliage much resembling that of *Eupatorium itatiayense* Hieron., its leaves being similarly elongate-ovate, long-attenuate, serrate, 3-nerved and submembranaceous.

On the other hand its inflorescence instead of being, as in most species of *Symphypappus* corymbose, is subracemosely paniculate as in *Eupatorium crenulatum* Spreng. The pappus-bristles are united at base into a distinct ring, which sometimes disarticulates from the summit of the achene. Therefore the plant must be referred to *Symphypappus* rather than to *Eupatorium* if these two very closely related genera are kept apart.

**S. Lymansmithii**, spec. nov., fruticosus uni- vel pluri-caulis 2-3 m. altus glaber lucidus vernicosus viscidus; caulibus erectis ascendenter ramosis subteretibus; ramis ramulisque purpureo-brunneis; foliis oppositis petiolatis ovato-oblongis utroque subabrupte angustatis apice obtusis vel rotundatis basi acuminate cuneata excepta grosse serratis pinnatim 5-nervatis utrinque glabris supra lucidissimis subtus vix pallidioribus sublucidis textura chartaceo-subcoriaceis 5-8 cm. longis 2.5-4.3 cm. latis; petiolo 8-12 mm. longis; corymbis compositis planiusculis terminalibus plerisque 1-2 dm. diametro; capitulis 5-floris ca. 1 cm. longis 3-4 mm. diametro; involucri cylindrati 3-4-seriatim imbricati squamis ca. 15 (saepe in seriebus 5 erectis dispositis) obtusis pallidis ciliolatis dorso glabris pulcherrime 3-5-nervatis (nervis rubro-purpureis); corollis cylindratis (sine faucibus distinctis) ca. 6 mm. longis verisimiliter albis vel pallide roseis; dentibus limbi 0.5 mm. longis deltoideis; achaeniis (immaturis) ca. 7 mm. longis glabris obovoideis deorsum attenuatis; pappi setis ca. 36 albis vix scabratis corollam subaequantibus.—BRAZIL: State of São Paulo: on campo, at the Biological Station in Alto da Serra, alt. 800-900 m., lat. 23° 47' South, long. 46° 19' West, Feb. 15, 1929, *Dr. Lyman B. Smith*, no. 1914 (TYPE, in Gray Herb.).

This species as to its heads rather closely simulates *S. compressus* (Gardn.) Robinson but has somewhat flatter corymbs and quite different foliage, its leaves being shorter, relatively broader (usually about half as wide as long), much more obtuse, fewer-toothed and in general more glutinous. From *S. cuneatus* (DC.) Bak. this new species differs in its thinner leaves of ovate rather than obovate tendency, less bluntly toothed, less gradually cuneate at base and with much less conspicuous reticulation. It is a pleasure to name this striking shrub for its discoverer, who during a recent journey to Brazil, undertaken primarily to obtain further knowledge of his specialty, the *Bromeliaceae*, found opportunity to gather helpful material in many other groups.

**Eupatorium angulare**, nom. nov. *E. fistulosum* Robinson, Proc. Bost. Soc. Nat. Hist. xxxi. 249 (1904), not Barratt [in a leaflet to accompany exsiccatae, and] in Wood, Class-book, ed. 2, 314 (1847).

The earlier homonym, obscurely put forth and omitted from the body of the *Index Kewensis*, was overlooked by the writer when naming the Costa Rican plant in 1904. A serious revival of Barratt's name has not seemed probable and until now there has appeared to be no special reason to rename the Central American plant bearing the later homonym. However, the recent ruling regarding homonyms by the International Congress at Cambridge, though reached contrary to the advice and best judgment of many experienced taxonomists, seems to place the obligation to rename all later homonyms rather than to await necessity as some few of the long discarded earlier ones may from time to time be revived. This decision is one of several popular with nomenclatural reformers in which an imposition of rules produces greater change than could have arisen had the matter been left to usage. The new name here chosen alludes, of course, to the unusual form of the palmately angled leaves.

*E. CERASIFOLIUM* (Sch.-Bip) Bak. in Mart. Fl. Bras. vi. pt. 2, 308 (1876). *Conoclinium cerasifolium* Sch.-Bip. ex Bak. l. c. in synonym. This species was founded on a plant collected by Spruce at San Gabriel da Cachoeira near the Cataracts of the Rio Negro. No further material of this species has been found by the writer in any of the herbaria which he has examined and no rediscovery of the plant has been reported so far as known to the writer. It therefore seems well worthwhile to give published record to a second station for this little known species, as follows: in open [places], at Cucuhy, Rio Negro, State of Amazonas, alt. 120 m., Feb. 1930, *Holt & Gehriger*, no. 341 (Gr.). This new station appears to be about 125 km. north of the type-locality. The specimen corresponds closely in all important details with Baker's description and with a photograph (Gr.) of the type (K.). The involucre closely resembles that of *E. macrophyllum* L. of § *Hebeclinium* but the disk is neither hairy as in this section nor much elevated in the middle as in § *Conoclinium* with which the species was associated by Schultz. On technical grounds it should be referred to § *Subimbricata*.

*E. CONNIVENS* Rusby, Mem. Torr. Bot. Club, vi. pt. 1, 57 (1896). The range of this plant, hitherto known only from Bolivia, can now be extended to central Peru for a specimen recently submitted by the United States National Herbarium to the writer for study and identification proves to agree closely with Bolivian material of this well marked species but comes from Peru and has the following data of collection: shrub 9–15 dm. high with lavender florets, growing on a rocky cliff, at Huanucayo, Prov. Junín, alt. 3400 m., Apr. 13, 1929, *Paul Ledig*, no. 51 (Gr.).

**E. (§ Eximbricata) lasiolepis**, spec. nov., erectum herbaceum molliter breviterque piloso-subvelutinum griseum; caule tereti 4 dm. vel ultra altitudine paullo flexuoso albo-medullosa virgato; foliis alternis parvis saepe deflexis oblanceolato-oblongis obtusis dentatis vel crenulatis vel (supremis) subintegris ad basin versus cuneatis et integris sessilibus saepe in axillis proliferis utrinque subvelutinis unicostatis (cum vel absque nervis lateralibus obscuris) ca. 1.8–2.4 cm. longis 5–7 mm. latis; inflorescentia corymbosa planiuscula e ramis alternis saepe elongatis cum foliis paucis parvis remotis instructis prope apicem solum capituliferis sistente, axe principi abortivo; bracteis linearibus; ramulis flexuosis; capitulis pedicellatis ca. 18-floris ca. 1 cm. altis ad apices ramulorum inflorescentiae in corymbulos paullo convexos densiusculos aggregatis; involucri squamis ca. 13 oblanceolato-oblongis maturitate vix imbricatis apice rotundatis saltim supra mediam partem densissime velutinis fulvido-griseis ca. 7 mm. longis; corollis tubulatis sursum paullo ampliatis 5 mm. longis ut videtur pallidis; dentibus limbi deltoideis brevibus dorso granulatis; achaeniis 3.2 mm. longis in faciebus et praecipue in angulis hispidulis; pappi setis ca. 40 albidis vix scabratis corollam subaequantibus.—BRAZIL: State of Rio Grande do Sul, *A. de Saint-Hilaire*, no. 950, Cat. C<sup>2</sup> no. 2737 (TYPE, Par., phot. and fragm. Gr.); no. 984, Cat. C<sup>2</sup> no. 2737 (Par., phot. and fragm. Gr.).

This plant, originally determined as *Trichogonia laxa* Gardn., but clearly distinct and having simple not plumose pappus, in habit recalls *E. alternifolium* var. *Burchellii* Bak., which however has much larger leaves, smaller heads, narrower, less obtuse and less velvety phyllaries and much smaller achenes (about 2.2 mm. long).

**E. (§ Subimbricata) Rimbachii**, spec. nov., arboreum usque ad 10 m. altum griseo-fulvide arachnoideo-tomentosum; ramulis subangulatis; internodiis plerisque 1.5–3 cm. longis denique glabris; foliis oppositis breviter petiolatis oblongo-lanceolatis vel -ovatis gradatim acuminatis vel attenuatis (sed ad apicem verum paullulo rotundatis) basi acutis integris margine revolutis pinnatim 5-nerviis vel fere regulariter penniveniis supra subglabris in costa venisque principibus solis puberulis subtus multo pallidioribus cum indumento fulvido-griseo arachnoideo-tomentoso laxo indutis 9–11 cm. longis 2.5–4 cm. latis textura firmiter membranaceis; petiolo ca. 1 cm. longo; inflorescentia (immatura) terminali densa rotundata ca. 6 cm. diametro verisimiliter ad maturitatem corymboso-expansa et planiuscula; capitulis sessilibus saepe binis vel ternis in ramulis paniculae 10-floris ca. 9 mm. longis (submaturis) et 5 mm. diametro; involucri squamis ca. 15 ca. 4–5-seriatim imbricatis, extimis brevissimis ovatis

subacutis, intermediis et intimis gradatim longioribus ovato-oblongis apice rotundatis dorso viridibus leviter striatis laxe pilosis margine ciliatis; corollis albis gracilibus sine faucibus distincte ampliatis ca. 5 mm. longis glabris, dentibus limbi acutis ca. 0.5 mm. longis; antheris apice bene appendiculatis; achaeniis (immaturis) ca. 2.5 mm. longis sparse cum glandulis subsessilibus ornatis; pappi setis ca. 40 albis sublaevibus corollas subaequantibus.—ECUADOR: inner slope of the eastern cordillera, alt. 3400 m., *A. Rimbach*, no. 31 (TYPE MATERIAL in Field Museum and Gray Herbarium).

This species is obviously related to *E. hypargyrum* Robinson, but may be readily distinguished by the fact that its intermediate and inner phyllaries are rounded instead of abruptly pointed at the tip, by its white instead of violet corollas, and by the fact that the leaves instead of being wholly glabrous on the upper surface are distinctly though finely pilose along the costa and chief veins. Finally the arachnoid tomentum on the lower surface of the leaves is in *E. Rimbachii* distinctly fulvescent especially along the midrib and chief lateral veins, while in *E. hypargyrum* the lower surface is silvery-pannose. According to a field-note of the collector the wood of *E. Rimbachii* is used for poles and for ox-yokes.

*E. SALTENSE* Hieron. in Engl. Bot. Jahrb. xxii. 786 (1897). To the synonymy of this Argentine species (the type of which the writer was able to examine in Berlin in 1927) there may be reduced the later Bolivian *E. eucosmum* Robinson, Contrib. Gray Herb. lxi. 6 (1920). Specimens obtained and studied by the writer in recent years have shown such inconstancy in the characters once thought to separate these habitally identical species that their union seems desirable.

**E. (§ Eximbricata) subferrugineum**, spec. nov., ut videtur frutescens oppositirameum; caulibus teretibus juventate griseo-ferrugineis a tomentulo brevissimo subpannoso obtectis; internodiis ca. 6 cm. longis; ramis brevibus oppositis adscendentibus; foliis (rameis solis visis) oppositis breviter petiolatis ovatis acuminatis serratis basi rotundatis vel subcordatis a basi 3-nervatis firmiter membranaceis vel subcoriaceis supra minutissime griseo-puberulis subtus paullo pallidioribus griseo-subpannosis et subferrugineis 1.8–2 cm. longis ca. 1.2 cm. latis; petiolo 3–4 mm. longo; capitulis breviter pedicellatis ca. 16-floris 7 mm. longis in glomerulos subglobosos terminales 3–5 cm. diametro congestis; involucri squamis ca. 12 lanceolatis acutis griseo-puberulis ca. 3.5 mm. longis; receptaculo planiusculo nudo; corollis glabris 4–5 mm. longis deorsum gradatim attenuatis sine faucibus distinctis; dentibus limbi reflexis ca. 0.5 mm. longis; achaeniis gracilibus 2 mm. longis deorsum gradatim decres-

centibus; pappi setis ca. 20 tenuiter capillaribus albis laeviusculis corollas longitudine subaequantibus.—PERU: without further indication of locality, 1839–1840, *Gay*, without number (Par., phot. and small fragm. Gr.).

This plant, which seems to have been hitherto undescribed, is unfortunately known only from the upper part of a flowering stem. This bears five pairs of opposite ascending branches, each having 2–3 pairs of small opposite grayish leaves of harsh texture and being terminated by dense subglobose or oblate glomerules of short-pedicelled heads. The main cauline leaves have fallen away. They may well have been larger but were presumably similar in form to the rameal. The latter, viewed against a strong light, are seen to have a fine translucent network of veinlets. Beneath they are closely punctate and shortly scurfy. Repeated efforts have failed to place this plant in any species thus far described. From those like *E. Cookii* Robinson and *E. pycnocephalum* Less. which it somewhat approaches in habit and inflorescence, it differs widely in indument and in its much less imbricated involucre. The specimen is unfortunately unprovided with any detailed data of collection, being merely stated to have come from Peru. Presumably it came from the Cuzco region.

**Mikania** (§ **Corymbosae**) **Allartii**, spec. nov., gracilis volubilis brevissime patenterque purpureo-setulosa; caulibus subteretibus 1.5–2 mm. diametro atropurpureis; foliis oppositis petiolatis anguste ovatis caudato-acuminatis cuspidate denticulatis basi rotundatis obscure supra viridibus dense brevissimeque setulosis subtus paullo pallidioribus molliter pubescenti-subvelutinis penniveniis vel obscure a parte inferiori laminae penninervatis 4.5–7 cm. longis 2–3 cm. latis; petiolo gracili 8–10 mm. longo, eis ejusdem jugi a linea transversa paullo incrassata conjunctis; appendicibus stipuliformibus nullis; corymbis ramos terminantibus sessilibus basi foliaceo-bracteatis valde convexis 6–10 cm. diametro; capitulis ca. 13 mm. longis sessilibus ad apices inflorescentiae ramulorum ternatim vel quinatim aggregatis; bracteolis oblanceolatis vel oblongis acutis subpetiolatis; involucri squamis lineari-oblongis ca. 9 mm. longis dorso rotundatis sparse fusco-setulosis apice rotundatis dense setulosis; corollis glaberrimis ut videtur viridibus; tubo proprio exacte tubulato 4 mm. longo; faucibus brevibus turbinatis vix 1 mm. longis; dentibus limbi lanceolatis acutis ca. 2 mm. longis; achaeniis paullo granulatis aliter laevibus ca. 5.5 mm. longis deorsum paullo attenuatis; pappi setis ca. 75 salmoneis vix scabratis corollam aequantibus.—VENEZUELA: Los Venados near Caracas, Oct. 1924, *A. Allart*, no. 112 (U. S., phot. and fragm. Gr.).

Among the *Mikania*s heretofore known from Venezuela this may



be placed near *M. trinitaria* DC. and *M. Johnstonii* Robinson. From both of these, however, as well as from *M. parviflora* (Aubl.) Karst. of French Guiana and *M. latifolia* J. E. Sm. of the Lesser Antilles, it is readily separable by its smaller relatively narrower leaves, which are densely and permanently setulose on the upper surface and sordidly pubescent beneath.

**M.** (§ **Spiciformes**) **Archeri**, spec. nov., paullo lignescens volubilis usque ad 3 m. adscendens; caule tereti laevi 3 mm. vel ultra diametro flexuoso; medulla alba; internodiis 8–10 cm. longis; foliis oppositis petiolatis oblongis integris acuminatis basi cuneatis paullo supra basin pinnatim nervatis utrinque glabris textura firmiter coriaceis 8–14 cm. longis 2.7–3.8 cm. latis subtus ornate reticulatis; venulis vix prominulentibus sed per colorem pallidum conspicuis; petiolis crassis supra canaliculatis 1–1.5 cm. longis; eis ejusdem jugi basi ab annulo suberoso-incrassato conjunctis; paniculis pyramidatis saepe lateralibus 4–18 cm. longis puberulis; capitulis sessilibus spicatim secus ramulos inflorescentiae dispositis 4.5 mm. longis (valde immaturis); involucri squamis anguste oblongis ca. 3.5 mm. longis brunneis apice rotundatis et ciliolatis; corollis ad limbum versus erubescens ca. 3.5 mm. longis fere glabris; tubo proprio fauces longitudine subaequante; achaeniis (valde immaturis) ut videtur glabris; pappi setis ca. 30.—COLOMBIA: Dept. Antioquia: Medellín, alt. about 1500 m., Jan. 4, 1931, *W. A. Archer*, no. 1318 (Gr.).

This interesting species, recently received for determination from the United States National Herbarium, immediately recalls by the thickness and general form of its leaves *M. pachydictya* Robinson. However, it is clearly a distinct plant, for it has much smaller and more closely set heads, and its leaves when more closely examined show several differences. Thus the base is cuneate instead of rounded. The veinlets are scarcely at all prominulent, but are on the lower surface curiously bordered on both sides by pale tissue, so that each veinlet appears as a narrow pale band practically flush with the leaf-surface.

**M.** (§ **Corymbosae**) **Dusenii**, spec. nov., herbacea gracilis volubilis primo aspectu glabra sed in partibus junioribus et in foliis ad marginem apicemque versus obscure puberulis; caule subtereti plus minusve costato-angulato vix 1.5 mm. diametro brunnescenti; internodiis usque ad 1.5 dm. longis; foliis oppositis graciliter petiolatis elongate lanceolato-ovatis perattenuatis et acutissimis in lateribus paullo undulatis et cuspidate subremoteque denticulatis basi sagittatis, lobis basilaribus triangularibus acutis vel subacutis, sinu suborbiculari patenti vel clauso; lamina 6–9 cm. longa 2–3 cm. lata

laete viridi subconcolori a basi 3-nervata textura firmiter membranacea; petiolis flexuosis 1.5–2.5 cm. longis, eis ejusdem jugi basi ab annulo crassiusculo transverso conjunctis, appendicibus stipuliformibus nullis; corymbis longipedunculatis oppositis axillaribus plerisque 2–4 cm. diametro duplice subumbellatim divisis puberulis; involucri squamis elliptico-ovatis acutis ad apicem versus plus minusve erosodenticulatis dorso pallidissimis sparse hirtellis vel subglabris ca. 3.7 mm. longis 1.3 mm. latis; corolla alba glabra; tubo proprio gracili 1.7 mm. longo; faucibus campanulatis ca. 1.2 mm. altis; dentibus limbi late deltoideis ca. 0.7 mm. altis; achaeniis (immaturis) glabris ca. 1.2 mm. longis; pappi setis ca. 40 tenuiter capillaribus albis vix scabratis non apice clavellatis.—BRAZIL: Paraná: Castro, in grassy somewhat marshy places. alt. 840 m., 29 Mar. 1916, *Dusén*, no. 18,040 (TYPE, in Gray Herb.). ARGENTINA: Chaco: Colonia Bebitez, in grassy places of ravines and bottom lands, Mar. 1931, *A. G. Schulz*, no. 185 (Gr.).

This plant, apparently first collected and distributed by the late Dr. Per Dusén, was by him regarded as a variety of *M. scandens*, a name vaguely applied in a very comprehensive way to a group of small-headed and cordate-leaved Mikanias of § *Corymbosae*. As already pointed out by the writer, *Contrib. Gray Herb.* lxiv. 23 (1922), the real *M. scandens* (L.) Willd. is a plant which appears to be restricted to Atlantic North America and which has purplish corollas and relatively long and narrow linear-oblongate and acute phyllaries. Dusén's plant here characterized has distinctly broader and ovate-elliptic phyllaries, white corollas (with proper tube exceeding the throat, which is not the case in the North American *M. scandens*), and highly characteristic narrow and very gradually pointed leaves, which are sagittate rather than hastate in tendency and have a small round often closed sinus at the base.

It has thus far proved impossible to place this plant satisfactorily in any of the rather numerous Mikanias which have been described from the South American countries. From all these it appears very readily distinguishable on account of its rather striking foliage. While Dusén's Brazilian material of this interesting plant was being held for further study, the writer was much pleased to receive (for examination and identification) through the courtesy of Mr. Angel L. Cabrera an Argentine specimen seemingly identical in all respects. This came from the Chaco, where it had been collected by Mr. A. G. Schulz in 1931.

There is still much need of close monographic work before the rather numerous, variable and excessively perplexing plants of this

affinity can be satisfactorily delimited and keyed. It is quite possible that the one here characterized may be found to intergrade with *M. micrantha* HBK., *M. periplocifolia* H. & A., *M. cynanchifolia* H. & A. or *M. umbellifera* Gardn., but in the absence of such evidence it seems best placed on record as a species. To refer it, as suggested by Dusén's label, to the North American *M. scandens* would be to surrender all hope of clarity in the classification of these small-headed and cordate-leaved Mikantias of § *Corymbosae*.

**M. (§ *Thyrsigera*) *Guilleminii***, spec. nov., praeter inflorescentiam obscure glandulari-puberulam glaberrima verisimiliter scandens et plus minusve lignescens; caulibus teretibus gracilibus post exsiccationem multcostulatis albo-medullosis; internodiis ca. 7 cm. longis; foliis oppositis graciliter petiolatis ovato-oblongis obtusis vel subacuminate angustatis ad apicem obtusum versus integris margine undulatis a basi 3-nervatis basi rotundatis supra viridibus sub lente papillatis subtus paullo pallidioribus delicatule cum venulis subexsertis laxe reticulatis 5–8 cm. longis 2.5–3.5 cm. latis; petiolo 2–2.5 cm. longo; paniculis axillaribus et terminalibus pyramidatis 5–10 cm. longis 2–6 cm. diametro oppositirameis subdensis; ramulis pedicellis-que cum glandulis fuscescentibus subsessilibus sparsis minute maculatis; pedicellis plerisque 1–2 mm. longis; capitulis ca. 6 mm. altis contiguis; involucri squamis ovato-ellipticis obtusis vel apice tenuioribus erosis rotundatis saepe nigrescente marginatis dorso viridibus ca. 3 mm. longis; corollis glabris ut videtur pallidis ca. 3 mm. longis sine faucibus distinctis; achaeniis viridibus argute angulatis sublaevibus ca. 1.5 mm. longis deorsum decrescentibus; pappi setis ca. 30 subcarneo-albidis corollam aequantibus laeviusculis.—BRAZIL: Corcovado, Rio de Janeiro, May 1839, *Dr. Antoine Guillemin*, no. 854 (Gen., phot. and small fragm. Gr.); also an obviously identical specimen from the Drake herbarium and said to have been collected by Guillemin in Rio de Janeiro, without number (Par.), doubtless a part of the same material.

This plant, if run down by Baker's key in the *Flora Brasiliensis*, would fall with *M. laevis* DC., a species for which the slightly earlier name *M. trinervis* H. & A. is now the valid designation. However, the plant of Guillemin differs in many ways. Its leaves are thinner, being truly membranaceous. They are also relatively narrower and less disposed to darken in drying. The heads are shorter-pedicelled and the inflorescence in consequence decidedly denser. The phyllaries are broader and more herbaceous. From the study of a photograph of the type of De Candolle's *M. laevis* var. *angustior* it seems probable that the plant of Guillemin may represent it, but even if

this be true it is still no less evident that the plant is so different from the typical *M. laevis* (or more properly *M. trinervis*) that its specific separation becomes essential to proper taxonomy.

**M. Widgrenii**, spec. nov., volubilis verisimiliter alte scandens praeter inflorescentias obscure puberulas subglabra; caule brunneo post exsiccationem multcostulato fistuloso oppositirameo 3–4 mm. vel ultra diametro; internodiis elongatis; foliis oppositis graciliter petiolatis deltoideis acuminatis utroque latere brevissime cuspidateque 2–4-denticulatis (dentibus ca. 0.2–0.3 mm. longis inter se ca. 5 mm. distantibus) basi patenter cordatis et ad insertionem petioli breviter acuminatis a basi 3-nervatis (nervis lateralibus mox bifurcatis) textura tenuiter membranaceis glabris viridibus (subtus paullo pallidioribus) post exsiccationem modice fuscescentibus; paniculis terminalibus compositis; partialibus lateralibus oppositis in pedunculo 3–6 cm. longo elevatis ovoideo-subpyramidatis ca. 5–12 cm. altis et 6–8 cm. diametro; ramulis pedicellisque brunneo-puberulis (pilis incurvis); pedicellis 3 mm. longis; capitulis ca. 8 mm. longis; involucri squamis lanceolatis brunneo-viridibus tenuibus dorso subglabris 3-nervatis ca. 5 mm. longis 1–1.2 mm. latis; corolla glabra; tubo proprio gracili 2 mm. longo; faucibus campanulatis ca. 1 mm. altis; dentibus limbi late ovatis ca. 0.6 mm. longis; achaeniis nigris 2.5 mm. longis cum angulis pallidis ornatis; pappi setis erubescensibus corollam subaequantibus vix scabratis.—BRAZIL: Minas Geraes, *Widgren*, 1845 (Par., phot. Gr.).

This puzzling plant, while slightly recalling some forms of the widely distributed and variable *M. micrantha* HBK. cannot be satisfactorily included in that species, since its inflorescence is of a different character, the heads being more openly and paniculately disposed and the shape of the inflorescence being somewhat more elongated and subpyramidal than is the case in *M. micrantha* where the heads are in flattish or but moderately convex corymbs. Nor has it been found possible to place the plant satisfactorily in any other of the now numerous Brazilian species. The lateral lobes of the leaves are rounded or but slightly angle-pointed, not hastately developed. Their teeth are reduced on each side to 2–4 obscure little cusps and the texture of the leaves, even at full maturity of the achenes, is unusually thin and delicate. As to the form of its inflorescence the species is about intermediate between § *Thyrsigerac* and § *Corymbosac*.

## THE STEVIAS OF COLOMBIA

THOUGH few in number the Colombian Stevias have never been carefully listed, keyed or mutually contrasted. In consequence their identification has long been a matter of no small difficulty and much of the Colombian material of the genus found in herbaria has been incompletely or often erroneously labelled. A revision of such specimens as have been available to the writer leads to the recognition of some ten species as occurring naturally within the limits of the country.

In the way of brief generalization it may be said that of these species two, namely *S. ophiomaches* and *S. Purdiei* are endemics, here presented as new to science. The Colombian record of a third species, *S. Wageneri*, rests upon an isolated and surprisingly remote station in southwestern Colombia for a plant hitherto recorded only from the neighborhood of Caracas in northern Venezuela. *S. Lehmannii*, a little known species of western Colombia, apparently reappears in southern Mexico. It is still rather doubtfully separable from *S. elatior* of which possibly it may prove only a form with denser inflorescence and awnless achenes.

Of the remaining Colombian species, four, namely the diffusely paniced *S. elatior*, the vernicose and shrubby *S. lucida*, the virgate herbaceous *S. serrata* with narrow, crowded and mostly alternate leaves, and the variable but always rather small-headed *S. rhombifolia*, are among the commonest species of the genus and are found in fairly characteristic form in Colombia as they are both to the northward in Central America and Mexico and to the eastward in Venezuela.

*S. elongata* HBK. constitutes something of a problem. The type-material in Paris is not very complete or characteristic. It shows only the uppermost part of the stem with not very satisfactorily developed inflorescence. After examining this specimen and comparing it with seemingly related material from Mexico and Venezuela, it has been impossible for the writer to escape the conviction that it is merely an awnless form or variety of the rather widely distributed and mostly awned plant later described from Venezuela as *S. caracasana* DC. and from western Mexico as *S. elliptica* H. & A. Strangely enough the type of *S. elongata*, though stated to have come from the vicinity of Bogotá, has not been very precisely or convincingly matched by any subsequently collected material from that region, though a specimen from Guadalupe (Ariste-Joseph, no. A76) in the United States National Herbarium, while having somewhat more prolonged glomerules, shows in most of its technical characters a fairly close approach.

Much better and more copious material of this species is needed before final conclusions can be reached regarding it.

The recently recognized Colombian occurrence of what is believed to represent *S. pallida* (Sch.-Bip.) Hieron. has made it necessary in this connection to review the mixed material on which this species was based and to determine the logical application of the name. A discussion of this matter will be found on pages 10-13.

KEY TO THE STEVIAS OF COLOMBIA.

- a. Inflorescence lax; pedicels at maturity equalling or often much exceeding the involucre. . . . b.
- b. Pappus coroniform, exaristate. . . . c.
- c. Mature pedicels fully twice the length of the involucre; heads borne singly; leaves white-tomentose beneath, not dark-dotted. . . . 1. *S. Wageneri*.
- c. Pedicels (even at full maturity) scarcely longer than the involucre; heads clustered in corymbose glomerules; leaves loosely pubescent and dark-dotted beneath. 2. *S. Lehmannii*.
- b. Pappus of scales and awns, the latter about equalling the corollas. . . . 3. *S. elatior*.
- a. Inflorescence or its component parts much denser, the heads sessile or on pedicels shorter than the involucre. . . . d.
- d. Distinctly shrubby; leaves and young inflorescence more or less vernicose. . . . 4. *S. lucida*.
- d. Herbaceous or suffruticose, not vernicose. . . . e.
- e. Leaves lanceolate or oblanceolate to narrowly oblong or linear. . . . f.
- f. Leaves scattered, narrowly oblanceolate; heads in a single dense fastigiately branched rounded or flattish terminal corymb. . . . 5. *S. serrata*.
- f. Leaves (except the uppermost) opposite or subopposite, lanceolate. . . . g.
- g. Leaves narrowed to a rounded tip; heads pedicelled in fastigate corymbs borne on short spreading branches; phyllaries shortly pointed, 4-5 mm. long; corolla throat and limb white. . . . 6. *S. ophiomaches*.
- g. Leaves acutish; heads subsessile in close glomerules at the ends of elongated ascending branches; phyllaries attenuate, 6-7 mm. long; corolla-throat purple. . . . 7. *S. Purdiei*.
- f. Leaves ovate. . . . h.
- h. Phyllaries subglabrous to rather densely incurved-puberulent or sometimes loosely villous with attenuate white glandless hairs usually interspersed with some sessile glands. . . . i.
- i. Phyllaries of firmish texture, more or less thickened in the median part, rarely over 5 mm. long; corollas mostly white; pedicels short but usually evident. . . . 8. *S. rhombifolia*.
- i. Phyllaries thinly membranaceous, loosely villous, not thickened in the median part except near the base, mostly 6-7 mm. long; corolla-throat rose-colored or more rarely greenish-white; heads subsessile. . . . 9. *S. pallida*.
- h. Phyllaries closely beset with short straight spreading gland-tipped hairs or stiped glands. . . . 10. *S. elongata*.

1. **S. Wageneri** Hieron. Weak-stemmed and often decumbent perennial herb, closely glandular-puberulent; leaves opposite, petiolate, ovate, obtuse, crenate-dentate except at the abruptly contracted then cuneate base, grayish-setulose above, at first white-tomentose beneath, sprinkled with lucid glands but not clearly punctate, 2–3 cm. long, 1–2 cm. wide; panicles diffuse; heads small, mostly 7–9 mm. long, solitary at tips of long filiform pedicels; phyllaries oblong, obtuse, glandular-puberulent; florets much exerted; corolla tube and throat pale yellow or greenish, the lobes white or nearly so; achenes crowned by scales only.—Hieron. in Engl. Bot. Jahrb. xxviii. 562 (1901).

EL CAUCA: along stream below "San Isidro," Purace, on the Cordillera Central, alt. 1900–2100 m., *Pennell & Killip*, no. 6407 (Gr.).

[VENEZUELA.]

A species previously known only from the neighborhood of Caracas yet closely matched by this geographically remote Colombian material.

2. **S. Lehmannii** Hieron. Closely related to the preceding but somewhat taller (4–6 dm. high) and coarser; leaves larger, clearly dark-punctate and much less canescent beneath; panicles or at least their component parts flattish-topped; pedicels even at full maturity not much exceeding the involucre; corollas said to be roseate; achenes crowned with short scales, exaristate.—Hieron. in Engl. Bot. Jahrb. xxviii. 562 (1901); Robinson, *Contrib. Gray Herb.* xc. 98 (1930).

EL CAUCA: Popayan, alt. 1700–2400 m., *Lehmann*, no. 5199 (Brl., Gr., N. Y.)

EL VALLE: El Saladito above Cali on road to Buenaventura, on the Western Cordillera, alt. 1600 m., *Pittier*, no. 750 (U. S., Field Mus.).

[Also apparently in southern MEXICO.]

3. **S. elatior** HBK. Of similar habit but with diffuse panicle and (in Colombia) mostly sessile leaves of broadly rhombic-ovate or even subdeltoid-ovate form; heads mostly 10–12 mm. long; corollas with tube and throat usually deep purple, occasionally varying to pale greenish yellow, and lobes pink or white; achenes usually heteromorphic; the adelphocarps (mostly 4) bearing 3–5 slender purple awns about equalling the corollas.—*Nov. Gen. et Spec.* iv. 144 (1820); Robinson, *Contrib. Gray Herb.* xc. 97 (1930), which see for synonymy and varietal subdivision.

MAGDALENA: Santa Marta, 1849, *Purdie* (Gr., where mixed with a bit of a distinct species, possibly *S. elongata*). NORTE DE SANTANDÉR: on páramos, Ocaña, *Schlim*, no. 555 (K., BM., Gen.); between Pamplona and La Isla, alt. 2000–2500 m., *Killip & Smith*, no. 20,745 (Gr.). CUNDINAMARCA: Bogotá, *Humboldt*

& Bonpland (Par., phot. Gr.); meadow at base of mountain south of Sibate, alt. 2800–2900 m., Pennell, no. 2463 (Gr., N. Y., U. S.). BOYACÁ: Duitama, Toro, no. 13 (N. Y.). EL CAUCA: in loose woods near Hacienda Sotará, alt. 2300 m., Lehmann, no. 3710 (Gr., K.). NARIÑO: in bushy woods on clay soil near Yacuanquer, alt. 2500 m., Lehmann, no. 663 (Gr., K.). WITHOUT STATED LOCALITY: Triana, no. 1165 (K.); Dawe, no. 405 (K.); Moritz, no. 398 (Gr., K. where stated to have come from the unlocated "Párama de la Culata").

[MEXICO, GUATEMALA, VENEZUELA; to the southward replaced in Ecuador and Peru by multiaristate species of similar habit, but re-appearing in BOLIVIA in a doubtful variety.]

4. **S. lucida** Lag. Shrub, mostly 0.6–3 m. high, the young parts vernicose; leaves opposite, slender-petioled, bright green, ovate-lanceolate to oblong, acuminate, serrate, 3.5–7(–11) cm. long, 1.5–3.5 cm. wide; heads sessile or nearly so in corymbosely disposed dense glomerules; phyllaries narrow, acute, very viscid and vernicose; corolla-tube and throat usually purple or rose-colored, but sometimes yellowish or greenish white, the lobes white or pale pink; achenes uniform, each having a crown of short erose or dentate irregularly connate scales.—Gen. et Spec. Nov. 28 (1816); Robinson, Contrib. Gray Herb. xc. 110 (1930), which see for more detailed statement of lit., synonym., and vars. *S. glutinosa* HBK. Nov. Gen et Spec. iv. 148, t. 353 (1820).

MAGDALENA: Riohacha, Schlim, no. 804 (K.). NORTE DE SANTANDÉR: shrub 2.4–3.6 m. high, Pamplona, alt. 2300–2400 m., Killip & Smith, no. 19,778 (Gr., N. Y.). SANTANDER: San Pedro, alt. 2440–3050 m., Kalbreyer, no. 586 (Brl., K.); open hillsides near La Baja, alt. 2700–3700 m., Killip & Smith, nos. 17,171 (Gr., N. Y.), 18,193 (Gr., N. Y.), and 18,393 (Gr., N. Y.); near Vetas, alt. 3100–3750 m., Killip & Smith, nos. 17,247 (Gr., N. Y.), 17,321 (Gr., N. Y.), and 17,903 (Gr., N. Y.); edge of Párama de Las Vegas, alt. 3300–3700 m., Killip & Smith no. 15,763 (Gr., N. Y.); near California, alt. 2200 m., Killip & Smith, no. 16,866 (Gr., N. Y.). CUNDINAMARCA: mountains about Bogotá, Humboldt & Bonpland (Par., phot. Gr.), Holton, no. 308 (K., N. Y.), Triana, no. 1167 (Par.), Stübel, no. 157 (Brl.), Rusby & Pennell, nos. 1292 (Gr., N. Y., U. S., Field Mus.) and 1293 (N. Y.), Ariste-Joseph, no. A957 (U. S., fragm. Gr.), Pring, no. 118 (Mo.); in open woods about Sibate and Bogotá, alt. 2500–3000 m., Lehmann, no. 2564 (Gr., K.); dry bushy mountains, San Cristobal, Bogotá, alt. 2800–2900 m., Pennell, no. 2312 (N. Y.); on sandy cliffs in the Eastern Cordillera at Facatativá, alt. 2650 m., André, no. 647 (Gr., K.). EL CAUCA: Párama de la Union, alt. about 2300 m., André, no. 2931 (Gr., K.); granitic cliffs, alt. 2300–2500 m., Killip, no. 6852 (U. S.); open rocky cliffs, below Coconuco, Pennell, no. 7170 (Gr., N. Y.). WITHOUT LOCALITY: Triana, no. 48 (K.); Dawe, no. 208 (K.); Lehmann, no. 4727 (K.).

[MEXICO, GUATEMALA, COSTA RICA, PANAMA, western and northern VENEZUELA.]

Of this species only the typical variety (itself subject to minor and formal changes) is as yet known from Colombia. Triana reports that it—doubtless its resinous and somewhat balsamic foliage—is employed by the natives as a compress for the healing of bruises.

5. **S. serrata** Cav. Erect virgate perennial herb, mostly 3–6 dm.



high; stem terete, incurved-puberulent, simple to the fastigiately branched corymb, very leafy; leaves chiefly alternate, oblanceolate to spatulate or sublinear, crenate-serrate from near the middle to the apex, gradually narrowed and entire toward the base, firmly membranaceous, often conduplicate and recurved-spreading, sessile or shortly petioled, mostly 2–3 cm. long and 4–6 mm. wide; corymb rather dense, moderately convex, mostly 5–10 cm. in diameter, its branches repeatedly divided, shortly pilose; heads pedicelled, 8–10 mm. long; phyllaries pale green, incurved- or appressed-puberulent and sprinkled with conspicuous sessile glands; corollas white or pale pink; achenes normally heteromorphous; adelphocarps (mostly 4 in number) 2–3-awned; isocarp mostly awnless but crowned with scale-pappus.—Ic. 33, t. 355 (1797); Robinson, *Contrib. Gray Herb.* xc. 122 (1930), which see for lit. and synonym. *S. ivaefolia*  $\beta$ ? *bogotensis* DC. *Prod.* v. 118 (1836).

CUNDINAMARCA: *Triana*, no. 1163 (N. Y., K., Par., fragm. Gr.); on open hillside, Usme, *Dawe*, no. 119 (K.); Tequendama. alt. 2400 m., *Bros. Apollinaire & Arthur*, no. 47 (Gr.); region of Bogotá, *Goudot* (Gen.), *Bro. Aristide-Joseph*, no. A276 (U. S., fragm. Gr.), also unnumbered (Gr.); San Cristobal, *Pring*, no. 30 (Mo.); southwest of Las Cruces, *Pennell*, no. 2193 (Gr., N. Y.). EL CAUCA: field in Central Cordillera, Coconuco, *Pennell & Killip*, no. 6477 (U. S.).

[MEXICO, CENTRAL AMERICA; VENEZUELA, ECUADOR.]

6. ***S. ophiomaches*** Robinson. Almost herbaceous curved-ascending or nearly erect perennial, usually simple below the middle, rather stiffly and spreadingly branched above, 4–6 dm. high; leaves opposite, oblanceolate, narrowed toward an obtuse or rounded tip., obscurely crenate on the distal half, cuneate and entire toward the base, 3-nerved, shortly pubescent; blade 1.5–3.5 cm. long 5–8 mm. wide, membranaceous in texture; petiole slightly margined, 4–7 mm. long; corymbs composite, terminal and lateral, convex, incurved-puberulent; heads mostly but 7–8 mm. long, shortly pedicelled; phyllaries substramineous, 4–5 mm. long, short-pointed, covered on the back with short incurved glandless hairs and bearing also a few scattered sessile glands; corollas white, much exserted; achenes heteromorphous; adelphocarps 4, each 3–5-awned and bearing a short scale crown; idiocarp also coronulate but awnless.—*Contrib. Gray Herb.* xcvi. 10 (1931).

NORTE DE SANTANDÉR: open space by roadside, Santa Maria Chica, Prov. of Ocaña, *Kalbreyer*, no. 1240 (TYPE, in herb. K., phot. & small fragm. Gr., isotype Brl.); also in open sunny dry spaces, common and glutinous, alt. 2125–2750 m., *Kalbreyer*, no. 605 (K., phot. Gr.; Brl.).

Flowers said to be fragrant; plant used for snake-bite.

7. **S. Purdiei**, Robinson. Suberect herbaceous perennial 4–6 dm. high, shortly and crisply hairy, upwardly branched from the middle; stem slender, terete, reddish brown; internodes 1–3.5 cm. long; leaves (except a few of the uppermost) opposite, sessile, lanceolate or narrowly subovate, pointed at each end, inconspicuously crenate-serrate from the middle, above covered with scattered white hairs (thickened at the base), beneath slightly paler, punctate, crisped-pilose on nerves and chief veins, 3-nerved from the base, 2–2.5 cm. long, 5–8 mm. wide, membranaceous, often proliferous in the axils; glomerules dense, 1–2.5 cm. in diameter, terminal on stem and elongated branches; heads sessile 10–11 mm. long; phyllaries lance-linear, attenuate, very acute, dorsally beset with many small short-stiped glands and a few longer crisped glandless hairs; corolla limb white or pink, the throat and tube probably purple; achenes slender, homomorphous, surmounted by a short crown of scarious erose partially connate scales.—Contrib. Gray Herb. xcvi. 13 (1931).

MAGDALENA: St. Miguel, Nevada de Santa Marta, *William Purdie* (K., phot. Gr.)

8. **S. rhombifolia** HBK. Upright perennial, herbaceous to suffruticose or sometimes distinctly shrubby, mostly 0.6–1 m. high; stem terete or nearly so, often purple, incurved- or crisped-pubescent; leafy to the inflorescence; leaves (except a few of the uppermost) opposite, rhombic-ovate, subacute to acuminate, crenate-serrate from about the middle, either sessile by a narrowed base or shortly petioled, sparingly to copiously pubescent on both surfaces, usually not much paler beneath, mostly 2–6 cm. long, 1.5–2.5 cm. wide; panicle a compound convex corymb; heads (small for the genus) mostly 6–9 mm. high, sessile or short-pedicelled; phyllaries narrowly oblong, shortly pointed, usually pale green though sometimes purple-tinged, incurved-puberulent with glandless hairs but sprinkled with sessile glands; corollas white or more rarely roseate to (at least as to throat and tube) deep purple; achenes bearing a scale pappus with or without 1–4 awns.—Nov. Gen. et Spec. iv. 143 (1820); Robinson, Contrib. Gray Herb. xc. 132 (1930), which see for further lit., synonym., and varietal subdivision.

This widely distributed and variable species exhibits in Colombia the same inconstancy in degree of pubescence already remarked in Mexico. Of the more definite varieties dependent upon pappus-distinctions two are to be readily recognized in Colombia.

Var.  $\alpha$ . **typica**. Achenes normally heteromorphous; adelphocarps (3–4) each bearing both scales and 1–4 (mostly 2–3) awns.—*S. caracasana* Klatt in Engl. Bot. Jahrb. viii. 33 (1887), not DC. *S.*

*Benthamiana* var. *pesarensis* Hieron. in Engl. Bot Jahrb. xxviii. 561 (1901).

MAGDALENA: clearings, Jiracusaca, alt. 760 m., *H. H. Smith*, no. 1996 (Gr., N. Y.); in clearing, Onaca, alt. 760 m., *H. H. Smith*, no. 612 in part (N. Y.). NORTE DE SANTANDÉR: borders of forest, Prov. Ocaña, *Kalbreyer*, no. 1234 (K.). CUNDINAMARCA: Cipaquirá, Prov. of Bogotá, alt. 2700 m., *Triana*, no. 1164 (K., Par.); Boqueron de Bogotá, alt. 2700 m., *André*, no. 745 (N. Y.); open slope, alt. 1800–2100 m., "Monte Redondo," south of Quetame, *Pennell*, no. 1816 (N. Y., U. S.), a form with leaves unusually hairy beneath and thus approaching the Mexican *S. nepetaefolia* HBK.; dry bushy mountain slope, alt. 2800–2900 m., *Pennell*, no. 2306 (Gr., U. S., N. Y.); field, Zipaquira, alt. 2800–2900 m., *Pennell*, no. 2520 (N. Y.); Sabana, alt. 2600 m., *Apollinaire & Arthur*, no. 77 (U. S.). EL CAUCA: El Chorro, about the River Tuluá, *Holton*, no. 307 (N. Y.); growing on loess formation near Hacienda Sotará, alt. 2200–2500 m., *Lehmann*, no. 3672 (Gr., K.); in dense shrubby thickets, Alto de Pasares above Popayan, alt. 2200–2500 m., *Lehmann*, no. 5968 (Brl., phot. Gr.); rocky bank, alt. 2300–2800 m., between "Canaan" and Coconuco, *Killip*, no. 6819 (U. S.). NARIÑA: on dry clayey soil, about Yacuanquer near Pasto, alt. 2500 m., *Lehmann*, no. 558 (Gr.).

[MEXICO, GUATEMALA, VENEZUELA, ECUADOR.]

Var.  $\beta$ . ***stephanocoma*** Sch.-Bip. Closely similar in habit and in variability of foliage; achenes homomorphous, all exaristate and crowned merely with a short scale-pappus.—*Linnaea*, xxv. 279 (1853); *Robinson*, l. c. 134 (1930). *S. compacta* Benth. Pl. Hartw. 197 (1845).

MAGDALENA: Sierras de Maracaybo, Sta. Marta, *Purdie* (K.); in hillside clearing, alt. 760 m., *H. H. Smith*, no. 612 in part (Gr., N. Y., Field Mus., U. S.). NORTE DE SANTANDÉR: shrub, 1.5 m. high, on savannas, alt. 1220 m., Ocaña, *Schlim*, no. 117 (Gen.); woods along streams, Culagá Valley north of Toledo, alt. 1500–2100 m., *Killip & Smith*, no. 20,139 (Gr., N. Y.). SANTANDÉR: thicket between Piedecuesta and Las Vegas, alt. 2000–2500 m., *Killip & Smith*, no. 15,527 (N. Y.). CUNDINAMARCA: between Fusagasugá and Pandi, *Hartweg*, no. 1091 (K., phot. Gr., N. Y., phot. Gr.); on open slope, alt. 1800–2100 m., "Monte Redondo," south of Quetame, *Pennell*, no. 1816 (Gr.). NARIÑA: Prov. Pasto, alt. 1500 m., *Triana*, no. 1164 (Par.).

[MEXICO, CENTRAL AMERICA, VENEZUELA, ECUADOR, PERU.]

Varying much in the degree of its lignescence. Some collectors refer to it as an herb, while others report it decidedly shrubby.

9. ***S. pallida*** (Sch.-Bip.) Hieron. Herbaceous or suffrutescent perennial 0.5–1 m. high, upwardly branched and finely crisped- or incurved-pubescent; root a fascicle of tough dark fibres; stem terete, thickish (sometimes 6 mm. in diam.) and a little woody at base, purplish-brown, leafy; leaves opposite, sessile or shortly petioled; blade rhombic-ovate, acute or acutish, rather sharply serrate except toward the cuneately narrowed base, pale green and shortly incurved-puberulent above, beneath even paler, dark-punctate, and pubescent on nerves and chief veins, 2.5–3.5(–5) cm. long, 1.4–1.8(–2.4) cm. wide; corymbs convex and compound; glomerules dense, mostly 1–3 cm. in diameter, terminating the ascending branches; heads about 11

mm. long, sessile or nearly so; phyllaries 7 mm. long, 1.3–1.6 mm. wide, oblong, acute, thin, dorsally crisped-hirtellous, the hairs white, articulated, subappressed, glandless but interspersed with lucid sessile glands; corolla as to throat and tube varying from greenish white to rather deep purple, its lobes white to roseate; achenes black, slender, 4 mm. long surmounted by a short crown of scarious scales (0.8 mm. long), either all awnless or 1–3 achenes in each head bearing 1–2 awns each.—Hieron. in Engl. Bot. Jahrb. xxi. 328 (1895), at least in its significant part, that is, as to the name-bringing synonym. (See page 10.) *S. elongata*  $\beta$ . *Moritziana* I. *pallida* Sch.-Bip. Linnaea, xxv. 275 (1853).

SANTANDÉR: herb. 6–9 dm. high, thicket, corolla-tube greenish-white, lobes pink, stigmas pink, vicinity of Vetas, alt. 3100–3250 m., Killip & Smith, no. 17,908 (Gr., N. Y.); open rocky hillside, woody herb, corolla and styles light pink, Killip & Smith, no. 17,269 (Gr., N. Y.); herb, somewhat woody, corollas deep pink [to purple on the throat], the lobes and styles paler, edge of Páramo de Vetas, alt. 3400–3700 m., Killip & Smith, no. 17,398 (Gr., N. Y.). CUNDINAMARCA: herb, field, base of mountain, alt. 2800–2900 m., Zipaquirá, Pennell, no. 2519 (Gr., N. Y.).

[WESTERN VENEZUELA.]

This plant, early gathered in western Venezuela by horticultural collectors, has long been one of the most vaguely and inadequately described members of the genus. Its precise identity and obscure publication are discussed on page 10. Copious and excellently prepared specimens, secured by Pennell and by Killip & Smith in central and northeastern Colombia, now happily permit it to be put upon far more complete and satisfactory record. The species in habit recalls some forms of *S. rhombifolia* HBK. but has larger heads and other differences indicated in the key. From the also nearly related *S. elongata* HBK. it may be distinguished by its smaller and much less petiolate lower leaves and by the quite different and glandless puberulence of the phyllaries.

10. ***S. elongata*** HBK. Erect herbaceous perennial, sometimes distinctly stoloniferous; stems terete, purple, at least when young closely beset with a short spreading gland-tipped puberulence, but bearing sometimes also some longer scattered glandless hairs; leaves opposite (the uppermost sessile or nearly so, the middle or at least the lower borne on rather long cuneately winged petioles), serrate or crenate except toward the base, ovate, acuminate to obtuse, membranaceous, green on both surfaces though a little paler beneath, 3-nerved from a point distinctly above the contracted basal portion, mostly 3–7 cm. long, 2–5(–6) cm. wide, inconspicuously pubescent at least along the nerves; floral leaves much reduced; heads 9–11 mm. long, sessile or nearly so in rather dense corymbosely disposed glom-

erules terminating upright or ascending branches; phyllaries oblong to lanceolate, sharp-pointed, pale green or more often purple-tinged, closely beset with short spreading at length stiffish gland-tipped hairs; corollas pale rose, lilac or white; achenes (in var. *typica*, the only form as yet known from Colombia) homomorphous, bearing a crown of short scarious scales but all exaristate.—Nov. Gen. et Spec. iv. 144 (1820); DC. Prod. v. 116<sup>r</sup> (1836); Robinson, Contrib. Gray Herb. xc. 140 (1930).

CUNDINAMARCA: near Bogotá, alt. about 2500 m., *Humboldt & Bonpland* (Par., Brl.); also at the mines of Zipaquira, alt. about 2700 m., *Humboldt & Bonpland* acc. to Kunth in HBK. l. c.

[MEXICO, WESTERN VENEZUELA.]

Never closely matched by material subsequently collected about Bogotá, this species has for more than a century remained something of a mystery. In essential features the original, unfortunately fragmentary, material is not separable from awnless forms occasionally found in Mexico and Venezuela of a plant which usually has awned adelphocarps. Of this aggregate, *S. elongata* is the earliest name for the awnless and *S. caracasana* DC., for the aristate element and the latter, as pointed out by the writer, l. c. 119, may appropriately be reduced to varietal rank. As yet the awned condition has not been found in Colombia though certainly to be expected there.

The nearest approach to the typical form of *S. elongata* thus far rediscovered near Bogotá is Bro. Ariste-Joseph's no. A 76 (U. S.) from Guadelupe. This has somewhat curiously prolonged, so to speak, subspiciform glomerules. Whether this is a normal or teratological condition is not yet clear, therefore the precise status of this rather striking form can not be satisfactorily determined without further study of better and much more copious material.

#### TRANSFERRED OR REDUCED TO SYNONYMY.

*S. Benthamiana* var. *pesarensis* Hieron. in Engl. Bot. Jahrb. xxviii. 561 (1901) = *S. RHOMBIFOLIA* HBK. (var. *TYPICA*).

*S. caracasana* Klatt in Engl. Bot. Jahrb. viii. 33 (1887), not DC. = *S. RHOMBIFOLIA* HBK. (var. *TYPICA*).

*S. compacta* Benth. Pl. Hartw. 197 (1845) = *S. RHOMBIFOLIA* var. *STEPHANOCOMA* Sch.-Bip.

*S. elongata*  $\beta$ . *Moritziana* I. *pallida* Sch.-Bip. Linnaea, xxv. 275 (1853) as to type = *S. PALLIDA* (Sch.-Bip.) Hieron.

*S. glutinosa* HBK. Nov. Gen. et Spec. iv. 148, t. 353 (1820). = *S. LUCIDA* Lag.

*S. ivaefolia*  $\beta$ ? *bogotensis* DC. Prod. v. 118 (1836) = *S. SERRATA* Cav.

## THE STEVIAS OF VENEZUELA.

Of the seven species and one variety of *Stevia* at present known from Venezuela none is endemic. Their occurrence in that country would seem to be of the nature of outlying and often surprisingly remote and isolated eastern stations in South America for plants prevailing of Cordilleran distribution. *S. elatior* HBK., *S. lucida* Lag., *S. serrata* Cav., and *S. rhombifolia* HBK., together with its awnless var. *stephanocoma* Sch.-Bip., are all common plants of the uplands from Mexico to Colombia. *S. Wageneri* Hieron., hitherto recorded only from the Caracas region in northern Venezuela, reappears without change of form in southwestern Colombia. *S. pallida* (Sch.-Bip.) Hieron. and *S. elongata* HBK. are plants inadequately known, at least in their Venezuelan occurrence, and each of them seems to be restricted in that country to the mountains about Mérida. Of these plants much more Venezuelan material must be assembled before it will be possible either to speak with any confidence regarding their eastern geographic limits or indeed to be quite certain of the precise identity of the Venezuelan forms and those assigned to the same species further to the westward.

The literature relating to the Venezuelan Stevias is slight. Humboldt & Bonpland, though early visiting portions of the country on their notable journey of exploration, do not appear to have collected there, with the exception of the previously described *S. lucida* Lag., any of the score or more of Stevias which they record from tropical America. De Candolle, Prod. v. 119 (1836), described as *S. caracasana* a plant of Vargas collected near Caracas. In 1853 Schultz-Bipontinus in the course of a treatment of *Stevia*, which he contributed to Klotzsch's Beiträge zur Flora der Äquinoctial-Gegenden der neuen Welt (Linnaea, xxv. 268-292), made incidental mention of such Venezuelan members of the genus as were known to him. Records of these were chiefly based on the collections of the horticultural explorers Linden, Funck, Schlim, and Moritz, secured mostly in the regions about Caracas and Mérida, the two centers from which these collectors chiefly operated while in Venezuela. Hieronymus in Engl. Bot. Jahrb. xxi. 328 (1895) rather obscurely raised to specific rank two Venezuelan plants earlier classified by Schultz as subvarieties or forms of the Colombian *S. elongata*. Some years later Hieronymus in Engl. Bot. Jahrb. xxviii. 562 (1901) described as new, under the name *S. Wageneri*, a delicate little species (closely related to *S. elatior* HBK.) which had been collected several times in the neighborhood of Caracas.

The only attempt to list the Venezuelan *Stevias* is that of Knuth, who in his "Initia Florae venezuelensis" published in Fedde, Rep. Spec. Nov. Beihefte xliii. 696-698 (1928) cites nine species and some half dozen subspecific, varietal or formal manifestations of the genus. This work, the sole enumeration as yet published of the Venezuelan flora, will be found very helpful because it brings together bibliographical references to exceedingly scattered literature. However, concerning the taxonomic validity or even in some instances the nomenclatural availability of the names it assembles, it should be used with due caution since it contains many errors of the kind inevitable in any catalogue of names drawn without close scrutiny from the works of many authors, of quite different periods, unequal ability and diverse classificatory methods.

Thus the "*S. dissoluta* Schlecht." of Knuth's enumeration rests, as to its Venezuelan occurrence, on precisely the plant characterized by Hieronymus as *S. Wagereri*, a species independently included in Knuth's list and quite distinct from the original Mexican *S. dissoluta* of Schlecht.

"*S. urticifolia* Thunb.," as employed by Knuth, covers material collected by Pittier and by Jahn, which was in part *S. Wagereri*, in part *S. rhombifolia* var. *stephanocoma* Sch.-Bip. and as to the rest *S. elatior* HBK., while the real *S. urticaefolia* Billb. ex Thunb. is a Brazilian plant as yet unknown from Venezuela.

Knuth unfortunately attributes to Klotzsch several names which should certainly be assigned to Schultz-Bipontinus, whose authorship of the paper on *Stevia* in *Linnaea* xxv. 268-292 is clearly and adequately indicated by the expression "auctore C. H. Schultz Bip." beneath the name of the genus.

Knuth appears to have overlooked the certainly rather obscure note of Hieronymus in *Engl. Bot. Jahrb.* xxi. 328 (1895) in which he raised to specific rank the plants briefly characterized by Schultz (not Klotzsch) as subvarieties or forms of *S. elongata* under the names *pallida* and *purpurascens*.

As already explained (*Contrib. Gray Herb.* lxxx. 11) the name *S. punctata* Sch.-Bip., employed by Knuth, has no nomenclatural validity.

#### KEY TO THE STEVIAS OF VENEZUELA.

- a. Inflorescence diffusely paniculate; pedicels equalling or more often much exceeding the involucre. . . . b.
- b. Pappus exaristate; lower leaves on petioles more than half as long as the blade; corolla-tube greenish-white. . . . 1. *S. Wagereri*.
- b. Pappus of the adelphocarps 3-5-aristate; awns about equaling the corolla; leaves (even the lower in Venezuelan forms) subsessile; corolla-tube mostly reddish-purple. . . . 2. *S. elatior*.

- a. Inflorescence much more compact; heads sessile or on pedicels normally shorter than the involucre. . . . c.
- c. Fruticose; leaves and young parts vernicose; pappus exaristate. . . . 3. *S. lucida*.
- c. Herbaceous or suffruticose, not conspicuously vernicose. . . . d.
- d. Phyllaries incurved-puberulent with glandless hairs but usually sprinkled with sessile glands. . . . e.
- e. Leaves alternate or scattered, mostly linear-oblongate. . . . 4. *S. serrata*.
- e. Leaves (except sometimes the uppermost) opposite, ovate. . . . f.
- f. Heads (small for the genus) mostly 6–8 mm. long; phyllaries rarely over 5 mm. long, normally somewhat thickened in the median line at least toward the base, mostly obtuse or shortly pointed; corollas mostly white. . . . 5. *S. rhombifolia*.
- f. Heads somewhat larger, 9–11 mm. long; phyllaries thin and of softer texture, usually purple-tinged toward the gradually pointed tip, mostly 6–7 mm. long. . . . 6. *S. pallida*.
- d. Phyllaries dorsally closely beset with short straight spreading at length stiffish gland-tipped hairs or stipitate glands . . . . 7. *S. elongata*.

1. **S. Wageneri** Hieron. (See p. 30.) Slender species with small long-pedicelled heads, coroniform pappus, and opposite petiolate ovate leaves arachnoid-tomentose and canescent beneath.—Hieron. in Engl. Bot. Jahrb. xxviii. 562 (1901); Knuth in Fedde, Rep. Spec. Nov. Beibl. xliii. 698 (1928). *S. elatior* var. *coronata* Sch.-Bip. Linnaea, xxv. 271 (1853). “*S. dissoluta* Schlecht.” as used by Knuth, l. c. 696 for plant of Venez., not *S. dissoluta* Schlecht., concerning the disposition of which see Robinson, Contrib. Gray Herb. xc. 98 (1930). “*S. urticifolia* Thunb.” as used by Knuth, l. c. 698 in part (i. e. for pl. of Fed. Dist.), not *S. urticaefolia* Billb. ex Thunb., which is Brazilian and wholly distinct.

FEDERAL DIST.: on savannas about Caracas, alt. 1200 m., *Wagener*, no. 407 (Brl.); upper Catuche wood, above 1400 m., *Pittier*, no. 7335 (U. S.); mountains between Caracas and Desagueros, *Gollmer* (Brl.); on mountains toward Galipán, *Gollmer* (Brl.); on savannas, Silla de Caracas, *Funck*, no. 317 (K., phot. Gr., Par.); La Ciénega, Silla de Caracas, alt. 2000–2640 m., *Pittier*, no. 8320 (Gr., U. S.); Cerro del Galipán. alt. 1370–1830 m., *Eggers*, no. 13,578 (Gr., Copenh.).

[Also in the Central Cordillera of COLOMBIA.]

2. **S. elatior** HBK. (See also p. 30.) Also diffuse as to inflorescence, but (in the Venezuelan form) having leaves (mostly 3–5 cm. long) sessile or nearly so, rather coarsely pubescent but not conspicuously arachnoid-canescant beneath; heads larger (12 mm. long at maturity); at least some of the achenes in each head 1–3-awned.—Nov. Gen. et Spec. iv. 144 (1820); Knuth, l. c. 697 (1928); Robinson, Contrib. Gray Herb. xc. 97 (1930), which see for further lit., synonym.,



and varietal division. *S. sessilifolia* Willd. and *S. rhombifolia* Willd., quite useless names, unpublished by their author but much later brought out by Schultz, l. c., 270, thus needlessly increasing the burden of synonymy. "*S. urticifolia*" as used by Knuth, l. c. 698 in part (i. e. as to *Jahn*, no 533), not *S. urticaefolia* Billb. ex Thunb.

FEDERAL DIST.: near Galipán, alt. 1220 m., *Otto*, no. 929 (Brl.). ARAGUA: grassy openings in the mountains, Colonia Tovar and on the Páramo de la Culata, *Moritz*, no. 398 (K., Brl.); Colonia Tovar, alt. about 1375 m., *Fendler*, nos. 622 (Gr., N. Y., K.) and 622 b. (Gr.), the latter a form with the leaves slightly clasping at base. TRUJILLO: near Agua Obispo, alt. about 1830 m., *Funck & Schlim*, no. 785, acc. to Schultz, l. c. 271. MÉRIDA: near Mérida, alt. 1525 m., *Linden*, no. 348, acc. to Schultz, l. c. (the same number at Kew where labeled, probably erroneously, as from Caracas); Páramo de La Sal, alt. 1525 m., *Jahn*, no. 553 (Gr., U. S.).

[MEXICO, GUATEMALA, COLOMBIA, and (in a doubtful variety) BOLIVIA.]

3. ***S. lucida*** Lag. (See also p. 31.) Upright glutinous and vernicose shrub with opposite petiolate oblong serrate leaves and densely corymbose heads; achenes of like form, all exaristate but having a crown of more or less connate scales.—Gen. et Spec. Nov. 28 (1816); Sch.-Bip. l. c. 288 (1853), including the unimportant foliar variants  $\alpha$ . *latifolia* Sch.-Bip. and  $\beta$ . *angustifolia* Sch.-Bip. l. c. 289; Pittier, Pl. usual. Venez. 210 (1926); Knuth, l. c. 697 (1928). *S. fastigiata* Willd. ex Sch.-Bip. l. c. 289 (1853), another name uselessly published in synonymy.

FEDERAL DIST.: Silla de Caracas, alt. 2600 m., *Humboldt* acc. to Sch.-Bip. l. c.; *Linden*, no. 141 (Gr., K.), *Funck*, no. 559 (K.); *Gollmer* (Brl.); alt. 2000–2640 m., *Pittier*, no. 8333 (Gr.); Pico de Galipán, *Pittier*, no. 6208, acc. to Knuth, l. c. MÉRIDA: Páramo de Mucuchies, *Moritz*, no. 368 (K.); Sierra Nevada de Mérida, *Linden*, acc. to Sch.-Bip. l. c.; Páramo de los Apartaderos, alt. 3300 m., *Jahn*, no. 546 (Gr.); San Rafael, Mérida, *Gehriger*, no. 6 (U. S., fragm. Gr.). Probably from near Mérida, *Moritz*, no. 1377 (Brl., K.), the number on which Schultz founded his  $\beta$ . *angustifolia*. Without precise locality: *Lansberg* (Brl.).

According to Pittier, l. c. 210, this species is in Venezuela called *chilca*, a name applied to several other plants also.

4. ***S. serrata*** Cav. (See also p. 31.) Erect virgate very leafy-stemmed perennial herb, with narrowly oblanceolate chiefly alternate leaves and a fastigiate corymb of short-pedicelled heads; corollas white or nearly so.—Ic. 33, t. 355 (1797); Robinson, Contrib. Gray Herb. xc. 122 (1930), which see for further lit., synon., distrib. and varietal subdivisions. *S. punctata* Sch.-Bip. *Linnaea*, xxv. 286 (1853); Knuth in Fedde's Rep. Spec. Nov. Beibl. xliii. 697 (1928).

MÉRIDA: Zumbador (an unverified place-name, differently spelled, Zumbados, Zumbadar, etc.), alt. 2440 m., *Linden*, no. 693 (Par., Gen., small fragm. Gr.).

[MEXICO, CENTRAL AMERICA, COLOMBIA and ECUADOR.]

5. **S. rhombifolia** HBK. (See also pl. 33.) Upright perennial herb or undershrub with opposite rhombic-ovate membranaceous leaves; heads small (mostly 6–8 mm. long) in compact corymbously disposed glomerules; phyllaries obtuse or shortly pointed, mostly pale green or stramineous, tending to be thickened in the middle, incurved-puberulent with glandless hairs.—Nov. Gen. et Spec. iv. 143 (1820); Robinson, Contrib. Gray Herb. xc. 132 (1930), which see for further lit., synonym., distrib. and vars.

The commonest, most widely distributed, and variable of the pauciaristate Stevias, this species though abundant in the cordilleras from Mexico to Ecuador has been reported but rarely from Venezuela, where however at least three of its pappus-varieties occur, as follows. All these without discrimination in Venezuela bear the vernacular name *molinillo*.

Var.  $\alpha$ . **typica**. Achenes (all crowned with short scales) normally heteromorphous; adelphocarps 3–4, each about 3-awned; awns about equalling the corollas; idiocarp awnless.—Robinson, l. c. *S. quitensis* HBK. Nov. Gen. et Spec. Nov. iv. 145 (1820); Kuntze, Rev. Gen. 366 (1891).

FEDERAL DIST.: La Guaira, Kuntze, no. 1288 (N. Y.); between Cotiza and los Venados, Allart, no. 71 (N. Y.). MÉRIDA: savannas, alt. about 1525 m., Linden, no. 323 in part (Gen., K., where wrongly labelled as from Caracas), mixed with vars. *uniaristata* and *stephanocoma*; Sto. Domingo in the Sierra de Mérida, alt. 1800 m., Jahn, no. 106 (U. S.); Páramo Agua de Obispo, alt. 2500 m., Jahn, no. 1175 (U. S.), a dwarf páramo form; hillsides, alt. 1800–2000 m., Agua Caliente, Tabay, Gehrigier, no. 532 (N. Y.), in part.

[MEXICO, GUATEMALA, COLOMBIA, ECUADOR and PERU.]

Var.  $\beta$ . **uniaristata** (DC.) Sch.-Bip. Pappus-awns present but few and scattered, rarely more than one or two in a head and only in some of the heads of the inflorescence.—Linnaea, xxv. 279 (1853). *S. uniaristata* DC. Prod. v. 120 (1836).

MÉRIDA: savannas, alt. about 1525 m., Linden, no. 323 [in part] acc. to Sch.-Bip., l. c.; hillsides, alt. 1800–2000 m., Agua Caliente, Tabay, Gehrigier, no. 532 in part (N. Y., small fragm. Gr.).

[MEXICO.]

Var.  $\gamma$ . **stephanocoma** Sch.-Bip. Achenes alike and awnless, crowned merely by a scale-pappus.—Linnaea, xxv. 279 (1853); Robinson, Contrib. Gray Herb. xc. 134 (1930). *S. compacta* Benth. Pl. Hartw. 197 (1845).

ARAGUA: open grassy slopes, Colonia Tovar, Moritz, no. 1918 (BM.); near Colonia Tovar, alt. about 1700 m., Fendler, nos. 619 (Gr., K.) and 620 (Gr., N. Y., K.). MIRANDA: Las Mostazas, alt. 963 m., Allart, no. 200 (U. S., N. Y., fragm. Gr.). TRUJILLO: Páramo de Jabón, alt. 3000–3200 m., Jahn, no. 27 (U. S.). MÉRIDA: savannas, alt. about 1525 m., Linden, no. 323 in part (Gen.,

small fragm. Gr.), a number also covering material of var.  $\alpha$ . and (acc. to Sch.-Bip. l. c.) var.  $\beta$ .; Mérida, *Moritz*, no. 1375 (Brl.). STATE DOUBTFUL: *Linden*, no. 475 bis (BM.). While the label here reads Caracas, the plant was probably collected in Mérida.

[MEXICO to northern PERU.]

6. ***S. pallida*** (Sch.-Bip.) Hieron. (For history and discussion of this species see p. 10.) In habit not very dissimilar to the preceding species, but with slightly larger heads (mostly 9–11 mm. long), thinner, broader, and more gradually pointed usually purple-tinged phyllaries, and achenes at full maturity about 4 mm. long, either all merely coronulate or in part each 1–3-awned.—Hieron. in Engl. Bot. Jahrb. xxi. 328 (1895), where raised to specific rank rather obscurely in notes upon quite a different plant from a region remote. *S. elongata*  $\beta$ . *Moritziana* I. *Pallida* Sch.-Bip. *Linnaea*, xxv. 274 (1853); Knuth, l. c. 697 (1928).

MÉRIDA: Culata, alt. about 2750 m., *Linden*, no. 483 (Par., sk. and notes Gr., also K. and BM., where erroneously labeled as from Caracas.)

This imperfectly known plant of western Venezuela appears to be identical with better and more copious material in recent years collected in Colombia. (See p. 34.)

7. ***S. elongata*** HBK. (See p. 35.) Similar in habit and foliage to the two preceding species but to be readily distinguished by its fine and copious glandular puberulence, which covers the stem, branches, inflorescence, and dorsal surface of the phyllaries.—Nov. Gen. et Spec. iv. 144 (1820); Sch.-Bip. l. c. 275 (1853) as to his subvariety or form *purpurascens*; Robinson, *Contrib. Gray Herb.* xc. 140 (1930), where affin., distrib., vars., etc. are discussed. Both pappus-forms of this species occur in Venezuela, namely

Var.  $\alpha$ . ***typica***. Achenes uniform, all exaristate and crowned merely with a scale-pappus.—Lit., etc., as above.

MÉRIDA: Páramo de Mucuchies, *Moritz*, nos. 1376 (Brl., sk. and notes Gr.) and 1376b (Brl., phot. Gr.). STATE UNCERTAIN: "Caracas," *Linden*, no. 475 bis (K.), probably labelled inaccurately and in reality from Mérida.

[MEXICO, COLOMBIA.]

Var.  $\beta$ . ***caracasana*** (DC.) Robinson. Achenes normally heteromorphic, 3–4 of them in each head 2–3-awned, the (1–2) idiocarps merely coronulate with scale-pappus.—*Contrib. Gray Herb.* xc. 141 (1930). *S. caracasana* DC. *Prod.* v. 119 (1836); Sch.-Bip. l. c. 282 (1853); Knuth, l. c. 696 (1928).

FEDERAL DIST.: about Caracas, *Vargas*, no. 108 (Gen., phot. Gr.), *Ernst* (Par.), *Moritz*, no. 71 (Par.); *L. H. & E. Z. Bailey*, no. 406 (Gr.); *Silla de Caracas*, *Birschel* (Gr.). ARAGUA: Colonia Tovar, alt. 1000–1100 m., *Fendler*, no. 621 (Gr., N. Y.). MÉRIDA: alt. 2440 m., *Linden*, no. 476 (Par., Gen., small fragm. Gr.); Páramo Santo Domingo, alt. 3600 m., *Jahn*, no. 1098 (Gr.).

## TRANSFERRED OR REDUCED TO SYNONYMY.

*S. caracasana* DC. Prod. v. 119 (1836) = *S. ELONGATA* var. *CARACASANA* (DC.) Robinson.

*S. compacta* Benth. Pl. Hartw. 197 (1845) = *S. RHOMBIFOLIA* var. *STEPHANOCOMA* Sch.-Bip.

"*S. dissoluta* Schlecht," as used by Knuth in Fedde Rep. Spec. Nov. Beibl. xliii. 698 (1928) = *S. WAGENERI* Hieron., while the original *S. dissoluta* Schlecht. applies to a Mexican exaristate variety of *S. elatior*.

*S. elatior* var. *coronata* Sch.-Bip. Linnaea, xxv. 271 (1853) = *S. WAGENERI* Hieron.

*S. elongata*  $\beta$ . *Moritziana* I. *Pallida* Sch.-Bip. Linnaea, xxv. 274 (1853) = *S. PALLIDA* (Sch.-Bip.) Hieron.

*S. elongata*  $\beta$ . *Moritziana* II. *Purpurascens* Sch.-Bip. l. c. = *S. ELONGATA* HBK. (var. *TYPICA*).

*S. punctata* (Jacq.) Sch.-Bip. Linnaea, xxv. 286 (1853) and Knuth, l. c. 697 (1928) = *S. SERRATA* Cav.

*S. quitensis* HBK. Nov. Gen. et Spec. iv. 145 (1820) and Ktze. Rev. Gen. 366 (1891) = *S. RHOMBIFOLIA* HBK.

*S. rhombifolia* Willd. ex Sch.-Bip. Linnaea, xxv. 270 (1853) = *S. ELATIOR* HBK.

*S. sessilifolia* Willd. ex Sch.-Bip. l. c. = *S. ELATIOR* HBK.

*S. uniaristata* DC. Prod. v. 120 (1836) = *S. RHOMBIFOLIA* var. *UNIARISTATA* (DC.) Sch.-Bip.

"*S. urticifolia* Thunb." as used by Knuth in Fedde Rep. Spec. Nov. Beibl. xliii. 698 (1928), as to both plants of Pittier = *S. WAGENERI* Hieron., as to *Jahn*, no. 553 = *S. ELATIOR* HBK., and as to *Jahn*, no. 27 = *S. RHOMBIFOLIA* var. *STEPHANOCOMA* Sch.-Bip., while the true *S. urticaefolia* Billb. in Thunb. is a Brazilian plant not as yet known to occur in Venezuela.

## THE STEVIAS OF ECUADOR.

WHILE not numerous the Stevias of Ecuador have a certain phyto-geographic interest, for this country is the meeting place for three quite different tendencies in the genus. To the north of Ecuador the species thus far known belong to what has been called *Eustevia* and have (with exceedingly few exceptions) a pappus consisting of a cycle of short *subequal* often connate scales with or without 1-5(-7) awns which about equal the corollas. To the south of the country, however, two other for the most part very easily differentiated pappus-tenden-

cies prevail and are illustrated by species which have (1) a short coroniform pappus of conspicuously *unequal* scales, and (2) a multi-*aristate* pappus, at least the adelphocarps having for the most part 9–20 awns each.

In Ecuador all three of these pappus-forms occur. Thus far little tendency on their part to break down or intergrade has been observed or recorded. Nevertheless, it seems best to base the keys in this genus as far as feasible upon characters of habit, foliage, or inflorescence rather than upon the distinctions of pappus. As in the case of the Venezuelan species, very much more material, especially from southern parts of the country, is needed before any satisfactory treatment of the Ecuadorian *Stevias* can be accomplished. The one here presented is obviously sketchy and can aim only at a usable, if pretty artificial, key for the distinction of such Ecuadorian members of the genus as have come to the attention of the writer during several years' study of the group.

#### KEY TO THE ECUADORIAN SPECIES OF STEVIA.

- a. Leaves scattered, narrowly oblanceolate. . . . . 1. *S. serrata*.
- a. Leaves (except sometimes the uppermost) distinctly opposite, broader, oblong to ovate. . . . . b.
- b. Pappus merely coroniform or at most 1–5-awned. . . . . c.
- c. Leaves closely sessile by a rounded somewhat amplexicaul base. . . . . 2. *S. tunguraguensis*.
- c. Leaves somewhat petioled or at least narrowed to a more or less cuneate base. . . . . d.
- d. Leaves rhombic-lanceolate, mostly less than half as wide as long; inflorescence beset with stipitate glands. . . . . e.
- e. Leaves of firmish texture, subchartaceous, much paler (almost whitened) beneath, acute to acuminate, sharply serrate. . . . . 3. *S. dianthoidea*.
- e. Leaves somewhat firm in texture but scarcely paler beneath, narrowed to a blunt or rounded tip, crenate. . . . . 4. *S. anisostemma*.
- d. Leaves rhombic-ovate to broadly ovate, usually at least half as wide as long, membranaceous. . . . . f.
- f. Inflorescence or its parts densely glomerate; pedicels short or none; involucre 4–5 mm. long, finely incurved-puberulent with glandless hairs (commonly interspersed with some sessile glands). . . . . 5. *S. rhombifolia*.
- f. Inflorescence loose; pedicels (at maturity) about equalling the involucre; phyllaries 7–8 mm. long, closely beset with stipitate glands. . . . . 6. *S. Bertholdii*.
- b. Pappus multiaristate; awns (of the adelphocarps) mostly 12–18 and about equalling the corollas. . . . . g.
- g. Middle and lower leaves broadly ovate, rather abruptly narrowed or rounded to a distinctly petioled base, coarsely villous on both surfaces, of soft texture. . . . . 7. *S. andina*.
- g. Middle and lower leaves lanceolate-ovate, acutish at both ends, sessile or nearly so, of firmly membranaceous texture, nearly glabrous beneath. . . . . 8. *S. crenata*.

1. **S. serrata** Cav. (See pp. 31 and 40.) Erect virgate perennial of characteristic habit; leaves mostly alternate, narrowly oblanceolate, crenate-serrate from about the middle, often proliferous in the axils; heads short-pedicelled in a rather dense convex fastigiately branched corymb; corollas white; adelphocarps mostly 3-awned.—Ic. 33, t. 355 (1797); Robinson, Contrib. Gray Herb. xc. 122 (1930), which see for further lit., synonym., distrib., and varietal subdivision. "*S. canescens* HBK." as used by Hieron. in Engl. Bot. Jahrb. xxix. 5 (1900).

PICHINCHA: on banks of the Machángara River near Quito, *Jameson* (U. S., fragm. Gr.); in the Chillo Valley and on banks of the Machángara River, *Jameson*, no. 619 (Par., small fragm. Gr.); on hills near Quito, *Sodiño*, no. 471 (Gr.); near Pifo on dry interandean hills, alt. 2650 m., *Mille*, no. 471 (K.); "Verde Cruz," alt. 2650 m., *Bro. Firmín*, no. 313 (Gr.).

[SOUTHWESTERN UNITED STATES, MEXICO, CENTRAL AMERICA, COLOMBIA, and VENEZUELA.]

2. **S. tunguraguensis** Hieron. Upright perennial herb, sometimes 1.5 m. high, leafy and usually simple to the inflorescence; stem terete, purplish, sparingly pubescent above, glabrate; leaves opposite, sessile by a broadish and sometimes amplexicaul base, crenate-serrate from below the middle to the gradually narrowed but at the tip often obtusish apex, 3(-5)-nerved from the base, dull green and scantily hirtellous or glabrate on both surfaces, becoming about 3 cm. long and half as wide; inflorescence terminal, mostly compound, its branches opposite, spreading-ascending, terminating in dense corymbously disposed glomerules; heads sessile or nearly so, about 12 mm. long; phyllaries 6.5-7 mm. long, acutish, often purple-tinged toward the tip, sparingly pubescent on the back; corollas said to be light rose; achenes homomorphous, each crowned with a scale-pappus, the scales conspicuously unequal, tending to be longer on one side and sometimes as much as 1.5 mm. in length.—Hieron. in Engl. Bot. Jahrb. xxviii. 563 (1901).

TUNGURAGUA: in bushy places about Baños on the lower slopes of the Volcano Tungurahua, alt. 1700-2500 m., *Lehmann*, no. 5000 (Brl., phot. Gr.).

An endemic species, to which *Spruce*, no. 5042 (Gen.), from the Andes of Ecuador (distributed as a new species and given an unpublished and now homonymic name), though slightly more pubescent, appears clearly referable.

3. **S. dianthoidea** Hieron. Erect virgate herbaceous perennial; stem terete, somewhat hirsute-villous but at length glabrate below, densely viscous-glandular in the inflorescence, 2-4 dm. high; leaves opposite, sessile by a narrowed base, subrhombic-lanceolate, acute to acuminate, serrate above the middle and perceptibly callous-margined, entire toward the base, dark-punctate, green and sparingly pubescent

above, much paler, indeed whitish and somewhat villous beneath, at most 4 cm. long and 1.5 cm. wide, of firmish membranaceous texture; inflorescence terminal, flattish, of small rather closely aggregated cymes of sessile or subsessile heads; phyllaries 6–6.5 mm. long, acute, purple, sparingly glandular-puberulent on the back; corollas deep purple; achenes all crowned with a pappus of very short scales (scarcely 0.3 mm. long), this being supplemented in 1–2 achenes of each head by a short awn scarcely 1 mm. in length.—Hieron. in Engl. Bot. Jahrb. xxix. 4 (1900).

PROVINCE NOT INDICATED: in bushy thickets at the eastern base of Mt. Piels, *Sodiro*, no. 5/4 (Brl., phot. Gr.).

Indigenous to Ecuador. A plant striking on account of the pale, almost white lower surface of the leaves.

4. **S. anisostemma** Turcz. Decumbent, curved-ascending, or suberect perennial herb, subsimple or several-stemmed almost from the base; stems terete, dark purple, sparingly to rather densely villous and toward the summit glandular-puberulent, 2–6 dm. high; leaves opposite, rhombic- or subelliptic-lanceolate, obtusish, crenate from the middle, entire toward the narrow sessile or subsessile base, 3-nerved, sparingly pubescent on both surfaces, of subcoriaceous texture, scarcely paler beneath, 3.5–4.5 cm. long, 8–18 mm. wide; the crenatures thickened and slightly callous on the margin; heads 11 mm. long, sessile or very shortly pedicelled in dense solitary and terminal or corymbously disposed glomerules; phyllaries lanceolate, acute, dark violet (sometimes almost nigrescent), glandular-puberulent, about 6 mm. long; corolla-tube and throat deep purple, the limb roseate to white; achenes homomorphous or nearly so, each crowned by erose scarious scales about 0.7 mm. long and at one side usually 2(1–3) short awns (1–2 mm. in length).—Bull. Soc. Imp. Nat. Mosc. xxiv. pt. 1, 167 (1851).

PICHINCHA: Quito, *Jameson*, no. 221 (K., phot. Gr.; U. S., where unnumbered); Mt. Pichincha, alt. 3300 m., *Bro. Firmín*, no. 684 (Gr.); in bushy interandean thickets, *Sodiro* (Gen., small fragm. Gr.).

An as yet little known endemic species from which the preceding one is but doubtfully separable.

5. **S. rhombifolia** HBK. (See pp. 33 and 41.) Erect perennial herb or somewhat frutescent plant, mostly 0.5–1 m. high; stem terete, incurved- or crisped-puberulent; leaves opposite (except the uppermost), rhombic-ovate, crenate-serrate, membranaceous, sessile by a narrowed base or shortly petioled, hirtellous to rather densely pubescent on both surfaces, mostly 3–7 cm. long, 1.5–3.5 cm. wide; heads small, mostly 6–9 mm. long, in dense corymbously disposed glomerules.

—Nov. Gen. et Spec. iv. 143 (1820); Robinson, Contrib. Gray Herb. xc. 132 (1930), which see for additional lit., synonym., vars., etc.

Var. **typica**. Achenes normally heteromorphous, 3–4 in each head bearing both a coroniform scale-pappus and 1–5 (mostly 2–3) awns each, the others having the scale-pappus but being exaristate.

Forma **normalis**. Corollas white or nearly so.—*S. quitensis* HBK. Nov. Gen. et Spec. iv. 145 (1820); Jameson, Syn. Pl. Aeq. ii. 79 (1865).

PICHINCHA: open places between Quito and Mt. "Burro Potrera," alt. about 2560 m., *Humboldt & Bonpland* (Par., phot. Gr.); along the torrent of Machángara near Quito, *Sodirol* (U. S.).

[MEXICO, CENTRAL AMERICA, COLOMBIA, and VENEZUELA.]

Forma **colorata** Robinson. Corolla-throat and tube a vivid rose or even purple, the limb pink to white.—Contrib. Gray Herb. xc. 133 (1930). "*S. quitensis* Humb. et Kunth" as used by Benth. Pl. Hartw. 197 (1845), not HBK. *S. Benthamiana* Hieron. in Engl. Bot. Jahrb. xxviii. 561 (1901).

PICHINCHA: near the bridge of Guápulo, *Hartweg*, no. 1090 (K., phot. Gr.); in interandean thickets at Guápulo, *Father Mille*, no. 473 (U. S., small fragm. Gr.).

[MEXICO, COLOMBIA.]

Var. **UNIARISTATA** (DC.) Sch.-Bip., with obsolescent awn-pappus, and var. **STEPHANOCOMA** Sch.-Bip., with achenes consistently exaristate, have as yet been unrecorded from Ecuador. That they occur and will ultimately be discovered in the country seems highly probable.

6. **S. Bertholdii** Robinson. Suberect perennial herb, 4 dm. high, spreadingly long-pilose; leaves opposite, shortly petiolate or the upper sessile, ovate, acutish or obtuse, crenate except toward the rounded or rather abruptly narrowed base, dull green and setulose above, a little paler and pilose on the nerves and veins beneath, 3–4 cm. long, 2–3 cm. wide; inflorescence an ovoid panicle, its spreading-ascending branches terminating in fastigiately divided cymes, the heads (about 12 mm. long) on pedicels about the length of the involucre and often falsely racemose (their pedicels opposite the corresponding bractlets); phyllaries linear-oblong, shortly pointed, 8 mm. long; corollas deep purple in throat and tube, the limb white; achenes homomorphous, coronulate with a short scale-pappus (about 0.4 mm. long).—Contrib. Gray Herb. xcvi. 4 (1931).

LOJA (?): Village of Sacaranga, *Berthold Seemann*, no. 658 in part (K., phot. Gr.). The type material mixed with the following habitually similar but technically quite different multiaristate species.

7. **S. andina** Robinson. Erect perennial (5 dm. or more in height) with rather closely the habit of *S. elatior* of more northern regions;



stem very shortly grayish-velvety or sometimes subglabrate, the inflorescence finely glandular-puberulent; leaves opposite, broadly ovate, obtuse, crenate, cuneately narrowed and entire toward the base; limb 2.5–5 cm. long, 2.3–3.5 cm. wide, membranaceous, puberulous above, paler and especially on the nerves and chief veins grayish-pubescent beneath, subsessile or often raised on a narrow cuneate-winged petiole; inflorescence ample, terminal, paniculate; pedicels usually exceeding the involucre; heads about 1 cm. long; phyllaries lance-linear, acute, glandular-puberulent, 5–6 mm. long; corollas reddish-purple as to throat and tube, the lobes white; achenes heteromorphous; adelphocarps each with an annulus surmounted by 9–12 awns about equalling the corolla; idiocarp with short scale-pappus and usually a single awn.—Contrib. Gray Herb. xcvi. 3 (1931).

LOJA: quebrada near the city of Loja, *Poortmann*, no. 138 (Par.); between Loja and San Lucas, alt. 2100–2600 m., *Hitchcock*, no. 21,475 (Gr., N. Y.); vicinity of Las Juntas, *Rose, Pachano & Rose*, no. 23,230 (Gr.). AZUAY: vicinity of Tablón de Oña, *Rose, Pachano & Rose*, no. 23,091 (Gr.).

[NORTHERN PERU.]

8. **S. crenata** Benth. Suberect or curved-ascending perennial herb, finely pubescent and toward the summit minutely and densely glandular-puberulent; leaves opposite, elliptic-lanceolate, narrowed to an obtusish apex, crenate above the middle, cuneate and entire almost from the middle to the subsessile base, obscurely puberulous above, nearly glabrous beneath, subchartaceous, 3.5–4.5 cm. long, 1.5–1.8 cm. wide, the margin callous-thickened especially around the blunt teeth; heads about 1 cm. long, borne in glomerules of varying size and density, sometimes sessile or nearly so, sometimes on slender pedicels 4–6 mm. in length, terminating opposite ascending rather elongated branches of the inflorescence; phyllaries acute, finely glandular-puberulent; corollas as to throat and tube purple, the limb white or nearly so; achenes heteromorphous, the adelphocarps bearing each 8–11 awns, the idiocarp exaristate but with a short crown of about 8 ovate to linear erose scales.—Pl. Hartw. 197 (1845); Jameson, Syn. Pl. Aeq. ii, 78 (1865), at least as to compiled char. but probably not as to all his material so referred.

PICHINCHA: at the village of Guápulo, *Hartweg*, no. 1089 (K., phot. Gr., N. Y., phot. Gr.); PROVINCE NOT STATED: Loma de Pucarita, *Rivet*, no. 396 (Par., phot. Gr.).

The typical material of this species had the glomerules rather loose and but 2–5-headed. On the other hand the material subsequently collected by Rivet has more compact and numerous headed glomerules. Though at first supposed to be a distinct plant, this latter

material agrees in all other respects so precisely with Hartweg's original specimens that the two collections may with confidence be regarded as conspecific.

#### IMPERFECTLY KNOWN SPECIES.

A *Stevia*, represented by the collection of *J. N. & G. Rose*, no. 23,825 (N. Y.), from Huigra in the southwestern part of the Province of Tungurahua is a plant not as yet satisfactorily referable to any of the here recognized Ecuadorian species. Unfortunately the material seen—a single lateral branch of the inflorescence—scarcely justifies its description as a novelty in a group so intricate and imperfectly understood as the Andean stevias. It has an irregular coroniform pappus of erose scales, some of them a little longer and slightly aristulate at the tip. Its leaves are rhombic-ovate, sharply serrate, sessile by a narrow base, and membranaceous in texture. The corollas have the throat and tube an almost orange red and the conspicuously villous limb yellowish-white, though these colors (quite unusual in the genus) may be solely the result of conditions during the drying. Better and more copious material is necessary in order to place this plant with any proper confidence.

#### TRANSFERRED TO SYNONYMY.

*S. Benthamiana* Hieron. in Engl. Bot. Jahrb. xxviii. 561 (1901) = *S. RHOMBIFOLIA* forma *COLORATA* Robinson.

"*S. canescens* Kunth" as used by Hieron. l. c. xxix. 5 (1900), not precisely of HBK. = *S. SERRATA* Cav.

"*S. quitensis* Kunth" as used by Benth. Pl. Hartw. 197 (1845), not quite of HBK. = *S. RHOMBIFOLIA* forma *COLORATA* Robinson.

CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCVII.

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A MONOGRAPH OF THE GENUS PEREZIA,  
SECTION ACOURTIA,

WITH A

PROVISIONAL KEY TO THE SECTION EUPEREZIA.

BY RIMO BACIGALUPI.

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1931.



A MONOGRAPH OF THE GENUS PEREZIA, SECTION  
ACOURTIA, WITH A PROVISIONAL KEY TO  
THE SECTION EUPEREZIA.

BY RIMO BACIGALUPI.

(Plates I-VII.)

THE need for a monographic treatment of the genus *Perezia* was brought to the writer's attention by Professor B. L. Robinson. The first species of the group was described one hundred and fifty years ago and the genus as such has been in existence since 1811. To it, there have been referred more than 150 species; yet most of these have never been keyed or mutually contrasted. Not since 1838, when De Candolle in the seventh volume of his *Prodromus* enumerated (under no less than six separate generic names) the then known elements of what today is called *Perezia* has the group been subjected to any general recension. At that comparatively early date only forty species had been described and of these, De Candolle reduced some ten to synonymy. Even of the remainder, no synopsis or key was attempted. Additions subsequent to its treatment in the *Prodromus* have more than trebled the extent of the genus.

That the South American *Perezias*, which form one of the two well defined sections, have been unduly multiplied is evident from a careful perusal of the many diagnoses. No less than thirty of these have been put forward by Rudolf Philippi, and it is especially in his work that considerable duplication of species is to be expected. Types or isotypes of most of the South American species described by the younger Linnaeus, Bonpland, Kunth, Lessing, D. Don, Hooker and Arnott, Weddell and others are still available and have been examined by the writer in the herbaria at Berlin-Dahlem, Geneva, Paris, Kew, and the collection of the Linnaean Society of London. However, until the types of Philippi in the National Museum of Chile at Santiago can be examined and critically compared, any attempt at a monographic treatment of the South American *Perezias* (i. e. § *Euperezia*) would be futile, inasmuch as authentic or even representative material of these Philippi species has been woefully absent from any of the American or European herbaria visited by the writer. Consequently, the task of revising § *Euperezia* must be postponed until the types in Chile can be examined by the monographer. Incidentally, it may be added that more abundant collections, particularly of Chilean species, are a great desideratum. In spite of these and a number of other obstacles, the writer has been able to prepare a key to those South

American species which are available in the Gray Herbarium. While relatively few in number, these represent the more widely ranging and therefore more commonly encountered species. For this reason, it is hoped that such a partial key will be more useful than would at first seem probable.

On the other hand, the mainly Mexican § *Acourtia*, though presenting problems of its own, is happily almost completely represented at the Gray Herbarium, and the few species which were not available there were very obligingly forwarded from the National Herbarium at the Smithsonian Institution in Washington and from the herbarium of Pomona College. It was therefore feasible to attempt a complete monographic treatment of § *Acourtia* which here is considered to consist of 44 species and 8 varieties. Of these, 4 species and as many varieties are proposed as new.

To Professor B. L. Robinson, under whose scholarly supervision this work was prosecuted and to whose advice and encouragement whatever merit this paper may possess is largely due, I tender my most heartfelt thanks. I would also express my appreciation of Dr. I. M. Johnston's friendly interest and stimulation. For help in the matter of photographing types, I am indebted to Dr. L. B. Smith. Dr. Maxon of the United States National Museum and Professor Munz of Pomona College were kind enough to forward types indispensable to the monographic study of the Mexican *Perezias*. Professor Briquet of the Conservatoire de Botanique in Geneva similarly authorized the transmittal of specimens which proved of invaluable aid. For assistance in bibliographical matters, I wish finally to express my gratefulness to Miss Ruth D. Sanderson, Librarian of the Gray Herbarium.

#### TAXONOMIC HISTORY OF THE GENUS.

During the thirty years prior to the publication of the generic name *Perezia*, seven of the South American species had been described and published, four of them under the soon defunct genus *Perdicium* and three temporarily referred to *Chaetanthera*. Of these the first, described in 1781, was *Perdicium magellanicum* Linn. f. Supplement 376, later to be made, appropriately enough, the type of the new genus *Perezia*. The Linnaean type is labelled merely "Forster," indicating certainly that the Fuegian plant had been collected by Johann Forster and his young son Georg, the botanists on board the "Resolution" during Cook's second expedition (1772-75). It reached the Linnaean herbarium through Abraham Bäck, "Linné's most intimate friend from whom he received occasional gifts of plants."

In 1790, M. Vahl, *Skript. af N. H. Selskab. i. pt. 2, pp. 8-15, pl. 5, 6, and 7*, described a number of *Perdicia*, three of which (*P. recurvatum*, *P. lactucoides*, and *P. squarrosus*) were later to be included in *Perezia*. The specimens had been collected in 1776 at Montevideo and the Straits of Magellan by Commerson, who accompanied the French naval expedition headed by de Bougainville, charged with the task of officially surrendering sovereignty over the Falkland Islands ("Iles Malouines") in favor of the Spaniards who had shortly prior thereto reclaimed them.

The extensive travels of Alexander von Humboldt and Aimé Bonpland next brought to light three more species of the nomenclatorially still non-existent genus *Perezia* from the high Andes of Peru and Ecuador. These were described and admirably illustrated in Humboldt and Bonpland's well known earlier work, *Pl. Aequin. ii.* (1809), 146, 168, 170, as *Chaetanthera pungens*, *C. multiflora* and *C. pinnatifida*.

In an article entitled "Disertacion sobre un Orden Nuevo de Plantas de la Clase de las Compuestas," published in the *Amenidades Naturales de las Españas, i.* (1811) 26-43, Mariano Lagasca characterized several new genera, many of them still current today, in his newly proposed "order" of bilabiate composites, the *Chaenanthophorae*. Among these was *Perezia*, based on *Perdicium magellanicum* Linn. f. and commemorating Lorenzo Perez of Toledo, a pharmacist and writer on materia medica in the sixteenth century. It is interesting to note that though Lagasca definitely based the genus on the Linnaean species, and doubtfully referred the three species of *Perdicium* described by Vahl to *Perezia*, he refrained from actually making any binomials under the newly erected genus.

That Augustin Pyramus de Candolle in 1812 was unaware of Lagasca's publication of *Perezia* a year earlier is clearly indicated in the foreword to his third "Mémoire" on the composites, devoted to the "Labiatiflores," *Ann. Mus. Par. xix.* (1812) 59-72, wherein he states that, although he had been in friendly communication with Lagasca for some time, untoward political conditions in Spain had interrupted that correspondence. It is not surprising, therefore, that no mention of Lagasca's *Perezia* is found in the tentative generic division of the labiate composites that follows and that, of the two genera proposed which refer to the present-day *Perezia*, one, *Clarionea*, attributed to an earlier unpublished communication by Lagasca, amounted to an inadvertent renaming of *Perezia*, since it was, like this genus, based on the Linnaean species. The other, *Homoianthus*, attributed to Bon-

pland and based on species separated from *Chaetanthera* because of their homomorphously hermaphrodite flowers clearly refers to *Chaetanthera multiflora*, *C. pungens*, and *C. pinnatifida*. Any possible doubt is at once dissipated by the diagnostic illustrations accompanying the genus *Homoianthus* which delineate the heads of the first two *Chaetantheras* mentioned.

Kunth, in H. B. K. Nov. Gen. et Sp. iv. (1820) 12-15, 309, published the generic name *Homanthis*, a renaming of *Homoianthus* Bonpl. To his new genus, Kunth relegated *Chaetanthera multiflora*, *C. pungens* and *C. pinnatifida*.

The first Mexican *Perezias* were described by La Llave and Lexarza in their pioneer pamphlet, *Novorum Vegetabilium Descriptiones*, i. (1824) 25-27. The binomials published were *Perezia turbinata*, *P. fruticosa*, *P. moschata* and *Perdicium cordatum*. Although it is quite likely that each of these names is properly referable to one or another of the Mexican *Perezias*, the indefiniteness of the diagnoses and the absence of authentic specimens make their application a matter of more than ordinary difficulty. As a result, only one of these binomials, *P. turbinata*, is in use today, and even here, its application is by no means certain. It is to be noted that in this Mexican publication, species are described for the first time under the generic name *Perezia*.

A partial review of the genus *Perezia* was included by Cassini in his *Dictionnaire des Sciences Naturelles*, xxxviii. 454 et seq. in 1825. He emphasized the fact that *Perezia* antedates *Clarionea*, and finding the latter name now available, employed it in a new sense, basing his new genus on *Perdicium lactucoides* Vahl. The newly erected *Clarionea* differed from *Perezia* in its fimbriose-pilose receptacle, since that of *Perdicium magellanicum* Linn. f. was described as naked. On p. 458 of the *Dictionnaire*, he described *Homoianthus echinulatus* which is, as he suspected, conspecific with *Perdicium recurvatum* of Vahl.

In *Linnaea* v. (1830) pp. 13-24, Lessing treated *Perezia* in the larger sense, reducing the generic segregates of De Candolle, Cassini, and Bonpland to synonymy, thus being the first to formulate the present-day generally recognized more or less homogeneous generic unit finally crystallized by Bentham and Hooker. Besides giving discriminating recognition to the species of his predecessors, he proposed three of his own, *P. squarrosa*, *P. cubataensis*, and *P. laevis*. He was evidently struck by the strong divergence in habit of the Mexican species of this genus which are here considered to comprise a well-defined section, for he based a new genus, *Dumerilia*, on a specimen of *Perezia* collected by Humboldt in Mexico. Unfortunately, the



specific identity of *Dumerilia Humboldtii* has not yet been clearly ascertainable.

From the Mexican collections of Sesse, Mociño, and Cervantes in 1788 secured by Lambert, David Don, Trans. Linn. Soc. xvi. (1830) 200-212, launched the genus *Acourtia*, first describing the plant known today as *Perezia formosa*. The Mexican *Perezia reticulata* was here first described as a *Proustia*. Under *Clarionia* (evidently an inadvertence for *Clarionea*) were described two Chilean species, the now current *P. spathulata* and *P. virens*, and the Mexican species *P. runcinata*. The Chilean specimens were among those collected by Ruiz and Pavón in 1777-1778. From the collections in the Chilean Andes of Dr. Gillies, Don, Phil. Mag. xi. (1832) 388, published, under *Clarionia*, two of the today better represented species of that region, *P. carthamoides* and *P. pilifera*. In the same year, Lessing, in his Synopsis Generum Compositarum (pp. 407-413), supplemented his previous account of *Perezia* by the diagnoses of seven new species secured during the explorations of Poeppig in Chile. From collections in the Andes by Gillies, Bridges, Mathews, Tweedie and others, Hooker and Arnott, Comp. Bot. Mag. i. (1835) 33-34, added three more species to this now adolescent genus.

In 1838 appeared the portion of De Candolle's Prodrômus treating the Mutisioid Composites, in which three Mexican species (*Acourtia rigida*, *A. hebeclada* and *Dumerilia Alamani*), one Chilean (*Perezia Gayana*), and another (*Acourtia microcephala*) from California (collected by Douglas) first saw the light of publication. Most of the segregates were here maintained, the 30 species of *Perezia* recognized being distributed among no less than six separate genera. These were based on the character of the receptacle and the outline and serial disposition of the phyllaries, characters at best of only specific value, for subsequently collected and described material has served to show that the distinctions upon which the segregates were based are very artificial and in no sense generic. Notwithstanding the work of Endlicher in his Genera Plantarum (pp. 492-3), issued in final form in 1840, in which he, like Lessing before him, reduced all the South American segregates, considering them at best sections and subsections, prominent Chilean workers on the group, among the foremost of whom were Julio Remy, who contributed the family *Compositae* to Claudio Gay's Flora Chilena, and Rudolf Philippi adopted and persisted in using the segregates *Clarionea*, *Homoianthus*, and *Perezia* in the restricted sense.

Conservative as his treatment of the South American segregates

was, Endlicher maintained the genus *Acourtia* of D. Don for the Mexican species. If habit alone be the criterion, the Mexican group certainly seems to deserve generic segregation, but unfortunately, truly diagnostic distinctions are difficult to find and still more difficult to maintain. Among those used by Endlicher, especially emphasized were the pappus-characters, and it requires only a short acquaintance with the Mexican *Perezias* to discover that the pappus-bristles are in no case penicillate, in very few species uniseriate and by no means consistently white as opposed to "flavidus." The differences in the character of the epigynous disc emphasized between the two groups is one that will not bear scrutiny, while a few of the Mexican species, contrary to Endlicher's assertions, do have short-bristly receptacles. The only difference mentioned by Endlicher that has not been disproved is the fact that in some (Endlicher would have it true for all) of the South American species, the marginal corollas appear radiate owing to a slight exaggeration of the ligulate lip, a distinction which only partially applies.

Baillon, *Hist. des Pl.* viii. (1882) 100–101, made the radical move of relegating the genus *Proustia* to *Perezia*, treating it as a section of the latter. Schultz Bipontinus, in *Seem. Bot. Herald* (1856) 315, had earlier referred the Mexican *Perezias* treated by him to *Trixis*. The work of O. Hoffmann in *Die Natürlichen Pflanzenfamilien* (hereafter referred to) clearly showed that both these genera were more properly considered distinct from *Perezia*. *Proustia*, with its diverse habit and apically rounded style-branches, papillose for the greater part of their length, is distinct enough to be included in a separate subtribe. *Trixis*, not so different from *Perezia* habitally, is differentiated by its 2-seriate involucre, consistently yellow corollas and apically tapering to beaked achenes.

Subsequent work on *Perezia* consisted for the most part of the description of new species. Chief among the contributors of supposed novelties was Rudolf Philippi who published, between 1856 and 1894, no less than 30 species. More than half of these appeared in *Anal. Univ. Chile* lxxxvii. (1894) 299–310. Among the other contributors were Remy, in C. Gay's *Flora Chilena* iii. (1847) 410–419; Weddell, *Chlor. And.* i. (1855) 39–43, who described many of the cespitose high Andean species of Bolivia and Peru from his own collections and those of d'Orbigny; Baker, in *Mart. Fl. Bras.* vi. pt. 3 (1884) 380; and more recently Otto Kuntze, Rusby, and Spegazzini.

The limits of the genus were finally set down in definite form by Bentham and Hooker in their monumental and still fundamental

Genera Plantarum ii. (1873) 500–501, their delimitation having been accepted by all subsequent workers in the group save Philippi and retained essentially unchanged in Engler and Prantl's *Die Natürlichen Pflanzenfamilien* iv. part 5 (1893) 349, by O. Hoffmann.

The only fairly general and usable treatment of the South American species of *Perezia* that has appeared since their enumeration in De Candolle's *Prodromus* is that in Carlos Reiche's *Flora of Chile* iv. (1905) 435–455. While quite evidently a compiled work and marred by many objectionable features, its key makes it an indispensable reference work since, as yet, the botanist who would try to identify a Chilean *Perezia* has nowhere else to turn unless he be willing to read through the overponderous mass of diagnoses which is his almost futile alternative.

Very few specimens of the Mexican species of *Perezia* came to the attention of the early workers on the genus. As already mentioned, until 1838 only twelve had been described. Of five of these, the exact identity never has been and probably never will be known with certainty. A new impetus was furnished by the explorations along the Mexican boundary and in northern Mexico in the late 40's and early 50's by such collectors as Fendler, Wright, and Thurber which brought new *Perezias* to the attention of Asa Gray. Three were described from Fendler's collections in *Pl. Fendl.* iv. (1849) 111, five from those of Wright in *Pl. Wright*, i. (1852) 127, and another from Thurber's collections in *Mem. Amer. Acad.* ser. 2. v. (1855) 324. Subsequent to this, in *Proc. Amer. Acad.* xv. (1880) 40–41 and *loc. cit.* xix. (1883) 58–61, five more were added from the collections of Parry and Palmer, Thomas Coulter, Dugès, Galeotti, Linden, Liebmann and Ghiesbreght. A tentative key, separating groups of species rather than individual species, published by Gray as a footnote in the periodical last mentioned, is the only key to the Mexican *Perezias* hitherto advanced.

The work of Gray was followed by that of Watson, who contributed three species, and of Rose, who published another. Between 1892 and 1909 several of the specimens received at the Gray Herbarium from that prince of collectors, C. G. Pringle, as well as a few from the collections of E. W. Nelson, Palmer, and Langlassé, formed the basis for ten additional interesting and highly local novelties characterized either separately or in collaboration by Robinson and Greenman. Finally, the subsequent explorations of Purpus disclosed several more which were described by T. S. Brandege.

The preceding brief account reviews in more or less summary

fashion the most important literature of the genus. Among those contributors not previously mentioned, most of whom treated *Perezia* floristically rather than taxonomically but a few of whom contributed one or more species each, are Lamarck, Sprengel, Meyen, Grisebach, Franchet, Gaudichaud, Walpers, d'Urville, J. D. Hooker, Hieronymus, Hemsley, Bartlett, Dusén, Skottsberg, de Wildeman, and Blake.

#### GEOGRAPHICAL DISTRIBUTION.

The *Mutisieae*, of which *Perezia* is one of the larger genera, form a preponderantly American group, denizens, with the notable exception of some species of *Mutisia*, of extra-tropical realms, either of the higher mountains in the tropics or of the more temperate plains of South America. Of the 57 genera admitted by O. Hoffmann in "Die Natürlichen Pflanzenfamilien," 40 are confined to the American continent and the Antilles, while the whole Subtribe *Nassauvinae* is peculiarly New World. The remaining 17 genera are largely restricted to central and southern Africa, and to a lesser degree, southern and eastern Asia.

*Perezia* is a strictly extratropical, for the greater part, austral American genus. Geographically, as well as taxonomically, the genus falls into two well marked groups. The species of the section *Acourtia* range from the coastal region of southern California to El Salvador and eastward to central Texas. They are restricted, for the most part, to the forested middle and higher slopes of the Mexican Sierra Madre and to the high plateau region east of the mountains in central and northern Mexico. Between El Salvador and southern Colombia occurs a gap of some 1300 miles in the distribution of *Perezia*. The § *Euperezia* is restricted to the middle and higher slopes of the Andes, ranging from southern Colombia, through Ecuador, Peru, Bolivia, and Chile to Tierra del Fuego, one of the Fuegian species even reaching the Falkland Islands.

By far the greater proportion of the species with this Andean distribution are depressed, acaulescent, more or less cespitose and, in a few cases, matted forms, some of the southernmost developing greatly thickened, coriaceous, much reduced, highly revolute linear leaves suggesting adaptation to more or less extreme xerophytic conditions. A limited few are found on the higher desert ranges which parallel the Andes south of Bolivia in the Argentine provinces of Jujuy, Salta, Catamarca, Tucumán, and Córdoba. Yet another small group of species, forming a habitually and, to a lesser degree, taxonomically distinct unit, are found, isolated from this essentially Andean group

and restricted to the plains from southern Brazil to the Rio Negro region in central Argentina. These are so few in number that they may be most conveniently enumerated at this point. They are *P. cubataensis*, *P. squarrosa*, *P. sonchifolia*, *P. Kingii*, and *P. laevis*.

Of the Andean types, the most widely distributed is *P. multiflora* with a northwesterly-southeasterly range of some 2600 miles from southern Colombia to Tacna in Chile, throughout western Bolivia and southward in the arid heights of the Argentine Republic to the province of Córdoba. The ranges of *Perezia pungens* and *P. pinnatifida* extend from Ecuador through Peru to Bolivia. *P. recurvata* is found in the extreme southern Andes in Fuegia and on the Falkland Islands. For the most part, the remaining species, certainly more than three-fourths of the § *Euperezia*, are much more restricted in their distribution, many being extremely local. Regions of high endemism occur in the central Chilean Andes, in Fuegia, and in the higher portions of the Bolivian and southern Peruvian Andes at elevations close to the snow-line.

Endemism is a marked feature of the Mexican Perezias as well. Of the 44 species admitted in the monograph of this section, fully twenty are as yet known either only from the original collections or from a very narrowly circumscribed area adjacent to the type locality. Nine are from the mountain slopes of the states of Nayarit and Jalisco, a region of generally recognized high endemism. Three more are from the upland fastnesses of Michoacán, two from Baja California, and three from the rugged region between Cuernavaca and northern Oaxaca, another focal point for endemism.

The more widely ranging species are those of the plateau region east of the Sierra Madre in northern and central Mexico. The most easterly ranging of these is the scapiform *P. runcinata* which reaches the Gulf coast in the region about the mouth of the Rio Grande. It ranges from south central Texas through Nuevo León and Coahuila southward to Hidalgo, occurring largely on the lower portions of the plateau area as well as on the coastal plain. The ranges of *P. nana* and *P. Wrightii*, approximately coextensive, are the largest of the entire group. These are species of the isolated ridges which break up the high central Mexican plateau and whose geographic ranges extend from northern Arizona (*P. Wrightii* extending somewhat more to the north than *P. nana*) eastward to west central Texas and southward to San Luis Potosí. The varieties of *P. rigida* are found only on the higher plateau close to the base of the Sierra Madre as well as in the main Cordillera, from central Chihuahua to Michoacán. *P. Thurberi*,

a Cordilleran species, extends in a narrow belt from southernmost Arizona to Guanajuato. A group of species, comprising *P. reticulata*, *P. Alamani*, *P. hebeclada*, *P. Dugesii* and *P. thyrsoides*, exhibit a more southerly distribution, occupying the lower mountain slopes that rise from the high southern plateau stretching from Guanajuato to Oaxaca. *P. nudicaulis*, the most southerly of the § *Acourtia*, is thus far known only from Guatemala and El Salvador. The few remaining which have not been accounted for are of restricted and widely isolated occurrence not coinciding with any of the general ranges just indicated.

#### GENERIC CONCEPT AND RELATIONSHIPS.

The vicissitudes through which *Perezia* passed during the early years of its existence have already been outlined in the section devoted to the taxonomic history of the genus. The concept here followed is that which has been adopted by workers on the group since the interpretations of Lessing, Endlicher and more especially of Asa Gray were ultimately expressed in full and definite form by Bentham and Hooker in their *Genera Plantarum*. Even though the emphasis was laid upon sets of characters other than those used by these authors, the subsequent work of O. Hoffmann in *Die Natürlichen Pflanzenfamilien* corroborated fully this earlier interpretation.

Most satisfactory of the characters which may be used to differentiate the genera are the form of the corollas and the character of the apex of and the distribution of the stigmatic papillae on the style-branches. The usefulness of this last character, that of the distribution of the papillae on the style-branches, was recognized by Hoffmann. On these characters, the tribe is divided by Hoffmann into three sufficiently natural subtribes. By making use of additional distinctions (e. g. the heads homogamous as opposed to heterogamous, anthers long-caudate or not, style-branches connate, connivent to the tip, or shortly spreading only at the apex, as opposed to divided), Bentham and Hooker succeeded in dividing the mutisioid genera into as many as five perhaps somewhat more natural subtribes. Hoffmann's treatment, however, has the virtue of greater convenience and clarity.

*Perezia* is relegated by these authors to the same and perhaps most closely interrelated of the subtribes—the *Nassauvieae* of Bentham and Hooker, or the *Nassauvinae* of Hoffmann. The members of this subtribe possess flattened, widely spreading and recurved style-branches whose stigmatic papillae are largely confined to the apex, or more rarely run down the margins of the style-branches for a short

distance as they sometimes do in *Perezia*. The corollas of the homogamously hermaphrodite flowers are always distinctly divided into the two highly dissimilar "lips." Occasionally the marginal corollas are radiatiform. This combination of characters quite effectively separates the *Nassauvinae* from either of the two other subtribes, the *Gochnatinae* and *Gerberinae* of Hoffmann, as well as from the other four subtribes of Bentham and Hooker.

Of the thirteen genera of the *Nassauvinae*, one, *Polyachyrus*, may be at once separated from the others by its 2-flowered heads, since the involucre of the other genera enclose from 4 to many flowers. Of these genera, two are distinguished by their sessile heads. These are *Nassauvia* and *Triptilion*. Of the remaining genera with pedunculate heads, two, *Jungia* and *Moscharia*, are at once separated by their chaffy receptacles, *Leuceria* and *Oxyphyllum* have plumose pappus-bristles, leaving the group of genera with simple pappus-bristles, of which *Perezia* is one, still to be accounted for. Three of these have truncate style-branches. These are *Perezia*, *Trixis*, and *Cleanthes*. *Trixis* is distinguished by its consistently yellow corollas and mostly 1-2-seriate involucre, *Cleanthes* by its mostly white corollas and uni-seriate involucre, *Perezia* by its mostly white, blue, purple to pink corollas and 3- to more usually many-seriate involucre. *Leunisia*, a genus with yellow corollas and many-seriate involucre, is distinguished from these three genera by its rounded style-tips.

#### CLASSIFICATORY DIFFICULTIES.

Since the main portion of these studies on *Perezia* is devoted to a monographic treatment of § *Acourtia*, it is to this section that the following few remarks have reference.

Though the species in most cases are, in their vegetative characters, clearly differentiated, the discovery of trustworthy diagnostic characters proved difficult. In the search for these, receptacle, achenes, pappus, and corollas were in turn carefully studied. The corolla, as was to be expected, exhibited very little variation. In only one case, that of *P. collina*, was the corolla of any value as a keying character, and there it is anomalous for the genus. The receptacles, pappus, and achenes, on the other hand, were not nearly so stereotyped but the differences were found to be too inconsistent to be considered of any important diagnostic value. The shape of the achenes, in the great majority of the species, is highly variable, depending largely upon the amount of compression they have had to withstand from their neighbors. Immature achenes were almost always found to be more

glandular or hirsutulous than the fully matured ones in any given species. The same difference was found to apply to the receptacle. The variations in the pappus were found to be few and in no case usable, consisting mostly of color-differences, probably due in part to age, and in the number of series of the bristles, a character thought to be of generic importance by early writers. The pappus in a single flower could be found to vary from 1-seriate on the portions of the often very uneven epigynous disc that were narrowest, to 3-seriate where it happened to be especially wide. Only the phyllaries remained to be exploited and, fortunately, these were found to be most useful in dividing the section into its primary species-groups. Except in the case of only three species, the character of the apex of the phyllaries is consistently either on the one hand rounded to obtuse or on the other acute. The acute apex is that characteristic of the majority of the species. In a few of these, the edges of the phyllaries taper gradually from near the base, forming a very acute apex with or without a slight terminal acumination. This type of phyllary has been characterized as lance-subulate. The majority of the remaining species have the phyllaries of an oblong type, the sides being parallel or even narrowing to the base, almost always with an acuminate tip. Many of the species have the phyllaries either consistently glabrous or glandular-puberulent. In the case of the three species falling not clearly into either of the two main categories (i. e. with phyllaries either unmistakably acute or obtuse), supplementary characters have been found useful. Among these is that of the number of florets in the heads, first used by Asa Gray, a character here used to a very limited extent and only when the disparity in number was considerable. Once these primary groups were successfully separated, the mutual contrasting of the species so thrown together proved a relatively easy task.

#### ECONOMIC USES.

So far as known to the writer, no *Perezia* except *P. multiflora* (see Gard. Chron., ser. 3, xc. 67. 1931) has ever been used as an ornamental, nor are any of the species of economic importance. Among the Mexican Indians, however, various species of *Perezia* have been in high regard because of their medicinal properties. According to José Ramírez, Dat. Mat. Med. i. (1894) 63-78, the Indians used an infusion of the underground portions as a violent purgative in cases of tropical fever. The various species were known collectively under the native name "Pipitzahoac," those species which are conspicuously glandular ap-



parently being those most sought. Definite reference was made by Ramírez to *P. adnata* (*P. Alamani* var. *adnata*), while on the label of a specimen of *P. oxylepis*, Schaffner made a note of its purgative properties.

According to a plant-label of Palmer's, the matted woolly hairs at the base of the stem of *P. Wrightii* were used by the Indians as a styptic.

#### DIAGNOSES OF NOVELTIES.

In order to preserve unity of presentation, it seems best to describe here the novelties of § *Acourtia* treated in the monograph before their presentation therein.

***Perezia scapiformis***, spec. nov. Herba perennis scapiformis caulibus floriferis sparse bracteatis sat altis rigidis insuper corymbosoramosis et foliis radicalibus ex rhizomate erecto vel horizontali sericeo-tomentoso; radices fibrosae diametro 1.5 mm.; folia omnia radicalia petiolata rigida chartaceo-coriacea pallide viridia saepe purpureo-tincta haud reticulata venis lateralibus haud prominentibus supra saepe leviter scabrida nervo medio pilis longis deciduis vestito ceterum glabra inaequalissime divaricateque mucronato-dentata vel subpectinato-denticulata plerumque ciliolata laminis interdum indivisis orbiculari-obovatis vel ovali-obovatis, 3-5 cm. longis, 3-3.5 cm. latis, saepius oblanceolatis magis minusve lyrato-lobatis vel lyrato-partitis, 6-10 cm. longis, 18-30 mm. latis; petioli 1.5-7 cm. plerumque 1.5-2.5 cm. longi, lamina decurrente praesertim insuper anguste alati sericeo-lanati demum glabri; caules floriferi erecti rigidi, diam. 1.3-2.3 mm., subnudi bracteas sparsas parvas gerentes, 2.5-6 dm. alti, striati laeves glabri insuper paniculati vel corymbosi; scapi bracteae basi latae lineari-lanceolatae magis minusve arachnoideae; pedunculi laxè divaricati arachnoidei, 1.5-3 cm. longi; capitula haud congesta late campanulata basi rotundata circa 30-flora, 10-13 mm. alta; involucri squamae 4-seriales rigidae induratae subcoriaceae pallide virides insuper plerumque atropurpureae, exteriores plerumque acuminatae lanceolatae vel lanceolato-ovatae, omnes arachnoideae magis minusve apiculatae, mediae interioresque apice rotundatae vel angustatae obtusiusculaeque oblongae utroque leviter angustatae; corolla brevis glabriuscula, 6 mm. longa; pappi setae molles tenuissimae sordide albae 2-seriales ad apicem versus parum clavellato-incrassatae; achenia circa 4 mm. longa, lineari-oblonga atrobrunnea pilis brevibus albidis dense adpresso-hirsutula insuper parum glandulosa disco epigyno parvo; receptaculum convexum vix scrobiculatum. (Plate I.)

MEXICO: OAXACA: dry, calcareous hills, Las Sedas, elev. about 2000 m., Pringle, no. 6015 (TYPE, Gr. and isotype, N. Y.). PUEBLA: Tehuacán, Purpus,

no. 5613 (Gr., N. Y.). PUEBLA OR OAXACA: Cerro de Matzize, *Purpus*, no. 3923 (Gr., N. Y.).

Heretofore referred to Dr. Gray's *P. nudicaulis* but quite distinct from that species. In *P. nudicaulis*, all the phyllaries, even the outermost, are blunt and rounded at the apex, narrowly scarious on the margins, glabrous dorsally and occasionally obscurely ciliolate toward the tips. In *P. scapiformis*, many of the outer phyllaries are acuminate-tipped, and these, as well as the blunt to narrowed and obtusish inner phyllaries, are somewhat apiculate and more or less arachnoid on the backs and margins. In addition to these distinctions in the phyllaries (later emphasized in the key to the species), there are a number of others to which attention may here be appropriately called. The leaves of *P. nudicaulis* (particularly the terminal lobe) are usually much wider, regularly triangular- to sinuate-dentate and runcinately pinnatifid below the middle. Those of *P. scapiformis* are more or less lyrate-lobed, the segments ascending rather than retrorse, the margin ranging from very unequally and divaricately dentate to subpectinately denticulate. Again, the heads of *P. nudicaulis* are 11-13-flowered; those of *P. scapiformis* are about 30-flowered.

***Perezia lobulata***, spec. nov. (*P. patens* var.  $\gamma$ . Gray, Pl. Wright. i. (1852) 127.) Herba perennis altitudine ignota verisimiliter sat alta ac robusta. Caulis teres glaberrimus laevis paullo flexuosus stramineus vel saturate purpureus diametro 2.5-5 mm.; folia sessilia oblonga rigida tenui-coriacea utrinque scabrida crebre reticulata supra parum glaucescentia apice leviter acuminata basi haud angustata cordato-amplexicaulia, alia auricula foliorum majorum ampliatorum saepe super aliam excedens, crebre et saepe inaequaliter spinuloso-denticulata ad basem versus interdum retrorso-denticulata vel grosse runcinato-dentata majora sinuate runcinato-lobulata vel runcinato-lobata apicibus lorum plerumque acuminato-dentatis, ea caulis 9-11 cm. longa, 27-40 mm. lata, ea ramulorum 4-6.5 cm. longa, 12-20 mm. lata; rami divaricatim patentes 16-45 cm. longi, foliosi graciles ad apices versus magis magisque densius pilulis articulatis crispisque pubescentes et valdius flexuosi; capitula 2-3 in cymulas ad apices ramulorum foliosorum versus glomerulata 15-flora ca. 18 mm. longa; involucri campanulatum 11-14 mm. longum; involucri squamae rigidiusculae ad basem versus induratae 4-5-seriales pallide virides ad apicem versus saepe atropurpureotinctae magis minusve sericeo-ciliolatae, exteriores lanceolato-ovatae interdum leviter acuminatae interiores attenuatae oblongo-lanceolatae acutae vel acutiusculae haud acuminatae apice saepe producto et involuto incurvatoque rarius

obtusiusculae, 10–12 mm. longae; corolla rosea ca. 11 mm. longa tubo insuper sparse glanduloso-punctulato lobis duobus linearibus interioribus ad basem versus glanduloso-ciliolatis; pappus rigidiusculus 2–3-serialis sordide albidus; achenia lineari-fusiformia atrobrunnea dense glanduloso-punctulata ca. 5 mm. longa, disco epigyno angustissimo; receptaculum paullo concavum haud profunde scrobiculatum sparsissime glandulosum ceterum glabrum. (Plate II.)

MEXICO: OAXACA: mountains, San Juan del Estado, alt. about 1920 m. *Lucius C. Smith*, no. 888 (TYPE, Gr.). NO STATE SPECIFIED: "Mexico. Fl. rose, lemon-scented," *Galeotti*, no. 2001 (type of *P. patens* var.  $\gamma$ . Gray).

A species of the habit of and related to *P. carpholepis* (Sch. Bip.) Gray, but to be distinguished from it by its thicker, coriaceous, runcinate-lobulate to runcinately lobed cauline leaves, its much narrower, more attenuate, acutish, often involute and incurved inner phyllaries and 15-flowered heads.

***Perezia dissiticeps***, spec. nov. Herba perennis glabra ca. 10 dm. alta; caulis simplex teretiusculus sat foliosus glaber laevis striato-angularis pallide brunneus glaucescens insuper parum flexuosus laxe adscendenterque in inflorescentiam ramosus; folia sessilia tenui-chartacea reticulata pallide viridia praesertim subtus glauca vel glaucescentia supra subnitidula, caulina oblonga obtusa mucronulata basi haud vel vix angustata inaequaliter spinuloso-dentata, 5.5–9 cm. longa, 16–25 mm. lata, ea ramulorum oblanceolata spinuloso-denticulata ad basem breviter rotundatam vel subsagittatam angustata, 2.5–6 cm. longa, 7–18 mm. lata; inflorescentiae ramuli tenues glabri subnudi bracteas minimas sparsissimas adscendentes lanceolato-subulatas minutim ciliolatas gerentes; pedunculi divaricati, 1.5–6 (plerumque 2–4) cm. longi, ad apicem summum minutim glandulosi; capitula 14–18-flora, 12–15 mm. longa; involucrium (3–) 4-seriale campanulatum 7–8 mm. longum; involucri squamae dorso glabratae sericeo-ciliolatae, exteriores patentibus lanceolato-oblongae, interiores oblongae ad basem versus valde incrassatae et parum angustatae apice purpureotincta sat variabiles obtusae saepe mucronulatae vel acutiusculae; corolla rosea, 8 mm. longa, segmentis ad basem versus et fauce tubi resinoso-punctulatis; pappus mollis sat albidus 1–2-serialis setis haud copiosis apice interdum parum incrassatis; achenia brunnea lineari-oblonga sparse vel interdum dense resinoso-punctulata, ca. 3 mm. longa; receptaculum planiusculum sat profunde alveolatum resinoso-punctulatum. (Plate III.)

MEXICO: SAN LUIS POTOSÍ: Sierra Tablón, Minas de San Rafael, *Purpus*, no. 5018 (TYPE, Gr. and isotype, N. Y.).

This novelty is most closely related to *P. Wrightii* Gray. It may be distinguished from that species by its absolutely glabrous, glaucescent and somewhat shining leaves and its distant, more abundantly flowered heads not in glomerulate cymules.

***Perezia aspera***, spec. nov. Herba perennis rigidiuscula altitudine 4 dm. vel ultra; caulis simplex insuper ramosus teretiusculus diam. 1.5–2 mm. striatus glaber laevis in axillis foliorum tantum pilis pallide brunneis sericeo-tomentosus flexuosus stramineus plerumque purpureotinctus; folia sessilia vel subsessilia rigido-coriacea oblongo-lanceolata apice rigido-mucronata basi cordato-amplexicaulia sat reticulata glabriuscula divaricatim et irregulariter et pungenter dentata minutim calloso-ciliolata, 4.5–5 cm. longa, 1.5–2 cm. lata, superiora minora oblonga, 2–3 cm. longa, 7–10 mm. lata; capitula 1–3 subcongesta 2–2.3 cm. longa 30-flora ad apices ramulorum elongatorum foliosorum adscendentium gesta; pedunculi 8–20 mm. longi, plerumque bracteas 9–10 mm. longas adscendenti-patentes anguste lanceolatas vel lineari-subulatas glabras gerentes; involucreum campanulatum basi obtusum ca. 3-seriale 20–23 mm. longum, pappum aequante; involucri squamae basi tantum imbricatae rigidaeque haud induratae 2–2.3 mm. latae attenuato-subulatae acutissimae glabrae striatae pallide virides ad apices purpureotinctas versus interdum minutissime ciliolatae interiores 17–19 mm. longae, exteriores rigidiores 8–10 mm. longae; corollae segmenta ad bases versus sparse glanduloso-ciliolata, corolla ceterum glabra rosea, 14–15 mm. longa; pappus mollis sordide albidus setis tenuissimis 2–3-serialibus discum epigynum infundibuliformem coronantibus; achenia linearia minutim resinosa ca. 5 mm. longa; receptaculum convexum profunde alveolatum membranis inter alveolos fimbriato-glandulosis. (Plate IV.)

MEXICO: COAHUILA: Saltillo, alt. 1650–1800 meters (coll. Bro. Nil, no. 55, Dec., 1908), *Arsène*, no. 3395 (TYPE, Gr.).

This hitherto undescribed *Perezia* is probably most closely related to *P. Purpusii*, differing from that species in not having its peduncles imbricate-squamose, in its glabrate to glabrous, fewer-seried, much more loosely imbricated and thinner phyllaries, about 30-flowered (as opposed to 40–60-flowered) heads, in not having an acute base to the involucre and in the absence of bristles on the receptacle.

PEREZIA RIGIDA (DC.) Gray var. **linearifolia**, var. nov. Flosculi in capitulis 14; folia caulina superiora lineari-oblonga supra partem mediam paullo ampliata aliquantulum arcuata valde conduplicata; corollae plerumque glabratae vel rarius sparsissime glanduloso-punctulatae; ceterum ut apud varietatem typicam. (Plate V.)

MEXICO: GUANAXUATO: Guanaxuato, *Dugès*. JALISCO: Rio Blanco, Oct., 1886, *Palmer*, no. 661 (Gr., N. Y.); cool hillsides near Guadalajara, *Pringle*, no. 1860 (TYPE, Gr. and isotype, N. Y.); rocky bluffs of a barranca near Guadalajara, elev. 1525 m., *Pringle*, no. 9950 (N. Y.).

PEREZIA RIGIDA (DC.) Gray var. **acuminata**, var. nov. Folia ac habitus ut apud varietatem linearifoliam; involucris squamae angustae praesertim intimae plerumque oblanceolatae supra partem mediam paullo ampliatae sericeo-ciliatae apice acutae abrupte acuminatae; flosculi in capitulis 9; corollae ut apud varietatem linearifoliam; achenia late fusiformia, 6 mm. longa, 1-1.5 mm. lata. (Plate VI.)

MEXICO: JALISCO: rocky bluffs of a barranca near Guadalajara, elev. 1525 m., *Pringle*, no. 9950 (TYPE, Gr.).

PEREZIA MONTANA Rose var. **intermedia**, var. nov. Inflorescentia e cymulis laxis 2-3-capitulis composita; pedunculi nudiusculi squamam unicam gerentes vel nudi, glabri vel glabriusculi; involucrum campanulatum basi rotundatum vel obtusum, 9-10 mm. longum; involucris squamae interiores oblongae basi haud angustatae apice obtusae vel rotundatae interdum minutissime mucronulatae; ceterum ut apud varietatem typicam.

MEXICO: DURANGO: Santiago Papasquiario, *Palmer* (1896), no. 59 (TYPE, Gr.).

Seemingly intermediate between *P. montana* var. *typica* and *P. rigida* var. *typica*. The phyllaries and involucre are almost identically those of the latter species, while the general habit conforms very closely with that of *P. montana*.

PEREZIA DUGESII Gray var. **pilulosa**, var. nov. A *Perezia Dugesii* var. *typica* foliis prominentius reticulatis valde grossius inaequaliusque dentatis obovato-spathulatis 9-11.5 cm. longis 5-7 mm. latis, corolla densius glanduloso-punctulata et acheniis dense adpresso-hirsutis differt. (Plate VII.)

The veins and veinlets of the lower leaf-surfaces are often much more strikingly hirsutulous than in var. *typica*.

MEXICO: OAXACA: below Jayacatlán, elev. about 1100 m., *Lucius C. Smith*, no. 373 (TYPE, Gr.). VERA CRUZ: Orizaba, *Müller*, 1855 (N. Y.).

In the course of these studies, specimens were examined from the herbarium of the New York Botanical Garden and the herbarium of Pomona College, while a few types were forwarded from the United States National Herbarium. These have been so indicated. Unless definitely stated to the contrary, the specimens quoted without evidence of source are those of the Gray Herbarium. In the citation of

specimens examined, the names of the herbaria referred to are abbreviated as follows: Gr. = Gray Herbarium; P. C. = Herbarium of Pomona College; N. Y. = Herbarium of the New York Botanical Garden; U. S. = United States National Herbarium.

#### TAXONOMIC ACCOUNT.

**Perezia** Lagasca, Amen. Nat. i. (1811) 31.

Heads homogamous, mostly many-flowered, occurring singly on a scapiform stem or in loose to dense, bracteate to leafy, paniculate, corymbose or thyrsoid cymes; phyllaries in 3-many series, broadly oblong or ovate to linear-subulate, acute to obtuse, often mucronulate, the inner sometimes with very narrow to wide scarious margins, the outer occasionally pungently ciliate-denticulate to ciliate-dentate, rarely pinnatisect, often merely ciliate to ciliolate, green, often reddish- or purplish-tinged, herbaceous and lax to indurate, rigid or subcoriaceous, loosely to densely imbricated, glabrous to densely glandular, less often woolly or arachnoid; flowers all hermaphrodite and fertile; corollas pink, purple, blue or white (yellow only in 2 species), glabrous or the upper portion of the tube often resinous-punctulate to stipitate-glandular, three of the segments coalesced to form the outer (lower) ligulate lip, that of the marginal corollas often longer and wider than that of the others, all terminally 3-dentate, the teeth sometimes minutely papillose, two inner (upper) segments free or readily separable, terminally often minutely papillose, equalling the ligulate lip or somewhat to much shorter, erect to highly cirrhiform, often almost to the base (in *P. collina*, the segments 5, subequal, linear); each of the anthers with two long tails from the base, tipped by elongated, more or less connate, somewhat rigid appendages colored above like the corolla; style terete, glabrous, deeply divided at the summit into two recurved branches, these flattened, with the stigmatic papillae collected at the truncate apices so that these appear penicillate, or sometimes running a short distance down the margins of the flattened stylar branches; achenes linear-cylindric to fusiform, sometimes costulate, glabrous to resinous-punctulate or stipitate-glandular, often sparsely to abundantly hirsutulous as well with stiff upwardly directed whitish trichomes (these, in one species, shortly forked at the summit), greyish-brown to dark brown or rarely even black, never rostrate but crowned by a very slightly expanded to relatively broad disc upon which the pappus stands; pappus bright white to tawny or bronze-purplish, of more or less abundant, simple, scabrous, soft to somewhat rigid bristles, usually in 1-2 (sometimes partly in 3) series, sometimes

fused at their bases; receptacle merely areolate to scrobiculate or even alveolar, sometimes with the membranes between the alveolae fimbriate or glandular-fimbriate, more rarely short-bristly, often merely resinous-punctulate.

West American, mostly short to dwarfed Cordilleran perennials, or more rarely annuals, with herbaceous to subligneous aerial shoots, the entire to pinnately parted leaves in a basal rosette and the flowering stem scapiform, or the plants tall, caulescent, the leaves alternate, mostly sessile, often crowded, sometimes densely so; the more or less woody caudex often covered by a dense felty mass of rust-colored wool.

#### KEY TO THE SECTIONS.

Flowers homomorphous, the ligulate lip of the marginal flowers never any broader or longer than that of the inner ones; linear segments of the upper (inner) lip of the corolla quite as long as or very little shorter than the lower ligulate lip, rarely cirrhiform; corollas lavender-pink (maroon in one species); phyllaries entire; basal caudex bearing a usually dense mass of rust-colored woolly hairs. Entirely North American, not known south of Guatemala and El Salvador..... § *Acourtia*.

Flowers often heteromorphous, the ligulate lip of the marginal corollas somewhat to much broader and longer than that of the inner ones; linear segments of the upper lip of the corolla usually much shorter than the lower ligulate lip, usually highly cirrhiform, sometimes to the base; corollas mostly blue or white, varying to purple, rose and, in 2 species, yellow; basal caudex glabrous or at least not densely rusty-tomentose. Entirely South American, confined, for the most part, to the higher Andes from southern Colombia to Tierra del Fuego.... § *Euperezia*.

§ *Acourtia* Gray, Proc. Amer. Acad. xix. (1883) 58, where indicated by species included; Syn. Fl. N. Amer. ed. 1. i. pt. 2 (1884) 408, where characterized.

Erect, mostly glabrate or resinous-punctulate, caulescent perennials, always with the base of the stem more or less rusty-woolly, for the most part tall and robust, the sometimes several usually very leafy stems simple below the terminal leafy or leafy-bracteate inflorescence, sometimes unbranched and terminated by a single large head, the alternate, mostly sessile, usually ample leaves thin-chartaceous to rigid and thick-coriaceous, generally finely reticulate, mostly oblong and broadly cordate-amplexicaul, varying from suborbicular to lance-attenuate, acute to obtuse, undivided, usually spinulose-denticulate to spinulose-dentate; or much less usually scapiform, the moderately tall, almost naked flowering stems mostly paniculately to less usually

corymbosely branched above, the leaves basal, more or less rosulate, semi-erect, petiolate, mostly pinnately to lyrate divided; heads homogamous, often glomerate, 4–60 (or more) -flowered (mostly 8–15-flowered); involucre obconic, turbinate or campanulate, rarely widely hemispheric and truncate at the base, 3–8-seried; phyllaries mostly more or less rigid, indurate at least at the base, entire, often sericeo-ciliate, more rarely arachnoid to tomentose on the margins, mostly glabrous or glandular-puberulent, the outer mostly ovate, the inner, in general, oblong to lance-subulate, the tips sometimes mucronulate, rounded and obtuse to attenuate-acuminate and very acute, stramineous to green, very often purplish on the exposed portions; corollas homomorphous, mostly lavender-pink and glabrous, the upper portion of the tube often sparingly resinous-punctulate, the inner 2-partite lip quite or almost as long as the ligulate outer one, very little, if at all, cirrhiform; anthers, achenes, pappus and receptacle as characterized in the generic diagnosis. The scabrous processes of the pappus-bristles are not infrequently denser toward the tips so that they appear slightly clavellate-thickened above—*Acourtia* D. Don, Trans. Linn. Soc. xvi. (1830) 203; *Clarionea* § *Palesia* D. Don, in part, loc. cit., 207; *Dumerilia* Less. Linnaea v. (1830) 13, not Lag. nor DC.; *Proustia* § *Thelecarpaea* DC. Prodr. vii. (1838) 27.

## KEY TO THE SPECIES.

- A. True foliage arising from the caudex, the flowering stems scapiform, but often bearing bracteal or scale-like leaves. . . . B.
- B. Phyllaries acuminate, lanceolate or narrowly oblanceolate to obovate. . . . C.
- C. Phyllaries glandular-puberulent, mostly irregularly ciliate, linear-lanceolate, the inner setaceous-acuminate; flowering stem 1(–3)-headed. . . . 1. *P. runcinata*.
- C. Phyllaries glabrous, short-acuminate, the inner narrowly oblanceolate, the outer obovate; flowering stem widely branching, many-headed. . . . 2. *P. nudiuscula*.
- B. Phyllaries obtusish to rounded at the apex, oblong to linear, only the shortest outermost occasionally very shortly acuminate. . . . D.
- D. At least the short outermost phyllaries somewhat apiculate and often shortly cuspidate-acuminate; the larger phyllaries conspicuously pubescent at least on the margin, this not scarious. . . . E.
- E. Inner phyllaries at most mucronulate from the blunt apex, sericeous on the margin, otherwise glabrous, uniformly thin-membranaceous; heads at anthesis narrowly campanulate, 15–20 mm. high. . . . 3. *P. umbratilis*.
- E. Inner phyllaries, as well as the outer, mostly apiculate from a blunt to narrowed and obtusish summit, especially the outer arachnoid on the back and margin, all firm and subcoriaceous; heads at anthesis broadly campanulate, 10–13 mm. high. . . . 4. *P. scapiformis*.



- D. All the phyllaries, even the outermost, blunt and rounded at the apex, narrowly scarious on the margins, glabrous, sometimes obscurely ciliolate toward the tip . . . . . 5. *P. nudicaulis*.
- A. True foliage mostly on the flowering stems and branches; plants caulescent, often with many leafy shoots from the caudex . . . . F.
- F. Cauline leaves runcinately lobed, those of the branches often retrorsely denticulate to coarsely runcinate-dentate toward the base, rigid and thin-coriaceous; innermost phyllaries often with a produced and incurved, somewhat involute tip . . . . . 6. *P. lobulata*.
- F. Cauline leaves not lobed, the dentations never retrorse; phyllaries neither involute nor incurved at the tip . . . . G.
- G. Phyllaries squarrose at tip, herbaceous . . . . . 7. *P. Lozani*.
- G. Phyllaries not squarrose, scarious to indurate, more or less rigid . . . . H.
- H. Phyllaries obtuse to rounded at the apex, often mucronulate or even mucronate, never in the least acuminate, the innermost rarely acutish . . . . I.
- I. Inflorescences isolated, several to many, consisting of 2-4-headed glomerules terminating the upper leafy branchlets; leaves broadly cordate-clasping, oblong to ovate . . . . . 8. *P. carpholepis*.
- I. Inflorescence essentially single and terminal . . . . J.
- J. Heads 4-6 (mostly 5)-flowered; leaves not cordate-clasping, oblanceolate to oblong-spatulate, usually narrowed to the base, or more rarely subtruncate to slightly sagittate or even the least bit auriculate at the base; cymules aggregated into a round-topped pyramidal thyrse . . . . . 9. *P. reticulata*.
- J. Heads 8-35-flowered; leaves more or less cordate-clasping, at least the cauline not narrowed to the base . . . . K.
- K. Heads 30-35-flowered, broadly campanulate, at least 2 cm. broad, 2.5-3 cm. high, on rigid stoutish peduncles; inflorescence sparse, 5-10-headed . . . . . 10. *P. Nelsonii*.
- K. Heads 8-22-flowered, narrowly campanulate to turbinate or obconic, at most 1.5 cm. (usually 6-10 mm.) broad . . . . L.
- L. Leaves thick-coriaceous or rigid-cartilaginous, glabrous . . . . M.
- M. Heads 19-22-flowered; leaves rigid-cartilaginous, spiny-toothed, the teeth narrowly triangular, 2-3.5 mm. long . . . . . 15. *P. montana* var. *intermedia*.
- M. Heads 9-14-flowered; leaves thickly coriaceous, at most spinulose-dentate . . . . N.
- N. Leaves suborbicular to oblong-obovate; phyllaries often with a more or less rusty tomentum on the margin . . . . . 16. *P. platyphylla*.
- N. Leaves elliptic- to linear-oblong, sometimes a little spatulate; phyllaries often minutely glandular-ciliolate or less often sericeo-ciliate . . . . . 17. *P. rigida*.
- L. Leaves neither thick-coriaceous nor rigid-

- cartilaginous, mostly thin and chartaceous to less often rigid-chartaceous. . . . *O*.
- O*. Leaves glabrous; heads not glomerulate, on long peduncles. . . . *P*.
- P*. Heads narrowly campanulate, 15–19 mm. high, on lax, thin, wiry peduncles; leaves not glaucous, rigid-chartaceous; phyllaries in 5–6 series. . . . 11. *P. patens*.
- P*. Heads broadly campanulate, 12–15 mm. high, on rigid, slender but not wiry peduncles; leaves glaucous to glaucescent at least on the midribs, thin-chartaceous; phyllaries mostly in 4 series. . . . 14. *P. dissiticeps*.
- O*. Leaves glandular-puberulent, not glaucous; heads on short peduncles, approximated into glomerulate cymules. . . . *Q*.
- Q*. Leaves sessile, not narrowed at the base, oblong to ovate, the lower not infrequently cordate- to subsagittate-clasping. . . . 12. *P. Wrightii*.
- Q*. Leaves subsessile, oblong-lanceolate to oblong-ob lanceolate, mostly narrowed to the sometimes abruptly rounded base, neither at all auriculate nor clasping. . . . 13. *P. Coulteri*.
- H*. Phyllaries, the inner as well as the outermost, acutish to acute, or the obtusish apex shortly acuminate. . . . *R*.
- R*. Phyllaries not at all acuminate, not even at the very tip, neither lance-subulate nor attenuate, though acutish to acute. . . . *S*.
- S*. Leaves thick-coriaceous to rigid-cartilaginous, glabrous. . . . *T*.
- T*. Phyllaries oblong-lanceolate, acute, the more numerous basal ones densely imbricated, gradating into the upper peduncular squamae; base of the involucre acute, more or less obconic; leaves rigid-cartilaginous, spiny-toothed, conspicuously bluish-green, glaucous; heads 19–22-flowered. . . . 15. *P. montana* var. *typica*.
- T*. Phyllaries oblong, often broadly so, barely (if at all) acutish, the basal neither more numerous than the others nor more densely imbricated; base of the involucre obtuse; leaves neither bluish-green nor conspicuously (even if somewhat) glaucous, thickly coriaceous, at most spinulose-dentate; heads 9–14-flowered. . . . *U*.
- U*. Leaves suborbicular to oblong-obovate; phyllaries often with a more or less rusty tomentum on the margin. . . . 16. *P. platyphylla*.
- U*. Leaves elliptic- to linear-oblong, sometimes a little spatulate; phyllaries often minutely glandular-ciliolate or less often sericeociliate. . . . 17. *P. rigida*.
- S*. Leaves neither thick-coriaceous nor rigid-cartilaginous, mostly thin and chartaceous. . . . *V*.
- V*. Leaves quite glabrous, glaucous to glaucescent

- at least on the midribs, a little shiny above; phyllaries (3-)4-seriate; heads not approximated into cymules, occurring singly on peduncles 1.5-5 (mostly 3-4) cm. long....14. *P. dissiticeps*.
- V. Leaves mostly glandular-puberulent, not at all glaucous; phyllaries in not more than 3 series; heads approximated into cymules, the ultimate peduncles not more than 3 cm. long....W.
- W. Leaves sessile, not narrowed at the base, oblong to ovate, the lower not infrequently cordate- to subsagittate-clasping.....12. *P. Wrightii*.
- W. Leaves subsessile, oblong-lanceolate to oblanceolate, mostly narrowed to the sometimes abruptly rounded base, neither at all auriculate nor clasping.....13. *P. Coulteri*.
- R. Phyllaries from mucronate-acuminate to acuminate, often lance-subulate, attenuate or even caudate-attenuate....X.
- X. At least the inner phyllaries caudate-attenuate, the slender tips not rigid and somewhat tortuous....Y.
- Y. Whole plant covered by a dense whitish tomentum; heads borne singly on a thickened leafy peduncle; phyllaries scarious.....18. *P. tomentosa*.
- Y. Plant at most viscid-puberulent, bright green in aspect; inflorescence a corymbiform cyme; phyllaries green, more or less herbaceous.  
29. *P. hebeclada* var. *urolepis*.
- X. None of the phyllaries truly caudate-attenuate....Z.
- Z. Plant 1-3 dm. high, diffusely branched from near the base, the branches terminated by a single relatively large, usually leaf-subtended head....a.
- a. Leaves more or less cuneate at the base, not exceeding 17 mm. in width, mostly narrower; achenes with sparse amber-colored sessile glands, otherwise glabrous...19. *P. Parryi*.
- a. Leaves mostly rounded to rhomboidal at the base, tending to be orbicular, 2-4(-5) cm. wide; achenes more or less densely and shortly stipitate-glandular.....20. *P. nana*.
- Z. Plant taller, more robust, usually simple....b.
- b. Heads 3.5-5 cm. thick, 3-4 cm. high, widely hemispheric, truncate at the base, usually borne singly at the tip of the main axis, this rarely forked above.....21. *P. Wislizeni*.
- b. Stems or upper branchlets terminated by an inflorescence of smaller and much narrower heads (none of them with a wide truncate base)....c.
- c. At least the inner phyllaries lance-subulate (i. e. like an attenuated triangle in outline) very gradually narrowed....d.
- d. Heads congested in a dense very leafy elongated cylindrical thyrses; involucre glandular, obconic; peduncles leafy-bracted.....22. *P. thyrsoides*.

- d.* Inflorescence not a leafy cylindrical thyrses . . . . .*e.*
- e.* Peduncles densely squamose, their scales more or less imbricated, grading into the phyllaries; involucre acutish to acute at the base . . . . .*f.*
- f.* Heads 2.5–3.5 cm. high, glabrous to glabrate; involucre at anthesis turbinate, phyllaries and peduncular scales scarious-chartaceous . . . . .*g.*
- g.* Phyllaries acuminate only at the tips, not acerose; leaves thickly coriaceous, strongly arcuate, conduplicate, linear-oblong, essentially glabrous save on the margins . . . . . 23. *P. formosa.*
- g.* Phyllaries attenuate-acuminate, acerose-tipped; leaves chartaceo-coriaceous, lance-elliptic, seldom narrower, minutely hispidulous beneath on the veinlets, neither arcuate nor conduplicate . . . . . 24. *P. longifolia.*
- f.* Heads not more than 2.5 cm. high, puberulent to woolly, not at all congested, obconic at least at the base; phyllaries not scarious, indurate at least below . . . . .*h.*
- h.* Phyllaries at most merely puberulent and irregularly ciliolate; leaves linear-oblong to -oblanceolate . . . . . 25. *P. lepidopoda.*
- h.* Phyllaries flocculent-lanate to arachnoid, at least on the margins . . . . .*i.*
- i.* Leaves oval to lance-ovate, irregularly and often saliently pungent-dentate; subulate scales of the thickish peduncles soon becoming leaf-like; inflorescence not ample, few-headed . . . . . 27. *P. Purpusii.*
- i.* Leaves oblanceolate- to linear-oblong, finely and regularly spinulose-denticulate; scales of the very slender peduncles acicular-subulate, not becoming leaf-like below; inflorescence widely open-paniculate, 10–12-headed . . . . . 26. *P. arachnolepis.*
- e.* Peduncles, even when somewhat squamose, not imbricate-squamose; heads obconic to barely turbinate or rounded at the base . . . . .*j.*
- j.* Involucre 9–10 mm. high, mostly obconic-campanulate, much exceeded by the pappus; stems alate with the decurrent leaf-bases . . . . . 28. *P. platyptera.*

- j.* Involucres 14-22 mm. high, mostly equalling or little exceeded by the pappus; leaves not decurrent. . . . *k.*
- k.* Inflorescence a broad-topped or pyramidal 20-60-headed more or less open cyme, the cymules glomerate; involucre 14-16 mm. high; phyllaries greenish, neither scarious nor coriaceous, especially the outer becoming lax and more or less spreading at the tips. . . . 29. *P. hebeclada.*
- k.* Inflorescence openly paniculate, not more than 14-headed; phyllaries tending to be rigid. . . . *l.*
- l.* Phyllaries attenuate-subulate, in only about 3 series, very little imbricated; heads not exceeding 23 mm. in height. . . . *m.*
- m.* Leaves rigid-coriaceous, not more than 2 cm. wide, irregularly and pungently toothed; heads 2-2.3 cm. high. . . . 30. *P. aspera.*
- m.* Leaves thin-chartaceous, merely spinulose-denticulate to -dentate, not pungently toothed, the cauline 9-10 cm. wide; heads 15-20 mm. high. . . . 31. *P. pinetorum.*
- l.* Phyllaries subulate-acuminate, in 4-5 series, fairly well imbricated; heads often 28 mm. high. . . . 32. *P. turbinata.*
- c.* Phyllaries not lance-subulate, though always acuminate, from lanceolate to oblong or oblong-ob lanceolate in form, from gradually to abruptly acuminate, even if only mucronate-acuminate on an obtusish tip. . . . *n.*
- n.* At least the innermost phyllaries attenuate-acuminate. . . . *o.*
- o.* Heads 4-6-flowered; phyllaries 1-1.5 mm. wide, minutely glandular-puberulent, in but three series; involucres narrow, obconic-campanulate, not exceeding 1 cm. in height; inflorescence a cylindric to pyramidal leafy-bracted thyrse. . . . 33. *P. Thurberi.*
- o.* Heads about 50-flowered; phyllaries 3-4 mm. wide, all glabrous save on the margins, in 6-7 series; involucres 2-3 cm. high; inflorescence strict, racemiform. . . . 34. *P. Pringlei.*
- n.* Phyllaries not attenuate-acuminate but more abruptly acuminate. . . . *p.*
- p.* Inflorescences isolated, several to

- many, consisting of 2-4-headed glomerules disposed laterally and terminally along the upper branchlets; involucre very slender, cylindrical-obconic; phyllaries glabrous dorsally . . . . . 35. *P. Dugesii*.
- p.* Inflorescence a terminal corymbose to paniculate cyme . . . . *q.*
- q.* Cymes congested, usually very little or not at all exceeding the but slightly reduced terminal foliage; bases of the larger leaves adnate to the stem; phyllaries often 2 mm. or more broad, glabrate to glandular-puberulent . . . . . 36. *P. Alamani*.
- q.* Cymes lax to subcongested, at all events well exceeding the reduced terminal foliage; leaves not at all adnate to the stem . . . . *r.*
- r.* Phyllaries copiously and evenly glandular-puberulent dorsally . . . . *s.*
- s.* Phyllaries ovate-lanceolate, mostly 2-3 mm. broad; leaves lance-attenuate, not crowded, chartaceous . . . . . 37. *P. Palmeri*.
- s.* Phyllaries oblong-lanceolate to -oblanceolate, 2 mm. or less broad . . . . *t.*
- t.* Phyllaries oblong-lanceolate; fruiting heads 15-18 mm. high . . . . *u.*
- u.* Phyllaries very acute, gradually attenuate-acuminate, 1.5-2 mm. broad, not indurate; leaves thin-chartaceous, oblong or lance-oblong . . . . . 38. *P. oxylepis*.
- u.* Phyllaries acute, not gradually but rather abruptly narrowed at the acuminate tip, 1-1.7 mm. broad, indurate; leaves subcoriaceous . . . . *v.*
- v.* Leaves cuneate-oblong, not more than 2 cm. wide, not amplexicaul; phyllaries at most 1.3 cm. broad . . . . . 39. *P. Seemannii*.
- v.* Leaves elliptic-oblong, the lower obovate and often 20 cm. wide, with a short, somewhat spatulate base, cordate-amplexicaul; phyllaries 1-1.7 mm. wide. 40. *P. grandifolia*.
- t.* Phyllaries oblong-oblanceo-

- late, abruptly acute and often very sharply acuminate, herbaceous, not indurate; fruiting heads 10–13 mm. high. . . . . 41. *P. microcephala*.
- r.* Phyllaries not glandular, dorsally glabrate to deciduous-lanate. . . . *w.*
- w.* Corollas at anthesis deeply parted into 5 linear segments; involucre cylindric-campanulate. . . . . 42. *P. collina*.
- w.* Corollas bilabiate, three of the lobes coalesced to form the usual oblong ligule. . . . *x.*
- x.* Fruiting heads 16–22 mm. high; phyllaries at most 2 mm. wide. . . . *y.*
- y.* Upper portion of the slender stem, except for very sparse highly reduced bract-like leaves, destitute of foliage. . . . . 2. *P. nudiuscula*.
- y.* Upper portion of the stem normally leafy. . . . *z.*
- z.* Involucres campanulate, not obconic at the base; basal phyllaries not extending along the peduncle; foliage neither bluish-green nor conspicuously glaucous. . . . *aa.*
- aa.* Involucres cylindric-campanulate, glabrate and sericeo-ciliate; heads glomerulate; leaves linear-oblong, arcuate, conduplicate.
17. *P. rigida* var. *acuminata*.
- aa.* Involucres hemispheric-campanulate, fulvous-tomentulose; heads not glomerulate; leaves obovate-spatulate, not arcuate. . 43. *P. michoacana*.
- z.* Involucres obconic at the base, the basal phyllaries numerous and graduating into the peduncular scales; heads not glomerulate; foliage bluish-green, conspicuously glaucous.
15. *P. montana* var. *typica*.
- x.* Fruiting heads 2.5–3 cm. high, turbinate; broadest phyllar-

ies 3.5–4 mm. broad, oblong-lanceolate to oblanceolate; leaves elliptic-oblong, not at all amplexicaul, most of them with a petiole 0.5–2 mm. long. . . . . 44. *P. cuernavacana*.

1. ***P. runcinata*** Lag. ex D. Don, Trans. Linn. Soc. xvi. (1830) 207, in syn.; *Clarionea runcinata* (Lag.) D. Don, loc. cit.

Acaulescent perennial from an elongated, erect, rather sparingly woolly caudex, this giving rise at its lower end to fascicles of elongated fusiform tuberous roots 8–15 cm. long; aerial shoots borne laterally on the caudex; leaves rosulate, the leaf-blades chartaceous, oblong-oblanceolate in outline, pinnately parted into rounded, spreading, often undulate lobes, irregularly spinulose-dentate, glandular-scabrous, especially beneath, hispidulous on the midrib and veins beneath, 15–17 cm. long, 4.5–7 cm. wide, narrowly decurrent and gradually decreasing along the petiole, this 1.5–7.5 cm. long, usually pilose at the base; scapes rigid, slender, usually bracteate above, glandular-scabrous, from much exceeding (33 cm. long) to about equalling (8–20 cm. long) the leaves, sometimes divided at the summit; bracts scale-like, subulate, as much as 5 mm. long, mostly shorter; heads 20–25 mm. high, about 40-flowered; involucre campanulate, 15–18 mm. high; phyllaries linear-lanceolate, the short outer ones tending toward ovate, gradually to somewhat abruptly acuminate, glandular-puberulent, mostly irregularly ciliolate, the inner setaceous-acuminate, not indurate; corollas lavender-pink, the bases of the segments occasionally resinous-punctulate on the margins, otherwise glabrous; mature achenes narrowly cylindrical, glandular, pilose above when young, 7–10 mm. long; receptacle moderately alveolate, in immature heads densely bristly, becoming less so.

South central Texas, southward in Mexico to Hidalgo.

UNITED STATES: TEXAS: bluffs above Austin, April 1, 1848, *Wright*, no. 409, in part; Mt. Burnell, Austin, *Elihu Hall*, no. 374 (Gr., N. Y., P. C.); on the Rio Grande, 1848, *Wright*, no. 409, in part; stony hills of the Pecos and San Felipe Creek, *Wright*, no. 1297; dry rocky banks, in canyon of Pecos River, near the Rio Grande, Valverde Co., *E. J. Palmer*, no. 33472 (N. Y.); Stillwell Crossing road, Brewster County, *V. L. Cory*, no. 2807; Uvalde, southwestern Texas, *Palmer*, no. 769 (1879–1880); calcareous hills near Eagle Pass, 246 m. elev., *Pringle*, no. 8280 (Gr., N. Y., P. C.); Starr County, July, 1922, *R. Runyon* (Gr., N. Y.); San Diego [Duval Co.], 1885–1886, *Mary B. Croft* (N. Y.); along Corpus Christi Bay, Nueces County, *Heller*, no. 1537 (Gr., N. Y.); without further locality, *Pope*.

MEXICO: TAMAULIPAS: "prope Matamoros," *Berlandier*, no. 3176 (Gr., N. Y.); vicinity of Victoria, alt. about 320 m., *Palmer*, no. 473 (1907). NUEVO LEÓN: limestone hills near Monterey, elev. 615 m., *Pringle*, no. 13741; Bishop's Hill, Monterey, Feb. 6, 1847, *Gregg*; Cerralvo, May 29, 1847, *Gregg*, no. 44



(Gr., N. Y.). COAHUILA: Saltillo, *Palmer*, no. 86 (1898) (Gr., N. Y.). DURANGO?: woods, Ramos-Carrizitos, Dec., 1852, *Thurber*, no. 860. SAN LUIS POTOSÍ: Agua Media, *Purpus*, no. 4784. HIDALGO: Iximiquilpán, dry slopes, July, 1905, *Purpus*, no. 1167, in part (Gr., P. C.); same locality, rocky slopes, Sept., 1905, *Purpus*, no. 1167, in part (Gr., N. Y.).

According to Dr. Gregg's label, locally known in Nuevo León as *cardito*, which signifies "little thistle."

In no specimen seen by the writer were the leaf-segments reflexed; hence the leaves cannot truly be characterized as runcinate, the specific name notwithstanding.

2. ***P. nudiuscula*** Robinson, Proc. Amer. Acad. xliv. (1909) 625.

Basal portion of stem as yet unknown; stems erect, evidently scapiform, rigid, slender, teretish, finely to obscurely striate, smooth, purple-tinged, glabrous except for small tufts of fulvous tomentum in the axils of the very sparse bract-like leaves, these sessile, linear-spatulate to linear, glabrous, pale green and purplish-tinged, rather firm and thick, ascending to erect, the larger subrevolute, sparsely denticulate, especially toward the often subamplexicaul base, 2-4 cm. long, 2-5 mm. wide; inflorescence laxly corymbose-paniculate, widely spreading, the very slender, sparsely subulate-squamose peduncles 12-65 mm. long; lower inflorescence-branches ascending, subtended by linear bracts 6-9 mm. long; scales sparse, subulate, appressed to merely ascending, 1-3 mm. long; heads ultimately 15-20 mm. high, 12-13-flowered, the larger as much as 20-flowered; involucre campanulate, 8-11 mm. long; phyllaries in 4 (occasionally 5) series, indurate only at the very base, thin and cartilaginous, all but the innermost fairly rigid, all narrowed toward the base, acuminate, glabrous, pale green, purplish on the exposed portions, entire to minutely fimbriolate, the margin often somewhat scarious below the exposed tip, those of the single outermost series often subulate to subulate-lanceolate, closely resembling the peduncular scales; those of the next 2 series elliptic-ovate, the innermost narrowed to a very slender base, narrowly oblanceolate; corollas lavender-pink, glabrous, about 1 cm. long; pappus bright white, in 2 series, moderately rigid, the bristles more slender than usual; achenes linear-cylindric, dark brown, about 4 mm. long, densely glandular-punctulate and hispidulous with ascending whitish trichomes, the epigynous disc light yellow and funnel-form.

MEXICO: NAYARIT: Tepic, *Palmer* (1892), no. 2018 (TYPE, Gr. and isotype, N. Y.).

More complete specimens of this interesting species are much to be desired. The general appearance of the type and isotype suggests

that it most likely is one of the scapiform *Perezias* related to *P. nudicaulis*.

3. *P. umbratilis* Robinson & Greenman, Proc. Amer. Acad. xxxii. (1896) 50.

Acaulescent perennial with aerial shoot-producing caudices and numerous stout fibrous roots from a horizontally creeping rhizome; caudices 8–12 mm. thick, sessile on the rhizome or raised 2–4 cm. above it on a slender stipe-like base, multicipital, bearing in the axils of the radical leaves, but especially at the top, tufts of sordid white sericeous hairs; leaves all radical; petioles 1.5–5.5 cm. long, ultimately glabrous, very narrowly alate with the decurrent base of the blade; leaf-blades thin-membranaceous, deciduous-pubescent with long relatively sparse weak silky hairs similar to those of the caudex, ultimately glabrate to glabrous, not at all reticulate, elliptic-oblong in outline, lyrate-pinnatifid, 7–11.5 cm. long, 3.5–4.5 cm. wide, 5–7-lobed, the large terminal lobe ovate to orbicular-ovate, slightly produced at the blunt and mucronulate apex, sinuate-dentate, each tooth sharply mucronulate; lower segments very shallowly sinuate, distantly mucronate-denticulate; scapes 2–4 from a caudex, erect but very lax and slender, 17–30 cm. high, divided above into 2–3 single-headed peduncles, obscurely angled, darkened (in drying?), smooth, glabrate to sparingly deciduous-pubescent with rather long weak silky hairs and puberulent with whitish crisped hairs above, bearing minute, thin, appressed, subulate, usually puberulent bracts, these more abundant and more closely approximated on the ultimate (2–4.5 cm. long) peduncles; heads narrowly campanulate, 15–20 mm. high, about 18-flowered; phyllaries in 5–6 series, uniformly thin-membranaceous, deep purplish, glabrous dorsally, more or less sericeous on the margins, appearing oblong when imbricated but narrowed toward the base, obtuse to rounded at the apex, often mucronulate, the basal ovate-oblong, only a few of the very outermost acutish, rarely the slightest bit acuminate; corollas lavender-pink, glabrous, 12 mm. long; pappus very tawny to brownish, very fine and soft, 1–2-seriate; achenes (immature) dark brown, subcylindric, copiously covered with semi-appressed stiff white hairs, stipitate-glandular just below the short light-colored epigynous disc; receptacle highly convex, densely white-bristly.

MEXICO: OAXACA: in shade, Tomellin Cañon, elev. 920 m., Pringle, no. 5966 (TYPE, Gr.).

4. *P. scapiformis* Bacigalupi (see p. 15).

Acaulescent perennial with rigid, relatively tall, scapose, corymbosely branching flowering stems and radical leaves from an erect to

horizontally creeping, deciduously silky-tomentose rootstock; roots fibrous, 1.5 mm. thick; leaves all from the basal caudex, petiolate, rigid, chartaceo-coriaceous, pale green often tinged with purple, not at all reticulate, the lateral veins of the upper surface hardly noticeable, often slightly scabrid above, deciduously long-sericeous on the midribs, otherwise glabrous, the midribs, too, at length glabrous, from very unequally and divaricately mucronate-dentate to subpectinately denticulate, often ciliolate as well, the blades sometimes undivided, orbicular-obovate to oval-obovate, 3-5 cm. long and 3-3.5 cm. wide, or more usually oblanceolate in outline and more or less lyrate lobed or parted, 6-10 cm. long and 18-30 mm. wide; petioles 1.5-7 cm. long, mostly between 1.5 and 2.5 cm. in length, narrowly winged, especially above, by the decurrent leaf-blade, deciduously sericeo-lanate; flowering stems erect, rigid, 1.3-2.3 mm. thick, naked except for much reduced, sparse bracts, 2.5-6 dm. tall, striate, smooth, glabrous above the very base, paniculately to corymbosely branched in the upper third to fifth to form the inflorescence; bracts of the scape from a broad base, linear-lanceolate, more or less arachnoid; heads laxly disposed on divaricate, somewhat arachnoid peduncles 1.5-3 cm. long, broadly campanulate, rounded at the base, about 30-flowered, 10-13 mm. high; phyllaries in 4 series, rigid, firm and subcoriaceous, light green, often dark purplish on the exposed portions, especially the mostly acuminate outer lanceolate to ovate, arachnoid on the backs and margins, all for the most part more or less apiculate, the inner from a blunt to narrowed and obtusish apex, these oblong, somewhat narrowed at both ends; corolla very small, the segments especially short, rather widened at the throat, 6 mm. long, probably lavender-pink, essentially glabrous; pappus soft and fine, slightly tawny, not dense, in 9 series, more densely scabrous toward the apex and hence appearing as though slightly clavellate-thickened outward; achenes about 4 mm. long, linear-oblong, dark brown, whitened by the dense coat of upwardly directed short stiff hairs, very slightly glandular above, the epigynous disc very short and very slightly expanded; receptacle highly convex, very shallowly scrobiculate, sparingly glandular and puberulent.

MEXICO: OAXACA: dry calcareous hills, Las Sedas, elev. 2000 m., *Pringle*, no. 6015 (TYPE, Gr. and isotype, N. Y.). PUEBLA: Tehuacán, *Purpus*, no. 5613 (Gr., N. Y.). PUEBLA OR OAXACA: Cerro de Matzize, *Purpus*, no. 3923 (Gr., N. Y.).

5. *P. nudicaulis* Gray, Pl. Wright. i. (1852) 127.

Acaulescent perennial, the underground portion a horizontally

creeping rhizome giving rise to thick fibrous roots and erect caudices, these in turn bearing the aerial shoots; caudices more or less densely brownish-tomentose, 7–17 mm. thick; leaves on pubescent petioles 1–10 cm. long, thin-membranaceous, rarely somewhat coriaceous, somewhat rigid in the dried state, pubescent with long weak hairs on the basal part of the lower midrib, otherwise glabrous, obscurely and not closely reticulate, rather regularly, closely and prominently triangular- to sinuate-dentate, the teeth mucro-tipped, somewhat roughened to decidedly scabrous above, lance-elliptic in outline, runcinately pinnatifid below, 5 (–7)-lobed, the blades most usually 9–18 cm. long, 4–7 cm. wide, the undivided terminal lobe comprising at least half the length of the leaf, broadly ovate to lance-ovate, often truncate at the base, occasionally, in very much reduced leaves, only the terminal lobe present; the lowest lobes decurrent for 1–2 cm. along the petiole; scapes 1–2, erect, rather slender, 2–6 dm. tall, striate, glabrate, smooth, bracteate, paniculately branched above into a 20–60-headed cyme; bracts of the scape scale-like, sparse, lance-subulate, pubescent, or at length glabrate, 3–12 mm. long; heads often closely approximated but not congested, 8–12 (mostly 10) mm. high, 11–13-flowered; involucre slenderly campanulate (when not crushed), 7–8 mm. high; phyllaries oblong, the inner linear-oblong, not narrowed toward the base, the outer broadly oblong, almost oblong-ovate, all bright green and glabrate, entire, scarious on the margin, blunt and rounded at the sometimes obscurely ciliolate tips, imbricated in 3–4 series; corollas lavender-pink, glabrous; pappus purplish-bronze, especially toward the base, very fine and soft, in 1 series; achenes linear-cylindric, 5 mm. long, striate, evenly but sparsely appressed-hispidulous, the epigynous disc very slightly developed; receptacle flattish, moderately alveolate, the ridges between the pits fimbriate and rather sparsely bristly.

GUATEMALA: NO DEPARTMENT SPECIFIED: *Skinner* (portion of TYPE). SALAMÁ: height above San Gerónimo, in a pine wood, on slaty sandy soil, *Caec. & Ed. Seler*, no. 340 (Gr., N. Y.). GUATEMALA: Guatemala, alt. 1538 m., *John Donnell Smith*, no. 2364. BAJA VERAPAZ: Sierra de las Minas, alt. 1077 m., opposite El Rancho, Jan. 5, 1908, *W. A. Kellerman*, no. 8040 (N. Y.) (leaves somewhat coriaceous). SANTA ROSA: Buena Vista, alt. 1692 m., *Heyde & Lux*, no. 4203 (Gr., N. Y.).

EL SALVADOR: Cerro El Roblar, *Calderon*, no. 2469.

This is the most southern of all the *Perezias* of the § *Acourtia* and is thus far known only from Guatemala and El Salvador.

6. ***P. lobulata*** Bacigalupi (see p. 16). *P. patens* var.  $\gamma$ . Gray, *Pl. Wright. i.* (1852) 127.

Erect, leafy, robust, evidently tall perennial; stem terete, quite

smooth and glabrous, slightly flexuous above, stramineous to dark purplish, 2.5–5 mm. thick; leaves sessile, oblong, rigid and thin-coriaceous, scabrid, closely reticulate-veiny, the slightest bit glaucescent above, shortly acuminate, not at all narrowed toward the cordate-clasping base, the ample auricles of the larger leaves frequently overlapping, closely and sometimes unequally spinulose-denticulate, often retrorse-denticulate to coarsely runcinate-dentate toward the base, the larger cauline leaves 9–11 cm. long, 27–40 mm. wide, sinuately runcinate-lobulate to runcinately lobed, the tips of the lobes usually acuminate-dentate; leaves of the branches 4–6.5 cm. long, 12–20 mm. wide; the leafy inflorescence-bearing branchlets spreading almost at right angles from the main axis, 16–45 cm. long, slender, gradually more and more pubescent toward the tips with crisped articulated hairs and becoming more pronouncedly flexuous; the glomerulate 2–3-headed cymules on short lateral leafy-bracted common peduncles, isolated from one another by the leafy portions of the branchlet-tips; heads 15-flowered, about 18 mm. high; involucre campanulate, 11–14 mm. high; phyllaries somewhat rigid, indurate at their bases, in 4–5 series, pale green, often tinged with dark purple toward the tips, more or less sericeo-ciliolate, the outer lanceolate-ovate, sometimes shortly acuminate, the inner attenuated, oblong-lanceolate, acute or acutish but not acuminate, 10–12 mm. long, the apex often produced, involute and incurved, more rarely somewhat obtusish; corolla lavender-pink, about 11 mm. long, the upper portion of the tube sparsely glandular-punctulate and the 2 inner segments glandular-ciliolate toward the base; pappus somewhat rigid, in 2–3 series, tawny; achenes linear-fusiform, dark brown, densely glandular-punctulate, about 5 mm. long, surmounted by a very narrow epigynous disc; receptacles slightly concave, shallowly scrobiculate, glabrous save for a few amber-colored glands.

MEXICO: OAXACA: mountains, San Juan del Estado, alt. 1938 m., *L. C. Smith*, no. 888 (TYPE). NO STATE SPECIFIED: "Mexico. Fl. rose, lemon-scented," *Galeotti*, no. 2001 (type of *P. patens* var.  $\gamma$ . Gray).

7. **P. Lozani** Greenman, Proc. Amer. Acad. xli. (1905) 268.

Erect, leafy, moderately slender, probably tall perennial; upper portion of stem teretish, striate, flexuous, more or less scabrid and hirtellous-puberulent with crisped articulated hairs to glabrate, stramineous and purplish-tinged; leaves thick-chartaceous, sessile, cordate-amplexicaul, mostly shortly acuminate and acute, oblong-ovate, some of the uppermost more nearly oblong, unequally spinulose-dentate to -denticulate, scabrous, the midribs often purplish, ob-

scurely reticulate, dark green and slightly puberulent on the midrib above, evenly glandular and densely hirtellous with crisped articulated hairs on the prominent reticulations beneath, 3–7 cm. long, 17–32 mm. wide, those immediately subtending the cymules smaller; cymules few-headed, lax to subcongested at the tips of the terminal leafy branchlets, forming a corymbose to paniculate cyme about 28 cm. wide; heads on densely glandular-pubescent peduncles 3–20 mm. long, 23–25-flowered, 12–17 mm. high; involucre hemispheric-campulate, 9–10 mm. high; phyllaries distinctly herbaceous, greenish to purplish, rigid only centrally toward their bases, mostly oblong, the apices highly variable, from truncatish-rounded or rounded and mucronate to tapering and acute, the outermost often quite foliaceous, lanceolate or oblong-ob lanceolate, all more or less squarrose and densely glandular-ciliolate, glabrate below and more or less hirsutulous toward the apex dorsally, densely papillose-glandular toward the tip on the inner reflexed exposed surface, the bases well imbricated, in 5–6 series; corollas essentially glabrous, lavender-pink; pappus tawny, somewhat rigid, mainly uniseriate; achenes fusiform-cylindric, costulate, 4–5 mm. long, covered with amber-colored sessile glands.

MEXICO: HIDALGO: under dry cliffs between Metepec and Zontecomate Stations, elev. about 2600 m., *Pringle*, no. 8871 (TYPE, Gr. and isotypes, N. Y., P. C.).

A well marked and apparently little collected species.

8. ***P. carpholepis*** (Sch. Bip.) Gray, Proc. Amer. Acad. xix. (1883) 60; *Acourtia carpholepis* Sch. Bip. ex Gray, in syn., loc. cit.; *P. patens* var.  $\beta$ . Gray, Pl. Wright. i. (1852) 127.

Leafy and evidently divaricately branched, probably somewhat scandent perennial; upper portion of stem flexuous, obscurely angled, slightly scabrid to smooth, stramineous, often purplish-tinged; upper branchlets leafy, flexuous, stramineous to purplish, smooth to scabrid, minutely crisped-puberulent, especially toward the tips, and often with minute articulated purplish trichomes as well; leaves chartaceous, sessile, oblong or lance-ovate, deeply auriculate- to subsagittate-clasping, acute, shortly to gradually acuminate, closely and somewhat unequally spinulose-dentate, more especially toward the base, to spinulose-denticulate, beneath somewhat prominently reticulate, scabrid, puberulent and glandular-punctulate, above not at all prominently reticulate, glabrate save at the base of the midrib, 5–10 cm. long, 2–5 cm. wide; inflorescence-bearing branchlets arising from the axils of the leaves toward the branch-tips, the cymules subcongested, 2–4-headed; ultimate peduncles fairly densely pubescent and glandu-

lar; heads 10–11-flowered, about 15 mm. high when fully developed; involucre widely obconic-campanulate, 8–9 mm. high; phyllaries glabrous dorsally, obtuse, often conspicuously purple-tipped, somewhat indurate, slightly to copiously sericeo-ciliate, loosely imbricated in 4–5 series, the outer basal spreading, ovate to suborbicular-ovate, the inner oblong; corollas lavender-pink; pappus moderately rigid, biseriate, some of the bristles very slightly clavellate-thickened above, the bristle-bases usually highly fused; immature achenes subcylindric, densely studded with amber-colored glands, the epigynous disc slight; receptacle convex, only slightly scrobiculate, glabrate to puberulent.

MEXICO: PUEBLA: Chapulco, Dec., 1841, *Liebmann*, no. 351. CHIAPAS: *Linden*, no. 439; in pine forests, *Ghiesbreght*, no. 525. All these specimens are co-types, being cited after the original diagnosis by Gray.

9. ***P. reticulata*** (Lag.) Gray, *Pl. Wright. i.* (1852) 128; *Proustia reticulata* Lag. ex D. Don, *Trans. Linn. Soc. xvi.* (1830) 200; *Perdicium serrulatum* Sesse & Moc. ex D. Don, in syn., loc. cit.

Rigid, simple, erect, suffruticose perennial, 1–1.5 m. tall; stems glabrous, more or less sulcate, densely leafy; leaves sessile or rarely having petioles 1–2 mm. long, inclined to be ascending and imbricated, coriaceous, cuneate-obovate to elliptic-ob lanceolate, mostly gradually narrowed to the base and strictly exauriculate, obtuse and rounded at the apex, sometimes abruptly acuminate and mucronulate, rarely truncate to slightly sagittate or the least bit auriculate at the base, finely reticulate with raised veins on both surfaces, acutely sinuate-dentate, often less closely so toward the base, yellowish green, slightly darker above, glandular-punctulate and minutely hirsutulous on the reticulations beneath, glabrate to glabrous above, 6–12 cm. long, 1.5–5 cm. wide; terminal lax to dense usually pyramidal thyrses composed of glomerulate 3–10-headed cymes, the ultimate peduncles pubescent; involucre cylindric-campanulate, 4–5-seried, 4–6-flowered, 8–10 mm. high; phyllaries ovate to oblong, very obtuse to rounded at the apex, glabrate dorsally, erose to fimbriate-ciliolate; corollas lavender-pink; exposed portion of pappus about equalling the involucre in length, the bristles the slightest bit clavellate-thickened toward the apex; mature achenes costulate, fusiform-cylindric, 4–5 mm. long, copiously stipitate-glandular; receptacle sparingly pilose.

High plateau and mountainous region of south central Mexico from San Luis Potosí to Oaxaca.

MEXICO: SAN LUIS POTOSÍ: "ex convalli San Luis Potosí, in umbrosis prope Penasco," *Schaffner*, no. 374. GUANAXUATO: hills near Acambaro, *Pringle*, no. 4324 (Gr., N. Y.). MICHOACÁN: vicinity of Morelia, alt. 1950 m., *Arsène* no. 3155. MICHOACÁN OR GUERRERO: Sierra Madre, alt. 1200

m., *Langlassé*, no. 599. MORELOS: prope Cuernavaca, alt. 1400–1500 m., *Woronow*, no. 2466; mountain side above Cuernavaca, elev. about 2000 m., *Pringle*, no. 11300. VERA CRUZ: "Borrego près Orizaba," *Bourgeau*, no. 3096; Hacienda del Sr. Pesado, Orizaba, Sept. 1850, *Fred. Müller* (N. Y.); Orizaba, *Botteri*, no. 495; *Müller* in 1855 (N. Y.). PUEBLA: vicinity of Puebla, alt. 2120 m., *Arsène*, no. 1986; rocky places, locality indefinite, *Purpus*, no. 3025 (Gr., N. Y.). OAXACA: Oaxaca, *Galeotti*, no. 2097; Sierra de San Felipe, alt. about 2135 m., *Chas. L. Smith*, no. 384 (N. Y.); mountains of Huitzo, alt. about 2000 m., *Lucius C. Smith*, no. 889; hills near Oaxaca, alt. about 1830 m., *Pringle*, no. 5777. NO STATE SPECIFIED: *Fred. Müller* (comm. H. Schlumberger) 1853, no. 1183 (N. Y.).

10. ***P. Nelsonii*** Robinson, Proc. Amer. Acad. xxxv. (1900) 342.

Erect, moderately leafy perennial 8–15 dm. tall; stems apparently several from the caudex, slightly decumbent at the base, soon erect, unbranched below the inflorescence, rigid or flexuous, striate, smooth, purplish, glabrous except for tufts of fulvous tomentum partly hidden in the leaf-axils; cauline leaves ample, firm, subcoriaceous, reticulate, especially above, paler and somewhat scabrous below, oblong-oblong-ovate to spatulate, auricular-clasping, shallowly sinuate-dentate, the teeth very acute and of unequal length, usually mucronate at the rounded apex; inflorescence naked, diffuse, 5–10-headed, the ascending rigid peduncles often 10–17 cm. long, bearing sparse, appressed, lance-attenuate bracts; heads 2.5–3 cm. long, about as wide above, 30–35-flowered; involucre broadly campanulate, 15–18 mm. high; phyllaries well imbricated in 6–7 series, green, purplish on the exposed portions, indurate, glabrous dorsally, sometimes ciliolate, the outer ovate, a trifle longer than broad, the outermost sometimes the slightest bit apiculate, the rest broadly oblong, at least 2 mm. wide, obtuse, with or without a small mucro at the apex, only 2 or 3 of the very innermost lance-oblong and acute; corollas 1.5 cm. long, lavender-pink; pappus soft, not dense, interruptedly biseriate; achenes subcylindric, often more or less compressed, appressed-hispidulous, covered with amber-colored sessile glands as well, 5–6 mm. long.

Apparently localized in Jalisco, Mexico.

MEXICO: JALISCO: mountains near Talpa, alt. 1400–1500 meters, *E. W. Nelson*, no. 4037 (TYPE); Real Alto, on trail to El Tajo de Santiago, Sierra Madre Occidental, alt. 2500 meters, dry rocky soil, *Ynez Mexia*, no. 1750 (Gr., N. Y.); Real Alto, rocky slope near crest of La Bufa, Sierra Madre, alt. 2500 meters, *Ynez Mexia*, no. 1623 (N. Y.).

11. ***P. patens*** Gray, Pl. Wright. i. (1852) 127; *Trixis patens* Sch. Bip. in Seemann Bot. Voy. Herald (1856) 315; *Acourtia formosa* Sch. Bip. loc. cit. and pl. 56, not D. Don nor DC.

Erect perennial up to 3.5 m. tall (acc. to Mrs. Mexia's label); stems very smooth, glabrous, glaucescent to glaucous, straw-colored



streaked with maroon; leaves rigid-chartaceous, sessile to subsessile, broadly oblong to elliptic-oblong, the uppermost inclined to be ovate, rounded to acutish at the apex, broadly auriculate-clasping at the base, loosely reticulate, more prominently so beneath, glaucous, especially beneath, or sometimes glaucous only on the lower midrib, smooth, glabrous, closely spinulose-denticulate, mucronulate, 4–16 cm. long, 1.5–6.5 cm. wide; inflorescence terminal, the one-headed, corymbosely disposed peduncles very slender and lax, subulate-squamose and sericeo-pubescent above; involucre narrowly campanulate, 9–15-flowered (20, fide Gray), 11–13 mm. long, at center about 6 mm. broad; phyllaries rigid-chartaceous, the outer ovate, the rest mostly oblong to lance-oblong, maroon-tipped, glabrate dorsally, sericeo-ciliate, obtuse, often the slightest bit carinate and mucronulate; corollas "dark maroon" or claret-colored; achenes minutely scurfy-glandular above, at anthesis 2.5 mm. long; receptacle glabrate.

MEXICO: JALISCO: Real Alto, trail to El Tajo de Santiago, densely wooded damp north slope, abundant, alt. 2500 m., Sierra Madre Occidental, *Ynez Mexia*, no. 1749 (Gr., N. Y.). DEFINITE STATE UNKNOWN: "Northwestern Mexico," *Seemann* (TYPE). *Seemann* collected in southern Sinaloa, southern Durango, Nayarit and northern Jalisco.

12. ***P. Wrightii*** Gray, *Pl. Wright. i.* (1852) 127; *P. Wrightii* var. *subpuberula* Gray, loc. cit. 128; *P. arizonica* Gray, *Bot. Calif. i.* (1876) 422; *P. Coulteri* Gray, *Proc. Amer. Acad. xv.* (1880) 40, in part; *P. Schaffneri* Gray; Urbina, *Cat. de Pl. Mex.* (1897) 197, nom. nud.; illustration in *Armstrong, West. Wild Fl.* 537 (1915).

Erect, leafy, simple or more commonly branching perennial about 70 cm. tall, varying from 30 cm. to 1 meter or more in height; stems smoothish and glabrous to glandular-scabrid, striate, stramineous or pale green, often varying to purplish; leaves sessile, oblong-lanceolate to elliptic-oblong or lance-ovate, chartaceous or rarely rigid, mostly minutely scabrid on the more prominent reticulations above and more or less copiously glandular-puberulent and scabrous beneath, sometimes varying to glabrate, the smaller floral leaves closely and regularly repand-dentate, tending to a truncate base, the larger coarsely and irregularly dentate, tending to be cordate- or subsagittate-amplexicaul, the smaller 2.5–3.5 cm. long, 5–15 mm. wide, the larger 6–13 cm. long, 2–5.5 cm. wide; inflorescence compound-corymbose, many-headed, the ramifications and peduncles usually densely glandular-pubescent; heads in subglomerate cymules, 8–11-flowered, 10–15 (–17) mm. high; involucre 2–3-seriate, 6–7 mm. high; phyllaries linear-oblong to lance-oblong, the tips varying from obtusish to acutish, very rarely the slightest bit acuminate, chartaceous, sericeo-ciliate,

dorsally glabrate to glandular-puberulent; corollas lavender-pink, more or less copiously and shortly stipitate-glandular; pappus moderately stiff, usually bright white, in 2 series; mature achenes linear-fusiform, costellate, glandular-puberulent, 5–6 mm. long, slightly to barely expanded into a disc above; receptacle sparingly covered with short thick-stalked amber-colored glands.

From southern Utah, south central New Mexico and western Texas southward in Mexico to San Luis Potosí.

UNITED STATES: UTAH: near St. George, *Parry*, no. 141. ARIZONA: "Mohave," *Lemmon*, no. 3126; rocky soil, Virgin Range, alt. 1625–1830 m., *Purpus*, no. 6169 (P. C.); Peach Springs, June 14, 1929, *M. E. Jones* (P. C.); Hackberry, *M. E. Jones*, no. 4577 (P. C.); Oak Creek, Cornville, *W. W. Jones*, no. 151; Skull Valley, alt. about 1300 m., May 1, 1903, *M. E. Jones* (P. C.); Wickenburg, alt. about 640 m., May 5, 1903, *M. E. Jones*, (P. C.); near Mt. Trumbull, *Palmer*, in 1877; Salt River, near Phoenix, *Lemmon*, in 1885; Roosevelt Dam, *Eastwood*, no. 8666; Roosevelt Dam, *Mrs. J. F. Wilson*, May 20, 1917 (P. C.); Yaqui, May 22, 1890, *M. E. Jones* (P. C.); rocky cliffs on Springerville road, 12 mi. from St. John, *Ferris & Duncan*, no. 2283 (N. Y.); San Juan, Camp Grant, *Palmer*, no. 145 (1867); vicinity of Tucson, *Rose, Standley & Russell*, no. 15187 (N. Y.); Sabino Cañon, vicinity of Tucson, alt. 1220 m., April 30, 1909, *S. B. Parish* (P. C.); south of Fort Whipple, *Coues & Palmer*, no. 220; Santa Catalina Mountains, May 30, 1881, *Pringle*; rocky slopes, Natanes Plateau, near Bisbee, *L. N. Goodding*, 1096 (N. Y.); near Fort Huachuca, *Lemmon*, nos. 2796 & 2797; gravelly slopes, Caliuero Mountains, near Bisbee, *L. N. Goodding*, no. 1072 (N. Y.); near Bisbee, May 25, 1894, *W. W. Price* (P. C.). NEW MEXICO: Apache Pass, (Grant Co.), *Lemmon*, no. 309, in 1881; Duck Creek Hills, Upper Gila (nw. Grant Co.), May 26, 1880, *E. L. Greene* (Gr., P. C.); Mangas Springs, Grant Co., *O. B. Metcalf*, no. 86; Organ Mountains, Dona Ana Co., alt. 1770 m., *Wootton*, no. 489 (N. Y.); without more specific locality, *G. R. Vasey*, in 1881. TEXAS: El Paso, Sept. 12, 1884, *M. E. Jones* (P. C.); Fort Davis, *Girard*, in 1880; low spur at northeastern end of Quitman Mountains near Sierra Blanca, Hudspeth Co., *Ferris & Duncan*, no. 2509 (N. Y.); along the Pecos River, *Thurber*, no. 112 (1850); Roy Hudspeth's, Sutton Co., *Cory*, no. 2810; border of Salt Basin, in thickets near Baylor Mountains, El Paso Co., Aug. 6, 1914, *M. S. Young*; "on the Rio Seco and westward; also on the Rio Grande," *Wright*, no. 411 (TYPE); hills between the Pecos and the Limpia, *Wright*, no. 412 (type of *P. Wrightii* var. *subpuberula*); prairies along the Rio Frio, western Texas, *Wright*, no. 1298.

MEXICO: SONORA: Fronteras, alt. about 1400 m., *C. V. Hartman*, no. 42; Las Playas, *Thurber*, no. 316. CHIHUAHUA: rocky mountain cañons, Ciudad Juarez, *Elmer Stearns* (N. Y.); foothills of the Sierra Madre, near Colonia Juarez, *E. W. Nelson*, no. 6341; Santa Eulalia Plains, *E. Wilkinson*, in 1885; vicinity of Chihuahua, alt. about 1300 meters, *Palmer*, no. 143 (1908) (Gr., N. Y.). COAHUILA: Párras, *Palmer*, no. 767 (1880); mountains north of Monclova, *Palmer*, no. 768 (1880); Sierra de la Paila, *Purpus*, no. 4710; Cerro del Mocho, near Mavono, *Purpus*, no. 4464; Sabinas, *E. W. Nelson*, no. 6180 (Gr., N. Y.). DURANGO: Ramos to Inde, *E. W. Nelson*, no. 4710 (N. Y.). NUEVO LEÓN: El Carrizo, near Monterey, *Pringle*, nos. 11905 & 13442. ZACATECAS: near Concepción del Oro, *Palmer*, no. 387 (1902) (Gr., N. Y.). SAN LUIS POTOSÍ: in region of San Luis Potosí, *Parry & Palmer*, no. 547, in part (1878); "ex convalli San Luis Potosí, in umbrosis prope Tloscalá (?)," *Schaffner*, no. 376 (type of *P. Schaffneri*).

According to Margaret Armstrong (West. Wild Fl. 536), the local name (southwestern U. S.) "Brown-foot" alludes to the mass of brown woolly hairs covering the caudex of this and the other North American species of *Perezia*.

13. ***P. Coulteri*** Gray, Proc. Amer. Acad. xv. (1880) 40; loc. cit. xix. (1883) 59.

Unbranched, erect perennial about 7.5 dm. high; stem rigid, sulcate to striate, glandular-puberulent, leafy to within a short distance of the inflorescence; leaves sessile, chartaceous, often somewhat rigid, oblong-lanceolate to -oblanceolate, glandular-puberulent, especially on the lower surface, prominently to weakly reticulate, repand-denticulate to subentire, often subrevolute, acute to obtuse at the apex, often abruptly rounded to truncatish at the base, 5–10 cm. long, 11–26 mm. wide; inflorescence corymbose, widely triangular, with a spread of 6–15 cm. and slightly less high; heads 10–20-flowered; involucre (2–)3-seriate, 6–10 mm. high; phyllaries membranaceous-chartaceous, linear-lanceolate, very little imbricated, slightly sericeo-ciliate to eciliate, subpuberulent to glabrate dorsally; corollas lavender-pink; mature achenes glandular-puberulent, striate, 5–6 mm. long; receptacle only slightly alveolate, obscurely glandular and very sparingly pilose.

South central Mexico and northwestern Guatemala; perhaps occurring in an uninterrupted range between these two regions.

MEXICO: SAN LUIS POTOSÍ: hillsides, San José Pass, *Pringle*, no. 3178 (Gr., N. Y.). HIDALGO: Zimapán, *Coulter*, no. 234 (TYPE).

GUATEMALA: HUEHUETENANGO: Chaculá, on sparsely wooded calcareous slopes, growing below oaks, alt. 1600 meters, *Caec. & Ed. Seler*, no. 3069.

In his original diagnosis (first citation above), Gray confused a form of *P. Wrightii* with this species. In the second citation given, he redefined *P. Coulteri*, basing it entirely on the Coulter specimen cited.

14. ***P. dissiticeps*** Bacigalupi (see p. 17).

Glabrous perennial about 10 dm. tall; stem simple, teretish, leafy, glabrous, smooth, striate-angular, buff-brown, glaucescent, very slightly flexuous and laxly branching above to form the inflorescence; leaves sessile, thin-chartaceous, reticulate, pale green, glaucescent to glaucous, especially below and more especially on the midribs, slightly shining above, the cauline oblong, obtuse and often mucronulate, slightly to not at all narrowed below, unequally spinulose-dentate, 5.5–9 cm. long, 16–25 mm. wide, those of the flowering branches oblanceolate, spinulose-denticulate, narrowed to the shortly rounded

to subsagittate base, 2.5–6 cm. long, 7–18 mm. wide; inflorescence-branchlets slender, glabrous, almost naked, the very sparse ascending bracts very small, 1–2 mm. long, lance-subulate, minutely ciliolate, one or two of the lower 5–10 mm. long; peduncles divaricate, 1.5–6 (mostly 2–4) cm. long, minutely glandular only at the very top; heads 14–18-flowered, 12–15 mm. high; involucre (3–)4-seried, campanulate, 7–8 mm. high; phyllaries dorsally glabrate, sericeo-ciliolate, the outer spreading, lanceolate-oblong, the inner oblong, strikingly thickened and very slightly narrowed toward the base, purplish-tinged on the margin toward the obtuse and somewhat mucronulate to somewhat acutish apex; corolla lavender-pink, 8 mm. long, the throat of the tube and the lower parts of the segments resinous-punctulate; pappus soft, whitish, in 1–2 series, the relatively sparse bristles sometimes very slightly thickened toward or at the apex; achenes brown, linear-oblong, sparsely to copiously resinous-punctulate, about 3 mm. long; receptacle flattish, quite deeply scrobiculate, the slender ridges between the alveolae resinous-punctulate.

MEXICO: SAN LUIS POTOSÍ: Sierra Tablón, Minas de San Rafael, *Purpus*, no. 5018 (TYPE, Gr. and isotype, N. Y.).

15. ***P. montana*** Rose.

Erect, slender, leafy, glabrous and glaucous perennial 9–15 dm. high, becoming attenuated above; stem sometimes somewhat decumbent at the base, soon erect and rigid, often slightly flexuous at the very slender top, striate, smooth, glabrous, often glaucescent to quite glaucous, light green, commonly reddish-tinged; leaves rigid-cartilaginous, thin, closely reticulate, glabrous, grey-green and conspicuously glaucous, oblong to linear-oblong, not at all narrowed toward the very broadly cordate- to subhastate-clasping base, the auricles usually overlapping and often greatly exaggerated, acute or very shortly acuminate, 5–15 cm. long, 18–30 mm. wide, very coarsely and unequally spinulose- to spinose-dentate, the acute triangular teeth 2–3.5 mm. long; inflorescence a more or less lax, divaricately branched, leafy-bracteate cyme, the branches very slender, smooth and glabrous, the glabrous ultimate peduncles rarely naked or bearing a single scale, more usually bearing several sparse to moderately crowded lance-subulate, cuspidate, entire to serrate-denticulate, often ciliolate scales; heads 18–25 mm. high, 19–22-flowered; involucre turbinate, acute at the base, 12–15 mm. high (in var.  $\beta$ . campanulate and rounded to obtuse at the base, 9–10 mm. high); phyllaries in 5–7 series, cartilaginous, greenish to stramineous, often purplish, the short basal ones densely imbricated, merging (in var.  $\alpha$ .) with the peduncular

scales, very rigid, narrowly ovate-lanceolate, cuspidate, more or less copiously sericeo-ciliate, the inner oblong-lanceolate (var.  $\alpha$ .) to oblong (var.  $\beta$ .), much more loosely imbricated, becoming much less densely ciliate than the basal ones, often ultimately eciliate, sometimes rigid only below, the often narrowly scarious apex varying (in var.  $\alpha$ .) from very shortly acuminate to merely acute or (in var.  $\beta$ .) obtuse to rounded and sometimes very minutely mucronulate; corollas lavender-pink, 12 mm. long, essentially glabrous; pappus slightly stiff, fine, a little tawny, in 1-2 series; mature achenes widely fusiform, costulate, more narrowed above just below the slightly expanded disc than toward the base, glabrous to hispidulous, 6-7 mm. long; receptacle flattish, very shallowly to somewhat deeply scrobiculate, essentially glabrous, the fimbriolate ridges between the areolae sometimes glandular.

## KEY TO VARIETIES.

- Inflorescence diffuse, the heads not aggregated into definite cymules; peduncles more or less densely squamose; involucre turbinate, acute at the base, 12-15 mm. high; inner phyllaries oblong-lanceolate, very shortly acuminate to merely acute. . . . Var.  $\alpha$ . *typica*.
- Inflorescence made up of definite, lax, 2-3-headed cymules; peduncles nearly naked; involucre campanulate, rounded to obtuse at the base, 9-10 mm. high; inner phyllaries oblong, obtuse to rounded at the apex, sometimes very minutely mucronulate. . . . . Var.  $\beta$ . *intermedia*.

Var.  $\alpha$ . **typica**. Inflorescence widely paniculate and abundantly leafy-bracteate, the branches divaricate and very slender, the closely approximated peduncular scales gradating into the basal phyllaries; the wiry peduncles mostly 2.5-3.5 cm. long, divergent, the heads widely separated, not arranged in definite cymules; involucre acute at the base, obconic-campanulate, 12-15 mm. high; inner phyllaries oblong-lanceolate, very shortly acuminate to merely acute.—*P. montana* Rose, Contrib. U. S. Nat. Herb. i. (1891) 105, pl. viii.

MEXICO: SONORA: "under oaks on the higher parts of the" Sierra de los Álamos, southern Sonora, *Palmer* (1890), no. 285 (Gr., isotype); vicinity of Álamos, Sierra de los Álamos, *Rose, Standley & Russell*, no. 13077 (N. Y.); Oakridge Pass, alt. 5730 feet, *Hartman*, no. 334; cañon, Rinconada, *C. E. Lloyd*, no. 419. CHIHUAHUA: (with immature heads) Guayanopa Canyon in the Sierra Madre, alt. about 1100 m., Sept. 24, 1903, *M. E. Jones* (P. C.).

Var.  $\beta$ . **intermedia** Bacigalupi (see p. 19). Inflorescence made up of more or less definite, lax, 2-3-headed cymules, less diffuse than in var. *typica*; peduncles smooth, glabrate to glabrous, naked or more usually bearing, at or about the middle, an ovate-lanceolate, glabrous, spreading or ascending bract (very rarely another much smaller one

just below the involucre), this campanulate, obtuse to rounded at the base, 9–10 mm. high; inner phyllaries oblong, not at all narrowed at the base, rounded and blunt to obtuse at the apex, sometimes tipped with a very minute mucro; otherwise as in variety *typica*.

MEXICO: DURANGO: Santiago Papasquiario, *Palmer* (1896), no. 59 (TYPE, Gr.).

16. ***P. platyphylla*** Gray, Mem. Amer. Acad. ser. 2, iv. [Pl. Fendl.] (1849) 111.

Rigid, erect perennial 6.5–18 dm. tall, apparently simple below the inflorescence; stem slightly flexuous, striate, often slightly glaucous, smooth, glabrous, often purplish; leaves sessile, rigid, coriaceous, glabrous, often slightly glaucous, finely reticulate, the lower midrib often very prominent, the cauline imbricate, orbicular- to widely oblong-obovate, more usually closely and sharply triangular-dentate, the teeth sometimes spinulose, sagittately to cordately clasping, sometimes shortly mucronate at the widely rounded apex, 6–12 cm. long, 5–10 cm. wide, those of the inflorescence becoming lance-ovate, finely and intermittently spinulose-denticulate to entire, the uppermost often merely subhastate to shortly rounded at the base, 1–3.5 cm. long; inflorescence made up of corymbosely disposed glomerulate cymules, even the ultimate peduncles quite glabrous; heads at anthesis 15–18 mm. high, 10–12-flowered; involucre turbinate-campanulate, 9–12 (mostly 10) mm. high; phyllaries broadly (slightly less than 2 mm. wide) to more narrowly (about 1 mm. wide) oblong, the outermost ovate, the broader inclined to be quite obtuse, the narrower somewhat acutish, all indurate, glabrous to glabrate dorsally, more or less copiously rusty-tomentulose on the edges; corollas lavender-pink; mature achenes fusiform-cylindric, somewhat incurved at the base, weakly striate, appressed-hirsutulous, glandular as well when young, 5–6 mm. long, only slightly expanded at the summit; pappus rather stiff, mostly in 2 series; receptacle very shallowly alveolate, very sparingly glandular.

Sierra Madre of Mexico from Chihuahua to Michoacán.

MEXICO: CHIHUAHUA: Cosiquiriachi, in the Sierra Madre, west of Chihuahua, *Wislizenus* (TYPE); cool slopes, mountains near Chihuahua, *Pringle*, no. 766 (N. Y.); Santa Eulalia Mountains, *Pringle*, no. 583; "southwestern Chihuahua," *Palmer*, no. 299 (1885). DURANGO: Sandía Station, *Pringle*, no. 13649; Cerro Prieto to La Providencia, *E. W. Nelson*, no. 4965 (N. Y.). MICHOACÁN: hills, Jesús del Monte, near Morelia, elev. about 2000 m., *Pringle*, no. 10401 (distributed as *P. michoacana*); hills near Patzcuaro, *Pringle*, no. 3949 (Gr., N. Y.).

17. ***P. rigida*** (DC.) Gray.

Erect, robust, leafy, apparently simple perennial 6–18 dm. high; stems smooth, glabrous, more or less striate, in more robust specimens sulcate as well, often slightly flexuous and tinged with purple above, usually somewhat glaucous; leaves highly variable in outline, the lower from spatulate-oblong to oblong or elliptic-oblong (or in vars.  $\beta$ . and  $\gamma$ . linear-oblong and broadest above the middle, ascending to spreading, arcuate and strongly conduplicate), the base truncatish to cordate-amplexicaul, the apex obtuse to merely obtusish, usually somewhat mucronate, subentire to coarsely and usually unequally spinulose-dentate, rigid, thick-coriaceous, closely reticulate, smooth, glabrous, very often somewhat though not conspicuously glaucous, 6–14 cm. long, 2.5–6.5 cm. wide; the upper more usually from linear or oblong to lance-oblong, often acute, closely spinulose-denticulate to subentire, 4–10(–15) cm. long, 1.5–3(–6) cm. wide (the linear ones 4–10 mm. wide), otherwise as in the basal leaves; floral leaves quite entire, not at all cordate at the base, sometimes oblanceolate; inflorescence corymbose to widely paniculate, the ultimate peduncles often sparingly puberulent; heads closely approximated into cymules at the periphery of the inflorescence, 9–11(–14)-flowered, 14–20 mm. high; involucre usually 4-seried, turbinate- to oblong-campanulate; phyllaries indurate, moderately well imbricated, more usually minutely glandular-ciliolate, less usually sericeo-ciliate, dorsally glabrate to slightly glandular or merely puberulent, the outer ovate, the others oblong, the tips mostly obtuse, sometimes barely acutish, rarely mucronulate (in var.  $\gamma$ . abruptly acuminate); corollas lavender-pink, more usually the upper portion of the tube glandular-punctulate, the basal portion of the segments, particularly the 2 linear inner ones, glandular-ciliolate, less usually glabrate; pappus stiffish, very often slightly clavellate-thickened toward the apex, in 2 series; achenes subcylindric (in var.  $\gamma$ . broadly fusiform and costulate), somewhat narrowed above, surmounted by the slightly expanded epigynous disc, densely glandular, 4–5 mm. long; receptacle not deeply alveolate, glabrous to sparingly glandular.

## KEY TO VARIETIES.

- Phyllaries obtuse to more rarely acutish, not at all acuminate, mostly glandular-ciliolate; mature achenes subcylindric, 4–5 mm. long, not more than 0.5 mm. wide.  
 Heads usually 10-flowered, varying from 9–11-flowered; upper cauline leaves broadly oblong or elliptic-oblong, neither arcuate nor conduplicate; corollas glandular-punctulate, the segments glandular-ciliolate toward the base. . . . . Var.  $\alpha$ . *typica*.  
 Heads 14-flowered; upper cauline leaves linear-oblong, slightly broader above the middle than below, somewhat arcuate

and strongly conduplicate; corolla mostly glabrate, with only an occasional gland present. . . . . Var.  $\beta$ . *linearifolia*.  
 Phyllaries narrower, shortly acuminate, broadest above the middle, shaggily sericeo-ciliate; mature achenes broadly fusiform, 6 mm. long, 1–1.5 mm. wide; leaves and corollas as in var.  $\beta$ . . . . . Var.  $\gamma$ . *acuminata*.

Var.  $\alpha$ . **typica**. Leaves broadly oblong or elliptic-oblong, the lower often widely spatulate-oblong, 6–14 cm. long, 2.5–6.5 cm. wide, those of the inflorescence 1–3 cm. long, often varying to lance-oblong or oblanceolate; heads 9–11-flowered, mostly 10-flowered; phyllaries obtuse, often tipped with a minute mucro, mostly widely oblong and densely glandular-ciliolate, the outer sometimes sparingly sericeo-ciliate; tube of the corolla glandular-punctulate above, the segments, particularly the 2 linear inner ones glandular-ciliolate at the base; mature achenes subcylindric, 4–5 mm. long, not more than 0.5 mm. wide.—*P. rigida* (DC.) Gray, Pl. Wright. i. (1852) 127; *Acourtia rigida* DC. Prodr. vii. (1838) 66; *A. formosa* Hook. & Arn. Bot. Voy. Sulph. (1845) 122, not D. Don.

Sierra Madre of Mexico from Durango to Guanajuato.

MEXICO: DURANGO: vicinity of Durango, *Palmer* (1896), no. 611, in part. SAN LUIS POTOSÍ: region of San Luis Potosí, alt. 1830–2440 m., *Parry & Palmer* (1878), no. 558; “ex convalli San Luis Potosí, in umbrosis prope San Miguelito,” *Schaffner*, no. 375 (Gr., N. Y.). GUANAJUATO: Moro León, Feb., 1898, *A. Dugès*; near Guanajuato (by inference from original diagnosis), *Mendez* (fragment of type of *Acourtia rigida* DC.).

Var.  $\beta$ . **linearifolia** Bacigalupi (see p. 18). General habit of variety *typica*; leaves linear-oblong, slightly wider above the middle than below, not narrowed toward the base, the lower about 14 cm. long, 2.5–4 cm. wide, tending to be arcuate and conduplicate, this tendency of the leaves increasing upward, the upper cauline narrowly oblong-linear to linear, strongly conduplicate, 6–9 cm. long, 8–24 mm. wide; heads 14-flowered; phyllaries glabrate to slightly glandular-puberulent, oblong to lance-oblong, obtuse to acutish, for the most part minutely but densely glandular-ciliolate, more rarely sparsely and shaggily sericeo-ciliate; corollas mostly glabrate exteriorly with only an occasional gland present; achenes as in var. *typica*.

MEXICO: GUANAJUATO: Guanajuato, *Dugès*. JALISCO: Rio Blanco, Oct., 1866, *Palmer*, no. 661 (Gr., N. Y.); cool hillsides near Guadalajara, *Pringle*, no. 1860 (TYPE, in Gr. and isotype, N. Y.); rocky bluffs of a barranca near Guadalajara, elev. 1525 m., *Pringle*, no. 9950 (N. Y.).

Var.  $\gamma$ . **acuminata** Bacigalupi (see p. 19). Leaves all linear-oblong, a little wider above the middle, not narrowed below to the base, very strongly conduplicate, arcuate, especially toward the tips,



divergent to ascending, 5–14 cm. long, 8–32 mm. wide, like those of var. *linearifolia* in all other particulars; heads 9-flowered; involucre narrowly obconic-campanulate, mostly 9 mm. long, varying in length from 8–10 mm.; phyllaries narrower than in the preceding varieties, all but the outermost narrowly oblanceolate in outline, gradually narrowed toward the base from above the middle, more or less copiously sericeo-ciliate, shortly acuminate and acute; corollas as in var. *linearifolia*; mature achenes minutely glandular, costulate, widely fusiform, 6 mm. long, 1–1.5 mm. wide.

MEXICO: JALISCO: rocky bluffs of a barranca near Guadalajara, elev. 1525 m., Pringle, no. 9950 (TYPE, Gr.).

18. **P. tomentosa** T. S. Brandegee, Zoe v. (1908) 258.

Simple, leafy, erect, densely deciduous-tomentose perennial 2–4 dm. tall; stem terete, striate, the dense, rusty tomentum of the caudex clothing its somewhat decumbent base for about 5 cm., the remaining portion densely floccose-lanate with a more nearly whitish and somewhat arachnoid tomentum; leaves sessile, closely approximate and imbricate, completely covering the stem, for the most part, above the base, oval to oblong-ovate, shortly acuminate, serrate-dentate, the teeth acute and mostly spinulose, densely white-tomentose beneath, arachnoid on the slightly nitidulous and reticulate upper surface, the uppermost tending to be revolute, 3–5 cm. long, 13–27 mm. wide; heads occurring singly at the thickened end of the axis and short (2.5–3 cm. long) ascending peduncular branches inserted just below the axis-tip, about 50-flowered, hemispheric, 2–3 cm. thick above, 1.5–2 cm. high, sometimes, according to the author, sessile in the axils of the upper leaves; phyllaries in 3–4 series, 1–1.5 cm. long, the outer oblong-lanceolate, acuminate, tomentose, indurate below, the inner becoming scarious and less tomentose, linear-lanceolate, stramineous, the innermost arachnoid, at least toward the purplish, caudate-attenuate, glandular-punctate and, at least in the dried specimen, recurved or tortuous tips; corollas lavender-pink, about 1 cm. long, the outer ligule and the two linear segments of the inner lip strikingly glandular-ciliolate; pappus soft and fine, with a silky lustre, biseriate only on the wider portions of the scarcely enlarged epigynous disc of the oblong-cylindric (5 mm. long) resinous-papillose achenes.

MEXICO: PUEBLA: dry, sunny hills, Esperanza, Sept., 1907, Purpus, no. 2632 (isotype, Gr.).

A well-marked and apparently little-collected species from a region by no means rarely visited by botanical collectors.

19. **P. Parryi** Gray, Proc. Amer. Acad. xv. (1880) 40.

Erect, caulescent perennial subequally branched from near the base; stems many, slender, rigid, leafy from near the base to the very summit, slightly to deeply striate, glandular-puberulent, scabrous, becoming glabrate and smoothish, inclined to be flexuous, 10–30 cm. long; leaves sessile, ascending, cuneate-oblong to cuneate-obovate, rarely rounded at the base, irregularly and rather saliently pungent-dentate, sometimes less so or not at all at the base, glandular-punctate and smoothish to glandular-scabrous, subcoriaceous, 18–30 mm. long, 9–16 mm. wide; heads terminating the branches, borne singly, immediately subtended by the uppermost leaves, 18–23 mm. high, 15–18-flowered; involucre subtruncate to rounded at the base, campanulate; phyllaries well imbricated, indurate, the outer ovate, 2–4 mm. broad, mostly abruptly cuspidate-acuminate, dorsally glandular to glabrate, sometimes glandular-ciliolate, the inner oblong, acute, about 1.5 mm. wide; corollas lavender-pink; mature achenes sometimes sparsely covered with subsessile glands, otherwise smooth and glabrous, slenderly subcylindric, 5–7 mm. long; receptacle somewhat deeply alveolate, sparsely glandular, otherwise glabrous.

Central Mexico from southern Coahuila to Querétaro.

MEXICO: COAHUILA: Saltillo, *Parry*, no. 41 (1878); same locality, *Palmer* (1898), no. 278 (Gr., N. Y.); Sierra de Párras, *Purpus*, no. 1129 (Gr., N. Y.). ZACATECAS: plains, Cedros, *Lloyd & Kirkwood*, no. 151. SAN LUIS POTOSÍ: "In arenosis prope S. Luis Potosí," *Schaffner*, no. 372; region of San Luis Potosí, *Parry & Palmer*, no. 545, in 1878 (TYPE). QUERÉTARO: along road to Cadereyta, near San Juan del Rio, *Rose, Painter & Rose*, no. 9620 (Gr., N. Y.).

20. **P. nana** Gray, Mem. Amer. Acad. ser. 2, iv. [Pl. Fendl.] (1849) 111; illustr. in Armstrong, West. Wild Fl. (1915) 537.

Suffruticose, usually dwarfed and densely leafy (2.5–15 cm. high), or when taller (up to 28 cm.), divaricately branching perennial; lower cauline nodes bracteate and usually bearing a conspicuous tuft of rust-colored tomentum; stems densely glandular-scabrous, ultimately smooth and glabrous, often somewhat sulcate and flexuous; leaves sessile, rhombic-orbicular to suborbicular, rhomboidal to rounded at the base, rounded to subattenuate at the apex, coarsely, acutely and irregularly spinulose-dentate, raised-reticulate on both surfaces, from copiously glandular-scabrous and glandular-ciliolate to smooth and glabrous, yellow-green to glaucescent, 2–4(–5) cm. wide, mostly as long as wide; heads single at the stem-tips, leaf-subtended (hence "sessile"), deeply campanulate, 19–28 (mostly 20–25) mm. high, the smaller heads about 15-flowered, the larger 20–24-flowered; phyllaries mostly in 4(–5) series, well imbricated, chartaceo-coriaceous, the

outermost ovate, obtuse to acuminate and mucronate, the others oblong-lanceolate, acuminate, often slightly scarious-edged, sericeo-ciliolate to merely glandular-ciliolate, glandular-puberulent (especially the outer) dorsally, corollas lavender-pink; achenes subcylindric, prominently costate, 6–8 mm. long, more or less densely beset, especially above, with shortly stipitate glands; receptacle deeply alveolate, the alveolae separated from one another by a brownish membrane, this fimbriate at the top.

Southeastern Arizona, southern New Mexico and southwestern Texas southward in Mexico to San Luis Potosí.

UNITED STATES: ARIZONA: Benson, May 7, 1882, *G. W. Dunn*; without more specific locality, *Lemmon*, no. 83 (1880); "southern Arizona," *Palmer*, no. 144 (1867); Wilmot, elev. 780 m., *Thornber*, no. 353 (P. C., N. Y.); Fort Verde, Aug. 27, 1887, *Mearns* (N. Y.); Fort Huachuca, May, 1892, *Wilcox* (N. Y.); Agua Verde Creek, *Harris*, no. C1483 (N. Y.); Tucson, *Griffiths*, no. 2061 (N. Y.); Mt. Desert, Chiricahua Mountains, alt. 1920 m., *Blumer*, no. 2194 (Gr., N. Y.). NEW MEXICO: plains of the upper Gila, May 27, 1880, *E. L. Greene* (Gr., N. Y.); Gila Valley, June, 1880, *E. L. Greene* (P. C.); Nogal, Lincoln County, *Josephine Skehan*, no. 26 (Gr., N. Y., P. C.); Organ Mountains, Dona Ana County, April 29, 1899, *E. O. Wooton*; mesa near Las Cruces, Dona Ana County, alt. 1300 m., Sept., 6, 1897, *Wooton* (N. Y.); Fillmore Canyon, Organ Mountains, April 29, 1899, *Wooton* (N. Y.); "chiefly in the Valley of the Rio Grande below Donana," *Parry, Bigelow, Wright, & Schott* (Mex. Bound. Surv.) (N. Y.); Rincon, April 30, 1884, *M. E. Jones* (P. C.), May 16, 1890, *M. E. Jones* (P. C.); dry hills and plains, Grant County, *Rusby*, no. 181 (N. Y.); Gila River bottom near Cliff, Grant County, alt. 1370 m., *Metcalf*, no. 773 (N. Y.); Florida Mountains, *A. Isabel Mulford*, no. 1044a. TEXAS: El Paso, April 15, 1884, *M. E. Jones* (P. C.); in arroyo on S. P. Railroad, 4 miles west of Sierra Blanca, Hudspeth County, *Ferris & Duncan*, no. 2487 (N. Y.); Castle Mountain Pass, *Thurber* (1850), no. 93; Barstow, *Tracy & Earle*, no. 60 (Gr., N. Y.); flats near Big Spring, Howard County, May 9, 1901, *H. Eggert*; Fort Stockton, *H. C. Hanson*, no. 565 (Gr., N. Y.); Marfa, June 9, 1895, *E. N. Plank* (N. Y.); Tom Greene County, 1878, *F. Tweedy*; without more specific locality, *Wright*, no. 410 (Gr., N. Y.).

MEXICO: SONORA: San Pedro, *Hartman*, no. 830. CHIHUAHUA: calcareous soil, hills near Chihuahua, *Pringle*, no. 979 (N. Y.); high dry valley near Chihuahua, April 28, 1847, *Gregg*, no. 45 (TYPE, Gr., isotype, N. Y.); (in this state by inference) *Gregg*, no. 520 ("1848-'49"); vicinity of Chihuahua, alt. about 1300 m., *Palmer* (1908), no. 156 (Gr., N. Y.); Santa Eulalia Mountains, *Pringle*, no. 13 (Gr., N. Y.). COAHUILA: Saltillo, *Palmer* (1898), no. 85 (Gr., N. Y.). SAN LUIS POTOSÍ: region of San Luis Potosí, alt. 1850–2430 m., *Parry & Palmer* (1878), no. 546; "ex convalli San Luis Potosí, *Schaffner*, no. 373 (Gr., N. Y., P. C.).

UNITED STATES AND MEXICO: "along branches of the San Pedro, Sonora; Sept. Stony hills, near El Paso; March," *Wright*, no. 1418.

"Desert Holly" is the local Southwestern name, according to Margaret Armstrong (West. Wild Fl. 536).

### 21. *P. Wislizeni* Gray.

Simple, erect, leafy, glabrous perennial 3.5–7 or more dm. tall; stems unbranched or rarely divided at the top, teretish, striate,

glabrous, smooth, often reddish-tinged and somewhat glaucous; leaves ascending, approximate, often imbricated, sessile, coriaceous and rigid, often very thick, oblong-obovate or spatulate-oblong to oblanceolate, narrowed to a base varying from narrowly truncatish to shortly rounded and semi-amplexicaul, rounded to obtuse and usually shortly mucronate at the apex, very closely and minutely spinulose-denticulate to irregularly and serrately sinuate-dentate, the teeth 1.5–2 mm. long, glabrous and smooth save for the close and prominently raised reticulations on either surface, often glaucescent, 5–14 cm. long, 2–5.5 cm. wide; upper leaves entire, often somewhat amplexicaul, oblong to elliptic-spatulate, crowded and subimbricate up to the involucre or sparse, 2–4 cm. long; single head sessile on the usually enlarged stem-summit, widely hemispheric, truncate at the base, 50–60(–“80”)-flowered, 3–4 cm. high, 3.5–5 cm. thick; phyllaries more or less coriaceous, in 5–7 series, entire to somewhat sericeo-ciliate, glabrous dorsally, from dark purplish throughout to only at the tips, the inner oblong-lanceolate, acute and long-acuminate to widely oblanceolate and obtuse, with or without a small mucro, the outermost ovate-lanceolate, ovate, oblong-lanceolate or oblanceolate; corollas lavender-pink, 17–20 mm. long; pappus soft to rather rigid, somewhat tawny, some of the bristles obscurely clavellate-thickened toward the apex, biseriate, most often slightly exceeded by the corolla; achenes oblong-cylindric to linear-cylindric, deeply striate, smooth and glabrous to very sparingly glandular-punctate, 8–11 mm. long; receptacle (fide Gray) subalveolate and glabrous.

#### KEY TO VARIETIES.

- Upper portion of the stem naked save for reduced and sparse bractlike leaves; cauline foliage thin-coriaceous, minutely spinulose-denticulate; outer basal phyllaries ovate or more rarely ovate-lanceolate. . . . . *Var. α. typica.*
- Upper portion of the stem more or less densely leafy-bracteate up to the involucre; cauline foliage thickly coriaceous, irregularly and serrately sinuate-dentate, the teeth 1.5–2 mm. long; outer basal phyllaries oblong-lanceolate to oblanceolate. *Var. β. megacephala.*

*Var. α. typica.* Apparently the more commonly collected and more northerly variety.—*P. Wislizeni* Gray, Mem. Amer. Acad. ser. 2, iv. [Pl. Fendl. (1849)] 111; *P. Wislizeni* subsp. *minor* Blake, Contrib. U. S. Nat. Herb. xxii. (1924) 653. The latter is based on a specimen with an underdeveloped and insect-ridden (in the field?) head.

MEXICO: CHIHUAHUA: Llanos, in the Sierra Madre west of Chihuahua, *Wislizenus*, no. 198 (TYPE); pine plains, base of the Sierra Madre, *Pringle*, no. 1307 (Gr., N. Y.); roadside near San Julian, alt. 2135–2440 m., *E. W. Nelson*, no. 4925. DURANGO: city of Durango and vicinity, *Palmer* (1896), no. 788;

without more definite locality, alt. 1000 meters, *P. Ibaña García*, no. 376 (type of *P. Wislizeni* subsp. *minor* Blake).

Var.  $\beta$  ***megacephala*** Gray. Apparently a more southerly variety.—*P. Wislizeni* var. *megacephala*, Gray, Proc. Amer. Acad. xxii. (1887) 433; *P. megacephala* Greenman, Proc. Amer. Acad. xli. (1905) 269.

MEXICO: NAYARIT: Tepic, *Palmer* (1892), no. 1962 (Gr., N. Y.); Tepic. *M. E. Jones*, no. 23358 (P. C.). JALISCO: Rio Blanco, *Palmer* (1886), no. 655 (TYPE, Gr. and isotype, N. Y.); gravelly hillsides near Guadalajara, *Pringle*, no. 2290 (N. Y.).

22. ***P. thyrsoides*** Gray, in Torr. Bot. Mex. Bound. (1859) 104.

Densely and amply leafy perennial 6–15 dm. high; stem apparently simple, robust, copiously glandular-pubescent, scabrid; leaves approximate, usually imbricate-ascending, sessile, all save the uppermost shortly sagittate-clasping at the somewhat rounded base, elliptic to oblong-ovate, obtusish to shortly acuminate and pungent at the tip, rigid, subcoriaceous, conspicuously reticulate, especially beneath, densely glandular-hispidulous, especially on the veins beneath, scabrid, glandular-ciliolate, the upper closely spinulose-serrulate, the lower much more remotely and irregularly so, the floral leaves 25–70 mm. long, 15–35 mm. wide, the lower 12 cm. long or longer and about half as wide; inflorescence a dense, strict, elongated cylindrical thyrses, each 2–4-headed cymule nearly equalled by a subtending leaf; ultimate peduncles bearing imbricated linear-lanceolate densely glandular bracts; heads 20–25 mm. long, 10–12-flowered; involucre obconic; phyllaries attenuate-subulate, very acute, in 3–4 series, densely and uniformly glandular-puberulent, not indurate though somewhat rigid below; corollas lavender-pink; immature achenes narrowly subcylindrical, slightly more narrowed above, densely glandular-puberulent, 5–6 mm. long; receptacle somewhat deeply alveolate, glandular-puberulent.

MEXICO: GUANAXUATO: mountains of Guanaxuato, 1902, *A. Dugès*; Guanaxuato, 1829, *Berlandier*, no. 1329 (TYPE). HIDALGO: hills near Tula, about 2075 m. elev., *Pringle*, no. 9950 (Gr., N. Y.). MICHOACÁN: hills near Patzeuaro, *Pringle*, no. 3985 (Gr., N. Y.); Acambaro, *Caec. & Ed. Seler*, no. 1175 (Gr., N. Y.).

23. ***P. formosa*** (D. Don) Gray, Proc. Amer. Acad. xix. (1883) 58; *Acourtia formosa* D. Don, Trans. Linn. Soc. xvi. (1830) 204; *P. turbinata* Gray, Pl. Wright. i. (1852) 126, not La Llave & Lex.; *Trixis turbinata* Sch. Bip. in Seem. Bot. Voy. Herald (1856) 315; *Acourtia macrocephala* Sch. Bip. in Seem. in syn., loc. cit. and pl. 55.

Erect, leafy, apparently simple perennial at least 6–9 dm. high; stems rigid, teretish, the slightest bit flexuous and quite striate above,

smooth and glabrous, often purplish-tinged, leafy up to the inflorescence; leaves closely approximated, the bases subimbricate, rigid-coriaceous, sessile, smooth save for the raised and close reticulations, rarely a little scabrid-puberulent on the larger reticulations beneath, linear-oblong to lance-oblong, cordate-clasping, attenuate and acute to obtusish and mucronulate at the apex, often ciliolate with minute callosities, strongly conduplicate and arcuate, irregularly and moderately closely spinulose-dentate, the major dentations 1–2 mm. long and very acute, the upper cauline leaves 9–15 cm. long, 2–3 cm. wide, gradually becoming shorter upward; inflorescence condensed, corymbose-glomerate, 4–5-headed; peduncles becoming gradually thickened above, merging into the base of the involucre, 10–12 mm. long, densely imbricate-squamose, the scales appressed, glabrous, lance-subulate; heads 25–30-flowered (fide D. Don and Gray), 2.5–3.5 cm. high; involucre obconic-turbinate, very acute at the base, spreading above, 2–3 mm. wide; phyllaries stiffish-chartaceous, lance-oblong, stramineous, purplish toward the very acute and shortly acuminate apex, readily disarticulating, well imbricated in 5–7 series; pappus rather soft, only a few of the bristles noticeably, and then very slightly, clavellate-thickened toward the apex.

MEXICO: DURANGO: city of Durango and vicinity, *Palmer*, no. 611, in part (1896) (immature specimen, referred here provisionally). No DEFINITE STATE SPECIFIED: "N. W. Mexico" (i. e. northwest of the City of Mexico), *Seemann*. (Seemann collected in southern Durango and Sinaloa, in Nayarit and northern Jalisco.)

The achenes in the only mature specimen seen by the writer were badly insect-eaten. Material at hand was moreover too scant to warrant an examination of the receptacle.

Don described the achenes as teretish, papillose-scabrous, a half inch long, with the epigynous disc very slightly dilated. The receptacle, according to this author, is glabrous and scrobiculate.

24. ***P. longifolia*** Blake, *Journ. Wash. Acad. Sci.* xviii. (1928) 36; *P. foliosa* M. E. Jones, *Contrib. West. Bot.* no. 15 (1929) 154, not of Rusby, 1896.

Erect, robust, leafy perennial at least 60 cm. tall; stems usually several from the caudex, simple, herbaceous and relatively slender (3–6 mm. thick), terete, usually hollow, very finely striate, very smooth and glabrous, purple-tinged and glaucescent; leaves sessile, ascending, overlapping, chartaceo-coriaceous, scabrid to scabrous, lance-elliptic to nearly linear-elliptic, shortly cordate-clasping, closely, unequally and somewhat serrately spinulose-denticulate (the sinuses between the teeth rounded), callose-ciliolate, entire at the acuminate

and very acute apex, somewhat prominently reticulate, especially beneath, roughened with minute hairs on the reticulations above, paler and roughish-hispidulous on the reticulations beneath, 15–27 cm. long, 3.5–7 cm. wide; inflorescence 2–3-headed or the heads sometimes sessile in the axils of the upper leaves; peduncles 0.5–3.5 cm. long, glabrous to puberulent, densely appressed-squamose; scales imbricate, sometimes spreading, lance-subulate, entire, glabrous, 0.5–1 cm. long; heads 3–3.5 cm. high, 45–55-flowered; involucre turbinate, acutish to very acute at the base, about 2.5–3 cm. high; phyllaries glabrous, thinly membranaceo-chartaceous, oblong-lanceolate, attenuate-acuminate and acerose-tipped, strongly imbricate, in about 7 series, stramineous and often suffused with lavender-pink, gradating into the peduncular scales; corollas lavender-pink, 2.5 cm. long, glabrous; pappus moderately stiff, mostly in 2 series, the bristles not appreciably thickened above; achenes narrowly cylindrical, 8 mm. long, densely glandular-punctate and appressed-hispid, infundibular-spreading above to form the epigynous disc; receptacle flattish, not deeply scrobiculate, glandular-punctate.

MEXICO: JALISCO: Calabazas, 1925, *Reko*, no. 4872 (TYPE, U. S.). NAYARIT: "on prairies," La Barranca, *M. E. Jones*, no. 23359 (type of *P. foliosa* Jones, P. C. The number of the type is doubtless erroneously cited in the original diagnosis as no. 23358); Tepic, *Palmer* (1892), no. 1972 (distributed as *P. turbinata* La Llave & Lex.).

25. *P. lepidopoda* Robinson, Proc. Amer. Acad. xliii. (1907) 47. Tall, erect, slender, very leafy, essentially glabrous perennial probably 12 dm. or more tall; upper 8 dm. of the stem (portion comprising the type specimen) slender, rigid, not more than 3.5 mm. thick, striate, very smooth and glabrous, dark-purplish; leaves sessile, crowded, rigid and thin-coriaceous, linear-oblong or -oblanceolate to linear, attenuate and very acute, sagittately to hastately clasping, reticulate, glabrous, arcuate to reflexed, conduplicate, yellow-green above, gray-green below, very saliently spinose-dentate, 6–14 cm. long, 6–22 mm. wide, the longer (2–4 mm. long) triangular-subulate spreading teeth usually alternating with others less than half as long; upper peduncular branches widely divaricate, the lower spreading almost at right angles to the axis, striate, sometimes slightly pubescent, 8–14 cm. long, distally somewhat appressed- and imbricate-squamose, the scales toward the base of the peduncles becoming distant and leaf-like; the upper acicular-subulate, minutely puberulent and ciliolate, gradating into the phyllaries, those toward the base linear-lanceolate, denticulate to entire, conduplicate and arcuate, sometimes subhastate, 1–2 cm. long; heads (immature) turbinate, many-flowered, 2.5–3 cm.

high; phyllaries lance-subulate, very acute, striate, greenish to stramineous and purplish-tinged, glabrate to slightly puberulent, minutely ciliolate, in about 7 series, easily disarticulating, the outer slightly spreading; receptacle somewhat convex, glabrate; flowers and fruit too immature.

MEXICO: MORELOS: valley near Cuernavaca, elev. 1220 m., *Pringle*, no. 9253 (TYPE).

In spite of the immature condition of the heads, it is plainly distinct from its most closely related species, *P. arachnolepis*.

26. ***P. arachnolepis*** Robinson, Proc. Amer. Acad. xliii. (1907) 47.

Slender, erect, moderately leafy perennial, simple below, branching above, 10–15 dm. high; stem more or less decumbent and tortuous at the base, soon rigid, straight and erect, very smooth, terete, striate below, glabrous, for the most part purplish, the lower leaf-axils often flocculent-tomentose with the tawny tomentum characteristic of the caudex; leaves sessile, oblanceolate- to linear-oblong, cordate-clasping to subhastate at the base, acuminate on an acutish to obtuse apex, closely and more or less regularly spinulose-denticulate, scabrid, thin-coriaceous, firm and rigid, finely reticulate, glabrous and dark green above, minutely hispidulous on the larger reticulations of the grey-green lower surface, 5.5–17 cm. long, 1.5–6 cm. wide; inflorescence a widely branching, lax, paniculate, 10–12-headed cyme; peduncles very slender, acicular-squamose and slightly arachnoid above, more or less naked below, 3.5–15 cm. long; heads 2–2.3 cm. high, about 15-flowered; involucre obconic-turbinate, acute at the base; phyllaries gradating into the peduncular scales, broadly lance-subulate, attenuate to a very acute apex, rigid except at the slender apex, arachnoid on the margins, glabrate dorsally, in 6–7 series; corollas lavender-pink, glabrous, 13 mm. long; pappus fine and soft, mostly biseriate; immature achenes subcylindric, densely appressed-hirsute, 3.5–4 mm. long.

MEXICO: JALISCO: canyons, Chapala Mountains, near Guadalajara, *Pringle*, no. 2935 (TYPE); barranca of Rio Blanco, near Guadalajara, *Pringle*, no. 13668.

27. ***P. Purpusii*** T. S. Brandege, Univ. Calif. Publ. Bot. iv. (1911) 194.

Leafy caulescent perennial of unknown height; stems and branches striate, becoming almost sulcate above, yellowish to purplish, glabrous save for small tufts of tawny wool concealed in all but the uppermost leaf-axils, occasionally puberulent; leaves sessile, lance-ovate, or oblong to oval, irregularly pungently dentate, the larger dentations somewhat acuminate, the smaller oval leaves usually spinulose-denticu-



late as well, very slightly cordate at the base, rounded at the apex and occasionally mucronulate, 25–55 mm. long, 14–35 mm. wide, the others quite cordate at the base, obtusish to acuminate at the apex, 30–70 mm. long, 13–32 mm. wide, all essentially glabrous, bright green and reticulate-veiny on both surfaces, smoothish to scabrid, especially on the upper surface, subcoriaceous; inflorescence 1–2(–“4”)-headed, terminal, the heads solitary on somewhat divaricate, densely squamose peduncles 6–10 cm. long; upper scales imbricated, often densely so, triangular-subulate to narrowly subulate, 5–6 mm. long, their margins becoming gradually more conspicuously sericeo-lanate upward, the lower becoming leaf-like and spreading, lanceolate, often long-acuminate, shortly ciliate to eciliate, 6–12 mm. long; heads 20–23 mm. high, 40–60-flowered; involucre obconic to turbinate-campanulate, its acutish base confluent with the somewhat expanded summit of the peduncle, 17–18 mm. high; phyllaries lance-subulate, mostly narrowed to a fine point, glabrate to puberulent dorsally, flocculent-lanate to arachnoid on the margins, fairly well imbricated in at least 4–5 series, especially the lower tending toward narrowly subulate and gradating into the peduncular scales; corollas lavender-pink; pappus copious, biserial, very fine and soft; achenes (immature) densely and minutely glandular, subcylindric, 3.5–4 mm. long, dilated above into a short epigynous disc; receptacle alveolate, moderately densely bristly.

MEXICO: SAN LUIS POTOSÍ: Minas de San Rafael, *Purpus*, no. 4787 (isotype, Gr.); Guadalucazar, *Dugès*, in 1883 (distributed as *P. turbinata*).

28. ***P. platyptera*** Robinson, Proc. Amer. Acad. xliv. (1909) 626.

Erect, leafy, moderately robust perennial 15 dm. tall; stem striate, slightly flexuous, stramineous, very smooth and glabrous, alate with the strikingly decurrent leaf-bases, these about 1 cm. wide at the top, gradually decreasing in width and shortly rounded off at the base, persisting for about two internodes, usually sparingly denticulate, like the leaves rigid and coriaceous, finely reticulate, smooth and glabrous; leaves spreading to somewhat erect, oblong-elliptic, mostly acute and acuminate, cuneate toward the decurrent base, spinulose-dentate, 10–12 cm. long, 3–4 cm. wide; inflorescence a widely corymbose cyme with the cymules subcongested at the flat broad top; branches of the inflorescence leafy-bracteate, the bracts lanceolate, the larger about 3 cm. long, decreasing upward, conspicuously decurrent, often sparingly denticulate only toward the base; heads 14–15-flowered, 15 mm. high; involucre obconic-campanulate, 9–10 mm. high; phyllaries rigid save at the acute, attenuate tips, narrowly lance-subulate, in 4–5 series, the basal ones very much shorter and

much more closely imbricated than the almost totally exposed inner ones, all minutely glandular-punctate; corolla lavender-pink, glandular-papillose externally, about 1 cm. long; pappus moderately rigid, dense, biseriate, bright white, many of the bristles clavellate-thickened toward the apex; immature achenes oblong-cylindric, glandular-punctate, 3–4 mm. long, slightly expanded above into the short, widely funnelform epigynous disc; receptacle flattish, very shallowly scrobiculate, glandular-punctate.

MEXICO: MICHOACÁN OR GUERRERO: in clayey soil, in the Sierra Madre, alt. 1700 meters, *Langlassé*, no. 773 (TYPE).

The only species thus far known with alate stems.

29. ***P. hebeclada*** (DC.) Gray, Pl. Wright. i. (1852) 127; *Acourtia hebeclada* DC., Prod. vii. (1838) 66; Deless., Ic. Sel. iv. (1839) 41, pl. 95; *Eupatorium affine* Mair., in syn. ex DC., loc. cit.

Rigid, erect, leafy, apparently simple perennial, 9–12 dm. high; stems slightly striate to sulcate, glandular-puberulent, more or less scabrous; leaves sessile, coriaceous, ascending, reticulate, especially beneath, cordate-clasping, the lower cauline elliptic-oblong to spatulate-oblong, auriculate-clasping, abruptly subacuminate, irregularly spinulose-dentate, glandular-scabrous, sometimes becoming glabrous above, very shortly bristly-glandular on the veins and prominent midrib beneath, 10–20 cm. long, 3.5–9 cm. wide, the upper lance-elliptic to -ovate or even linear-lanceolate, often less scabrous, 3.5–6.5 cm. long, 8–30 mm. wide; thyrses leafy-bracteate, corymbose, from short and spreading to thickly cylindrical in form, 20–60-headed, the peduncles densely glandular, the cymules more or less glomerate; heads 20–23 mm. high, 16–30-flowered; involucre turbinate to turbinate-campanulate, 14–16 mm. high; phyllaries in 4–6 series, moderately well imbricated, greenish, indurate only below, chartaceous toward the tip, the outermost often linear and distinctly herbaceous, recurved-spreading, the inner erect, subulate, copiously glandular dorsally, often glandular-ciliolate; corollas lavender-pink; achenes fusiform-cylindric, minutely glandular-punctate, 7 mm. long; pappus-bristles relatively few, mostly in one series, often very slightly clavellate-thickened toward the apex; receptacle moderately deeply alveolate, sparingly glandular.

MEXICO: FEDERAL DISTRICT: Pedrigal, valley of Mexico, *Pringle*, no. 4360 (Gr., N. Y., P. C.); lava fields above Tlalpám, elev. 2440 m., *Pringle*, no. 9949 (Gr., N. Y.). MORELOS: mountain side, near Cuernavaca, elev. 1980 m., *Pringle*, no. 7178. PUEBLA: Cerro Tepoxuchitl, alt. 2330 m., vicinity of Puebla, *Arsène*, no. 2273; barranca near Hacienda Álamos, on the road to Vera Cruz, alt. 2170 m., vicinity of Puebla, *Arsène*, no. 2084 (Gr., N. Y.). OAXACA:

Teposcolula, alt. 2440 m., *F. López*, no. 63. STATE NOT SPECIFIED: "Mex.," *Alaman* (fragment of TYPE).

**P. hebeclada** (DC.) Gray var. **urolepis** Robinson, Proc. Amer. Acad. xliv. (1909) 625.

Differs from the typical form by having the phyllaries less rigid, the outer much elongated, almost equalling the attenuate, subherbaceous inner in length, caudate-attenuate, the slender tips lax, somewhat spreading and tortuous; heads 23–25 mm. high; otherwise undifferentiated from the typical form.

MEXICO: HIDALGO: Sierra de Pachuca, elev. 2900 m., *Pringle*, no. 13975 (TYPE).

30. **P. aspera** Bacigalupi (see p. 18).

Rather rigid slender perennial, branching above, at least 4 dm. tall; stem simple below, teretish, slender (diam. 1.5–2 mm.), striate, glabrous except for small tufts of a light brown silky tomentum in the leaf-axils, smooth, flexuous, straw-colored and purplish-tinged; leaves sessile or subsessile, rigid-coriaceous, oblong-lanceolate, pungently and rigidly mucronate, cordate-amplexicaul, quite prominently reticulate, glabrate, divaricately, irregularly and pungently toothed, minutely callose-ciliolate, 4.5–5 cm. long, 1.5–2 cm. wide, the upper smaller, oblong, 2–3 cm. long, 7–10 mm. wide; heads 1–2, subcongested at the tips of the elongated, ascending, leafy upper branchlets, 2–2.3 cm. high, 30-flowered; peduncles 8–20 mm. long, usually bearing glabrous, ascending-spreading, narrowly lanceolate to linear-subulate bracts 9–10 mm. long; involucre campanulate, obtuse at the base, in about 3 series, 20–23 mm. long, equalling the pappus; phyllaries imbricated only at the bases, rigid, not indurate, 2–2.3 mm. wide, attenuate-subulate, very acute, glabrous, striate, light green, purplish toward the apices, sometimes very minutely ciliolate, the inner ones 17–19 mm. long, the outer more rigid, 8–10 mm. long; corolla-lobes sparsely glandular-ciliolate toward the base, the lavender-pink corolla otherwise glabrous, 14–15 mm. long; pappus soft, tawny, the bristles very fine, in 2–3 series; achenes linear, minutely resinous-punctulate, about 5 mm. long, the epigynous disc funnelform; receptacle convex, deeply alveolate, the membranaceous partitions between the alveolae fimbriolate-glandular.

MEXICO: COAHUILA: Saltillo, alt. 1650–1800 m. (coll. of Frère Nil, no. 55, Dec., 1908), *Arsène*, no. 3395 (TYPE, Gr.).

31. **P. pinetorum** T. S. Brandege, Zoe v. (1901) 105.

Erect, leafy perennial, branching above, 10 dm. high; stem rigid, teretish, shallowly grooved, stramineous, crisped-puberulent with

articulated hairs; inflorescence-branchlets spreading, the slightest bit flexuous, leafy up to the peduncles, striate-angular, densely glandular-hirtellous and crisped-puberulent with hairs less evidently articulated than those of the stem; leaves sessile, thin-chartaceous, ciliolate, uniformly a little scabrid and puberulent on the not at all prominent reticulations above, rather copiously and uniformly glandular-hirtellous and articulately hirsutulous on the prominent veins and reticulations beneath, the cauline oval-oblong, acuminate, broadly auriculate-clasping, unequally spinulose-dentate, 18–20 cm. long, 9–10 cm. wide, those of the branchlets lance-oblong, spinulose-denticulate, shortly acuminate, cordate-clasping, the auricles broad and truncatish-rounded, 4–6 cm. long, 16–20 mm. wide; inflorescence a widely divergent, leafy, paniculate cyme, the 1–5-headed cymules not at all congested; peduncles 1.5–3 cm. long, bearing a few, spreading, lance-subulate, glandular scales 2.5–4 mm. long; heads campanulate, 15–20-flowered, 1.5–2 cm. high; phyllaries rigid-herbaceous, attenuate-subulate from a broadish base, gradually and evenly narrowed to a very acute tip, loosely imbricated in about 3 series, glandular-puberulent dorsally, fimbriolate-ciliolate on the narrow scarious margin, the longest inner ones 14–15 mm. long; corollas sparingly stipitate-glandular exteriorly, lavender-pink, 11–13 mm. long; pappus soft, biseriate, white, the bristles very fine and not thickened toward the apex; achenes linear-cylindric, 5 mm. long, densely covered with shortly stipitate amber glands and rather densely spreading-hirsute as well; receptacle shallowly scrobiculate, slightly convex, moderately densely beset with amber-colored shortly stipitate glands.

MEXICO: BAJA CALIFORNIA: Sierra de la Laguna, Jan. 22, 1899, *T. S. Brandege* (isotype, Gr.).

Sierra de la Laguna is the northern continuation of the Sierra de la Victoria, in the Cape San Luis region at the southern extremity of the peninsula of Lower California.

32. ***P. turbinata*** La Llave & Lexarza, Nov. Veg. Descr. i. (1824) 25.

Erect, apparently simple, glabrate, more or less leafy perennial sometimes 12.5 dm. tall; stems slender, especially above, conspicuously roughened below to smoothish and glaucescent above, slightly angled to somewhat sulcate; leaves sessile, chartaceous to chartaceo-coriaceous, oblong to cuneate-oblong, closely spinulose-denticulate, cordate-amplexicaul, rounded at the apex to acutish and abruptly mucronulate, scabrid to smoothish, the upper sometimes slightly arcuate, 9–15 cm. long, 2.5–6 cm. wide, those of the inflorescence lance-ovate,

or linear-lanceolate to linear, attenuate, 1.5–5 cm. long; inflorescence openly paniculate, the heads usually well separated by the long slender peduncles, these bearing remote lance-subulate to subulate scales or mostly naked, glabrate to glabrous, angled; heads 20–28 mm. high, 20–30-flowered; involucre widely obconic to turbinate-campanulate and somewhat rounded at the base, 15–22 mm. high; phyllaries fairly well imbricated in 4–5 series, the outer lance-attenuate, the inner subulate, often the slightest bit acuminate as well, chartaceous, not rigid, often slightly scarious-edged, occasionally purplish, glabrous dorsally, some rarely sericeo-ciliolate; corollas lavender-pink; immature achenes scabrous with upwardly appressed hairs, shortly stipitate-glandular as well, 5–6 mm. long; pappus soft; receptacle fairly deeply alveolate, stipitate-glandular.

MEXICO: STATE OF MEXICO: Istlava Valley, on a mountain slope, not very common, Valley of Mexico, *Schaffner*, no. 226; dry open wood, elev. 2440 m., Salto de Agua, *Purpus*, no. 1558 (Gr., N. Y., P. C.); dry slopes, Ixtaccihuatl, 2100–2400 m., *Purpus*, no. 63 (1903); Coñode Mountains, near Mexico, *Schmitz*, no. 701.

In Pl. Wright. i. (1852) 126, the specimens which Gray referred to *P. turbinata* should have been referred to *P. formosa* (D. Don) Gray, as he later admitted in Proc. Amer. Acad. xix. (1883) 58. It is the interpretation Gray gave to *P. turbinata* in the latter publication that is here followed.

Following Gray's earlier interpretation in Pl. Wright., Schultz Bipontinus, who sought to refer the genus *Perezia* to *Trixis*, founded the binomial *Trixis turbinata* on specimens properly referable to *Perezia formosa* (D. Don) Gray. (*Trixis turbinata* Sch. Bip. in Seem. Bot. Voy. Herald (1856) 315, pl. 55.)

33. **P. Thurberi** Gray, Mem. Amer. Acad. n. s. v. (1855) 324 [Pl. Nov. Thurb.].

Erect, usually simple, densely leafy perennial, 4–15 dm. tall; stems robust, shallowly sulcate below to striate above, densely glandular-puberulent, occasionally scabrid above; leaves sessile, chartaceo-coriaceous, the larger oval- to obovate-elliptic, more usually short-acuminate and rarely pungent at the often rounded tip, shortly sagittate- or more rarely shallowly cordate-clasping, the floral leaves oblong-elliptic to lance-attenuate, merely abruptly rounded at the base, all closely acerose-denticulate, less often saliently and irregularly dentate, densely glandular-puberulent, scabrid, conspicuously reticulate beneath, the cauline 5–18 cm. long, 3–10 cm. wide, the floral 1.5–4 cm. long, 6–20 mm. wide; subcongested cymes of the usually elongated to triangular thyriform inflorescence exceeding the leafy bracts; heads

at anthesis 16–20 mm. high, 4–6-flowered; involucre obconic-campanulate, 7–10 mm. long; phyllaries oblong-ob lanceolate, the outer sometimes somewhat lanceolate, all attenuate-acuminate, minutely glandular-puberulent, somewhat indurate below; corollas lavender-pink, upper part of the tube and the segments glandular-papillose; achenes subcylindric to subfusiform, striate, glandular, 5–6 mm. long; pappus rather rigid, only an occasional bristle very slightly clavellate-thickened above; receptacle glandular.

Southeastern Arizona and adjacent New Mexico, southward along the Sierra Madre to Guanajuato.

UNITED STATES: ARIZONA: Santa Rita Mountains, June 3, 1884, *Pringle* (N. Y.) [leaves abnormally narrow]; Wilgus Ranch, alt. 1830 m., Chiricahua Mountains, *J. C. Blumer*, no. 1771 (Gr., N. Y.); dry slopes, Dixie Cañon, Mule Mountains, *L. N. Goodding*, no. 447 (Gr., N. Y.); southern Arizona, *Lemmon*, nos. 360 & 361 (1881); Fairbank, *David Griffiths*, no. 1972 (N. Y.); "The Basin," Santa Catalina Mountains, *Harris*, no. C16509 (N. Y.). NEW MEXICO: Dog Spring, Dog Mountains, *Mearns*, no. 2385 (Gr., N. Y.).

MEXICO: SONORA: La Tinaja, elev. 1128 m., *Hartman*, no. 244 (Gr., N. Y.); rocky hills, Santa Cruz, Sept., 1851, *Thurber*, no. 939 (TYPE, Gr. and isotype, N. Y.). CHIHUAHUA: Guayanopa Canyon, Sierra Madre Mountains, alt. 1100 m., Sept. 24, 1903, *M. E. Jones* (P. C.); Colonia Juarez, Sierra Madre Mountains, alt. 1830 m., Sept. 12, 1903, *M. E. Jones* (P. C.); Sierra en Media, *Nelson*, no. 6480; in the Sierra Madre near Rio de Aroz, alt. 2290 m., *Townsend & Barbour*, no. 401 (Gr., N. Y.); southwestern Chihuahua, *Palmer*, no. 272 (1885). GUANAJUATO: in the mountains near Guanajuato, Oct., 1894, *Dugès*.

According to *Dugès*, this species is known in Guanajuato as "Calzadilla" and "Cola de Zorra."

The last specimen cited, collected by *Dugès*, has heads decidedly immature but doubtless belongs here. The lower leaves show a strong tendency to adnation, a feature noted neither in the other specimens of *P. Thurberi* at hand, nor, except for *P. Alamani*, in those of any other species of the section *Acourtia*. It is possible that *Lessing* had just such a form of *P. Thurberi* before him when he described *Dumerilia Humboldtii*.

34. **P. Pringlei** Robinson & Greenman, Proc. Amer. Acad. xxix. (1894) 388.

Erect, apparently strict and simple, tall perennial (definite height unknown but probably 9 dm. or more); stem rigid, teretish, rather stout (about 6 mm. thick), striate, stramineous, purple-tinged, especially above, scabrous, pubescent with articulated hairs; leaves sessile, prominently reticulate, scabrous, the middle cauline crowded (nodes 2–4 cm. long), oblong, cordate-clasping to subhastate at the very broad base, mucronate at the very obtuse to rounded apex, coarsely and unequally spinose-dentate, hispidulous on the reticulations of the dark, blue-green, upper surface, fulvous-pubescent with articu-

lated hairs on the grey-green lower surface, 7–11 cm. long, 4–5 cm. wide, the upper inclined to be narrower, lance-oblong and quite arcuate and conduplicate, more densely pubescent beneath, mostly 4–7 cm. long; inflorescence moderately leafy, narrowly racemiform, in the specimen at hand (type) not more than 12 cm. wide, 29 cm. long; heads for the most part single, on rigid, ascending, pubescent, leafy-bracted peduncles 2.5–6 cm. long, very broadly campanulate, about 50-flowered, mostly 2.5 cm. wide and 3 cm. high; phyllaries well imbricated in 6–7 series, acute, the inner oblong-lanceolate and attenuate-acuminate, the outer ovate-lanceolate and much more abruptly acuminate, all glabrous, striate dorsally, shaggily sericeo-ciliate, rigid, greenish, deep purplish on the exposed portions; corollas not exerted beyond the involucre, lavender-pink, essentially glabrous, 14 mm. long, the two lips very short, exceeded by the anther-column by as much as 2 mm.; pappus relatively soft, whitish, biseriate, included within the involucre; immature achenes cylindrical, densely appressed-hirsute, 4–5 mm. long, expanded above into a funnelform epigynous disc; receptacle slightly convex, shallowly scrobiculate, essentially glabrous.

MEXICO: MICHOACÁN: hills near Morelia, *Pringle*, no. 5464 (TYPE).

A striking species as yet too little collected.

35. ***P. Dugesii*** Gray.

Slender, laxly and widely branching, flexible, evidently somewhat scandent perennial 18–30 dm. high; stems striate, glandular-scabrid, often ultimately quite smooth, greenish to stramineous, sometimes purplish-red; leaves sessile, submembranaceous to chartaceous, very closely spinulose-denticulate or shallowly triangular-dentate with the teeth terminated by spinules to rather coarsely and irregularly dentate, minutely callose-ciliolate, moderately to quite prominently reticulate, more prominently so beneath, especially in the forms with thicker leaves, glabrous and smooth to scabrid above, smoothish to scabrid, glabrate to crisped-puberulent and glandular-punctate beneath, broadly lanceolate to oblong-lanceolate or obovate-spatulate, cordate to subsagittate at the base, the two auricles often overlapping, attenuate-acuminate and very acute to obtuse at the apex, 7–15 cm. long, 2.5–7 cm. wide; upper branchlets very slender and flexible, gradually becoming more sharply flexuous outward; inflorescences several to many, isolated, separated by the leafy terminal portions of the branchlets, consisting of 2–4-headed glomerulate cymules, the axis and peduncles geniculate, leaf-bearing at the nodes, from sparingly to densely crisped-pubescent; heads 5–7-flowered; involucre very slender, cylindrical-obconic, 9–12 mm. high; phyllaries for the most part oblong,

glabrous dorsally, chartaceous, rigid only at the base, sericeo-ciliate to eciliate, the very short outer narrow, acute, the widest narrowly ovate-lanceolate, well imbricated in 3-4 series, the inner exposed for most of their lengths, in but 2-3 series, for the most part abruptly acuminate from an obtuse tip, sometimes more gradually narrowed and acuminate; corollas from sparsely to rather densely and very minutely glandular-papillose exteriorly, lavender-pink; pappus soft to somewhat rigid, intermittently biseriate, usually exceeding the innermost phyllaries by 4-7 mm.; achenes densely glandular-punctate and very sparingly to very densely hirsute, narrowly fusiform, rather more conspicuously narrowed above than below, 6-7 mm. long, the epigynous disc very narrow.

#### KEY TO VARIETIES.

- Leaves broadly lanceolate to oblong-lanceolate, attenuate-acuminate at the very acute apex, only moderately reticulate, very closely spinulose-denticulate to shallowly triangular-dentate; achenes very sparingly appressed-hirsute. . . . . Var. *α. typica*.  
 Leaves obovate-spatulate, rounded and obtuse to very shortly acuminate at the apex, prominently reticulate, coarsely and irregularly dentate; achenes very densely appressed-hirsute  
 Var. *β. pilulosa*.

Var. *α. typica*. Leaves only moderately reticulate, more prominently so beneath than above, very closely spinulose-denticulate to shallowly triangular-dentate with the teeth terminated by spinules, broadly lanceolate to oblong-lanceolate, mostly attenuate-acuminate and very acute at the apex, 7-15 cm. long, 2.5-5.5 cm. wide; corolla sparsely and very minutely glandular-papillose exteriorly; achenes very sparingly appressed-hirsute.—*P. Dugesii* Gray, Proc. Amer. Acad. xix. (1883) 60.

MEXICO: GUANAXUATO: Guanaxuato, *Dugès* (TYPE); same locality, 1883, *Dugès*, no. 430. STATE OF MEXICO: wet meadows, valley of Mexico, elev. about 2220 m., *Pringle*, no. 8253 (N. Y., labelled "Aster pauciflorus," doubtless a label confusion); Nov. 22, 1892, *Pringle*, no. 5254 (see below). PUEBLA: Boca del Monte, *Purpus*, no. 2977. VERA CRUZ: hills near Jalapa, elev. 1220 m., *Pringle*, no. 8131 (Gr., P. C.); Orizaba, *Mohr*.

The additional data, in Pringle's own hand, on the label of his no. 5254, above cited, is as follows: "warm wooded ledges, mts. near Lake Chapala." Lake Chapala, however, is situated between Jalisco and Michoacán, more than 150 miles west of the state of Mexico (the printed label bears the inscription "State of Mexico"). Specimens bearing numbers immediately preceding and following no. 5254 were found to have come unquestionably from the region just south of the city of Mexico. Perhaps "Lake Chapala" here is a *lapsus calami* for Lake Chalco.



Specimens referable to *P. oxylepis* have been confused with *P. Dugesii* var. *typica*. The inflorescences of the two species are quite dissimilar. *P. oxylepis* has the corymbose, many-headed terminal inflorescence typical of the majority of the species of *Perezia* § *Acourtia*, while *P. Dugesii* has several isolated inflorescences which terminate the upper lateral branches as well as the central axis. Moreover, the very acute attenuate-acuminate and copiously glandular phyllaries and wider 15–21-flowered heads of *P. oxylepis* at once distinguish it.

Var.  $\beta$ . **pilulosa** Bacigalupi (see p. 19). Leaves prominently reticulate, especially beneath, coarsely and irregularly dentate, obovate-spatulate, rounded and obtuse to very shortly acuminate at the apex, 9–11.5 cm. long, 5–7 cm. wide; corollas more densely glandular-papillose externally than in var. *typica*; achenes very densely appressed-hirsute. The veins and veinlets of the lower leaf-surfaces are often much more strikingly hirsutulous than in var. *typica*.

MEXICO: OAXACA: below Jayacatlán, elev. 1067 m., *L. C. Smith*, no. 373 (TYPE, Gr.). VERA CRUZ: Orizaba, *Müller*, in 1855 (N. Y.).

36. **P. Alamani** (DC.) Hemsl.

Erect, densely leafy perennial 3–6 dm. high; stem rigid, simple, at least below, teretish, leafy to the summit, in the dried specimen more or less costulate-angular, glandular-puberulent, scabrid, stramineous, less commonly purplish above; leaves more or less imbricated, sessile, glandular-scabrid and moderately reticulate on both surfaces, often somewhat nitidulous above, serrate-dentate to widely triangular-dentate, rigid-chartaceous to -coriaceous, ovate to oblong or oval, truncate-cordate at the base to distinctly cordate-clasping, the lower cauline more or less adnate to the stem below, the auricles free; inflorescence many-headed, flat-corymbose, densely congested, very little to not at all exceeding the terminal leaves; heads 7–12-flowered; involucre cylindrical-campanulate, 9–14 mm. high, somewhat acutish at the base; phyllaries widely ovate-lanceolate to oblong, densely glandular-puberulent to glabrate, eciliolate to sericeo-ciliate or fulvous-arachnoid on the margins, mostly somewhat acuminate, in 3–5 series; corollas lavender-pink, the three terminal teeth of the outer ligulate lip and the tips of the two segments of the inner lip minutely papillose, occasionally the inner segments, lower portion of the ligulate lip and the summit of the tube more or less covered with very minute amber-colored outgrowths; pappus quite stiff, not greatly exceeding the involucre, 1–2-seriate; immature achenes glandular-puberulent, about 4 mm. long; receptacle shallowly scrobiculate, short-bristly and sparingly glandular to glabrate.

## KEY TO VARIETIES.

- a. Involucre 12–14 mm. high; phyllaries glabrate, often sericeo-ciliate, relatively loosely imbricated in 3–4 series, the inner often exposed for more than half their length. . . . . Var.  $\alpha$ . *typica*.
- a. Involucre 9–10 mm. high; phyllaries glandular-puberulent and more or less fulvous-arachnoid, relatively well imbricated in 5 series, the inner often with less than half their length exposed. . . . b.
- b. Cauline leaves ovate- to lance-oblong, membranaceo-coriaceous, those subtending the inflorescence narrowly oblong-elliptic or lance-oblong; stem simple to the top. . . . Var.  $\beta$ . *adnata*.
- b. Cauline leaves broadly oval to ovate-spatulate, truly coriaceous, those subtending the inflorescence ovate to lance-ovate; stem divaricately branched at the top, each branch terminated by an inflorescence. . . . . Var.  $\gamma$ . *oolepis*.

Var.  $\alpha$ . *typica*. Stem simple below, the inflorescence-bearing branches sometimes as many as 7, often widely divaricate; leaves rigid-coriaceous, ovate, lance-ovate or rarely lance-elliptic, serrate-dentate, sometimes coarsely so, to triangular-dentate, the upper little, if at all, adnate, the larger cauline adnate for not more than 2.5 mm. and usually truncate-cordate to very shallowly cordate-clasping at the base, 4–5 cm. long, 2–3 cm. wide; heads 7–10-flowered; involucre 12–14 mm. high; phyllaries glabrate to densely glandular dorsally, occasionally sericeo-ciliate, imbricated in 3 to mostly 4 series, the outer not wider than broadly lanceolate; corollas, especially the inner segments, somewhat more densely covered with amber-colored excrescences than in the other varieties; receptacle glabrate.—*Dumerilia Alamani* DC. Prod. vii. (1838) 67; Mem. ix. (1838) 41, pl. 17; *Perezia Alamani* Hemsl. Biol. Centr.-Amer. Bot. ii. (1881) 255.

MEXICO: GUANAXUATO: Guanaxuato, *Dugès*. HIDALGO: rocky hills, Cuyamaloya Station, elev. 2290 m., *Pringle*, no. 10270 (Gr., N. Y.). MEXICO: "Valle de Toluca," near Tenancingo, *Schaffner*, Sept., 1854; same locality and collector, Oct. 1, 1854. PUEBLA: Esperanza, alt. 2450 m., *Arsène*, no. 2106 (Gr., N. Y.); grassy hills, Esperanza, *Purpus*, no. 2631 (Gr., N. Y.). NO STATE SPECIFIED: "Mexico," *Alaman* (fragment of authentic material of De Candolle's *Dumerilia Alamani*).

Var.  $\beta$ . *adnata* (Gray), comb. nov. Stem simple below the short terminal inflorescence, sometimes slightly flexuous above; leaves subimbricated, rigid-chartaceous, serrate-dentate, oblong-ovate, the upper sometimes oblong-elliptic, obtusish to acute and shortly acuminate, the larger cauline distinctly cordate-clasping, adnate to the stem for a distance of 2.5 mm., 8–11 cm. long, 4–5 cm. wide, the upper becoming narrower, ultimately more acuminate and lance-ovate, the amount of adnation decreasing, the uppermost often merely shortly rounded at the base; inflorescence single and terminal; heads 9–12-flowered; involucre 9–10 mm. long; phyllaries, especially the ovate-lanceolate

outer, glandular-puberulent, well imbricated, the oblong inner becoming glabrate dorsally, all more or less fulvous-arachnoid on the margins, in 5 series; corollas glabrous except for occasional amber-colored outgrowths at the summit of the corolla-tube; receptacle shallowly scrobiculate, sparingly glandular, short-bristly when young.—*P. adnata* Gray, Pl. Wright. i. (1852) 127.

MEXICO: MICHOACÁN: forests of pine near Morelia, "Terre froide," Sept. 1844, *Ghiesbrecht*, no. 378 (TYPE of *P. adnata*); Quinceo, vicinity of Morelia, elev. 2800 meters, *Arsène*, no. 5800.

Var.  $\gamma$ . **oolepis** (Bartlett), comb. nov. Leaves coriaceous, the cauline broadly oval, 10–11.5 cm. long, 7–7.5 cm. wide, the lower ovate-spatulate, the uppermost ovate to lance-ovate; stem divaricately branching above, each branch terminated by an inflorescence; phyllaries, especially the outer, inclined to be broader than in the other varieties.—*Perezia adnata* Gray, var. *oolepis* Bartlett, Proc. Amer. Acad. xliv. (1909) 637.

MEXICO: STATE OF MEXICO: rocky hills, Tultenango, *Pringle*, no. 3244 (Gr. N. Y.); hills near Tultenango Station, elev. 2530 m., *Pringle*, no. 9945 (Gr., N. Y.).

There is some probability that this variety may be the same as *Perezia fruticosa* of La Llave & Lexarza, since the above specimens fit, in a general way, the diagnosis [Nov. Veg. Descr. (1824) 26] of that species. In view of the very general nature of the diagnosis, this inference must, unfortunately, remain merely conjectural.

Bartlett [Proc. Amer. Acad. xliv. (1909) 636–7] pointed out several characters which might be used to distinguish from *P. Alamani*, both *P. adnata* and *P. adnata* var. *oolepis*. Specimens inserted in the Gray Herbarium since 1909 largely invalidate many of the distinctions set forth in Bartlett's publication. *Arsène's* number 5800, which matches very closely Gray's *P. adnata*, has glandular-puberulent phyllaries varying from 14 to 20 in number. The characteristic numbers of phyllaries attributed by Bartlett to *P. adnata*, *P. adnata* var. *oolepis* and *P. Alamani* are 28, 21 and 14 respectively, those of the last being further distinguished as typically "paene glabris." Yet, *Purpus*, no. 2631, which agrees with all other characters of *P. Alamani*, has its phyllaries, which number 13, copiously viscid-glandular with stalked glands.

An attempt has been made by Bartlett to use the number of pappus-bristles as a character to help distinguish these entities. This character is not any more reliable here than elsewhere in the genus. While the number of pappus-bristles in the flowers of any given head

often tends to be approximately the same, there will be found to be no uniformity in this respect when the flowers are chosen at random even from neighboring heads.

In this same publication, the inner lip of the corolla of *P. Alamani* is said to be papillose-pubescent on the outside while that of both *P. adnata* and *P. adnata* var. *oolepis* is described as glabrous. To be sure, in many of the specimens cited by Bartlett under *P. Alamani*, the inner lip of the corolla, seen under a binocular which magnifies somewhat more highly than a  $\times 20$  hand-lens, may be seen to be more or less covered with semi-appressed amber-colored projections which are easily detachable with a needle. These are most abundant at the summit of the corolla-tube and occasionally are found some distance up on the ligulate outer lip. An examination of material of both *P. adnata* and *P. adnata* var. *oolepis*, however, shows that these amber-colored projections are very often present on the corollas of these two entities as well, though here much more restricted toward the bases of both the inner and outer lips. This difference, then, proves to be one of degree rather than an absolute one, and it is further noteworthy that this corolla character is by no means confined to this species.

An interesting case of teratology was noted in the pappus from several heads taken from *Purpus*, no. 2631. In these, the ring of pappus-bristles was interrupted and, at the point of interruption, replaced by a bract-like structure of a texture closely simulating that of the inner phyllaries. The margins of some of these had the scabrous bristliness characteristic of the pappus-hairs. In one head, three of the seven flowers present exhibited this irregularity. That this phenomenon is by no means of uncommon occurrence is indicated by the following statement, quoted from the general introductory remarks on the *Compositae* in O. Penzig's "Pflanzen-Teratologie," ii. ed. 1 (1894) 55; ii. ed. 2 (1921) 469: ". . . an Stelle des Pappus treten gemeinhin lineare oder lanzettliche (oft mehr als fünf!) Kelchblättchen . . ."

37. **P. Palmeri** Wats. Proc. Amer. Acad. xxiv. (1889) 58.

"Tall and branching" leafy perennial; stems more slender and not so rigid as in most of its congeners, glandular-puberulent, scabrid, slightly flexuous, very slightly striate, at least above; leaves sessile, thin-chartaceous, moderately reticulate, the midrib prominent, especially on the lower side, oblong-lanceolate, attenuate-acuminate, shallowly cordate-clasping, glandular-scabrid, especially above, very acutely pungent-dentate and denticulate, the longer teeth not more than 2 mm. long, 11-15 cm. long, 3.5-4.5 cm. wide, the lower doubt-

less larger; floral leaves similar, linear-lanceolate, 2-6 cm. long; inflorescence diffusely paniculate, the heads not glomerate, 13-18 mm. high, about 10-flowered, on densely glandular-puberulent peduncles 1-3 cm. long; involucre widely campanulate, 10 mm. high; phyllaries not indurate, greenish, well imbricated, glandular-puberulent dorsally, the margins inclined to be scarious and fimbriate-ciliolate, the outer ovate, sharply acuminate, often exceeding 2 mm. in width, the inner spatulate-oblong, broadest above the middle where 2 mm. wide, abruptly acuminate; corollas "lilac"; pappus not rigid, biseriate; achenes (immature) subcylindric, densely stipitate-glandular, sparingly hirsutulous as well, 4 mm. long; receptacle shallowly alveolate, stipitate-glandular.

Range as yet only imperfectly known; the type specimen from north central Lower California.

MEXICO: BAJA CALIFORNIA: mountain sides near Los Angeles Bay, Gulf of California, *Palmer*, no. 527, collected in 1887 (TYPE, Gr. and isotype, N. Y.).

38. ***P. oxylepis*** (Sch. Bip.) Gray, Proc. Amer. Acad. xv. (1880) 41; *Acourtia oxylepis* Sch. Bip. ex Gray, in syn., loc. cit.

Erect, apparently simple, leafy, aromatic and more or less glandular perennial; stems rigid, only the slightest bit flexuous above, more or less striate, densely glandular-puberulent with an admixture of crisped hairs, somewhat scabrid, tawny-floccose in the lower leaf-axils; leaves sessile, thin-chartaceous, scabrid above, glandular-punctate and crisped-puberulent on the midribs and veins beneath, oblong or lance-oblong, spinulose-denticulate, cordate-amplexicaul to subsagittate-amplexicaul, acute to less commonly obtuse at the apex, the lower usually clasping the stem so as to enclose completely the tomentum in the axils, these lower leaves only somewhat prominently reticulate beneath and often irregularly subserrate-dentate, the middle cauline 9-16 cm. long, 3-6 cm. wide, those of the inflorescence 3-5 cm. long, 1-2 cm. wide; inflorescence widely and loosely branched; each densely leafy, copiously glandular branchlet terminated by a subcongested to somewhat lax corymbiform cyme; ultimate peduncles bearing spreading or recurved lance-subulate bractlets; heads 15-18 mm. high, (12- acc. to Gray) 15-21-flowered; involucre campanulate, 11-13 mm. high; phyllaries in 3-4 series, thin, not indurate, copiously stipitate-glandular, often purplish-tinged, the outer ovate-lanceolate, the inner lance-oblong, gradually attenuate-acuminate, very acute; corollas lavender-pink, very sparsely glandular-punctate exteriorly; pappus moderately stiff, biseriate; mature achenes narrowly fusiform, densely stipitate-glandular as well as sparsely appressed-hispid, about 6 mm. long; receptacle convex, scrobiculate, stipitate-glandular.

MEXICO: SAN LUIS POTOSÍ: in the region of San Luis Potosí, alt. 1830–2440 m., *Parry & Palmer* (1878), no. 547, in part (TYPE); “in umbrosis prope Penasco, ex convalli San Luis Potosí,” *Schaffner*, no. 377 (Gr., N. Y.). GUANAXUATO: mountain valleys, Jaral, *W. Schumann* (1886), no. 120.

This species has been confused with *P. Dugesii* Gray. The distinctions between these two species are discussed in conjunction with the treatment of the latter.

On the label of his no. 377, Schaffner made the following notation: “Eine ausgezeichnete im frischen Zustande . . . etwas klebrig . . . sehr aromatische Pflanze.” Inasmuch as the dried specimen in this instance gave not the slightest evidence of its ever having been an aromatic plant, it is quite probable that the exudations of many of the other more glandular species of *Perezia* § *Acourtia* are, in the fresh state, equally aromatic.

39. **P. Seemannii** Gray, Pl. Wright. i. (1852) 127; *Trixis Seemannii* Sch. Bip. in Seem. Bot. Voy. Herald (1856) 315; *Acourtia Seemannii* Sch. Bip. in Seem. loc. cit., in syn. and pl. 54.

Erect, leafy, rigid, probably tall perennial, simple below the inflorescence; upper portion of stem terete, striate, smooth, glabrous, glaucescent, purplish-tinged; leaves sessile, rigid, subcoriaceous, slightly glaucous, smooth, glabrous, finely reticulate on both surfaces, ascending and imbricated, cuneate-oblong, broadest above the middle, truncatish to subauriculate at the narrowed base, shortly acuminate, the slightly callose-thickened margin serrate-dentate to denticulate (the larger teeth terminated by a spinule), tending to be entire toward the base, 5–10 cm. long, at the widest point 9–20 mm. wide, those of the inflorescence entire, narrowly elliptic to spatulate-oblong, cuspidate, 6–13 mm. long; inflorescence wide and open, made up of laxly disposed corymbiform cymes, the 8–12-flowered heads not at all congested, on slender, subulate-squamose peduncles 1–2 cm. long; involucre narrowly obconic, acute at the base, 8–9 mm. long; phyllaries indurate, oblong-lanceolate, acuminate and acute, glandular-punctate dorsally, glandular-ciliolate, in 3–4 series, the lower well imbricated, the lowermost cuspidate; corollas lavender-pink, very sparingly glandular-papillose externally; pappus moderately stiff, uniseriate, exerted 7–9 mm. beyond the fruiting involucre; achenes 3–4 mm. long, linear-oblong, moderately to densely glandular-papillose, somewhat narrowed at the neck; epigynous disc slight; receptacle slightly convex, scrobiculate, glandular-papillose.

MEXICO: STATE NOT SPECIFIED: *Seemann*, “N. W. Mexico,” in the Sierra Madre (TYPE). *Seemann* collected in southern Durango and Sinaloa, in Nayarit and in northern Jalisco.

40. **P. grandifolia** Wats. Proc. Amer. Acad. xxv. (1890) 156.

Erect, robust, leafy perennial, simple below the inflorescence, 18–30 dm. high; stem stout, rigid, terete, sulcate and 1 cm. thick below, smooth, glabrous, greenish to stramineous, often purplish-tinged, becoming flexuous and angled upward; leaves sessile, subcoriaceous, finely reticulate, glabrous, nitidulous and, save for the reticulations, smooth above, crisped-puberulent on the reticulations, glandular-punctulate and slightly scabrid beneath, the larger cauline obovate with a short and wide spatulate base to oval-ovate, repandly serrate-dentate toward the broadly auriculate, cordate-clasping base, becoming repandly spinulose-denticulate toward the rounded and sometimes mucronulate apex, 27–32 cm. long, 17–20 cm. wide, the upper from oblong to elliptic-oblong, auriculate-clasping, glabrous except for the sessile glands beneath, 3–8 cm. long, 2.5–4.5 cm. wide; floral leaves 1.5–2 cm. long, oblong to oblanceolate, often apiculate, the lower auriculate; inflorescence composed of corymbiform laxish cymules disposed at the periphery of a more or less hemispheric cyme 2.5–3 dm. wide, the slender ramifications of the cymules densely glandular-puberulent, the ultimate peduncles bearing somewhat spreading, glandular, lance-subulate scales; heads 13–16 mm. high, 10–12-flowered; involucre obconic-cylindric, 8–10 mm. high; phyllaries mostly in 4 series, thin, indurate below, densely glandular-punctulate dorsally, glandular-ciliolate, often purplish, oblong-lanceolate, the inner 1–1.7 mm. wide, shortly acuminate; corollas lavender-pink, the upper portion of the tube densely glandular-punctulate; pappus stiff and very scabrous, slightly clavellate-thickened toward the apex, sub-uniseriate; achenes cylindrical, copiously glandular-papillose, 4–5 mm. long, the epigynous disc very slight to quite broad; receptacle flattish, slightly scrobiculate, glandular-punctate.

MEXICO: JALISCO: cool, rocky hillsides near Guadalajara, *Pringle*, no. 1858 (TYPE, Gr. and isotype N. Y.); slopes of barrancas near Guadalajara, elev. 1525 m., *Pringle*, no. 9948 (Gr., N. Y.). NAYARIT: Tepic, *M. E. Jones*, no. 23356 (N. Y.).

A species with strikingly large leaves, the largest thus far known in the genus. Watson described the achenes as glabrous; all those examined, while certainly destitute of trichomes, were found to be densely glandular-punctate.

41. **P. microcephala** (DC.) Gray, Pl. Wright. i. (1852) 127; *Acourtia microcephala* DC. Prod. vii. (1838) 66; *Perezia sericophylla* Millsp. & Nutt. Field Mus. Publ. Bot. v. (1923) 297 (incidental mention); illustration in Jepson, Man. Fl. Pl. Calif. (1925) 1013.

Erect, stout, usually very leafy perennial, 6–12 dm. high; stem rigid, sometimes slightly flexuous, more or less densely glandular-scabrid, striate; leaves sessile, oblong-ovate to elliptic-oblong, the larger usually deeply cordate-clasping, the base sometimes varying from subattenuate to shortly truncatish, mostly obtusish at the apex, occasionally mucronate, chartaceous to chartaceo-coriaceous, irregularly spinulose-denticulate, only the principal veins prominent beneath, densely glandular-scabrid to -scabrous on both surfaces, 5–15 cm. long, 2.5–6 cm. wide; inflorescence ample, primarily loosely paniculate, the bracts leaf-like, the ultimate peduncles usually densely glandular; heads approximated into cymules at the tips of the inflorescence-branchlets, 10–13 mm. high, 10–20-flowered; phyllaries oblong-ob lanceolate, abruptly acuminate on the broadened apex, densely glandular-puberulent dorsally, often glandular-ciliolate, loosely imbricate, green, not indurate, usually in 3 series; corollas lavender-pink; achenes more or less cylindrical, bristly glandular-puberulent, 1.5–3 mm. long; receptacle very shallowly alveolate, glandular-puberulent.

Coastal southern California from San Luis Obispo County southward, doubtless extending some distance into Lower California.

CALIFORNIA: SAN LUIS OBISPO Co.: Templeton, *Abrams*, no. 5045. SANTA BARBARA Co.: Mountain Drive, Santa Barbara, *Abrams*, no. 4151 (N. Y.); hills back of Santa Barbara, *Rothrock*, no. 121; oak grove, Santa Barbara, *Lemmon*, no. 43 (1878); thickets, Montecito, ex herb. C. P. Bingham (N. Y.); Zaca Mountain, June 17–22, 1902, *Eastwood*; Santa Barbara, *Elmer*, no. 3862 (Gr., N. Y.); Santa Cruz Island, *Eastwood*, no. 6375; without further locality, *Torrey*, no. 260 (Gr., N. Y.). LOS ANGELES Co.: dry soil near Pasadena, *McClatchie*, in 1892 (N. Y.); dry hillsides, Sierra Madre, *Abrams*, no. 2635 (Gr., N. Y.); Santa Catalina Island, *Eastwood*, no. 6493. RIVERSIDE Co.: Beaumont, July 10, 1902, *Mrs. J. M. Whitworth* (N. Y.). SAN BERNARDINO Co.: foothills of the San Bernardino Mountains, *S. B. & W. F. Parish*, no. 1035 (N. Y.). SAN DIEGO Co.: Warners Hot Springs, Aug. 1, 1913, *Alonia F. Buttle*; near railroad, Linda Vista, *Macbride & Payson*, no. 806; chaparral, Howard Canyon, La Jolla, *F. E. & E. S. Clements*, no. 259 (Gr., N. Y.); on sandy hills, Encanto, *Spencer*, no. 904 (N. Y.); San Diego, *D. Cleveland*, in 1874; idem, in 1875; idem, without date (N. Y.); San Diego, *T. S. Brandege*, no. 1654; mesa north of San Diego, *Chandler*, no. 5356 (N. Y.); near San Diego, *Palmer*, in 1875; same locality, *Palmer* (1875), no. 203 (N. Y.).

42. ***P. collina*** Wats. Proc. Amer. Acad. xxvi. (1891) 144.

Tall, leafy, erect, stout and rigid perennial, apparently simple below the inflorescence; stem teretish, angular-striate, slightly flexuous above, very smooth and glabrous, stramineous and purple-tinged; leaves rigid-coriaceous, subsessile, glabrous, sometimes slightly roughened on the close reticulations, widely elliptic-ob lanceolate, 9–15 cm. long, 28–60 mm. wide, coarsely and unequally serrate-dentate, the teeth



tipped by a spinule, strongly conduplicate, arcuate, ascending only toward the base, more or less abruptly narrowed at the apex and acuminate, very acute, rounded to subhastate at the not strongly narrowed base, the lower only about half-clasping the stem, the upper hardly or not at all clasping; floral leaves much reduced, denticulate to subentire; inflorescence a more or less leafy paniculate cyme, the cymules glomerulate and often densely crowded at the axis-apex, the ultimate peduncles usually pubescent, subtended by a rigid, very narrowly spatulate to lance-subulate sometimes pungent bract; fruiting heads 15 mm. high, consistently 8-flowered; involucre cylindrical-campanulate, acutish at the base, about 12 mm. high; phyllaries indurate save at the apices of the innermost, glabrate dorsally, shortly acuminate and acute, obscurely fimbriolate-ciliolate to subentire, more rarely glandular-ciliolate, stramineous to slightly purplish, imbricated in 5-6 series, the outer subulate-lanceolate, rigid, often pungently tipped, the inner linear-oblong, not at all narrowed below, 1 mm. wide; corollas with the outer lip (ligulate in other species of *Perezia*) ultimately parted almost to the base into its 3 component linear segments, these and the 2 inner ones subequal; pappus soft, whitish, 2-3-seriate, not thickened apically; achenes 5-6 mm. long, very slenderly cylindrical, sometimes slightly narrowed above, densely glandular-punctulate and hirsutulous with stiff ascending white trichomes; receptacle slightly convex, rather deeply alveolate, densely gland-studded.

MEXICO: JALISCO: hills near Guadalajara, *Pringle*, no. 2123 (TYPE).

The corolla in this species is anomalous for *Perezia*, simulating, in its 5-partite character, that of the not too closely related genus *Gochnatia*. If, however, the corollas from young flowers (all too few on the type specimen) be examined, the outer ligulate lip will be seen to be still unparted, though the lines along which the ligule is later to split may be clearly discerned. In florets a little more advanced, the segments will be seen to have separated below, though still coalesced toward the tips.

In every other particular, including the all-important diagnostic stigmatic characters, this species is clearly one of the members of *Perezia* § *Acourtia*. It strongly suggests *P. rigida* var. *acuminata* and is undoubtedly more closely related to it than to any other *Perezia* thus far described, but it may be distinguished by its strictly linear-oblong inner phyllaries not in the least narrowed toward the base, by its very slenderly cylindrical achenes and anomalous corolla. The involucre of *P. collina*, in addition, is longer, measuring about 12 mm.

in length, while that of *P. rigida* var. *acuminata* is not more than 9–10 mm. long.

43. ***P. michoacana*** Robinson, Proc. Amer. Acad. xxvii. (1892) 179.

Erect, simple, leafy perennial 12–18 dm. tall; stem rigid, glabrous, striate, dark purplish, striate-angled above; leaves sessile, subcoriaceous, moderately reticulate, especially below, the cauline glabrous save for a sparse minute pubescence on the midrib and veins beneath, obovate-spatulate, closely, very acutely and somewhat irregularly denticulate, auriculate-clasping, rounded at the apex, 14–15.5 cm. long, 6.5–7.5 cm. wide, the upper inclined to be shortly acuminate and acutish, spatulate-oblong, entirely glabrous, more evenly callous-denticulate, 4–6 cm. long, 1.5–2.5 cm. wide, those of the inflorescence much sparser, lanceolate to lance-subulate, entire; inflorescence widely and loosely corymbose, the ultimate peduncles 1–2 cm. long, fulvous-tomentulose; heads relatively few, not glomerulate, 17–20 mm. high, 40–50-flowered; involucre hemispheric-campanulate, 1.5 cm. high; phyllaries dark purplish on the exposed portions, fulvous-tomentose, especially on the margins, 5–6-seried, the short outer ovate, the inner narrowly elliptic-oblong, about 11 mm. long, all and especially the outermost abruptly acuminate and acute; corollas lavender-pink; pappus not very rigid, a few of the bristles the slightest bit clavellate-thickened toward the apex; immature achenes subcylindric, copiously covered with dark brown sessile glands; receptacle shallowly alveolate, studded with sessile glands, crisped-pilose as well.

Apparently localized in Michoacán, Mexico.

MEXICO: MICHOCÁN: hills near Patzcuaro, *Pringle*, no. 3988 (TYPE, Gr. and isotype, N. Y.).

44. ***P. cuernavacana*** Robinson & Greenman, Proc. Amer. Acad. xxxii. (1896) 50.

Erect, leafy perennial, for the most part glabrous, 6–9 dm. high, branching above; stems sometimes several from the caudex, slender, striate-angular, the least bit flexuous, stramineous to purplish, smooth, glabrous except for tufts of light brown tomentum in the leaf-axils; petioles 0.5–2 mm. long; leaves ascending, subimbricate, thin-coriaceous, elliptic-oblong, narrowed to broad and rounded at the base, not at all cordate or amplexicaul, obtuse and mucronulate to acute at the apex, closely reticulate, nitidulous and glabrous above, evenly glandular-punctulate beneath, somewhat repandly spinulose-denticulate, the upper reduced, often subentire, the middle cauline 5–7 cm. long, 15–25 mm. wide; inflorescence racemose, sparse, leafy, the heads occurring singly on angled, terminally puberulent and squamose

peduncles 3–8 cm. long, or at the tips of the axis and branchlets; scales rigid, not imbricated, spreading, acicular-subulate and shaggily ciliate, gradating into the phyllaries and sometimes into the more foliaceous bracts below when these are present; heads 2.5–3 cm. high, about 30-flowered; involucre turbinate, 20–22 mm. high; phyllaries in about 7 series, thin-coriaceous, striate, bright green, purplish and sericeo-ciliate with long, weak, tawny hairs toward the tips, somewhat scarious on the margin except toward the obtuse, mucronulate tip, the basal well imbricated, ovate to lance-ovate, 3–8 mm. long, those of the 3 innermost series more loosely imbricated, oblong-lanceolate to oblanceolate, 13–16 mm. long, the broadest 3.5–4 mm. wide; corolla lavender-pink, the tube often sparingly glandular-punctulate above; pappus soft and fine, tawny, the bristles slightly clavellate-thickened above, mostly biseriate, often triseriate on the wider portions of the scarcely enlarged funnelform epigynous disc; mature achenes oblong-cylindric, 7–8 mm. long, costulate, appressed-hirsutulous; receptacle glabrate.

MEXICO: MORELOS: woodlands above Cuernavaca, elev. 2140 m., *Pringle*, no. 6196 (TYPE, Gr. and isotype, N. Y.); pine woodlands above Cuernavaca, elev. 1980 m., *Pringle*, no. 9947 (Gr., N. Y.).

A very handsome and apparently local species.

#### DOUBTFUL OR UNCERTAIN SPECIES.

ACOURTIA FORMOSA DC. Prod. vii. (1838) 66, not of D. Don. Gray (Proc. Amer. Acad. xix. 61) refers this, with some misgiving, to *P. rigida* (DC.) Gray. A bit of material of De Candolle's *Acourtia formosa*, unfortunately, does not settle the question today any more than it did when Gray had the same fragment before him. The broad phyllaries, which are a trifle tawny-arachnoid on the margins, are far too acute and even shortly acuminate for *P. rigida*, and the involucre are a little too broad. It may represent a phase of *P. platyphylla*.

DUMERILIA HUMBOLDTII Less. Linnaea v. (1830) 13; *Perezia Humboldtii* Gray, Pl. Wright. i. (1852) 128. Lessing described this species from a specimen of Humboldt's in Willdenow's herbarium. It is only doubtfully one of the Mexican *Perezias*. Among the characters of Lessing's redefined genus (De Candolle, Ann. Mus. Par. xix. 64, 1812, had taken up Lagasca's name in erecting the earlier *Dumerilia*, which is a phase of *Jungia*) are the following: achenes beaked, papillose, the epigynous disc large; pappus 1-seriate, paleaceous, the paleae linear, serrulate. No member of the genus *Perezia* has beaked achenes, nor

is the pappus ever paleaceous. Were it not for these objections, the specific diagnosis would seem to fit the unbranched *P. Alamani* var. *adnata* reasonably well, the mention of adnate leaf-bases (foliis "semiamplexicaulibus profunde cordatis, auriculis apice parum decurrentibus et adnatis basi liberis") being especially striking. Another possibility is that Lessing may have had an aberrant form of *P. Thurberi* with adnate leaf-bases similar to that of the Dugès specimen quoted under this species from Guanaxuato. The phyllaries, described as glabrate, from ovate to obovate or oblong-obovate, would seem, however, to exclude this interpretation.

*PERDICCIUM CORDATUM* La Llave & Lexarza, Nov. Veg. Descr. i. (1824) 27. Herb with a strict, herbaceous, simple, terete, glabrous, dark purple stem 3 feet high; leaves cordate-oblong, alternate, subimbricate, the lower oval, the upper acute, membranaceous-coriaceous, very minutely dentate, glabrous on both surfaces, not veiny save for the thick, dark purple midrib; inflorescence corymbose; flowers labiate, purple, odorless. "Habitat in montibus del Desierto Mexico viciniis, floretque novembri."

The very inadequate nature of the diagnosis gives no clue whatever as to the probable identity of this species. De Candolle (Prod. vii. 66) doubtfully referred it to his *Acourtia hebeclada*, and Ramírez [Dat. Mat. Med. Mex. i. (1894) 65] comes likewise, though still questioningly, to the same conclusion, but it would seem that if the plant here described were that very glandular species, some mention of its viscid nature would have forced itself into the diagnosis. Moreover, as pointed out under *Perezia moschata*, the description of this last species seems to fit *P. hebeclada* much better than does that of *Perdicium cordatum*.

*Perezia capitata* Wats. Proc. Amer. Acad. xxv. (1890) 156 = *GOCHNATIA GLOMERIFLORA* Gray, Proc. Amer. Acad. xix. (1883) 57, as pointed out by Blake in Standley's Trees and Shrubs of Mexico, Contrib. U. S. Nat. Herb. xxiii. (1926) 1636.

*Perezia foliosa* M. E. Jones, Contrib. West. Bot. no. 15. (1929) 154, not Rusby, 1896 = *PEREZIA LONGIFOLIA* Blake, Journ. Wash. Acad. Sci. xviii. (1928) 36.

*PEREZIA FRUTICOSA* La Llave & Lexarza, Nov. Veg. Descr. i. (1824) 26. Described from the mountains about Morelia ("Vallisoletum" = Valledolid, the old name for Morelia) as an alpine shrub, about the height of a man; stem branching, striate, becoming purplish; cauline leaves alternate, amplexicaul, suborbicular, coriaceous, reticulate, nitidous, obtuse, serrate, the teeth spinose; floral leaves acute, entire,

heads ("Flores") corymbose, very crowded; involucre cylindric, many-flowered, imbricated; phyllaries somewhat reddish, ovate, the margins woolly; marginal flowers radiate, pink, equal; inner flowers small, bilabiate, trifold.

In a very general way, this scant description seems to fit *P. Alamani* var. *oolepis* better than any other described Mexican *Perezia*, though the mention of two types of corolla, an outer radiate series and inner smaller ones, offers an obstacle too great to overlook. Is it not possible that these authors were deceived by the centripetal order of flowering which is the rule in the family *Compositae*?

An additional source of doubt is the fact that the authors of *P. fruticosa* made no mention of the shortly adnate leaf-bases so striking in the varieties of *P. Alamani*.

PEREZIA MOSCHATA La Llave & Lexarza, Nov. Veg. Descr. i. (1824) 26. Described, likewise from the mountains about Morelia, as a plant with a simple, erect stem 3-4 feet high, the upper leaves and flowers forming a very long thyrses; leaves alternate, sessile, sub-imbricate, ovate, ample, "scarioso-membranacea," reticulate, smooth, serrate, the teeth and apex acute, the upper gradually smaller; thyrses oblong, a foot or more long, the pedunculate heads congested into corymbs; corymbs axillary, many-headed, bracteate; involucre oblong, imbricate, the phyllaries not scarious, linear, acute, reflexed at the apex; outer radiate corollas violet, 18 in number; inner corollas bilabiate, similar to those of the other *Perezias*. The whole plant exudes a strong odor of musk, whence the name.

Here again we find two kinds of flowers described. But for this fact (and it may be that the authors did not take into account the centripetal order of flowering!), this description might plausibly fit *P. hebeclada*, a very glandular species having, not infrequently, a very large thyrses. It is not improbable that a species as glandular as *P. hebeclada* may be highly aromatic in the fresh condition. Of a not distantly related species, *P. oxylepis*, Schaffner, on the plant label of his no. 377, wrote "Eine . . . im frischen Zustande . . . etwas klebrig . . . sehr aromatische Pflanze." Yet the specimen has retained none of the aromatic odor which evidently was so striking when the plant was freshly gathered. As to the phyllaries with reflexed apices, those of *P. hebeclada*, especially the often linear outer ones, become recurved-spreading, and in some cases the slender tips have become decidedly reflexed. At all events, the contention here is merely that the description would seem to fit *P. hebeclada* more closely than any other Mexican *Perezia*.

*Perezia paniculata* Gray, Proc. Amer. Acad. xxi. (1886) 393, based on *Palmer*, no. 279 (1885) = *VERNONIA SERRATULOIDES* H. B. K. Nov. Gen. et Spec. iv. (1820) 33.

*PEREZIA TURBINATA* La Llave & Lexarza, Nov. Veg. Descr. i. (1824) 25. The original diagnosis calls for acute ovate leaves and short peduncles. Although Dr. Gray, Proc. Amer. Acad. xix. (1883) 58, described the leaves as "ovatis oblongisve," none of the leaves in the two sheets of Schaffner's no. 226, the number cited by Gray, can be said to be ovate, being in fact mostly oblong, a few even somewhat narrowed toward the base, while the reduced upper leaves are lance-attenuate. Most of the cauline leaves, moreover, are decidedly obtuse to rounded at the apex. Of the 9 peduncles present, one is as short as 1 cm., the rest measuring 23 mm., 32 mm., 42 mm., 50 mm., two 55 mm., and two more 65 mm. in length, all exceptionally long for this group. More fundamental still is the fact that it is hard to reconcile a head with radiate outer corollas ("corollulae") with those of any of the known members of the § *Acourtia*. Dr. Gray raised this very objection to *P. fruticosa* La Llave & Lex. (Proc. Amer. Acad. xix. 61); yet, in the case of *P. turbinata*, these very corolla-characters seem to meet with no objection.

In spite of the uncertainty still attending the identity of this species, it has seemed best, inasmuch as a more positive interpretation of the species seems improbable, to follow that of Dr. Gray.

*Perezia vanillosma* (Wright) Molt. & Gomez, Anal. de la Soc. de Hist. Nat. Madrid xix. (1890) 268 = *PROUSTIA VANILLOSMA* Wright in Sauv. Fl. Cub. (1873) 83. In transferring this Cuban *Proustia* to *Perezia*, the authors followed Baillon [Hist. des Pl. viii. (1882) 101] in reducing *Proustia* as a section under *Perezia*. Gomez makes this species the type of a new sub-section (*Vanillosma* G-M) under § *Proustia*.

Although, as Hoffmann (Engl. & Prantl, Natur. Pflanzenfam. iv. Abt. 5, 343) indicates, *Proustia vanillosma* differs from the other species of *Proustia* in having a smaller portion of the style-branch covered with papillae and in its almost truncate stigmas, it is hardly to be referred to *Perezia*. Habitally at least, it is quite distinct, being a subscandent, very branching shrubby plant with pairs of short, not pungent, slightly to strongly recurved, spine-like processes below each of the nodes and elliptic-oblong, shortly petiolate leaves 2-3 cm. long. The specimen at hand (*Wright*, no. 3616, the isotype) at the Gray Herbarium is in the fruiting stage; hence an examination and comparison of the styler characters was not feasible.

*Perezia vernonioides* Gray, Proc. Amer. Acad. xxii. (1887) 433, based on *Palmer*, no. 745 (1886) = *VERNONIA JALISCANA* Gleason, Bull. N. Y. Bot. Gard. iv. (1906) 198. According to the international rules of nomenclature, however, Gray's earlier specific name must be taken up. The binomial ***Vernonia vernonioides*** (Gray), comb. nov., is therefore proposed.

*PROUSTIA MEXICANA* Lag. ex D. Don, Trans. Linn. Soc. xvi. (1830) 201. Erect branches sulcate, glandular; leaves amplexicaul, cordate-ovate or oblong, acuminate, sharply and closely spinulose-denticulate, occasionally subserrate, membranaceous, reticulate-veiny, rough-papillose on both surfaces, green, the lower surfaces, like the branches, covered with glistening, resinous glands, an inch or two long, one inch wide; heads fasciculate-corymbose; peduncular bracts ovate-lanceolate, acuminate, somewhat recurved, minutely glandular; involucre tubular-oblong, many-bracted, copiously glandular; phyllaries ovate-lanceolate, appressed, acuminate; flowers 5, white; achenes teretish, papillose-scabrous; pappus white, the scabrous bristles united at the very base, subsimple at the apex.

This description, as Dr. Gray himself intimated (Proc. Amer. Acad. xix. 59) "answers not badly to *P. Thurberi* of which the outermost bracts are 'ovato-lanceolatis acuminatis.'" Inasmuch as there is nothing in the diagnosis definitely to exclude *P. Thurberi* and much that agrees with that species, it is quite possible that the plant Don had before him was this Grayian species.

Lessing (Syn. Comp. 408), and De Candolle (Prodr. vii. 67) who followed him, must both be incorrect in referring *Proustia mexicana* of Lagasca to Lessing's *Dumerilia Humboldtii*, since it is quite evident, from a perusal of the two diagnoses, that Lessing described quite a different plant.

*TRIXIS LATIFOLIA* Hook. & Arn. Bot. Beech. (1840) 300. In the supplement to the "Botany of Capt. Beechey's Voyage," on p. 437, the authors of this binomial referred it to *Acourtia formosa* D. Don and of De Candolle. But these are most certainly not the same. Gray, Pl. Wright. i. (1852) 127, referred *Trixis latifolia* to *P. rigida* (DC.) Gray; later (Proc. Amer. Acad. xix. 61, 1883) he again referred it to *P. rigida*, though here not without reservation. In the original diagnosis of *Trixis latifolia*, the leaves are described as obovate, 4-5 inches long and 3 inches wide, the cymules as laxly corymbose and the phyllaries as lanceolate and "spinoso-acuminatis." The peduncles are squamose, the acuminate subspinulose scales "gradually passing into the spinescent scales of the involucre." This combination of

characters definitely excludes *Trixis latifolia* from either *P. formosa* or *P. rigida*, nor does it give any clue to its probable identity, inasmuch as none of the *Perezias* so far described from Mexico has spinescent phyllaries.

§ **Euperezia** Gray, Syn. Fl. N. Am. ed. 1, i. pt. 2 (1884) 408.

Mostly acaulescent often cespitose single-headed annual or perennial herbs with the pinnately sinuate to parted often spinose-ciliate leaves radical, or with the leaves restricted to the base of the stem, or (much more rarely) taller and truly caulescent, branching and several-headed above with the cauline leaves alternate, denticulate to dentate, often spinose-ciliate, not infrequently pinnatifid to pinnately parted; herbage glabrous to glandular-puberulent, smooth to scabrid; phyllaries for the most part not indurate, lax to rigid, the margins of the inner very often scarious, often widely so, the outer sometimes pungently ciliate-denticulate to -dentate, rarely pinnatisect, usually well imbricated; corollas mostly blue or white, varying to purple, rose and, in 2 species, yellow, the marginal corollas often with the ligulate "lip" somewhat broader and longer than that of the inner ones, the heads thus appearing radiate; otherwise as in the generic diagnosis.—*Perezia* Lagasca, Amen. Nat. i. (1811) 31; *Chaetanthera* Humb. & Bonpl. Pl. Aequin. ii. (1809) 146, 168 and 170, not Ruiz & Pav.; *Clarionea* Lag. ex DC. Ann. Mus. Paris, xix. (1812) 65; *Homoianthus* Bonpl. ex DC. loc. cit.; *Homanthis* H. B. K. Nov. Gen. et Sp. iv. (1820) 12; *Drozia* Cass. Dict. Sci. Nat. xxxiv. (1825) 217; *Homoeanthus* Spreng. Syst. iii. (1826) 503; *Clariona* Spreng. loc. cit. 504; *Clarionia* D. Don, Trans. Linn. Soc. xvi. (1830) 204; *Clarionia* § *Palesia* D. Don, loc. cit. 207, in part; *Clarionella* DC. ex Steud. Nom. i. (ed. 2, 1840) 377; *Clarionema* Phil. Linnaea xxviii. (1856) 717.

PROVISIONAL KEY TO THE COMMONER SPECIES.

- a. Inflorescences paniculate-branching, at least in mature plants, and often congested; plants typically caulescent. . . . b.
- b. Phyllaries with scarious margins, neither linear-lanceolate nor acuminate. . . . c.
- c. Cauline leaves reduced, bract-like; scarious margins of the phyllaries very narrow and obscure. . . . 1. *P. viscosa*.
- c. Cauline leaves ample, amplexicaul; scarious margins of the phyllaries conspicuous, often wide. . . . d.
- d. Inflorescence (in mature plants) 7-40-headed. . . . e.
- e. Heads at anthesis more or less congested into somewhat leafy-bracted cymes, hemispheric-campanulate, 1-1.5 cm. high; cauline leaves crowded, oblong, saliently spiny; phyllaries ovate-lanceolate to oblong-lanceolate. . . . 2. *P. multiflora*.
- e. Heads not congested, disposed in an elongate inflor-



- escence; cauline leaves not saliently spiny; phyllaries widely oblong....*f*.
- f*. Inflorescence a diffusely branched, usually 20–40-headed paniculate cyme, the heads aggregated into cymules at the tips of the elongate inflorescence-branches; basal leaves smooth, chartaceous, incised-dentate, the dentations very shortly mucronate-ciliate.....3. *P. cubataensis*.
- f*. Inflorescence narrow, 7–10-headed; basal leaves scabrous, especially above, subcoriaceous, closely repand-dentate, the teeth attenuated into stiff ciliary processes.....4. *P. squarrosa*.
- d*. Inflorescence in mature plants few (2–5)-headed, not diffuse....*g*.
- g*. Heads at anthesis narrowly campanulate, 2–2.5 cm. high; phyllaries oblong-lanceolate, at least the inner entire; achene-trichomes (when present) not forked at the summit....*h*.
- h*. Phyllaries dimorphic, the outer calyculate and foliaceous, like the cauline leaves ciliate-dentate; entire plant glabrous; ligules arcuate, 2.5 mm. wide; corolla 22 mm. long.....5. *P. carduncelloides*.
- h*. Phyllaries not dimorphic, the outer at most but slightly more foliaceous than the inner; plants at least in part viscid-pubescent; ligules not arcuate....*i*.
- i*. Inner phyllaries oblong-lanceolate or narrower, their central portions not coriaceous, light green, often abruptly attenuate-mucronate, the scarious margin not very broad; cauline leaves not crowded; ligules 2 mm. wide; corolla 19 mm. long.....6. *P. pungens*.
- i*. Inner phyllaries oblong, obtuse, their central portions coriaceous, dark green, with very broad scarious margins, terminating in a stiff callous mucro....*j*.
- j*. Flowering stem exceeding the basal leaves, corymbosely branched at the summit into the short flowering branches; cauline leaves crowded; whole plant rigid; ligules 3 mm. wide; corolla 20 mm. long.....7. *P. multicapitata*.
- j*. Flowering stems little or not at all exceeding the basal leaves; plant not rigid. Here may be sought occasional 2-headed specimens of  
21. *P. carthamoides*.
- g*. Heads at anthesis broadly campanulate, 8–15 mm. high; phyllaries obovate-ob lanceolate, more or less fimbriolate-dentate; trichomes of the black achenes bright white, forked at the very summit.....8. *P. sonchifolia*.
- b*. Phyllaries without scarious margins, at least the inner linear-lanceolate, attenuate; cauline leaves lyrate, ample; inflorescence diffuse.....9. *P. Gayana* (*P. perfoliata*).
- a*. Inflorescence reduced to a single head per stem....*k*.
- k*. Achene-trichomes with a dark brown waxy base; corollas yellow; leaves entire, the basal linear-ob lanceolate..10. *P. lactucoides*.
- k*. Achene-trichomes (when present) without a waxy base; corollas mostly white to blue, more rarely violet or pink (yellow in *P. virens*)....*l*.

- l.* Peduncles exceeding the basal leaves—when by as little as 1 cm. or even when shorter (*P. pilifera*), then the plants depressed and more or less matted; peduncles scape-like, not infrequently bearing bract-like leaves, or, at all events, leaves much smaller than the basal ones. . . . *m.*
- m.* Leaf-blades neither pinnatifid nor pinnately parted, at most pectinate-dentate; achenes shortly stipitate-glandular. . . . *n.*
- n.* Basal leaf-blades narrowly oblanceolate to somewhat spatulate, neither pectinate-ciliate nor coriaceous; scapes 15–30 cm. tall, wiry. . . . *o.*
- o.* Basal leaves narrowly oblanceolate, attenuate at both ends, the larger repand-dentate and 8–15 cm. long, not more than 8 mm. wide; achenes glabrous except for the glands; plant glabrous not glandular. . . . 11. *P. Mandoni.*
- o.* Basal leaves oblong-lanceolate to cuneate-obovate, ciliolate and sometimes weakly dentate, 3–6 cm. long, 8–14 mm. wide; achenes sparsely tawny-strigose as well as glandular; scape glandular, especially above. . . . 12. *P. laurifolia.*
- n.* Leaf-blades linear, entire, rigid-coriaceous, more or less pectinate-ciliate; scapes 2–7 (–9) cm. tall, not wiry. . . . *p.*
- p.* Leaves conspicuously beset with stiff callous processes 1.5–2 mm. long, apparently on the margin but really from the surface of the strongly revolute blade; achenes glabrous (acc. to D. Don) . . . 13. *P. Doniana.*
- p.* Leaves merely bristly short-ciliate. . . . *q.*
- q.* Leaves strongly revolute, thus appearing thickened, the “marginal” ciliation really from the leaf-surface; phyllaries slightly scurfy, merely acute; achenes glabrous except for abundant short-stipitate glands; heads 14–22 mm. high . . . 14. *P. recurvata.*
- q.* Leaves hardly if at all revolute, bristly-ciliate on the actual margin; phyllaries glabrous, particularly the inner acuminate; achenes sparsely canescent-strigose, especially above; heads 22–28 mm. high. . . . 15. *P. linearis.*
- m.* Leaf-blades more or less pinnately parted, oblanceolate to linear in outline; achenes sericeous to strigose, usually so densely as to mask the short-stipitate glands when present. . . . *r.*
- r.* Achenes whitish-strigose; heads narrowly campanulate, 1–1.5 cm. wide; peduncles 1–3.5 cm. long, mostly little to rarely not at all exceeding the dense rigid-coriaceous basal leaves. . . . *s.*
- s.* Leaves linear, the margins pectinate-pinnatifid, not ciliate, the pinnae tipped with a callous bristle; peduncles very little to less usually not at all exceeding the basal leaves; corollas apparently cyanic. . . . 16. *P. pilifera.*
- s.* Leaves cuneate-oblanceolate in outline, pinnately parted, the more or less rounded-obtuse lobes

- ascending and pectinate-ciliate; peduncles always longer than the basal leaves; corollas (when fresh) bright yellow. . . . . 17. *P. virens*.
- r. Achenes more or less tawny-strigose; heads broadly campanulate, 18–20 mm. wide; peduncles 5–25 cm. high. . . . t.
- t. Basal leaves glandular-ciliolate; outer phyllaries at most merely dentate. . . . u.
- u. Corollas white; scape always more than twice as long as the basal leaves; phyllaries glabrate. . . . . 18. *P. magellanica*.
- u. Corollas blue; basal leaves as long as the scape or longer; phyllaries densely glandular. . . . . 19. *P. lyrata*.
- t. Basal leaves not ciliate; outer phyllaries with a strong tendency to being pectinately parted. . . . . 20. *P. pedicularidifolia*.
- l. Peduncles not exceeding the basal leaves, often equalling them—if slightly longer (1 cm.), then the leaves more or less erect, not rosulate. . . . v.
- v. Peduncles about equalling the basal leaves (not infrequently longer or shorter by 1 cm.), bearing foliage leaves. . . . w.
- w. Heads mostly 2.5–3 cm. high; plants 1.5–2.5 dm. tall; outer phyllaries always spinulose-ciliate. . . . x.
- x. Inner phyllaries oblong, obtuse, tipped by a stiff callous mucro, coriaceous, achenes broadly cylindrical, uniformly short-strigose, the trichomes whitish and the glands inconspicuous. . . . 21. *P. carthamoides*.
- x. Inner phyllaries linear-lanceolate, acute, merely abruptly attenuate, not at all coriaceous; achenes slenderly cylindrical, conspicuously glandular, rather sparsely strigose with light brown trichomes. . . . . 22. *P. atacamensis*.
- w. Heads not more than 2 cm. high; plants mostly less than 1 dm. tall; outer phyllaries often subentire. . . . 23. *P. purpurata*.
- v. Peduncles decidedly shorter than the basal leaves; depressed-acaulescent or but subcaulescent plants with relatively large heads; plants of high altitudes in nw. Argentina, Bolivia and Peru. . . . y.
- y. Phyllaries glabrous or nearly so, not glandular. . . . z.
- z. Leaves narrowly oblong, pinnatisect; the very outermost (and often the inner) phyllaries at least spinulose-ciliate, more usually laciniately spinulose. . . . . 24. *P. coerulescens*.
- z. Leaves narrowly spatulate-obovate, not dissected, at most dentate, often undulate. . . . . 25. *P. integrifolia* (*P. pygmaea*).
- y. Phyllaries glandular-puberulent or at least dark-punctate; foliage glandular-puberulent. . . . aa.
- aa. Leaves oblanceolate, pinnately lobed above the spatulate base. . . . . 26. *P. violacea*.
- aa. Leaves linear-elliptic, pinnately parted. . . . 27. *P. pinnatifida*.



PEREZIA SCAPIFORMIS Bacigalupi.



PEREZIA LOBULATA Bacigalupi.



**PEREZIA DISSITICEPS** Bacigalupi.



**PEREZIA ASPERA** Bacigalupi.



DETERMINED AT THE GRAY HERBARIUM

*Perezia rigida* (DC.) Gray  
var. *linearifolia* Bacigalupi  
nov.

C. G. PRINGLE  
PLANTÆ MEXICANÆ  
1860  
1860 *Perezia rigida*, Gray ?  
—DC. Paris  
Cordillera near Guadalupe  
4 to 6 feet high  
Mexico

*PEREZIA RIGIDA* (DC.) Gray var. *LINEARIFOLIA* Bacigalupi.





PEREZIA RIGIDA (DC.) Gray var. ACUMINATA Bacigalupi.



PEREZIA DUGESII Gray var. PILULOSA Bacigalupi.

CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCVIII.

ISSUED APR 14 1932

STUDIES IN THE BROMELIACEAE.—III.

1. Notes preliminary to a Revision of the *Bromeliaceae* . . . . . 3
2. Provisional key to the Genus *Guzmania* with notes on new or  
critical species . . . . . 18

BY LYMAN B. SMITH.

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## STUDIES IN THE BROMELIACEAE.—III.

### 1. NOTES PRELIMINARY TO A REVISION OF THE BROMELIACEAE.

THE largest sources of material for the present paper have been the collections of the Gray Herbarium (G), the Field Museum of Natural History (FM), and the United States National Museum (US). These have been studied intensively in the preparation of a treatment of the *Bromeliaceae* for the projected flora of Peru undertaken by the botanists of the Field Museum. Constant use has been made of the photographs of types in the Berlin Herbarium (B) taken by Mr. J. Francis Macbride under the Rockefeller Foundation Fund. Since nearly all the recent types based on the specimens of Weberbauer, Ule, and Herrera are at Berlin, these photographs have proved extremely valuable in establishing the relationships of the various species and in constructing keys. It is only justice to say that the quality of the photographs themselves leaves little to be desired.

All novelties and new combinations from the Peruvian material are treated in the present paper, since it is considered advisable to publish them before their inclusion in the flora. At the same time it is possible to discuss the species in more detail than could be done in a strictly floristic work. In making certain new combinations it has been necessary to take the liberty of using manuscript or herbarium names of Mez, but in each instance their origin is duly acknowledged.

In a study of the complete ranges of the Peruvian species of *Bromeliaceae*, they have been found to illustrate certain geographic tendencies of the family very well. The most striking single feature is their apparently high degree of endemism, well over half the Peruvian species not being known outside the country. This degree of endemism is partially discounted by the large area involved in Peru and by the incompleteness of collecting in tropical America generally, but on the whole it is not unreasonably high for such a generally mountainous country. Of the large Peruvian genera, *Puya* is the most strongly endemic and *Pitcairnia* next, while *Tillandsia* shows by far the strongest extra limital character. The Peruvian endemic species of these three genera follow the same tendencies, those of *Puya* being largely restricted to a single locality each, those of *Pitcairnia* sometimes from several localities each, and those of *Tillandsia* often having a wide range within the country. These genera show practically the same relation to each other when viewed as a whole, *Puya* having the smallest range as a genus and only one widely distributed species, *P. floccosa* Morr., *Pitcairnia* having a larger range and several widely

distributed species, and *Tillandsia* having the largest range of all, or practically the same as the whole family, and a large number of wide-ranging species.

The remaining Peruvian genera are too poorly represented to be significant in considering endemism, but taken by tribes they illustrate extra limital affinities well. Those with the superior or partly superior ovary, *Pitcairnieae* and *Tillandsieae* are strongly Andean in affinities, while those with the completely inferior and indehiscent ovary, *Bromelieae*, are derived almost exclusively from Brazil and in Peru are limited for the most part to the northeastern lowland.

The following table summarizes briefly the geographic affinities of the Peruvian *Bromeliaceae*:

	Total Peruvian		Extra limital distribution of Peruvian species:													
	species:	Endemic:	Brazil	Argentina	Uruguay	Paraguay	Chile	Bolivia	Ecuador	Colombia	Venezuela	Guiana	Antilles	Central America	Mexico	United States
1. <i>Puya</i> . . . . .	32	30	-	-	-	-	-	2	-	-	-	-	-	-	-	-
2. <i>Lindmania</i> . . . . .	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
3. <i>Deuterocohnia</i> . . . . .	1	0	1	1	-	-	-	-	-	-	-	-	-	-	-	-
4. <i>Pitcairnia</i> . . . . .	26	20	1	-	-	-	-	2	2	2	-	-	-	-	-	-
5. <i>Tillandsia</i> . . . . .	68	34	8	8	3	5	3	14	16	14	7	5	7	6	4	3
6. <i>Vriesia</i> . . . . .	2	0	1	-	-	-	-	-	-	-	-	1	2	-	-	-
7. <i>Guzmania</i> . . . . .	14	10	-	-	-	-	-	-	2	2	1	1	1	1	-	-
8. <i>Catopsis</i> . . . . .	1	0	1	-	-	-	-	-	-	1	-	1	1	1	1	-
9. <i>Bromelia</i> . . . . .	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
10. <i>Greigia</i> . . . . .	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
11. <i>Aregelia</i> . . . . .	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-
12. <i>Streptocalyx</i> . . . . .	7	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
13. <i>Aechmea</i> . . . . .	10	7	2	-	-	-	-	-	1	2	-	1	1	1	1	-
14. <i>Ananas</i> . . . . .	1	0	1	-	-	-	-	-	-	-	-	1	-	-	-	-
15. <i>Billbergia</i> . . . . .	4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total <i>Bromeliaceae</i> . . . . .	175	113	21	10	3	5	4	18	21	21	8	10	12	9	6	3

Thanks to a generous loan of material from the Riks Museum at Stockholm (S) and from the Biological Institute of São Paulo, it is

possible to publish several new species of Brazilian *Bromeliaceae*. There are also scattering notes on other collections. For the sake of convenience, genera and species have been arranged in alphabetical order. In the case of *Guzmania* the subject has grown so in preparation that it seems best to give it separate treatment.

***Aechmea ferruginea***, spec. nov., terrestris, acaulis: foliis 6–7 dm. longis, subtus punctulato-lepidotis; vagina magna, atro-brunnea; lamina lineari, 3 cm. lata, spinuloso-serrata, spinis 1–2 mm. longis: scapo gracili, erecto, foliis multo brevioribus; scapi bracteis lanceolatis, acuminatis, membranaceis, internodia subaequantibus: inflorescentia foliis breviori, tripinnatim paniculata, pyramidali, 17 cm. longa, stellato-ferrugineo-lepidota, superne densa, inferne laxa; bracteis primariis eis scapi similibus, infimis exceptis, quam rami axillares brevioribus: ramis laxe florigeris, suberectis vel patentibus; bracteis florigeris minutis, aciculis: floribus gracile pedicellatis, 2 cm. longis, pedicellis ad 8 mm. longis; sepalis 4 mm. longis, inermibus, rubris, valde asymmetricis, latere dextro in alam membranaceam quam pars centralis majorem producto; petalis albis, ad apicem rubenti-caeruleis, 13 mm. longis, basi ligulis binis auctis; placentis loculis apice affixis, ovulis obtusis. Pl. I, figs. 1–3.

PERU: JUNIN: in dense forest, Pichis Trail, Dos de Mayo, alt. 1700–1900 m., 1929, Killip & Smith 25815 (US, TYPE; phot. G).

This species belongs to the small subgenus *Podaechmea*, and presents the second instance of the extension of the group down into South America. Its classification is extremely simple since it differs from the other four species of the subgenus in having unarmed sepals. Its scales as seen under the hand-lens have a very striking form, which is more like that in *Pitcairnia ferruginea* R. & P. than in any other Bromeliad known to me.

***Aechmea recurvata*** (Klotzsch), comb. nov. *Macrochordium recurvatum* Klotzsch, in Allg. Gartenz. xxiv. 393 (1856). *Hohenbergia Legrelliana* Bak. in Saund. Ref. Bot. iv. t. 285 (1871). *Ortgiesia palleolata* Morr. Cat. 2 (1871). *O. tillandsioides* var. *subexserta* Regel in Gartenfl. xxiv. 188 (1875). *Aechmea Legrelliana* Bak. in Journ. Bot. xvii. 236 (1879). *Portea Legrelliana* Benth. & Hook. Gen. iii. 662 (1883). *Ortgiesia Legrelliana* Bak. Brom. 19 (1889).

***Aregelia eleutheropetala*** (Ule) Mez in herb. Berol., comb. nov. *Nidularium eleutheropetalum* Ule, Verhandl. Bot. Ver. Brandenb. xlviii. 131 (1907). According to Ule this species can not be included in any of the genera as given by Mez in 1896, unless *Aregelia*, *Euni-dularium* and *Canistrum* are all merged under *Nidularium*. Un-

fortunately in his discussion Ule does not indicate directly why the species differs in character from each of the three genera, but gives its points of similarity so that the distinctions must be drawn by inference. In comparing Ule's description with Mez's key it is at once evident that the species is excluded from *Canistrum* on the basis of naked petals. Examination of fragments of the isotype material from the Goeldi Museum in Para confirm this point (t. I, figs. 4-6). Apparently Ule excludes the species from *Nidularium* in the sense of Mez because of its free petals, while slighting a better distinction with the words "floribus . . . subpedicellatis." To be sure the outlines of ovary and pedicel merge without abrupt distinction, but when the pedicel is as long as the ovary the flower may be considered quite thoroughly pedicellate as opposed to the sessile flowers of *Nidularium* (t. I, fig. 5).

Though admitting that the species resembles *Aregelia* in habit Ule seems to exclude it on the grounds of free petals and compound inflorescence. Checking Mez's generic description for *Aregelia* shows that the character of joined petals is usual but not absolute. The character of compound inflorescence, however, can not be reconciled with *Aregelia*. An examination of photographs of the type and isotype material shows no indication of a compound inflorescence, but both appear as in typical *Aregelia*. Consequently it seems that Ule must have made some miscalculation in his description. This impression is strengthened by the fact that he gives the inflorescence as 300-500-flowered when it can not be much more than a tenth of that figure.

In Mez's key, *Aregelia eleutheropetala* comes nearest to *A. concentrica* from which it is distinguished by having the floral bracts straight and the sepals acute rather than acuminate.

**Dyckia Dusenii**, spec. nov., valida, ad 7 dm. alta: foliis 3-4 dm. longis, subtus dense pallido-lepidotis, supra glabris nitidisque; vagina ampla, suborbiculari, omnino vel parti superiori atro-castanea; lamina anguste triangulari, basi 15-20 mm. lata, acuminata, flavo-viridi, spinose serrata, spinis uncinatis, 2-3 mm. longis, laxe dispositis: scapo erecto, valido, mox glabro; scapi vaginis amplis, late ovatis, acuminatis, internodiis multo longioribus, dorso dense pallido-lepidotis, integris vel minutissime denticulatis, infimis longe laminatis: inflorescentia simplici, cylindrice racemosa, subdensa, multiflora, 2-3 dm. longa: bracteis florigeris late ovatis, acuminatis, omnibus quam sepala, infimis quam flos tota longioribus: floribus subpatentibus, pedicello crasso incluso 26 mm. longis, mox glabris; sepalis ovatis, acutis, valde alatim carinatis, 16 mm. longis, saepe denticulatis; petalis aureis, late laminatis, staminibus multo longioribus; filamentis



ultra tubum petaleo-stamineum inter sese connatis; antheris sub-linearibus, acuminatis. Pl. II.

BRAZIL: PARANÁ: Porto Amazonas, alt. 800 m., 1916, *Dusén 18081* (S, TYPE; phot. G); Tamandaré, alt. 870 m., 1914, *G. Jönsson 1029a* (S); Serrinha, 1909, *Dusén 8686, 8996* (S).

The outstanding characters of this species are its simple inflorescence, large floral bracts, and wing-carinate sepals.

***Greigia columbiana***, spec. nov., e fragmentis solum cognita: foliis ultra 4 dm. longis; vagina ignota; lamina peranguste lanceolata, ad 3 cm. lata, glabra, toto margine spinosa, spinis validis, atro-castaneis, 4–5 mm. longis: inflorescentia subpauciflora, densa; bracteis exterioribus basi late ovatis, atro-castaneis, dissite lepidotis, integris, late hyalino-marginatis, apici anguste triangularibus, pallidis, grosse denseque serratis: bracteis florigeris lineari-lanceolatis, pungenti-acuminatis, ad 4 cm. longis, sepalis brevioribus, integris, mucroni terminali dorso inserto, parti inferiori straminea, membranacea, parti superiori atro-castanea, subcoriacea, dissite lepidota: floribus 5–6 cm. longis; sepalis bracteis florigeris similibus; corolla sepalis 10–15 mm. longiore. Pl. I, figs. 7–8.

COLOMBIA: NORTE DE SANTANDER: Paramo de Romeral, alt. 3800–4200 m., 1927, *Killip & Smith 18689* (G, TYPE).

***Greigia Macbrideana***, spec. nov., e fragmentis solum cognita, ad 7 dm. alta: foliis 3–7 dm. longis, subtus adpresse albo-lepidotis; vagina magna, atro-brunnea, dense serrata cum spinis 3–4 mm. longis; lamina lineari, acuminata, 22 mm. lata, basi paulo constricta, spinis minutis laxisque: inflorescentia ca. 8-flora, densa; bracteis exterioribus basi infima straminea excepta atro-castaneis, triangulari-ovatis, acuminatis, pungentibus, dense uncinato-serratis, adpresse lepidotis: bracteis florigeris, lineari-lanceolatis, 35 mm. longis, sepala superantibus, integris, pungentibus, punctato-lepidotis, parti inferiori straminea, membranacea, parti superiori atro-castanea, subcoriacea: floribus 4 cm. longis; sepalis bracteis florigeris similibus, 2 cm. longis; corolla 27 mm. longa, rubenti, tubo lobis subaequilongo, lobis erectis; staminibus styloque inclusis. Pl. I, figs. 9–11.

PERU: HUANUCO: wet places, Tambo de Vaca, alt. ca. 3700 m., 1923, *Macbride 4442* (FM, TYPE; phot. G).

The two above-mentioned species of *Greigia* can not be interpolated in the key given by Mez,<sup>1</sup> since neither the material itself nor the notes accompanying it indicate whether the inflorescence is lateral or

<sup>1</sup> Bromeliaceae Mez, in *Monographiae Phanerogamarum*, De Candolle ix. 44 (1896).

terminal. The following key serves to show their relationships as nearly as possible without the complete plant:

1. Outer bracts of the inflorescence entire.
  2. Sepals 25 mm. long, mucro dorsal. Chile.....1. *G. Landbeckii*.
  2. Sepals 15 mm. long, mucro terminal. Chile.....2. *G. Pearcei*.
1. Outer bracts of the inflorescence definitely serrulate.
  3. Sepals 40 mm. long, ecarinate, white. Chile, Peru.....3. *G. sphacelata*.
  3. Sepals scarcely over 20 mm. long, often carinate, green or more or less castaneous.
    4. Leaf-blades finely and remotely serrulate.
      5. Bracts wholly or in large part dark-castaneous.
        6. Bracts wholly castaneous, with a few short teeth at apex. Ecuador.....4. *G. Sodiroana*.
        6. Bracts partly castaneous and partly stramineous, with at least the upper half coarsely and closely serrate.
          7. Bracts and sepals stramineous at apex. Venezuela.....5. *G. albo-rosea*.
          7. Bracts and sepals stramineous at base. Peru.
            6. *G. Macbrideana*.
            5. Bracts and sepals green. Costa Rica.....7. *G. sylvicola*.
    4. Leaf-blades coarsely and rather closely serrate throughout.
      8. Bracts serrate throughout. Colombia.....8. *G. vulcanica*.
      8. Bracts serrate only along the narrowly triangular apex. Colombia.....9. *G. columbiana*.

**Hohenbergia Brittoniana**, spec. nov., e fragmentis solum cognita: foliis ad 5 dm. longis, utrinque dense minuteque lepidotis; lamina ligulata, basi 7-8 cm. lata, minute spinuloso-serrata, apice late rotundato-apiculata: inflorescentia laxa bipinnata, glabra, 3 dm. vel ultra longa; bracteis primariis anguste lanceolatis, stipites subaequantibus; strobilis omnibus gracile stipitatis, ad 8 cm. longis, 12 mm. latis, 40-50-floris, *Tritici* spicam in animo revocantibus: bracteis florigeris late ovatis, subacutis, mucronatis, sepalis multo brevioribus, valde nervatis: floribus valde compressis, petalis neglectis 9 mm. longis; sepalis asymmetricis, nervatis, 5 mm. longis; ovulis ignotis. Pl. I, figs. 12-14.

JAMAICA: without further locality, *N. L. Britton 2313* (NY, TYPE; phot. G).

The narrowly cylindrical long-stipitate spikes and strongly nerved short floral bracts distinguish this species of *Hohenbergia* from all others.

**Pitcairnia Calderonii**, Standley & Smith, spec. nov., acaulis, semimetralis, rhizomate foliorum delapsorum vaginis oblecto bulbum efformante: foliis dimorphis, alteris persistentibus, fere setiformibus, brunneis, uncinato-serratis, alteris foliaceis, tempore sicco deciduis; lamina anguste lanceolata, ad 3 dm. longa, 16 mm. lata, integra, supra glabra, subtus floccose albo-lepidota: scapo valido, erecto,

floccose lepidoto; scapi bracteis foliaceis, internodia multo superantibus: inflorescentia simplicissima, floccose lepidota, 2 dm. longa, apici densa, inferne laxa: bracteis florigeris lanceolatis, acuminatis, magnis, infimis sepala superantibus: floribus erectis, ad 6 cm. longis, brevissime pedicellatis; sepalis anguste lanceolatis, acuminatis, 28 mm. longis, valde carinatis, dorso omnino albido-lepidotis; petalis rubris, eligulatis, stamina subaequantibus; antheris ad 8 mm. longis; ovario ad  $\frac{2}{3}$  longitudinis supero. Pl. III, figs. 1-2.

SALVADOR: SONSONATE: Volcano of Izalco, 1931, *Salvador Caldéron 2595* (G, TYPE).

This species is closely related to *P. splendens* and *P. Karwinskyana*. It differs from the former in its smaller sepals and narrow rather lax inflorescence, and from the latter in its very short flower-pedicels.

**Pitcairnia cuzcoensis**, spec. nov., ca. 9 dm. alta: foliis dimorphis, exterioribus ad vaginas atro-brunneas squamiformes pungenti-mucronatas reductis, interioribus viridibus, super vaginam angustatis sed non distincte petiolatis, basi excepta integris, lineari-lanceolatis, 5-6 dm. longis, 25 mm. latis, supra glabris, subtus minute albo-puberulis: scapo erecto, gracili, dissite furfuraceo; scapi bracteis anguste triangularibus, acuminatis, superioribus quam internodii brevioribus: inflorescentia paupere paniculata; axi dissite pallido-furfuraceo: bracteis florigeris elliptico-lanceolatis, acutis vel acuminatis, pedicellos subaequantibus: floribus suberectis vel patentibus, 40 mm. longis, gracilibus, pedicellis gracilibus, 10 mm. longis; sepalis anguste triangularibus, acuminatis, dissite punctulato-lepidotis; petalis rubro-scarlatinis, nudis; staminibus exsertis; ovario ad  $\frac{3}{4}$  longitudinis supero. Pl. III, figs. 3-5.

PERU: CUZCO: mixed grass and shrub formation, Chaupichaca, Marcapata Valley, province of Quispicanchi, alt. 1700 m., 1929, *Weberbauer 7825* (FM, TYPE; phot. G).

**Pitcairnia pectinata**, spec. nov., metralis: foliis 1 m. vel ultra longis, spinose petiolatis; lamina lanceolata, integra, 8 cm. lata: scapo erecto, ferrugineo-lanato, mox glabro; scapi vaginis anguste triangularibus, ferrugineo-lanatis, pectinato-serratis, quam internodii superiores multo brevioribus: inflorescentia simplicissima, dense subspicata, axi bracteisque ferrugineo-lanatis: bracteis florigeris eis scapi similibus, pectinato-serratis: floribus pallido-rubris (Archer), erectis, glabris, breviter pedicellatis, solum perjuvenilibus cognitis; sepalis angustissime triangularibus, ad 28 mm. longis; petalis eligulatis; ovario ca.  $\frac{1}{2}$  supero. Pl. III, figs. 6-7.

COLOMBIA: ANTIOQUIA: La Sierra, Medellín, alt. ca. 1500 m., 1931, *W. A. Archer 1372* (G, TYPE).

This species is unusual for *Pitcairnia* in having the floral bracts serrate instead of entire.

***Pitcairnia subpetiolata*** Bak. A study of the type material indicates that *Pitcairnia sessiliflora* Rusby should be included in this species. Consequently the range of *P. subpetiolata* is extended as follows:

BOLIVIA: LA PAZ: province of Nor Yungas, Polo-Polo near Coroico, alt. 1100 m., 1912, *Buchtien 3675* (NY, phot. G). INDEFINITE: *M. Bang* (NY, phot. G; TYPE of *P. sessiliflora*).

***Pitcairnia truncata***, spec. nov., fere metralis: foliis fasciculatis, dimorphis, alteris setiformibus, margine valde spinosis, badiis, alteris foliaceis, petiolatis, laminis lineari-lanceolatis, acuminatis, 4-5 dm. longis, 20 mm. latis, remote minuteque spinuloso-serratis, supra glabris, subtus dense minuteque puberulis: scapo erecto, dissite furfuraceo-lepidoto; scapi bracteis anguste triangularibus, filiformicaudatis, submembranaceis, integris: inflorescentia laxe bipinnatimque paniculata, pyramidata, albo-furfuracea; ramis patentibus, rectis, ad 7 cm. longis (non omnino evolutis), basi sterili brevissimi: bracteis florigeris ellipticis, apiculatis, pedicellis brevioribus et bases suas involventibus: floribus gracilibus, ca. 4 cm. longis, plerumque patentibus, pedicellis gracilibus, 6 mm. longis; sepalis oblongis, truncatis, 10 mm. longis, carinatis, paullo asymmetricis; petalis fulgide rubris, ligulatis, stamina subaequantibus; stylo exserto, ovario ultra  $\frac{1}{2}$  supero. Pl. III, figs. 8-9.

PERU: AYACUCHO: wooded hillside, Ccarrapa, between Huanta and Rio Apurimac, alt. 1500 m., 1929, *Killip & Smith 22414* (G, TYPE).

The outstanding character of this species is its short truncate sepals, a very uncommon form in *Pitcairnia*.

***Puya depauperata***, spec. nov., ca. 5 dm. alta: foliis anguste triangularibus, 4 dm. longis, 3 cm. latis, supra glabris, subtus minutissime adpresso-lepidotis, spinis 6 mm. longis: scapo erecto, gracili; scapi bracteis densis, foliaceis, grosse spinoso-serratis: inflorescentia atro-purpurea, dense minuteque adpresso-lepidotis, e racemo terminali et 2 lateralibus valde reductis composita, bracteis primariis suborbicularibus, apiculatis, ramos laterales fere obscurantibus: bracteis florigeris ovatis vel ellipticis, apiculatis, integris, quam sepala longioribus: floribus erectis, 40-45 mm. longis, pedicellis crassis, obconicis, ad 10 mm. longis; sepalis oblanceolatis, acutis, 25 mm. longis; petalis luride viridibus, marcescentis purpureis (*Macbride & Featherstone*), 37 mm. longis, lamina haud distincta, intus nudis; staminibus styloque inclusis, ovario pyramidalis. Pl. III, figs. 10-11.

PERU: JUNIN: shrubby rocky canyon side, Cabello, hacienda 9 miles above Huertas, alt. ca. 2700 m., 1922, *Macbride & Featherstone 1339* (FM, TYPE; G).

Further collections of this species will doubtless demonstrate that the inflorescence may be simple at times. The inflorescence in the present specimen might easily be mistaken for the simple type, so insignificant are the lateral racemes.

***Puya gracilis***, spec. nov., ca. 8 dm. alta: foliis anguste triangularibus, 6–7 dm. longis, 18 mm. latis, ferrugineo-lepidotis, furfuraceis, spinis gracilibus, uncinatis, 7 mm. longis: scapo erecto, glabro, 5 mm. in diametro; scapi bracteis remotis, ovatis, spinuloso-serratis, infimis longissime caudatis: inflorescentia elongate racemosa, 35 cm. longa, omnino minute stellato-lepidota: bracteis florigeris membranaceis, ovato-apiculatis, plerumque quam sepala brevioribus: floribus erectis vel suberectis, gracilibus, pedicellis gracilibus, 5–7 mm. longis; sepalis anguste ovatis, acuminatis, 30 mm. longis; petalis tubuloso-erectis, intus nudis, stamina subaequantibus; stylo exserto. Pl. III, figs. 12–13.

PERU: without definite locality, *Weberbauer 6474* (FM, TYPE; phot. G).

At first glance this plant scarcely seems to be a member of the genus *Puya* so slender are all its proportions, yet the flowers show the characteristic features of the genus. The individual flowers are more like those of *P. longisepala* of the subgenus *Pitcairniopsis* than like those of any other species known to the writer. This resemblance brings up the point of the phylogenetic value of the divisions which Mez has given under *Puya*. His subgenus *Eupuya* seems to be logical and to contain closely related species, but his subgenera *Pitcairniopsis* and *Pourretia*, based solely on whether the inflorescence is simple or compound, appear decidedly artificial. Further collections and study probably will give rise to a more logical system of classification based on the characters of the flowers and their bracts.

***Puya llatensis***, spec. nov., ca. 2 m. alta: foliis anguste triangularibus, 1 m. longis, utrinque aequaliter pallide adpresso-lepidotis, supra glabrescentibus, spinis 7–8 mm. longis: scapo basi 15 cm. in diametro (*Macbride & Featherstone*): inflorescentia composita; ramis ad apicem usque fertilibus, dense strobiliformibus, ovoideis vel ellipsoideis, quam bractee primariae longioribus: bracteis florigeris late ellipticis, apice acuminulatis, integris, dense ferrugineo-lanatis, sepala ad  $\frac{1}{2}$  aequantibus, late convexis, ecarinatis: floribus 7–8 cm. longis, pedicellis crassis, 15 mm. longis; sepalis late ellipticis, 30 mm. longis, dense ferrugineo-lanatis; petalis 65 mm. longis, intus nudis, lamina elliptica; staminibus styloque inclusis, ovario pyramidali. Pl. III, figs. 14–16.

PERU: HUANUCO: steep canyon slope, Llata, alt. ca. 2300 m., 1922, *Macbride & Featherstone 2300* (FM, TYPE; G).

The above specimen was described from separate leaves and fragments of the inflorescence. Although incomplete the material was sufficient to indicate that the specimen could not be included satisfactorily in any known species.

**Puya Macbridei**, spec. nov., 1 m. alta: foliis anguste triangularibus, 7-8 dm. longis, 25 mm. latis, supra glabris, subtus minute adpresso-lepidotis, apice longe caudatis, spinis validis, atro-brunneis, uncinatis, 6 mm. longis: scapo erecto, tereti, glabro; scapi bracteis deciduis: inflorescentia elongata, laxe racemosa, omnino minute cinereo-tomentosa: bracteis anguste lanceolatis, acuminatis, pedicellis brevioribus, crassis, reflexis: floribus erectis vel suberectis, pedicellis validiusculis, sursum incrassatis, 2 cm. longis; sepalis anguste lanceolatis, 35 mm. longis, 7 mm. latis; petalis 6 cm. longis, spiraliter contortis, intus nudis. Pl. III, figs. 17-18.

PERU: ANCACHS: gravel river bluffs, Recuay, alt. ca. 3000 m., 1922, *Macbride & Featherstone 2516* (FM, TYPE; G).

This species is closely allied to *P. stenostele* Harms, from which it differs chiefly in the smaller floral bracts.

**Puya pectinata**, spec. nov., saxicola, verisimiliter metralis: foliis anguste triangularibus, subtus dense adpresseque pallido-lepidotis, supra glabris, spinis usque ad 8 mm. longis: scapo erecto, valido; scapi vaginis foliaceis, grosse serratis, longissime caudatis: inflorescentia laxe bipinnatim paniculata, sordide pruinoso-lepidota; bracteis primariis late ovatis, acutis vel acuminatis, serratis, racemis distincte brevioribus: racemis laxe 4-8-floris, erecto-patentibus; bracteis florigeris ovatis, acutis, valde pectinatis, sepala aequantibus vel eis paullo brevioribus, dorso rotundatis, non carinatis: floribus breviter crasseque pedicellatis, ad 25 mm. longis; sepalis pallide rubris, lanceolatis, 16 mm. longis, mucronulatis; petalis atro-purpureis, intus nudis; staminibus inclusis; ovario pyramidato. Pl. IV, figs. 1-2.

PERU: LIMA: common, especially on s. e. exposures, in rock crevices, Matucana, alt. ca. 2700 m., 1923, *Macbride 2920* (FM, TYPE; phot. G).

The specimen described above is somewhat immature so that it is probable that all the parts attain slightly larger dimensions than given here. The photograph accompanying the specimen is quite evidently not of the specimen itself, and is so difficult to correlate that it seems best not to consider it in describing the species.

**Puya penduliflora**, spec. nov., ad 6 dm. alta vel paulo ultra:

foliis interioribus solum cognitis, his anguste triangularibus, spinuloso-serratis, supra glabris, subtus minute dissiteque lepidotis: scapo erecto, e comparatione gracili; scapi bracteis ex ovato longe laminatis, serrulatis, submembranaceis, rubris: inflorescentia ad 25 cm. longa, paupere paniculata, omnino minute albo-tomentosa; bracteis primariis ovatis, acutis, serrulatis, submembranaceis, rubris, nervatis, quam racemi axillares multo brevioribus: racemis laxe paucifloris, apice sterilibus, basi complanatis, lateralibus haud ultra 9 cm. longis; bracteis florigeris primariis similibus sed integris, quam pedicelli paullo longioribus: floribus pendulis, ca. 5 cm. longis, ad 13 mm. longe pedicellatis, sepalis anguste lanceolatis, 35 mm. longis, acuminatis; petalis oblongis, 45 mm. longis, intus nudis, (ex sicco) violaceo-virentibus; staminibus styloque petalis brevioribus sed post anthesin paulo exsertis. Pl. IV, figs. 3-4.

BOLIVIA: LA PAZ: province of La Recaja, Hacienda Casana on the road to Tipuani, alt. 1400 m., 1922, *O. Buchtien 7182* (US, TYPE; phot. G).

It is difficult to say whether this species should be included in the subgenus *Eupuya* or *Pitcairniopsis*. Its branches are sterile at apex, but this sterile portion is short and bud-like just as in some specimens of such species as *P. caerulea*, *P. violacea*, and *P. floccosa*. Probably it would be best to consider *Eupuya* as comprising only such species as have the sterile apex of the branches definitely elongated, and consequently to include *P. penduliflora* in *Pitcairniopsis*. In this case its relations would be with *P. Pearcei* from which it differs in its short racemes and serrate primary bracts.

***Puya stipitata***, spec. nov., ca. 2 m. alta: foliis anguste triangularibus, 5-6 dm. longis, 18 mm. latis, supra glabris, subtus membrana cinerea e lepidibus formata obtectis, spinis 5-6 mm. longis: scapo valido, erecto; scapi bracteis foliaceis elongatis: inflorescentia paniculata; racemis ad apicem usque fertilibus, dense strobilatis, 9-10 cm. longis, 3 cm. latis, patentibus vel reflexis, omnino dense pallideque lanatis, stipite 20-25 mm. longo: bracteis primariis anguste ovatis, acutis, stipite paulo longioribus: bracteis florigeris late ovatis, abrupte acutis, sepala ad  $\frac{1}{2}$  aequantibus, integris, late convexis, ecarinatis: floribus erectis, 35 mm. longis, obscure crasseque ad 7 mm. pedicellatis; sepalis late ellipticis, obtusis, 20 mm. longis; petalis caeruleo-viridibus, 28 mm. longis, intus nudis; staminibus styloque petala aequantibus, ovario pyramidali. Pl. IV, figs. 5-6.

PERU: HUANUCO: rocky grass-shrub hillsides, Cani, pueblo 7 miles northeast of Mito, alt. ca. 2800 m., 1923, *Macbride 3436* (FM, TYPE; G), 3854 (FM, G).

In Mez's key to *Puya* in DeCandolle's *Monographiae*, this species would come out to *P. venusta* but differs in having the floral bracts only half as long as the sepals. Judging by the descriptions of the more recent species, it seems most nearly related to *P. gummiifera* Mez & Sodiro, but has the woolly covering of the bracts persistent and the racemes very definitely stipitate.

**Streptocalyx Williamsii**, spec. nov., e fragmentis solum cognita: foliorum laminis linearibus, acuminatis, 6 dm. vel ultra longis, 3 cm. latis, subtus dense adpresseque albo-lepidotis: scapo ignoto: inflorescentia cylindrica, ad 3 dm. longa, bipinnatim paniculata, utrinque dense albo-farinosa; bracteis primariis amplis, spicas axillares aequantibus vel superantibus, late ovatis, acutis, lacinato-denticulatis, chartaceis, fulgide rubris: spicis laxe 2-5-floris, distichis, apice sterilibus, infimis distincte stipitatis; rhachi angusta, subrecta; bracteis florigeris late ovatis, pungenti-mucronatis, integris, ovarium aequantibus vel superantibus sed non omnino obtegentibus, nervatis, ad 12 mm. longis: floribus 3 cm. longis, suberectis; sepalis liberis, mucronatis, valde asymmetricis, 17 mm. longis; petalis 26 mm. longis, intus nudis, (ex sicco) purpureis, quam stylus staminaque longioribus; ovario oblongo, valde angulato. Pl. IV, fig. 7.

PERU: LORETO: forest, La Victoria on the Amazon River, 1929, *L. Williams* 2722 (FM, TYPE; phot. G).

In the general form of the inflorescence this species resembles *Streptocalyx Poeppigii*, *Vallerandi*, and *juruana*. It differs from *S. Poeppigii* and *S. Vallerandi* on account of its large floral bracts and from *S. juruana* on account of its slender nearly straight spike-rhachis.

**Thecophyllum capituligera** (Griseb.), comb. nov. *Tillandsia capituligera* Griseb. Cat. Cuba 254 (1866). *T. fastuosa* André, Rev. Hort. lx. 568 (1888). *Guzmania fastuosa* André ex Mez in DC. Mon. ix. 926 (1896). *G. capituligera* Mez in DC. Mon. ix. 926 (1896).

CUBA: ORIENTE: Loma del Gato, *Wright* 3275 (G, ISOTYPE); Gran Piedra, alt. ca. 1500 m., 1911, *J. A. Shafer* 9053 (G). JAMAICA: *Harris* in herb. bot. dept. 5148, 5155 (acc. to Mez). BRITISH GUIANA: NORTHWEST DISTRICT: Yarikita Police Station, junction of Yarikita and Amakura Rivers, 1920, *A. S. Hitchcock* 17633 (G, NY). COLOMBIA: CUNDINAMARCA: Barroblanco, near Fusagasuga, alt. 2900 m., 1876, *André* 1746 (NY, ISOTYPE of *Tillandsia fastuosa*; phot. G). EL VALLE: forest above La Cumbre, alt. 1800-2100 m., 1922, *Pennell & Killip* 5747 (G).

In studying the isotype material of *Tillandsia capituligera* Griseb. and *T. fastuosa* André it was impossible to find differences between the two which seemed of specific value. At the same time it was noted



that André in his *Broméliacées* gave an excellent plate (t. 37) of *T. fastuosa* and showed the petals (fig. 3) as free and bearing two scales each at base. These characters plus the polystichous-flowered spikes would exclude the species from *Tillandsia* and *Guzmania* and make it a *Thecophyllum*.

***Tillandsia boliviensis*** Baker emend. L. B. Smith, acaulis videtur sed basi extrema ignota, 2 dm. alta: foliis fasciculatim rosulatis, inflorescentiam subaequantibus, dense lepidibus cinereis paullo pruinose obtectis, margine lepidibus magnis paleaceis patentibus auctis; vagina vix distincta; lamina anguste triangulari, subulato-acuminata: scapo erecto, brevi, foliis fere omnino obtecto; scapi vaginis imbricatis, lanceolatis, apiculatis vel infimis breviter caudatis, dense cinereo-lepidotis: inflorescentia e spica terminali 8 cm. longa et una laterali 4–5 cm. longa composita; bracteis primariis eis scapi similibus, spicis subduplo brevioribus: spicis oblongo-lanceolatis, 4–10-floris; bracteis florigeris imbricatis sed ob formam angustam rhachin haud obtegentibus, lanceolatis, acutis, ad 30 mm. longis, sepala superantibus, non carinatis, adpresse cinereo-lepidotis; rhachi glabra, alatim angulosa, leviter geniculata: floribus erectis, brevissime pedicellatis; sepalis liberis, anguste lanceolatis, acutis, 21 mm. longis, glabris, nervatis, posticis alatim carinatis; petalis staminibusque ignotis: capsula brevi, bracteam subaequantem. Pl. IV, figs. 8–9.

BOLIVIA: LA PAZ: vicinity of La Paz, alt. 3,300 m., 1890, *Bang 159a in part* (NY, phot. G).

The original description of this species was evidently compounded from two sheets bearing the same number. One of these sheets is *Tillandsia paraensis* Mez, the other after exhaustive checking with all species of *Tillandsia* and *Vriesia* appears to be a distinct species. Consequently the species is redescribed here in order to clarify its identity. Owing to the absence of good flowers it is impossible to ascertain its exact relationships but the spikes have much the same general appearance as those of *Tillandsia patula* Mez and the leaves can not be distinguished from those of *T. Lorentziana* Griseb.

***Tillandsia exserta*** Fernald, Bot. Gaz. xx. 537 (1895). *T. cinerea* Mez in DC. Mon. ix. 679 (1896). Pl. IV, figs. 10–11.

MEXICO: SONORA: Agiabampo, 1890, *Palmer 805* (G, ISOTYPE of *T. cinerea*). SINALOA: Mazatlan, 1895, *F. H. Lamb 381* (G, TYPE); 1926, *J. G. Ortega 6477* (G); vicinity of Topolobampo, 1910, *Rose, Standley & Russell 13345* (G, US); Altata, 1903, *C. A. Purpus* (Univ. Calif.); Yerba Buena, vicinity of Culiacan, 1904, *T. S. Brandege* (Univ. Calif.); Los Mochis, 1927, *M. E. Jones 23458* (Pomona College); vicinity of Guadalupe, 1910, *Rose, Standley & Russell 14755* (US); vicinity of Mazatlan, 1910, *Rose, Standley & Russell 13793* (US).

A study of the material cited above leaves no doubt that *Tillandsia exserta* and *T. cinerea* are identical. Evidently *T. exserta* was published just too late for inclusion in Mez's monograph of the *Bromeliaceae*, and until now has never been correlated with that treatment. It is generally rather dangerous to try to predict ranges in the *Bromeliaceae*, but in this case it seems likely that *T. exserta* is another example of the strong endemism of the flora of northwestern Mexico.

**Tillandsia Harmsiana**, spec. nov., florifera 6 dm. alta vel ultra, verisimiliter multo altior: foliis anguste triangularibus, acuminatis, 6 dm. longis, basi 4 cm. latis, omnino dense adpresseque cinereo-lepidotis: scapo erecto, valido; scapi bracteis dense imbricatis, ovatis cum laminis longis angustis recurvatisque: inflorescentia bipinnatim paniculata, e spicis ca. 7 composita, dense cylindrica, 30 cm. longa, infra 5 cm. lata; axe spicis bracteisque omnino obtecto; bracteis primariis ovatis, acutis, erectis, spicarum bases arte vaginantibus: spicis rectis, stricte erectis, lineari-lanceolatis, acutis, 11-15 cm. longis, 3 cm. latis, 12-20-floris; rhachi dense lepidota, ad florum receptionem valde excavata: bracteis florigeris imbricatis, ovatis, acutis, 3-4 cm. longis, quam sepala longioribus sed rhachin non obtegentibus, carinatis, dissite lepidotis, aureo-brunneis, basi purpureis: floribus stipitatis, 5 cm. longis; sepalis liberis, anguste ovatis, 3 cm. longis, glabris, ecarinatis; petalis angustis, purpureis, intus callis binis verticalibus auriculatis auctis; staminibus petala subaequantibus; stylo exserto. Pl. IV, figs. 12-15.

PERU: HUANUCO: steep rocky shrubby slopes, Mito, alt. ca. 3000 m., 1923, Macbride 3272 (FM, TYPE; G).

The spikes of this species closely resemble that of *T. lateritia* André, and the petals have pronounced lateral folds as in *T. lateritia* and with the summits of the folds definitely auricled so that at first glance they might be taken for the scales found in *Vriesia*.

**Tillandsia subandina** (Ule) Mez in ms. comb. nov. *Cipuropsis subandina* Ule, Verhandl. bot. Ver. Brandenb. xlviii. 149 (1907).

**Vriesia altodaserrae**, spec. nov., metralis vel ultra: foliis dense rosulatis, 6-7 dm. longis, minutissime punctulato-lepidotis; vagina atro-brunnea; lamina subtriangulari, pallide viridi, basi 5-6 cm. lata: scapo erecto, glabro; scapi bracteis maximis, e basi late ovata fulgide rubra longe foliaceoque laminatis: inflorescentia pyramidata, bipinnata; bracteis primariis infimis eis scapi similibus, ramos unifloros bene occultantibus, supremis late ovatis, apiculatis, basi sterili ramorum brevioribus: racemis spiciformibus, 2-3 dm. longis, laxe 7-13-floris, basi a prophyllis 1-2 auctis; bracteis florigeris late ellipticis,

obtusis, per anthesin patentibus flores involventibus, fulgide aureis, ad 28 mm. longis, quam sepala distincte brevioribus, apice paulo punctulato-lepidoto excepto glabris, laevibus vel leviter venosis, haud carinatis; rhachi gracili, glabra, flexuosa, sulcata: floribus distichis, per anthesin patentibus, ad 7 mm. longe stipitatis; sepalis anguste ellipticis, obtusis, ad 26 mm. longis, stramineis, valde nervatis; petalis ad 34 mm. longis, staminibus subaequantibus, basi a ligulis binis auctis. Pl. V, figs. 1-2.

BRAZIL: SÃO PAULO: epiphytic or terrestrial in dense forest, Estação Biologica, Alto da Serra, alt. 800-900 m., 1929, *L. B. Smith* 1875 (G, TYPE), 1926 (G), 1924, *F. C. Hoehne* 9476 (G, SP), 1875, *Mosén* 3249 (S); Praia de São Vicente, Santos, 1875, *Mosén* 3197 (S). PARANÁ: Bahado, 1910, *Dusén* 9537 (S), 1916, *Dusén* 17496 (S); Serra do Mar, Ypiranga, 1914, *Dusén* 14414 (S).

In habit this species closely resembles *Vriesia procera* and *V. glutinosa*, but can be distinguished from both of them even when it is in fruit by the long narrowly triangular blades of the scape-bracts and lower primary bracts. The flowers of all specimens so far examined would indicate that it belongs in a group different from that of *V. procera* and *glutinosa* on account of the slightly included stamens. Consequently its systematic position probably should be next to *V. reticulata* from which it differs in its acuminate leaf-blades. The plant is very beautiful when growing. The branches are bright yellow, the leaves and the blades of the large bracts are light green, and the broad bases of the bracts are bright red.

***Vriesia Dusenii***, spec. nov., semimetralis: foliis dense rosulatis, minutissime punctato-lepidotis, ad 3 dm. longis; vagina elliptica, brunnea; lamina lineari, acuminata, basi 15 mm. lata: scapo erecto, gracillimo, glabro; scapi vaginis foliaceis, dense imbricatis: inflorescentia graciliter cylindrica, bipinnata; bracteis primariis a basi ovata longe acuminatis, quam spicae axillares multo longioribus: spicis laxe 2-3-floris, stricte erectis, basi prophylo parvo auctis; bracteis florigeris ovatis, acutis, sepalis duplo brevioribus, carinatis, nervatis, dissite lepidotis: floribus subsessilibus, subpatentibus; sepalis lanceolatis, acutis, 14 mm. longis, carinatis, nervatis, dissite lepidotis; petalis aureis, 25 mm. longis, in laminam subrhomboideam dilatatis, a ligulis binis triangularibus alte insertis auctis; stylo staminibusque petalis brevioribus. Pl. V, figs. 3-4.

BRAZIL: PARANÁ: cultivated, Jacarehy, 1910, *Dusén* 10712B (S, TYPE; phot. G); Antonina, Rio Debeora, epiphytic in virgin forest, 1914, *Dusén* 14690 (S).

This species with its spikes largely concealed by the bracts has a

habit so unlike that of any known *Vriesia*, that were it not for the indubitable scales on the petals one would be inclined to seek its relations in the vicinity of *Tillandsia biflora*. Even the scales are unusual in being inserted high up near the junction of the blade and claw instead of at the base.

**Vriesia Schippii**, spec. nov., ca. 4 dm. alta: foliis rosulatis, ad 3 dm. longis, minutissime punctulato-lepidotis, subtus vittis transversalibus atro-brunneis ornatis; vagina magna, elliptica; lamina ligulata, apice acuta, basi ad 3 cm. vel paulo ultra lata: scapo erecto, gracili, glabro; scapi vaginis imbricatis, e basi ovata acuminatis, inflatis, pallide brunneis, apice lepidotis, cetera glabris, sublaevibus: inflorescentia simplicissima, secunda, laxe pauciflora; bracteis florigeris eis scapi similibus, ad 43 mm. longis, non carinatis, sepala longe superantibus, nullo modo imbricatis, cum floribus secunde versis; rhachi gracili, flexuosa: floribus ad 5 mm. longe stipitatis; sepalis late ellipticis, 17 mm. longis, glabris, leviter venosis; petalis ignotis: capsula anguste ellipsoidea, 3 cm. longa. Pl. V, figs. 5-6.

BRITISH HONDURAS: epiphytic in mountain forest near Middlesex, alt. 600 m., *W. A. Schipp S82* (FM, TYPE; phot. G).

*Vriesia macrochlamys* Mez & Wercklé is probably the nearest relative of the above species, but differs in its obtuse floral bracts and larger sepals.

## 2. PROVISIONAL KEY TO THE GENUS GUZMANIA WITH NOTES ON NEW OR CRITICAL SPECIES.

In the course of preparing a number of notes and descriptions of novelties in the genus *Guzmania*, it has been found necessary to make a study of all previous species in that genus. As yet not enough material has been seen upon which to base a thorough monographic treatment, and many species are known to me only by their descriptions. Consequently the following provisional key has been constructed not so much as a basis of revision as an indication of the essential differences between the new species here proposed and those already described. Only the range and a brief literary reference are given for each previously described species, unless there is some evidence calling for addition or change.

The limits of the genus adopted here are essentially those used by Mez in his monograph of the *Bromeliaceae* in 1896<sup>1</sup> with the exclusion of the subgenus *Thecophyllum* which he later recognized as a genus.<sup>2</sup>

<sup>1</sup> Mez in DC. Mon. Phan. ix. (1896).

<sup>2</sup> Mez in Bull. Herb. Boiss. ser. 2, iii. 131 (1903).

The more recent work of Harms in the 2nd edition of the Pflanzenfamilien<sup>1</sup> is not adopted here because it is felt that the segregates from *Guzmania*, namely *Caraguata*, *Massangea*, and *Schlumbergera* are made on characters that are not of sufficient value to be generic. *Caraguata* is distinguished from *Guzmania* on the basis of the outline of the spike. *Massangea* is distinguished by having the sepals "petaloid" and highly fused, yet to be consistent it would be necessary to set off *Guzmania Weberbaueri* and *G. Scherzeriana* as a segregate from *Schlumbergera* on the same basis. *Schlumbergera* itself seems the least tenable of all, its one distinction being a compound inflorescence. This character is a very convenient one in keying species, but is scarcely of phylogenetic value since it does not correlate with any characters of the flowers themselves and since at least one species, *G. Roezli*, may have either a compound or a simple inflorescence. Consequently *Guzmania* is here understood to include all members of the *Tillandsiaceae* with fused or agglutinated naked petals, polystichous-ranked spikes or racemes, and either non-petaloid sepals or else rosulate leaves. This last distinction is for the purpose of excluding *Sodirola*, which seems to be a rather weak genus and on further study may well follow *Caraguata*, *Massangea*, and *Schlumbergera* into the discard.

1. Inflorescence simple.
2. Inflorescence cyathiform, the outer bracts much enlarged.
3. Inner bracts differing in shape from the outer, much reduced.
  4. Inner bracts cucullate, persistent, exceeding the sepals: inflorescence scapose . . . . . 1. *G. lingulata*.
  4. Inner bracts straight, membranaceous, soon disintegrating: inflorescence sunk in the leaf-rosette.
  5. Inner bracts elliptic, obtuse, shorter than the sepals.
    2. *G. sanguinea*.
    5. Inner bracts triangular, exceeding the sepals. . . . . 3. *G. crateriflora*.
3. Inner bracts similar to the outer.
  6. Leaves exceeding the inflorescence: inflorescence 6 cm. or more long. . . . . 4. *G. minor*.
  6. Leaves equaling the inflorescence: inflorescence not over 3 cm. long. . . . . 5. *G. brachycephala*.
2. Inflorescence elongate, spicate, the outer bracts not at all conspicuous.
  7. Floral bracts thin, membranaceous.
  8. Inflorescence sterile toward apex.
  9. Plant long-caulescent: leaves narrowly triangular.
    6. *G. caulescens*.
  9. Plant acaulescent.
    10. Leaves acute or acuminate.
    11. Inflorescence few-flowered: leaves not over 7 mm. wide. . . . . 7. *G. angustifolia*.

<sup>1</sup> Harms, in Engl. & Prantl, Nat. Pflanzenf. 2 Aufl., xva. 65 (1930).

11. Inflorescence many-flowered: leaves 12-50 mm. wide.
12. Leaves thin or chartaceous, not strongly lepidote.
13. Bracts distinctly shorter than the flowers: flowers up to 6 cm. long.....8. *G. Berteroniana*.
13. Bracts about equaling the flowers: flowers not over 3 cm. long.....9. *G. monostachia*.
12. Leaves rigid, subpungent, strongly lepidote.  
10. *G. Fuerstenbergiana*.
10. Leaves rounded-apiculate.
14. Inflorescence few-flowered: sepals 25 mm. long.  
11. *G. fusispica*.
14. Inflorescence many-flowered: sepals 12 mm. long.  
12. *G. apiculata*.
8. Inflorescence fertile throughout.
15. Sepals broadly obtuse: bracts not dark-farinose.
16. Sepals 15 mm. long.
17. Inflorescence few-flowered: sepals relatively narrow.....13. *G. Melinonis*.
17. Inflorescence many-flowered: sepals 8 mm. wide.....14. *G. platysepala*.
16. Sepals 21-25 mm. long.
18. Upper floral bracts acute or narrowly obtuse.  
15. *G. bracteosa*.
18. Upper floral bracts broadly rounded.
19. Floral bracts all obtuse: leaves subglabrous.  
16. *G. erythrolepis*.
19. Lower floral bracts broadly acute: leaves densely pale-appressed-lepidote below.  
17. *G. nicaraguensis*.
15. Sepals acuminate: bracts dark-farinose.....18. *G. calothyrsus*.
7. Floral bracts stout, coriaceous.
20. Floral bracts little if at all shorter than the sepals: at least the upper part of the inflorescence densely strobilate.
21. Floral bracts erect.
22. Inflorescence lax below, sterile toward apex.....19. *G. laxa*.
22. Inflorescence strobilate and fertile throughout.
23. Scape-bracts with a leaf-like blade.
24. Upper floral bracts acute.
25. Flowers much exceeding the bracts: sepals up to 30 mm. long.....20. *G. conifera*.
25. Flowers about equaling the bracts: sepals 15 mm. long.....21. *G. Devansayana*.
24. Upper floral bracts obtuse.....22. *G. mucronata*.
23. Scape-bracts without a leaf-like blade.
26. Floral bracts strongly nerved.
27. Floral bracts broadly obtuse, subtruncate: scape-bracts imbricate.....23. *G. strobilantha*.
27. Floral bracts broadly acute: scape-bracts remote.....24. *G. pallida*.
26. Floral bracts even, not at all nerved.
28. Floral bracts equaling or exceeding the sepals.
29. Floral bracts broadly triangular at apex.  
25. *G. coriostachya*.

29. Floral bracts rounded at apex. . . . . 26. *G. Michellii*.  
 28. Floral bracts slightly shorter than the  
 sepals. . . . . 27. *G. strobilifera*.  
 21. Floral bracts reflexed at apex. . . . . (29. *G. Osyana*.)  
 20. Floral bracts much shorter than the sepals.  
 30. Inflorescence dense: floral bracts about  $\frac{1}{2}$  as long as  
 the sepals. . . . . 28. *G. musaica*.  
 30. Inflorescence rather lax: bracts about  $\frac{3}{4}$  as long as  
 the sepals. . . . . (77. *G. Roezli*.)  
 1. Inflorescence compound.  
 31. Floral bracts equaling or longer than the sepals.  
 32. Floral bracts strongly recurved: primary bracts incon-  
 spicuous. . . . . 29. *G. Osyana*.  
 32. Floral bracts straight or incurved.  
 33. Spikes densely corymbose, at least the upper ones ex-  
 ceeded by the primary bracts.  
 34. Inflorescence short, capitate, few-flowered. . . . 30. *G. Cornuaulti*.  
 34. Inflorescence elongate, cylindric or nearly so, many-  
 flowered.  
 35. Floral bracts broadly obtuse. . . . . 31. *G. Harrisii*.  
 35. Floral bracts acute.  
 36. Sepals acuminate, 38 mm. long. . . . . 32. *G. megastachya*.  
 36. Sepals abruptly acute, 22 mm. long. . . . . 33. *G. columnaris*.  
 33. Spikes more or less elongate, not corymbose.  
 37. Inflorescence short and compact, the spikes pressed  
 together.  
 38. Spikes exceeding the primary bracts at maturity.  
 39. Spikes ovoid, acute: sepals connate for 2-3 mm.  
 . . . . . 34. *G. Morreniana*.  
 39. Spikes ellipsoid: sepals connate for 10 mm.  
 . . . . . 35. *G. glomerata*.  
 38. Spikes shorter than the primary bracts at maturity.  
 . . . . . 36. *G. densiflora*.  
 37. Inflorescence more or less elongate, interrupted or at  
 least the lower spikes spreading or reflexed.  
 40. Spikes dense or if slightly lax then the inflorescence  
 dense.  
 41. Floral bracts acute.  
 42. Primary bracts ample, nearly or quite conceal-  
 ing the spikes.  
 43. Primary bracts straight: sepals connate for  
 nearly half their length. . . . . (36. *G. densiflora*.)  
 43. Primary bracts spirally recurved at apex:  
 sepals free. . . . . 37. *G. Sodiroana*.  
 42. Primary bracts narrow, not at all concealing  
 the elongate spikes. . . . . 38. *G. calamifolia*.  
 41. Floral bracts obtuse.  
 44. Spikes pendulous: scape-bracts shorter than  
 the internodes. . . . . 39. *G. Bakeri*.  
 44. Spikes erect or spreading, but not nodding.  
 45. Spikes long-stipitate.  
 46. Spikes abbreviated, ovoid or obovoid.  
 47. Leaves and bracts finely and irregularly  
 cross-striate. . . . . 40. *G. Lindeni*.  
 47. Leaves and bracts regularly and heavily  
 marked with longitudinal stripes.  
 . . . . . 41. *G. Killipiana*.

46. Spikes elongate.
48. Floral bracts not at all carinate, strongly imbricate: sepals 15 mm. long.....42. *G. Altsonii*.
48. Floral bracts carinate toward apex, barely imbricate: sepals 24 mm. long.  
43. *G. Splitgerberi*.
45. Spikes sessile or very short-stipitate.
49. Floral bracts not at all emarginate.
50. Sepals free or equally connate.
51. Floral bracts carinate toward apex.  
(43. *G. Splitgerberi*.)
51. Floral bracts not at all carinate.
52. Spikes few, remote.....44. *G. ventricosa*.
52. Spikes many, massed at apex of inflorescence.
53. Floral bracts enfolding the sepals, 13 mm. long.....45. *G. brevispatha*.
53. Floral bracts nearly flat, 21 mm. long.....46. *G. tarapotina*.
50. Sepals connate for 6 mm. axially and 3 mm. for each abaxial sinus, densely punctulate-lepidote.....47. *G. pleiosticha*.
49. Floral bracts strongly emarginate: spikes erect or nearly so.....48. *G. polycephala*.
40. Spikes and inflorescence lax: flowers mostly spreading.....49. *G. panniculata*.
31. Floral bracts shorter than the sepals.
54. Spikes abbreviated, or if elongate then dense.
55. Spikes pendulous: sepals 37 mm. long.....50. *G. Lehmanniana*.
55. Spikes erect or spreading, or if slightly nodding then the sepals much shorter.
56. Inflorescence amply tripinnate.
57. Flower-pedicels stout, shorter than the floral bracts.....51. *G. candelabrum*.
57. Flower-pedicels slender, longer than the floral bracts.....52. *G. Pennellii*.
56. Inflorescence not more than bipinnate.
58. Spikes, or at least the lowest, definitely stipitate.
59. Spikes 2-3-flowered: sepals 16-25 mm. long.
60. Petals spreading, more than twice as long as the sepals: sepals 25 mm. long.....53. *G. virescens*.
60. Petals tubular-erect, only about 5 mm. longer than the sepals: sepals 16 mm. long  
54. *G. Donnellsmithii*.
59. Spikes 4-∞-flowered.
61. Spikes several to many: inflorescence elongate.
62. Sepals connate for 9-10 mm.: spikes short-stipitate.....55. *G. Weberbaueri*.
62. Sepals not connate for more than 5 mm.
63. Sepals 20-38 mm. long.
64. Spikes corymbose.
65. Sepals acuminate.....(32. *G. megastachya*.)
65. Sepals obtuse.
66. Axis of the inflorescence concealed by the very large primary bracts: flowers slenderly long-pedicellate.  
56. *G. Dussii*.



66. Axis of the inflorescence not at all concealed: flowers subsessile. 57. *G. Andreana*.
64. Spikes globose or ellipsoid.
67. Sepals equally connate for 3 mm. 58. *G. straminea*.
67. Sepals free..... 59. *G. Ekmanii*.
63. Sepals not over 15 mm. long.
68. Spikes lax, at least at base.
69. Spikes very short-stipitate, dense toward apex, ca. 15-flowered.... 60. *G. elongata*.
69. Spikes conspicuously stipitate, lax throughout.
70. Axis of inflorescence and spike-rhachis slender: spikes 3-6-flowered..... 61. *G. gracilior*.
70. Axis of inflorescence and spike-rhachis stout: spikes many-flowered..... 62. *G. multiflora*.
68. Spikes dense throughout: flowers all pressed one against another.
71. Spikes subcylindric..... 63. *G. Van Volxemi*.
71. Spikes globose..... 64. *G. mitis*.
61. Spikes few: inflorescence usually abbreviated.
72. Leaves densely cinereous-lepidote..... 65. *G. lepidota*.
72. Leaves glabrous or subglabrous.
73. Spikes all spreading.
74. Spikes globose..... 66. *G. sphaeroidea*.
74. Spikes subcylindric..... (76. *G. patula*.)
73. Spikes mostly erect.
75. Floral bracts obtuse..... 67. *G. Zahnii*.
75. Floral bracts acuminate..... 68. *G. Goudotiana*.
58. Spikes all sessile.
76. Inflorescence pinnate.
77. Sepals not more than 12 mm. long.
78. Spikes subglobose, not over 25 mm. long. 69. *G. acorifolia*.
78. Spikes ellipsoid, 60 mm. long..... (60. *G. elongata*.)
77. Sepals 23-38 mm. long.
79. Floral bracts acuminate..... (32. *G. megastachya*.)
79. Floral bracts obtuse.
80. Sepals connate for  $\frac{1}{2}$  their length: spikes erect..... (55. *G. Weberbaueri*.)
80. Sepals connate for much less than half their length: spikes spreading.
81. Spikes ellipsoid, 8-12-flowered... (59. *G. Ekmanii*.)
81. Spikes corymbose, 2-3-flowered.. (53. *G. virescens*.)
76. Inflorescence digitate.
82. Inflorescence scapose.
83. Leaves marked with irregular transverse lines: floral bracts even..... 70. *G. vittata*.
83. Leaves without transverse lines: floral bracts nerved..... 71. *G. compacta*.
82. Inflorescence subsessile and nidular..... 72. *G. Eduardi*.
54. Spikes elongate and lax, the flowers not at all touching one another.

84. Sepals connate for 8–10 mm.  
 85. Floral bracts and sepals acute . . . . . 73. *G. brasiliensis*.  
 85. Floral bracts and sepals obtuse . . . . . 74. *G. Scherzeriana*.  
 84. Sepals not connate for more than 3 mm.  
 86. Sepals 25–32 mm. long.  
 87. Floral bracts lanceolate, acute, 25 mm. long.  
 . . . . . 75. *G. Fawcettii*.  
 87. Floral bracts oblong or elliptic, obtuse, only 15 mm.  
 long . . . . . (59. *G. Ekmanii*.)  
 86. Sepals not more than 16 mm. long.  
 88. Scape-bracts lax, at least the uppermost shorter  
 than the internodes.  
 89. Some of the floral bracts slightly imbricate . . . 76. *G. patula*.  
 89. None of the floral bracts at all imbricate . . . . 77. *G. Roezli*.  
 88. Scape-bracts dense, all exceeding the internodes.  
 90. Sepals acute, lanceolate . . . . . 78. *G. Plumierii*.  
 90. Sepals obtuse.  
 91. Sepals connate for 3 mm . . . . . (60. *G. elongata*.)  
 91. Sepals free.  
 92. Floral bracts 12 mm. long, slightly shorter  
 than the sepals: inflorescence densely  
 tripinnate . . . . . 79. *G. condensata*.  
 92. Floral bracts 17 mm. long, much shorter  
 than the sepals: inflorescence laxly bi-  
 pinnate . . . . . 80. *G. costaricensis*.

1. ***Guzmania lingulata*** (L.) Mez. The Antilles and Nicaragua (acc. to Mez in ms.) south to Ecuador, Bolivia, and the Brazilian state of Matto Grosso. Mez in DC. Mon. Phan. ix. 899 (1896). *Tillandsia lingulata* L. Sp. Pl. 286 (1753). *Caraguata lingulata* var. *cardinalis* André, Illustr. Hort. xxvii. 35, t. 374 (1880). *Guzmania lingulata* var. *cardinalis* André ex Mez in DC. Mon. Phan. ix. 900 (1896).

ECUADOR: GUAYAS: Teresita, 3 km. west of Bucay, alt. 270 m., 1923. Hitchcock 20406 (G). BRAZIL: MATTO GROSSO: Capão Secco, 1894, Lindman A2359 (S, phot. G).

The above citations constitute large extensions of range for the species. The variety *cardinalis* does not seem sufficiently distinct to warrant maintaining it.

2. ***G. sanguinea*** André. Southern Colombia. André ex Mez in DC. Mon. Phan. ix. 901 (1896). *Caraguata sanguinea* André in Rev. Hort. lv. 468 (1883).

On account of its prominent scape and floral bracts it is probable that *G. sanguinea* var. *erecta* André ex Mez<sup>1</sup> or *Caraguata myriostigma*<sup>2</sup> as André tentatively called it, is specifically distinct from typical *G. sanguinea*. However, the specimens upon which the variety is based

<sup>1</sup> Mez in DC. Mon. Phan. ix. 901 (1896).

<sup>2</sup> André, Brom. André, 46 (1889).

are so imperfect that it has been impossible to include them in the foregoing key.

3. **G. crateriflora** Mez & Wercklé. Costa Rica, Cocos Island (to Costa Rica). Bull. Herb. Boiss. ser. 2, v. 110 (1905). *Tillandsia* sp. Stewart in Proc. Calif. Acad. Sci. ser. 4, i. 388 (1912). Pl. V, fig. 7.

COCOS ISLAND: 1889, *Snodgrass & Heller 962* (G); Wafer Bay, 1930, *H. K. Svenson 322, 434* (G).

4. **G. minor** Mez. Nicaragua, Costa Rica, Panama, Brazil. Mez in DC. Mon. Phan. ix. 901 (1896).

BRAZIL: PARÁ: epiphytic in woods, Tapaná, near Pará (Belém), 1929, *Killip & Smith 30349* (US).

5. **G. brachycephala** (Bak.) Mez. Peru. Mez in DC. Mon. Phan. ix. 902 (1896). *Tillandsia brachycephala* Bak. in Journ. Bot. xxvi. 40 (1888).

6. **G. caulescens** Mez & Sodiro. Ecuador. Bull. Herb. Boiss. ser. 2, v. 112 (1905).

7. **G. angustifolia** (Bak.) Wittm. Costa Rica, Colombia. Wittm. in Engl. Bot. Jahrb. xi. 62 (1889). *Caraguata angustifolia* Bak. in Gard. Chron. New Series, xxii. 616 (1884).

8. **G. Berteroniana** (R. & S.) Mez. Porto Rico. Mez in DC. Mon. Phan. ix. 904 (1896), as *G. Berteroana*. *Caraguata Berteroniana* Schult. f. in R. & S. Syst. vii. 1229 (1830).

9. **G. monostachia** (L.) Rusby. Antilles, Costa Rica, Panama, Venezuela, Colombia, Ecuador, Peru, Bolivia. Rusby ex Mez in DC. Mon. Phan. ix. 905 (1896), as *G. monostachya*. *Renalmia monostachia* L. Sp. Pl. 287 (1753).

10. **G. Fuerstenbergiana** (Kirchh. & Wittm.) Wittm. Ecuador. Wittm. in Engl. Bot. Jahrb. xi. 61 (1889). *Caraguata Fuerstenbergiana* Kirchh. & Wittm. in Berl. Gartenz. ii. 299 (1883).

11. **G. fusispica** Mez & Sodiro. Ecuador. Bull. Herb. Boiss. ser. 2, v. 112 (1905).

12. **G. apiculata**, spec. nov., acaulis, semimetralis: foliis rosulatis, 5 dm. longis, subtus obscure punctulato-lepidotis; vagina lata, ovata; lamina lineari, 30–35 mm. lata, late rotundata, apiculata: scapo erecto, glabro, gracili; scapi bracteis ovatis, apiculatis, membranaceis, internodia paulo superantibus: inflorescentia simplicissima, polysticha, multiflora, dense strobiliformi, 8 cm. longa, fusiformi, ad apicem versus sterili, glabra: bracteis florigeris suborbicularibus, latissimis, membranaceis, striatis, 2 cm. longis, quam sepala multo longioribus: floribus breve stipitatis; sepalis ellipticis, 12 mm. longis,

late acutis, aequaliter ad 3 mm. connatis, membranaceis, striatis: capsulis 3 cm. longis; coma rubro-brunnea. Pl. V, figs. 8-9.

PERU: JUNIN: epiphytic, Hacienda Schunke, La Merced, alt. ca. 1300 m., 1923, *Macbride 5711* (FM, TYPE; phot. G).

13. **G. Melinonis** Regel. French Guiana. Gartenfl. xxxiv. 116 (1885), as *G. Melinoki*, which however was a typographical error according to Mez in DC. Mon. Phan. ix. 908 (1896).

14. **G. platysepala** Mez & Baker. Nicaragua. Bull. Torr. Bot. Club, xxx. 437 (1903).

15. **G. bracteosa** André. Ecuador. André ex Mez in DC. Mon. Phan. ix. 908 (1896). *Caraguata bracteosa* André, Rev. Hort. lx. 565 (1888).

16. **G. erythrolepis** Brongn. Cuba, Jamaica, Porto Rico. Brongn. ex Planch. Flor. d. Serres, ser. 2, i. 25, t. 1089 (1856).

17. **G. nicaraguensis** Mez & Baker. Nicaragua. Bull. Torr. Bot. Club, xxx. 436 (1903).

18. **G. calothyrsus** (Beer) Mez. Peru. Mez in DC. Mon. Phan. ix. 910 (1896). *Anoplophytum calothyrsus* Beer, Brom. 263 (1857).

19. **G. laxa** Mez & Sodiro. Ecuador. Bull. Herb. Boiss. ser. 2, v. 111 (1905).

20. **G. conifera** André. Ecuador, Peru. André ex Mez in DC. Mon. Phan. ix. 911 (1896). *Caraguata conifera* André, Rev. Hort. lx. 565 (1888).

PERU: JUNIN: Hacienda Schunke, La Merced, alt. ca. 1300 m., 1923, *Macbride 5615* (FM, G); same, above San Ramón, alt. 1400-1700 m., *Killip & Smith 24872* (US).

21. **G. Devansayana** Morr. Ecuador. Belg. Hort. xxxiii. 113, t. 8-9 (1883).

22. **G. mucronata** (Griseb.) Mez. Venezuela. Mez in DC. Mon. Phan. ix. 912 (1896). *Tillandsia mucronata* Griseb. in Goett. Nachr. 20 (1864).

23. **G. strobilantha** (R. & P.) Mez. Peru. Mez in DC. Mon. Phan. ix. 913 (1896). *Bonapartea strobilantha* R. & P. Fl. Peruv. iii. 39, t. 263 (1802). *Guzmania parviflora* Ule, Verhandl. Bot. Ver. Brandenb. xlviii. 146 (1907).

PERU: LORETO: epiphytic in mountain forest, Pampas de Ponasa, alt. 1000 m., 1903, *Ule 55p* (B, TYPE of *G. parviflora* Ule, phot. G).

Since no good distinction has been found between *Guzmania parviflora* and *G. strobilantha* and since an annotation label of Mez on the former indicates that he considers them probably identical, the two

species are merged in this treatment. This merging extends the range of *G. strobilantha* from central to northeastern Peru.

24. **G. pallida**, spec. nov., verisimiliter acaulis, ad 6 dm. alta: foliis 4 dm. longis; vagina ovata, minutissime dissiteque punctulato-lepidota; lamina ligulata, 35 mm. lata, rotundato-apiculata, supra glabra: scapo glabro, sulcato; scapi bracteis remotis, ovato-acutis, submembranaceis, nullo modo foliaceis, minutissime obscureque punctulato-lepidotis: inflorescentia simplicissima, ellipsoidea, dense strobiliformi, 75 mm. longa, 35 mm. lata: bracteis florigeris late ovatis, acutis, coriaceis, basi excepta valde striatis, sepala bene superantibus: floribus brevissime pedicellatis; sepalis ovatis, acutis, basi ad 3 mm. connatis, 15 mm. longis, minutissime obscureque punctulato-lepidotis; petalis 25 mm. longis, flavis (ex sicco), lamina patenti, elliptica, obtusa; staminibus styloque e petalorum fauce exsertis. Pl. V, figs. 10-11.

COLOMBIA: MAGDALENA: epiphytic in forest on banks of the Rio Gaira, alt. ca. 1200 m., 1898-99, *H. H. Smith 2342* (NY, TYPE; phot. G).

25. **G. coriostachya** (Griseb.) Mez. Venezuela, Colombia. Mez in DC. Mon. Phan. ix. 914 (1896). *Caraguata coriostachya* Griseb. in Goett. Nachr. 21 (1864). *Tillandsia nigrescens* André, Rev. Hort. lx. 568 (1888).

COLOMBIA: MAGDALENA: Santa Marta, 1898-99, *H. H. Smith 2853* (NY, phot. G). SANTANDER: terrestrial in woods, vicinity of Las Vegas, alt. 2600-3000 m., 1926, *Killip & Smith 15958* (G). EL VALLE: epiphytic in forest above La Cumbre, alt. 2000-2200 m., 1922, *Pennell & Killip 5793* (G). NARIÑO: Altaquer, alt. 1400 m., 1876, *André 3327* (K, TYPE of *Tillandsia nigrescens* André; phot. G).

André, and Mez following his lead, have confused *Tillandsia nigrescens* with *Bonaparteia strobilantha* R. & P., but an examination of the type of the former species shows that it has the triangular even bracts of *Guzmania coriostachya* and should be included under that species. This view is further strengthened by the occurrence of *Guzmania coriostachya* at several stations (as cited above) between its type locality and that of *Tillandsia nigrescens*.

26. **G. Michellii** Mez. Colombia. Bull. Herb. Boiss. ser. 2, iii. 226 (1903).

27. **G. strobilifera** Mez & Wercklé. Costa Rica. Bull. Herb. Boiss. ser. 2, v. 110 (1905).

28. **G. musaica** (Linden) Mez. Colombia. Mez in DC. Mon. Phan. ix. 898 (1896). *Tillandsia musaica* Linden in Cat. Expos. Gand. (1873).

29. **G. Osyana** (Morr.) Mez. Ecuador. Mez in DC. Mon. Phan. ix. 914 (1896). *Caraguata Osyana* Morr. in Belg. Hort. xxxv. 254, t. 16-17 (1885).

30. **G. Cornuaulti** André. Colombia. André ex Mez in DC. Mon. Phan. ix. 925 (1896). *Tillandsia Cornuaulti* André, Rev. Hort. lx. 568 (1888).

31. **G. Harrisii** Mez. Jamaica. Mez in DC. Mon. Phan. ix. 927 (1896).

32. **G. megastachya** (Bak.) Mez. Lesser Antilles. Mez in DC. Mon. Phan. ix. 928 (1896). *Tillandsia megastachya* Bak. in Journ. Bot. xxvi. 46 (1888).

ST. VINCENT: Morne à Gavon, alt. 600 m., 1890, *H. H. & G. W. Smith 1682* (NY, phot. G).

The above specimen has the floral bracts slightly shorter than the sepals, but is typical in other respects. Contrary to Mez's description, the sepals in this species are somewhat connate at base (Pl. V, fig. 12).

33. **G. columnaris** Mez & Sodiro. Ecuador. Bull. Herb. Boiss. ser. 2, v. 113 (1905).

34. **G. Morreniana** (Linden) Mez. Peru. Mez in DC. Mon. Phan. ix. 932 (1896). *Massangea Morreniana* Linden in Cat. Expos. Brux. (1880).

PERU: Cuzco: epiphytic, slopes of Media Naranja, Urubamba Basin, alt. 2000 m., *F. L. Herrera 2039* (FM, G).

Prior to this collection the country whence the species was derived was in doubt.

35. **G. glomerata** Mez & Wercklé. Costa Rica. Fedde Rep. Spec. Nov. xiv. 256 (1916).

36. **G. densiflora** Mez. Colombia. Bull. Herb. Boiss. ser. 2, iii. 226 (1903).

37. **G. Sodiroana** Mez. Ecuador. Bull. Herb. Boiss. ser. 2, v. 114 (1905).

38. **G. calamifolia** André. Colombia. André ex Mez in DC. Mon. Phan. ix. 931 (1896). *Caraguata acorifolia* André, Rev. Hort. lx. 566 (1888), not *Guzmania acorifolia* (Griseb.) Mez (1896).

39. **G. Bakeri** (Wittm.) Mez. Colombia. Mez in DC. Mon. Phan. ix. 933 (1896). *Caraguata Bakeri* Wittm. in Engl. Bot. Jahrb. xi. 59 (1889).

40. **G. Lindeni** (André) Mez. Peru. Mez in DC. Mon. Phan. ix. 933 (1896). *Massangea Lindeni* André, Ill. Hort. xxv. 55, t. 309 (1878).

41. **G. Killipiana**, spec. nov., terrestris, ad 1 m. alta: foliis 8–9 dm. longis, subtus obscure punctulato-lepidotis; vagina haud distincta, badia; lamina ligulata, acuminata, 5–7 cm. lata: scapo pervalido, erecto, glabro; scapi bracteis imbricatis, late ovatis, acuminatis, pungentibus, flavo-viridibus, dorso longitudinaliter rubro-striatis: inflorescentia laxe bipinnata; axe valido, angulato, glabro; bracteis primariis eis scapi similibus, quam spicae brevioribus vel infimis paulo longioribus: spicis valide ad 1 cm. longe stipitatis, dense strobiliformibus, ellipsoideis vel obovoideis, 30–40-floris, 7 cm. longis, 4–5 cm. latis; bracteis florigeris 3 cm. longis, sepalis multo longioribus, anguste ellipticis, obtusis vel minute apiculatis, fere planis, coriaceis, striatis, subglabris: floribus subsessilibus, 38 mm. longis; sepalis ovatis, acuminatis, 16 mm. longis, subliberis, carinatis, coriaceis, punctatis; petalis albis, erectis; staminibus inclusis. Pl. VI, figs. 1–2.

PERU: JUNIN: Pichis Trail, Eneñas, alt. 1600–1900 m., *Killip & Smith 25630* (US, TYPE; phot. G); Pichis Trail, Yapas, alt. 1350–1600 m., *Killip & Smith 25561* (US).

42. **G. Altsonii** L. B. Smith. British Guiana. *Contrib. Gray Herb.* lxxxix. 7 (1930).

43. **G. Splitgerberi** Mez. Dutch Guiana. *Mez in DC. Mon. Phan.* ix. 930 (1896).

44. **G. ventricosa** (Griseb.) Mez. Venezuela. *Mez in DC. Mon. Phan.* ix. 929 (1896). *Tillandsia ventricosa* Griseb. in *Goett. Nachr.* 19 (1864).

45. **G. brevispatha** Mez. Peru. *Fedde Rep. Spec. Nov.* iii. 45 (1906).

46. **G. tarapotina** Ule. Peru. *Verhandl. Bot. Ver. Brandenb.* xlviii. 147 (1907).

47. **G. pleiosticha** (Griseb.) Mez. Venezuela. *Mez in DC. Mon. Phan.* ix. 930 (1896). *Tillandsia pleiosticha* Griseb. *Goett. Nachr.* 19 (1864).

48. **G. polycephala** Mez & Wercklé. Costa Rica. *Fedde Rep. Spec. Nov.* xiv. 254 (1916).

49. **G. panniculata** Mez. Peru. *Bull. Herb. Boiss.* ser. 2, v. 116 (1905).

50. **G. Lehmanniana** (Wittm.) Mez. Colombia. *Mez in DC. Mon. Phan.* ix. 934 (1896). *Schlumbergeria Lehmanniana* Wittm. in *Engl. Bot. Jahrb.* xi. 60 (1889).

51. **G. candelabrum** André. Colombia. André ex *Mez in DC. Mon. Phan.* ix. 935 (1896). *Caraguata candelabrum* André, *Rev. Hort.* lx. 566 (1888).

COLOMBIA: SANTANDER: epiphytic in woods, vicinity of Las Vegas, alt. 2600–3000 m., *Killip & Smith 15873* (G).

52. **G. (?) Pennellii**, spec. nov., e fragmentis solum cognita: foliis verisimiliter rosulatis, 55 cm. longis, subtus minutissime punctato-lepidotis, supra glabris; vagina late ovata, brunnea; lamina ligulata, acuta, 25 mm. lata: inflorescentia ample tripinnatim paniculata, glabra; bracteis primariis parvis, quam rami axillares multo brevioribus, ovato-acutis; ramis 7 cm. vel ultra longis, laxiuscule florigeris: spicis paucifloris, apice sterilibus, longe stipitatis; bracteis florigeris ellipticis, 5 mm. longis, quam pedicelli subduplo brevioribus, obtusis, nervatis, submembranaceis: floribus suberectis, longe gracileque pedicellatis; petalis (ex sicco) albis, 15 mm. longis, stylo staminibusque longioribus, lamina ovata, obtusa; sepalis anguste ellipticis, obtusis, nervatis, 8 mm. longis, aequaliter ad 3 mm. connatis: capsula angustissime subclavata, 17 mm. longa. Pl. VI, fig. 3.

COLOMBIA: BOLIVAR: terrestrial in shrub zone, below Paramo de Chiquiro, Cordillera Occidental, alt. 2800–3100 m., 1918, *Pennell 4344* (NY, phot. G).

The petals on the above specimen are so old and shriveled that it has been impossible to ascertain whether they are free or fused much less whether any scales are present. Consequently it is not certain that it is a *Guzmania* and not a *Thecophyllum*, but its unusual habital characters immediately distinguish it from any known species in either genus.

53. **G. virescens** (Hook. f.) Mez. Venezuela or Colombia? Mez in DC. Mon. Phan. ix. 943 (1896). *Puya virescens* Hook. f. in Bot. Mag. lxxxiii. t. 4991 (1857). *Caraguata Beleana* André, Rev. Hort. lxiii. 114 (1891). *Guzmania Beleana* André ex Mez in DC. Mon. Phan. ix. 944 (1896).

54. **G. Donnellsmithii** Mez. Costa Rica. Bot. Gaz. xxxv. 9 (1903).

55. **G. Weberbaueri** Mez. Ecuador, Peru. Bull. Herb. Boiss. ser. 2, v. 114 (1905).

ECUADOR: TUNGURAHUA: valley of Pastaza River between Baños and Cashurco, 8 hours east of Baños, alt. 1300–1800 m., 1923, *A. S. Hitchcock 21861* (G).

56. **G. Dussii** Mez. Guadeloupe, W. I. Mez in DC. Mon. Phan. ix. 923 (1896). *Thecophyllum Dussii* Mez, Bull. Herb. Boiss. ser. 2, iii. 131 (1903). Pl. V, figs. 13–14.

In reërecting the genus *Thecophyllum* on the basis of free petals bearing scales, Mez transferred<sup>1</sup> to it all species which he had treated

<sup>1</sup> Mez, Bull. Herb. Boiss. ser. 2, iii. 130 (1903).



under the section of the same name in the genus *Guzmania*. As a section, *Thecophyllum* was characterized by its extremely abbreviated secondary axes, and Mez's action at the time implies that he considered this as correlating perfectly with the petal characters. But he did not mention having seen the petal structure of any but *T. ororiense* among these transferred species, and later he described species of *Thecophyllum* with well developed secondary axes. Consequently it is possible that better material of these transferred species will show that some should have been kept in *Guzmania* as in the case of *G. Dussii*.

57. **G. Andreana** (Morr.) Mez. Colombia. Mez in DC. Mon. Phan. ix. 936 (1896). *Caraguata Andreana* Morr. Rev. Hort. lvi. 247 (1884).

58. **G. straminea** (C. Koch) Mez. Colombia? Mez in DC. Mon. Phan. ix. 937 (1896). *Anoplophytum stramineum* C. Koch in Ind. Sem. Hort. Berol. 7 (1856).

59. **G. Ekmanii** Harms. Haiti. In synonymy as *Schlumbergeria Ekmanii* Harms, Notizblatt, x. 804 (1929).

60. **G. elongata** Mez & Sodiro. Ecuador. Bull. Herb. Boiss. ser. 2, v. 115 (1905).

61. **G. gracilior** (André) Mez. Colombia. Mez in DC. Mon. Phan. ix. 937 (1896). *Caraguata Van Volxemi* var. *gracilior* André, Brom. André, 54 (1889).

62. **G. multiflora** André. Colombia, Ecuador. André ex Mez in DC. Mon. Phan. ix. 939 (1896). *Caraguata multiflora* André, Rev. Hort. lx. 566 (1888).

63. **G. Van Volxemi** André. Colombia. André ex Mez in DC. Mon. Phan. ix. 938 (1896). *Caraguata Van Volxemi* André, Ill. Hort. xxv. 139, t. 326 (1878).

64. **G. mitis**, spec. nov., terrestris, metralis vel ultra, acaulis: foliis rosulatis, 5–7 dm. longis, minutissime punctato-lepidotis; vagina late ovata; lamina ligulata, acuta, 3–5 cm. lata: scapo erecto, valido, glabro, scapi bracteis foliaceis, densis, internodia longe superantibus: inflorescentia bipinnatim paniculata, anguste cylindrica, 26 cm. longa, 5 cm. crassa, glabra; bracteis primariis ovatis vel lanceolatis, suberectis, infimis quam spicae multo longioribus: spicis globosis vel late ovoideis, breviter stipitatis, 25 mm. longis, dense 12–15-floris, infimis remotis, supremis dense aggregatis; bracteis florigeris late ovatis, late rotundatis, quam sepala multo brevioribus: floribus subsessilibus; sepalis 10 mm. longis, obovatis, obtusis, ad 2 mm. connatis, nervatis; petalis albis, 18 mm. longis, staminibus styloque longioribus. Pl. VI, figs. 4–5.

COLOMBIA: NORTE DE SANTANDER: dense woods, Pica-Pica Valley above Tapatá (north of Toledo), alt. 2100–2400 m., 1927, *Killip & Smith 20195* (G, TYPE); SANTANDER: dense wet woods, western slope of Mount San Vicente near Charta, alt. 2500–2700 m., 1927, *Killip & Smith 18990* (G).

65. **G. lepidota** André. Ecuador. André ex Mez in DC. Mon. Phan. ix. 941 (1896). *Caraguata lepidota* André, Rev. Hort. lx. 566 (1888).

66. **G. sphaeroidea** André. Colombia. André ex Mez in DC. Mon. Phan. ix. 942 (1896). *Caraguata sphaeroidea* André, Rev. Hort. lx. 566 (1888).

COLOMBIA: SANTANDER: epiphytic in dense woods, Mesa de los Santos, alt. 1500 m., 1926, *Killip & Smith 15291* (G).

67. **G. Zahnii** (Hook. f.) Mez. Costa Rica. Mez in DC. Mon. Phan. ix. 940 (1896). *Caraguata Zahnii* Hook. f. in Bot. Mag. xcix. t. 6059 (1873).

68. **G. Goudotiana** Mez. Colombia. Mez in DC. Mon. Phan. ix. 942 (1896).

69. **G. acorifolia** (Griseb.) Mez. Venezuela. Mez in DC. Mon. Phan. ix. 945 (1896). *Tillandsia acorifolia* Griseb. Goett. Nachr. 19 (1864).

70. **G. vittata** (Mart.) Mez. Brazil. Mez in DC. Mon. Phan. ix. 946 (1896). *Bonaparteia vittata* Mart. in R. & S. Syst. vii. 1198 (1830).

71. **G. compacta** Mez. Nicaragua, Costa Rica, Colombia. Mez in DC. Mon. Phan. ix. 947 (1896). *Guzmania capitulata* Mez & Wercklé, Fedde Rep. Spec. Nov. xiv. 255 (1916).

COLOMBIA: EL VALLE: wooded cliffs of Dagua Valley, Cordoba, alt. 80–100 m., 1922, *Killip 5059* (G).

72. **G. Eduardi** André. Colombia. André ex Mez in DC. Mon. Phan. ix. 947 (1896). *Caraguata Morreniana* André, Rev. Hort. lix. 12 (1887), not *Guzmania Morreniana* (Linden) Mez, (1896).

73. **G. brasiliensis** Ule. Brazil. Verhandl. Bot. Ver. Brandenb. xlviii. 147 (1907).

74. **G. Scherzeriana** Mez. Costa Rica. Mez in DC. Mon. Phan. ix. 949 (1896).

75. **G. Fawcettii** Mez. Jamaica. Mez in DC. Mon. Phan. ix. 951 (1896).

76. **G. patula** Mez & Wercklé. Costa Rica, Colombia. Fedde Rep. Spec. Nov. xiv. 255 (1916).

COLOMBIA: TOLIMA: epiphytic in forest, Libano, alt. 1500–1800 m., 1917, *Pennell 3396* (NY, phot. G).

77. **G. Roezli** (Morr.) Mez. British Guiana, Colombia, Peru. Mez in DC. Mon. Phan. ix. 948 (1896), as *G. Roezlii*. *Schlumbergeria Roezli* Morr. in Belg. Hort. xxviii. 311 (1878).

COLOMBIA: EL VALLE: epiphytic in forest, Cisneros, Dagua Valley, alt. 300–500 m., 1922, *Killip 11474* (G). PERU: SAN MARTIN: San Roque, alt. 1350–1500 m., 1930, *L. Williams 7236* (G); AYACUCHO: terrestrial, open rocky hillside, Aina, between Huanta and Rio Apurimac, alt. 750–1000 m., 1929, *Killip & Smith 22686* (G).

Mez expressed doubt that the plants collected in Peru could be the same species as those in British Guiana, but further material from both localities shows no essential differences and an intermediate station in Colombia makes their equality all the more plausible.

78. **G. Plumierii** (Griseb.) Mez. Lesser Antilles. Mez in DC. Mon. Phan. ix. 950 (1896), as *G. Plumieri*. *Brocchinia Plumierii* Griseb. Fl. Br. W. Ind. 593 (1864).

LESSER ANTILLES: GUADELOUPE: Savane à Mulets, Matoula, 1893, 1894, *Père Duss 3327/3443* (NY, phot. G); ST. KITTS: Summit of Mt. Misery, *Britton & Cowell 553* (NY, phot. G).

The above specimens are characteristic of the species except that the inflorescence is bipinnate instead of tripinnate. Consequently it seems best to transfer the emphasis to other characters in keying *G. Plumieri* and *G. Fawcettii*.

79. **G. condensata** Mez & Wercklé. Costa Rica. Bull. Herb. Boiss. ser. 2, iii. 228 (1903).

80. **G. costaricensis** Mez & Wercklé. Costa Rica. Fedde Rep. Spec. Nov. xvi. 78 (1919).

#### EXCLUDED OR NEWLY REDUCED TO SYNONYMY:

*Caraguata* Lindl. Bot. Reg. xiii. sub t. 1068 (1827) = GUZMANIA R. & P. (see p. 19).

*C. Beleana* André in Rev. Hort. lxiii. 114 (1891) = *G. VIRESCENS* (Hook. f.) Mez (see p. 30).

*C. myriostigma* André, in synonymy as *C. sanguinea* var. *erecta* André, Brom. André, 46 (1889) = GUZMANIA SP., but not *G. sanguinea* André (see p. 24).

*C. sanguinea* var. *erecta* André, see *C. myriostigma*.

*G. Beleana* André ex Mez in DC. Mon. Phan. ix. 944 (1896) = *G. VIRESCENS* (Hook. f.) Mez (see p. 30).

*G. capitulata* Mez & Wercklé, Fedde Rep. Spec. Nov. xiv. 255 (1916) = *G. COMPACTA* Mez (see p. 32).

*G. capituligera* (Griseb.) Mez in DC. Mon. Phan. ix. 926 (1896) = *THECOPHYLLUM CAPITULIGERA* (Griseb.) L. B. Smith (see p. 14).

*G. clavata* (Lam.) Urban, Fedde Rep. Spec. Nov. xv. 99 (1917) = *G. MONOSTACHIA* (L.) Rusby. This plant as described by Lamarck is obviously the same as *G. MONOSTACHIA* (L.) Rusby, and remains so in spite of Urban's evident intention of interpreting it otherwise. I can account for all the characters which Urban cites from Lamarck's description except the one important one: "bracteis serratis." There is no such character in Lamarck's description, but there is a passage: "epi . . . . embriqué d'écaillés serrées," in which Urban may have mistaken "serrées" to mean serrate instead of imbricate. If the bracts are truly serrate the plant could not be a *Guzmania* or even a member of the *Tillandsieae*.

*G. complanata* Wittm. Mededell. Rijks Herb. xxix. 92 (1916). This plant is described as having distichous-ranked spikes and consequently if it does not prove to be a *Tillandsia* it should constitute a new genus rather than be included in *Guzmania*.

*G. fastuosa* André ex Mez in DC. Mon. Phan. ix. 926 (1896) = *THECOPHYLLUM CAPITULIGERA* (Griseb.) L. B. Smith (see p. 14).

*G. obtusa* Rusby, Mem. N. Y. Bot. Gard. vii. 212 (1927) = *VRIESIA HELICONIOIDES* Lindl.

*G. parviflora* Ule, Verhandl. Bot. Ver. Brandenb. xlviii. 146 (1907) = *G. STROBILANTHA* R. & P. (see p. 26).

*G. Peacockii* (Morr.) Mez in DC. Mon. Phan. ix. 915 (1896). This species is so imperfectly known that it is impossible to ascertain its position within the genus.

*G. sanguinea* var. *erecta* André ex Mez in DC. Mon. Phan. ix. 901 (1896) = *GUZMANIA* SP., but not *G. sanguinea* André (see p. 24).

*Massangea* Morr. in Belg. Hort. xxvii. 59, 199, t. 8-9 (1877) = *GUZMANIA* R. & P. (see p. 19).

*Schlumbergera* Morr. in Belg. Hort. xxxiii. 46, t. 4-6 (1883) = *GUZMANIA* R. & P. (see p. 19).

*Thecophyllum Dussii* Mez, Bull. Herb. Boiss. ser. 2, iii. 131 (1903) = *G. DUSSII* Mez (see p. 30).

*Tillandsia capituligera* Griseb. Cat. Cub. 254 (1866) = *THECOPHYLLUM CAPITULIGERA* (Griseb.) L. B. Smith (see p. 14).

*T. nigrescens* André, Rev. Hort. lx. 568 (1888) = *G. CORIOSTACHYA* (Griseb.) Mez (see p. 27).

## EXPLANATION OF PLATES.

## PLATE I.

- Fig. 1. *AECHMEA FERRUGINEA* L. B. Smith (*Killip & Smith 25815*), flower  $\times 1$ .  
 2. Same, sagittal section of flower  $\times 2$ .  
 3. Same, sepal  $\times 1$ .  
 4. *AREGELIA ELEUTHEROPETALA* (Ule) Mez (*Ule 6304*), flower  $\times 1$ .  
 5. Same, sagittal section of ovary  $\times 1$ .  
 6. Same, sepal  $\times 1$ .  
 7. *GRIEGIA COLUMBIANA* L. B. Smith (*Killip & Smith 18689*), outer bract  $\times 1$ .  
 8. Same, sepal  $\times 1$ .  
 9. *GREIGIA MACBRIDEANA* L. B. Smith (*Macbride 4442*), inflorescence  $\times 1$ .  
 10. Same, dorsal view of sepal  $\times 1$ .  
 11. Same, lateral view of sepal  $\times 1$ .  
 12. *HOHENBERGIA BRITTONIANA* L. B. Smith (*N. L. Britton 2313*), spike  $\times 1$ .  
 13. Same, flower  $\times 1$ .  
 14. Same, sepal  $\times 2$ .

## PLATE II.

- DYCKIA DUSENII* L. B. Smith (*Dusen 18081*), habit with collector's sketches from fresh material.

## PLATE III.

- Fig. 1. *PITCAIRNIA CALDERONII* Standley & Smith (*Caldéron 2595*), flower and bract  $\times \frac{1}{2}$ .  
 2. Same, sepal  $\times 1$ .  
 3. *PITCAIRNIA CUZCOENSIS* L. B. Smith (*Weberbauer 7825*), flower and bract  $\times 1$ .  
 4. Same, sepal  $\times 1$ .  
 5. Same, petal  $\times 1$ .  
 6. *PITCAIRNIA PECTINATA* L. B. Smith (*W. A. Archer*), flower and bract  $\times \frac{1}{2}$ .  
 7. Same, sepal  $\times 1$ .  
 8. *PITCAIRNIA TRUNCATA* L. B. Smith (*Killip & Smith 22414*), flower and bract  $\times 1$ .  
 9. Same, sepal  $\times 1$ .  
 10. *PUYA DEPAUPERATA* L. B. Smith (*Macbride & Featherstone 1339*), flower and bract  $\times 1$ .  
 11. Same, sepal  $\times 1$ .  
 12. *PUYA GRACILIS* L. B. Smith (*Weberbauer 6474*), flower and bract  $\times 1$ .  
 13. Same, sepal  $\times 1$ .  
 14. *PUYA LLATENSIS* L. B. Smith (*Macbride & Featherstone 2300*), floral bract  $\times \frac{1}{2}$ .  
 15. Same, flower  $\times 1$ .  
 16. Same, sepal  $\times 1$ .  
 17. *PUYA MACBRIDEI* L. B. Smith (*Macbride & Featherstone 2516*), flower and bract  $\times \frac{1}{2}$ .  
 18. Same, sepal  $\times 1$ .

## PLATE IV.

- Fig. 1. *PUYA PECTINATA* L. B. Smith (*Macbride 2920*), spike  $\times 1$ .  
 2. Same, sepal  $\times 1$ .  
 3. *PUYA PENDULIFLORA* L. B. Smith (*Buchtien 7182*), branch  $\times \frac{1}{2}$ .  
 4. Same, sepal  $\times 1$ .  
 5. *PUYA STIPITATA* L. B. Smith (*Macbride 3436*), flower and bract  $\times 1$ .  
 6. Same, sepal  $\times 1$ .

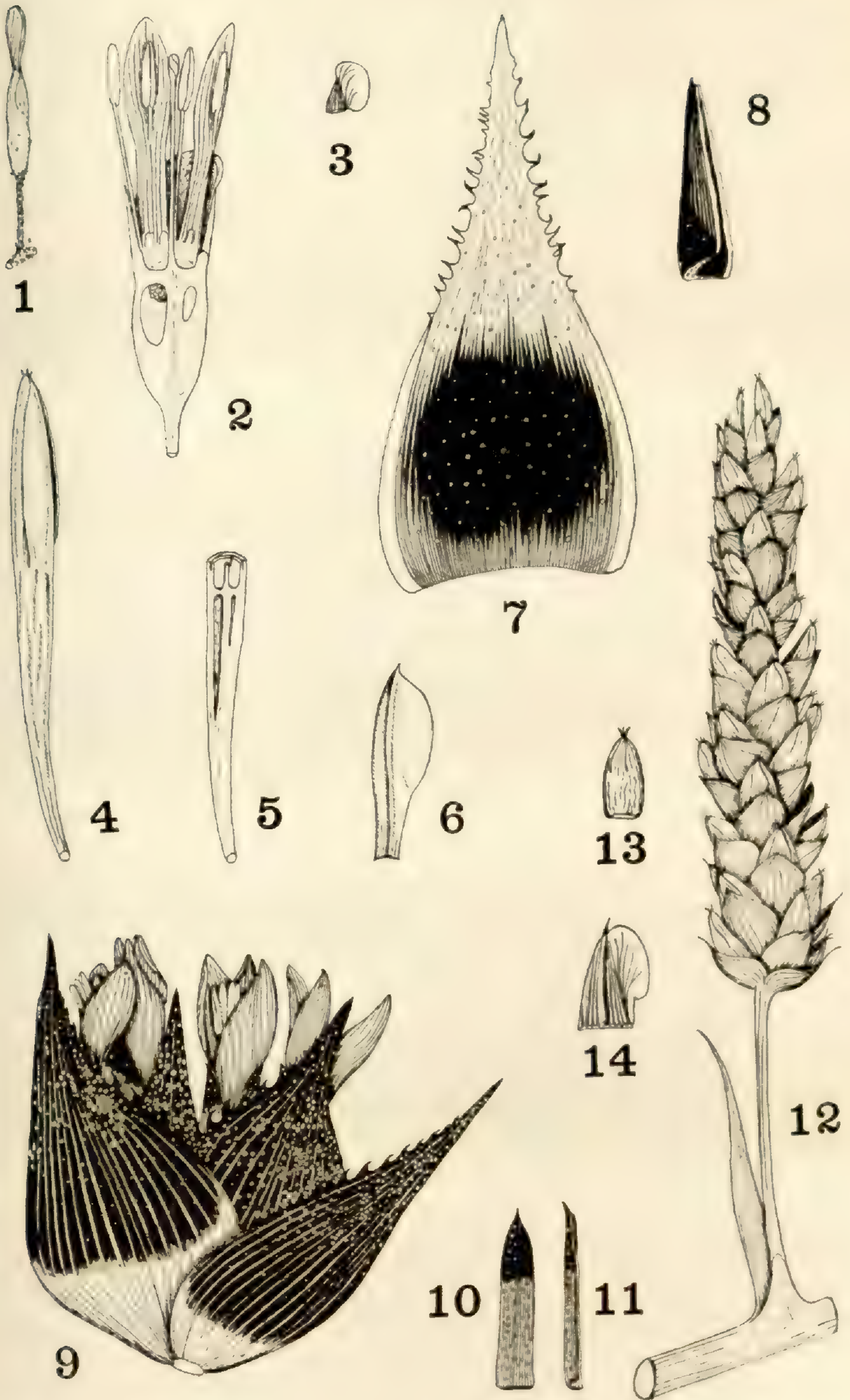
7. STREPTOCALYX WILLIAMSII L. B. Smith (*L. Williams 2722*), branch  $\times 1$ .
8. TILLANDSIA BOLIVIENSIS Bak. (*Bang 159a in part*), inflorescence  $\times \frac{1}{2}$ .
9. Same, flower and capsule  $\times 1$ .
10. TILLANDSIA EXSERTA Fernald (*F. H. Lamb 381*), spike  $\times 1$ .
11. Same, partially united posterior sepals  $\times 1$ .
12. TILLANDSIA HARMSIANA L. B. Smith (*Macbride 3272*), inflorescence  $\times \frac{1}{4}$ .
13. Same, flower  $\times 1$ .
14. Same, sepal  $\times 1$ .
15. Same, petal  $\times 1$ .

## PLATE V.

- Fig. 1. VRIESIA ALTODASERRAE L. B. Smith (*L. B. Smith 1875*), spike  $\times \frac{1}{2}$ .
2. Same, flower  $\times 1$ .
  3. VRIESIA DUSENII L. B. Smith (*Dusen 10712B*), spike  $\times 1$ .
  4. Same, petal  $\times 1$ .
  5. VRIESIA SCHIPPII L. B. Smith (*W. A. Schipp S82*), inflorescence  $\times \frac{1}{2}$ .
  6. Same, calyx  $\times 1$ .
  7. GUZMANIA CRATERIFLORA Mez & Wercklé (*H. K. Svenson 322*), expanded corolla  $\times 1$ .
  8. GUZMANIA APICULATA L. B. Smith (*Macbride 5711*), floral bract  $\times 1$ .
  9. Same, calyx  $\times 1$ .
  10. GUZMANIA PALLIDA L. B. Smith (*H. H. Smith 2342*), floral bract  $\times 1$ .
  11. Same, expanded calyx  $\times 1$ .
  12. GUZMANIA MEGASTACHYA (Bak.) Mez (*Duss 3405, 3726*), calyx  $\times 1$ .
  13. GUZMANIA DUSSII Mez (*Duss 3326*), spike  $\times \frac{1}{2}$ .
  14. Same, expanded corolla  $\times 1$ .

## PLATE VI.

- Fig. 1. GUZMANIA KILLIPIANA L. B. Smith (*Killip & Smith 25630*), spike  $\times \frac{1}{2}$ .
2. Same, flower  $\times 1$ .
  3. GUZMANIA PENNELLII L. B. Smith (*Pennell 4344*), branch  $\times 1$ .
  4. GUZMANIA MITIS L. B. Smith (*Killip & Smith 20195*), spike  $\times 1$ .
  5. Same, calyx  $\times 1$ .
  6. Map, showing relative distribution of the *Bromeliaceae* as a whole and of the genus *Guzmania*.



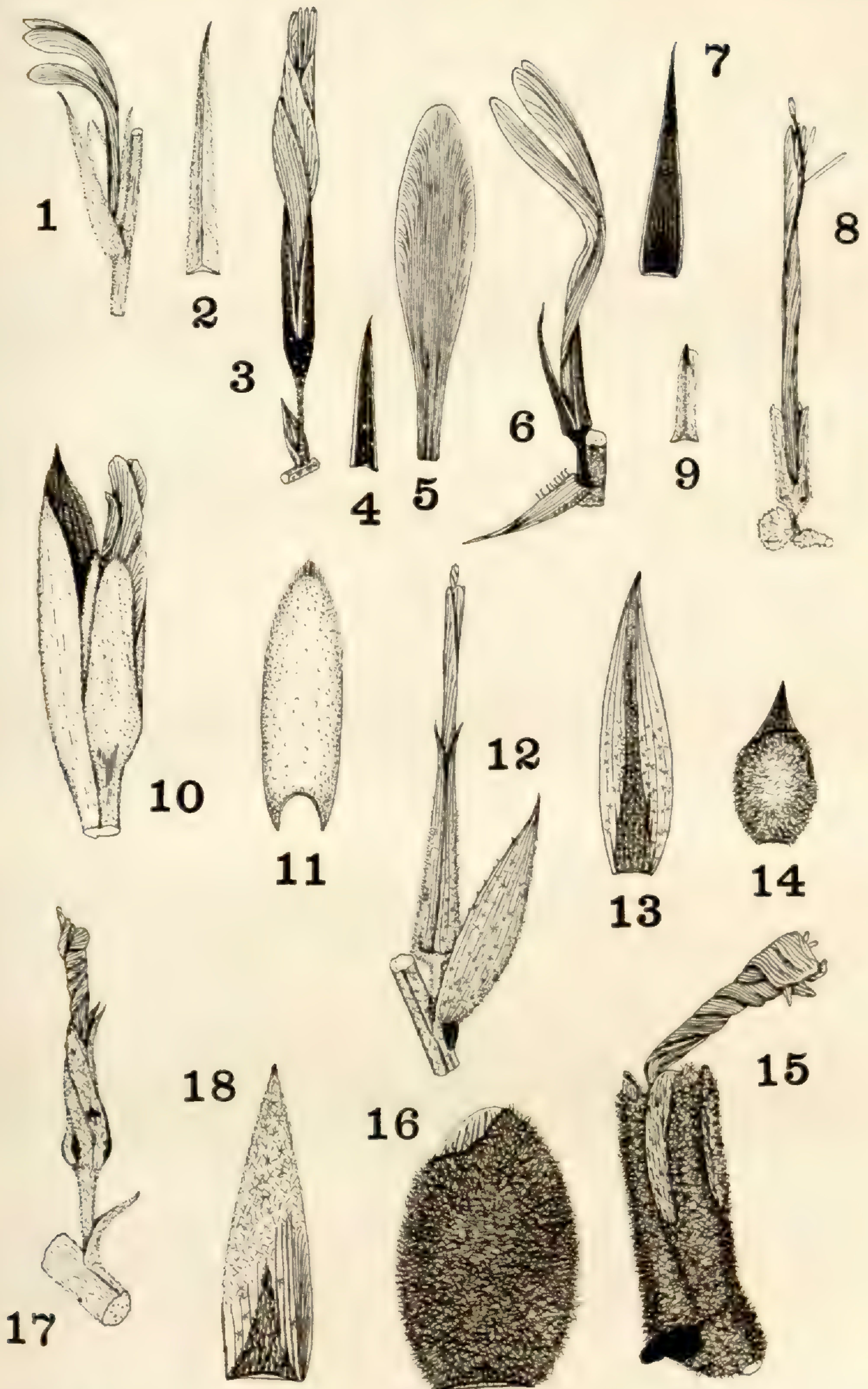
Figs. 1-3, *AECHMEA FERRUGINEA* L. B. Sm.; 4-6, *AREGELIA ELEUTHEROPETALA* (Ule) Mez; 7-8, *GREIGIA COLUMBIANA* L. B. Sm.; 9-11, *G. MACBRIDEANA* L. B. Sm.; 12-14, *HOHENBERGIA BRITTONIANA* L. B. Sm.



Plantae Brasilienses  
 18084 *Dyckia*  
 Paraná Porto Amazonas, in rupibus  
 5. 4. 1846 C. 800 A. A.

DYCKIA DUSENII L. B. Sm.

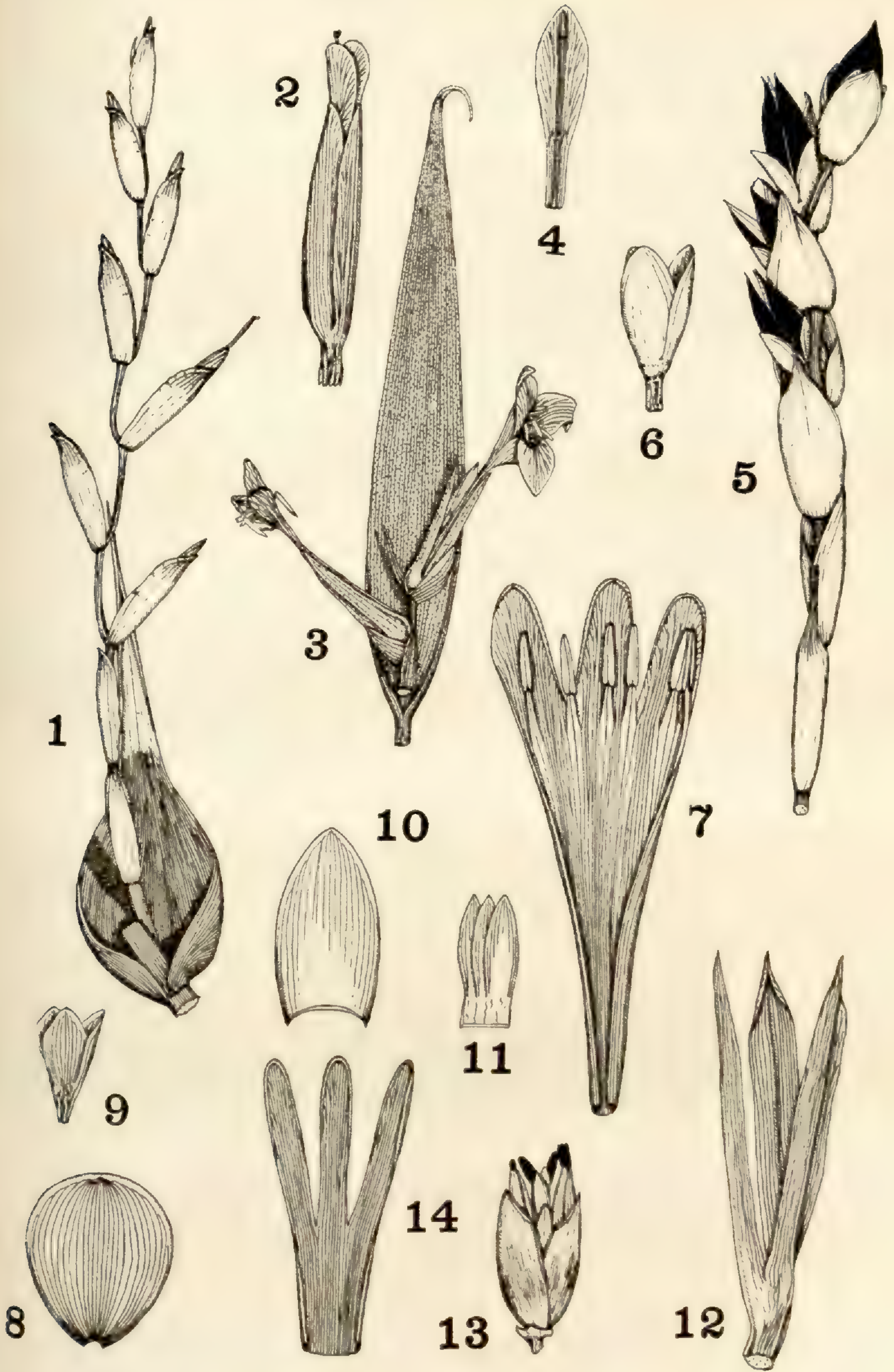




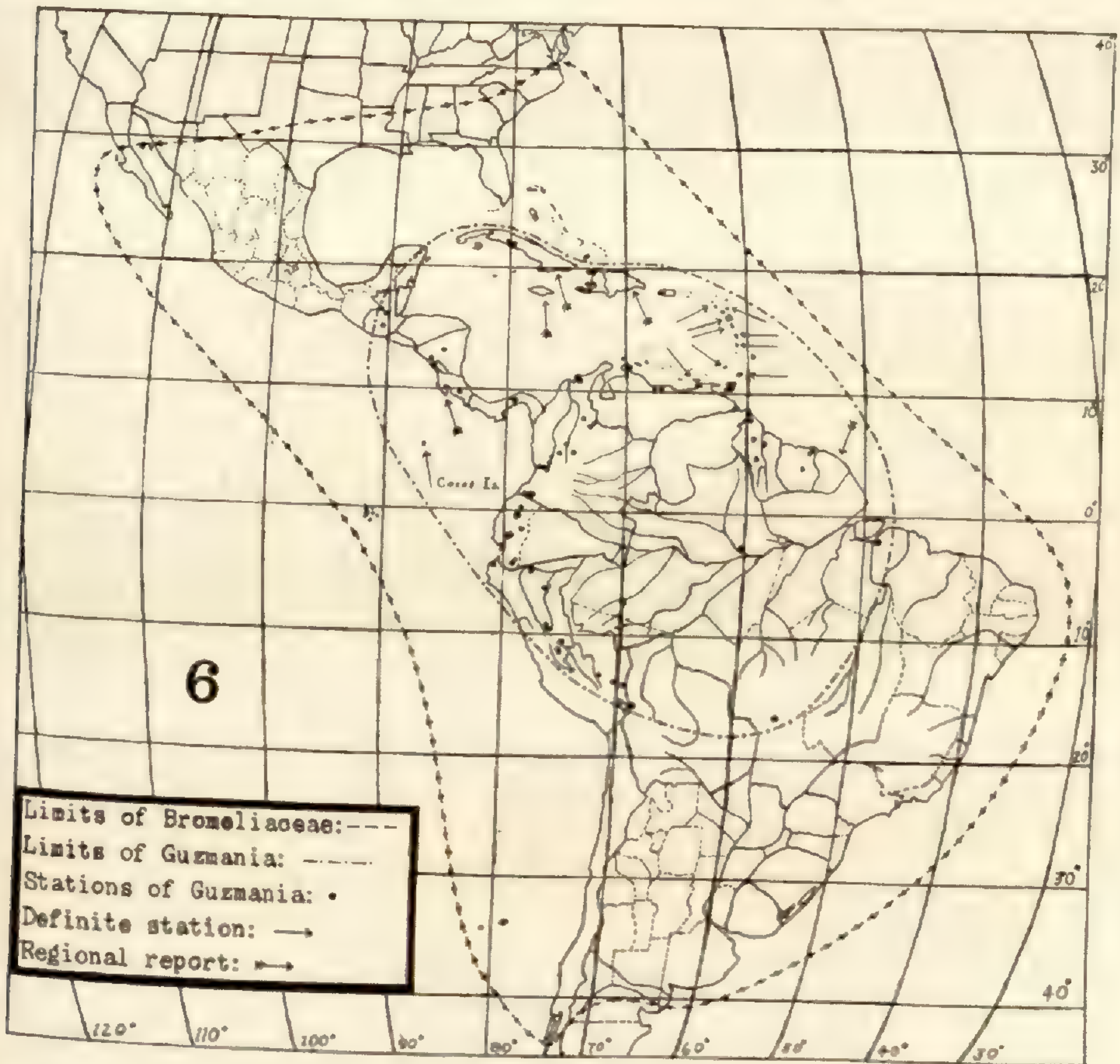
Figs. 1-2, PITCAIRNIA CALDERONII Standley & Smith; 3-5, P. CUZCOENSIS L. B. Sm.; 6-7, P. PECTINATA L. B. Sm.; 8-9, P. TRUNCATA L. B. Sm.; 10-11, PUYA DEPAUPERATA L. B. Sm.; 12-13, P. GRACILIS L. B. Sm.; 14-16, P. LLATENSIS L. B. Sm.; 17-18, P. MACBRIDEI L. B. Sm.



Figs. 1-2, *PUYA PECTINATA* L. B. Sm.; 3-4, *P. PENDULIFLORA* L. B. Sm.; 5-6, *P. STIPITATA* L. B. Sm.; 7, *STREPTOCALYX WILLIAMSHII* L. B. Sm.; 8-9, *TILLANDSIA BOLIVIENSIS* Bak.; 10-11, *T. EXSERTA* Fernald; 12-15, *T. HARM-SIANA* L. B. Sm.



Figs. 1-2, *VRIESIA ALTODASERRAE* L. B. Sm.; 3-4, *V. DUSENII* L. B. Sm.; 5-6, *V. SCHIPPII* L. B. Sm.; 7, *GUZMANIA CRATERIFLORA* Mez & Werkló; 8-9, *G. APICULATA* L. B. Sm.; 10-11, *G. PALLIDA* L. B. Sm.; 12, *G. MEGASTACHYA* (Bak.) Mez; 13-14, *G. DUSSEI* Mez.



Figs. 1-2, GUZMANIA KILLIPIANA L. B. Sm.; 3, G. PENNELLI L. B. Sm.; 4-5, G. MITIS L. B. Sm.; 6, Distribution of family and genus.

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CONTRIBUTIONS FROM THE GRAY HERBARIUM  
OF HARVARD UNIVERSITY.

XCIX.

BOTANICAL EVIDENCE OF POST-PLEISTOCENE MARINE  
CONNECTION BETWEEN HUDSON BAY AND  
THE ST. LAWRENCE BASIN.

BY DAVID POTTER.

DATES OF ISSUE

Pages	69 to 89.....	4 May, 1932
"	101 to 112.....	3 June, 1932

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BOTANICAL EVIDENCE OF A POST-PLEISTOCENE  
MARINE CONNECTION BETWEEN HUDSON BAY AND  
THE ST. LAWRENCE BASIN

DAVID POTTER

INTRODUCTION

FLORISTIC studies about the region of Hudson Bay have suggested an interesting phytogeographical problem. Among the many species of plants reported from this area are several of maritime occurrence. The nearest representatives of these plants are found along the Atlantic seaboard, about the region of the Gulf of St. Lawrence. Such cases of discontinuous distribution are fairly common, but the agencies responsible for these phenomena are not always the same.

It is the purpose of this paper to examine the various environmental agencies which might effect the distribution of these maritime plants and to determine, if possible, or at least to suggest, which factor has been most important. The writer wishes to express his sincere appreciation of the never-failing kindness and assistance of all members of the staff of the Gray Herbarium. Particular thanks are due, also, to Mr. C. M. Pomerat for his help in the field-work. Above all is the writer indebted to Professor M. L. Fernald, whose inspiration and guidance have made this work possible.

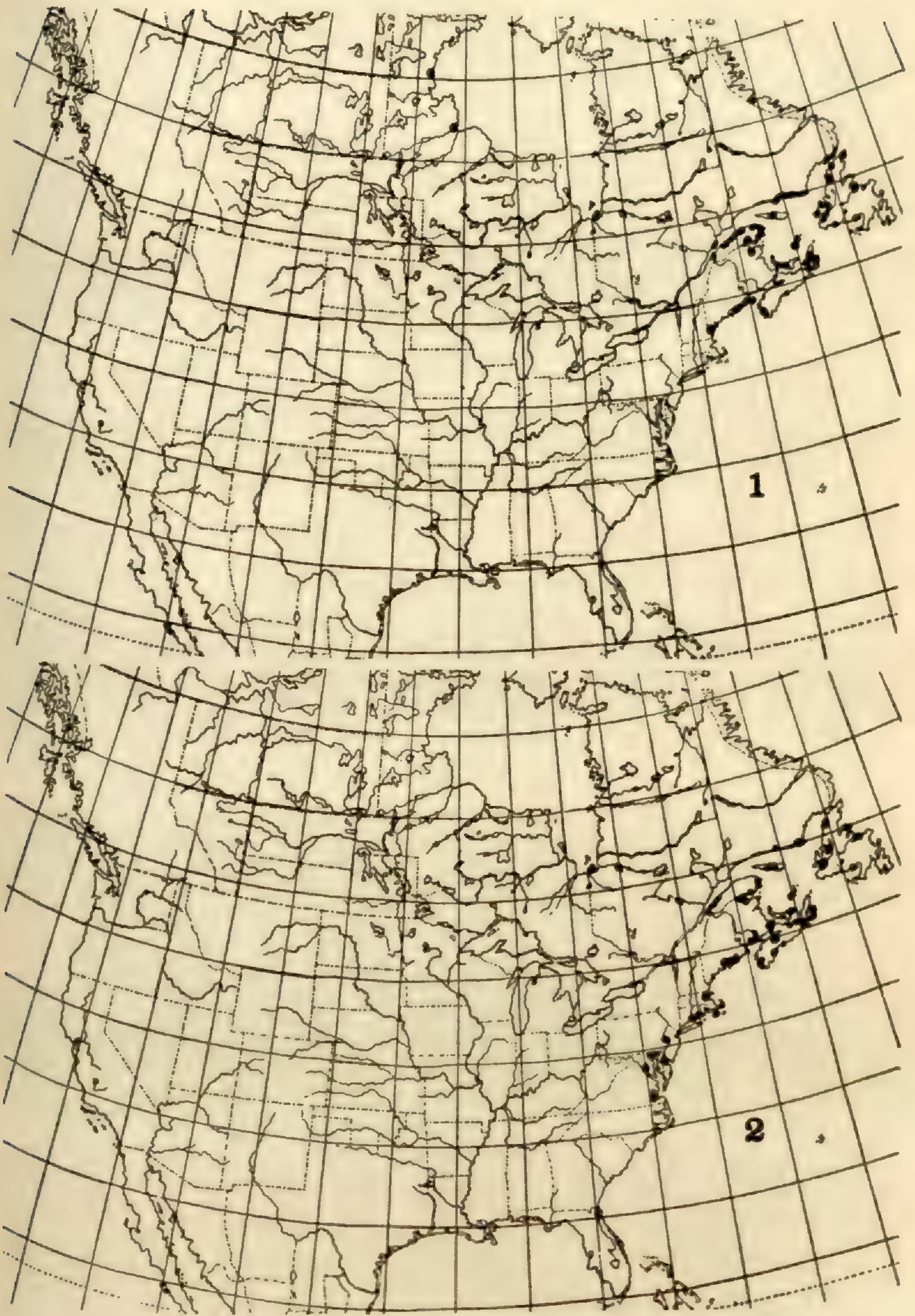
THE DISTRIBUTION OF CERTAIN HALOPHYTIC PLANTS  
OF THE HUDSON BAY REGION

Of the numerous plants collected by the writer around the southern region of Hudson Bay, during the summer of 1929, the following species were found representing this peculiar distribution: *Zanichellia palustris* L. var. *major* (Boenn.) Koch; *Glaux maritima* L. var. *obtusifolia* Fernald; *Juncus Gerardi* Loisel.; *Carex maritima* O. F. Mueller; *Carex norvegica* Willd.; *Carex glareosa* Wahlenb. var. *amphigena* Fernald; *Plantago juncoides* Lam. var. *decipiens* (Barneoud) Fernald; *Poa eminens* J. S. Presl and *Scirpus rufus* (Hudson) Schrad.

Associated with these plants were found the following indifferent halophytes, whose occurrence in this region may or may not have been brought about by the same agencies as effected the distribution of the above-mentioned halophytes: *Potamogeton filiformis* Pers.; *Triglochin maritima* L.; *Triglochin palustris* L.; *Scirpus americanus* Pers.; *Juncus balticus* Willd. var. *littoralis* Engelm.; *Potentilla Anserina* L.; *Myriophyllum exalbescens* Fernald; *Lathyrus maritimus* (L.) Bigel.; *Arenaria peploides* L. and *Mertensia maritima* (L.) S. F. Gray. To the above list should be added *Bidens hyperborea* Greene, an estuarian species, and *Zostera marina* L., a plant confined strictly to salt water. Maps 1-6 give the geographic ranges<sup>1</sup> of the strict

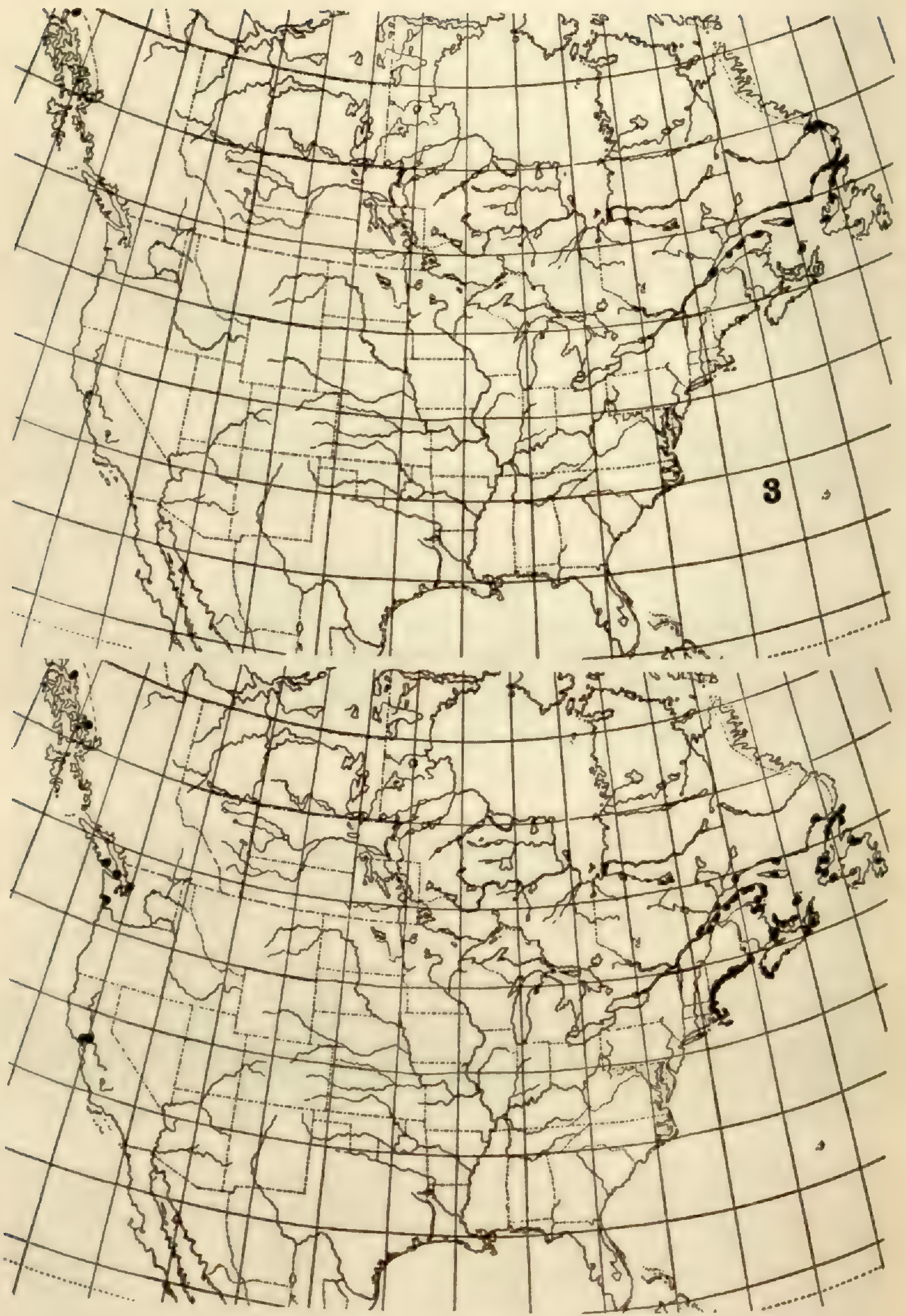
<sup>1</sup> The geographic ranges are based upon specimens in the Gray Herbarium and in the Herbarium of the New England Botanical Club, and upon the following publications:

- Alcock, F. J., List of Plants Collected Along the Churchill River between Missi Falls and the Mouth of the Little Churchill River. Geol. Surv. Can., Summ. Rep. for 1915, p. 136.
- Bell, John, On the Plants of Manitoulin Island. Geol. Surv. Can., Rep. of Prog., 1866-1869.
- Bell, Robert, Report on Exploration of the Churchill and Nelson Rivers and around God's and Island Lakes. Geol. Surv. Can., Rep. for 1878-79, pp. 1-72 C.
- Bell, Robert, List of Plants Collected in 1880. Geol. Surv. Can., Rep. for 1879-80, p. 59 C.
- Bell, Robert, List of Plants Collected in Hudson Straits. Geol. Surv. Can., Ann. Rept. xi. 1898, pp. 34-37 M.
- Dowling, D. B., List of Plants Collected at the Mouth of the Ekwan and Albany Rivers. Geol. Surv. Can., Ann. Rep. xiv. pt. F, p. 60.
- Drummond, A. T., The Distribution of Plants in Canada in Some of its Relations to Physical and Past Geological Conditions. Can. Nat., n. s. iii. (1869) pp. 161-177.
- Drummond, A. T., The Distribution of Some Canadian Plants, an Argument for the Marine Origin of the Erie Clays. Can. Nat., n. s. vii. (1874) pp. 217-223.
- Fernald, M. L., The Botanical Evidence of Marine Conditions in Hamilton Inlet, Labrador. In the Privy Council, In the Matter of the Boundry Between the Dominion of Canada and the Colony of Newfoundland in the Labrador Peninsula. Report of the Lords of the Judicial Committee of the Privy Council, delivered the 1st March, 1927, London.
- Henderson, A., Agricultural Resources of Abitibi. Rept. Bur. Mines, Ont., xiv. pt. 1, p. 241.

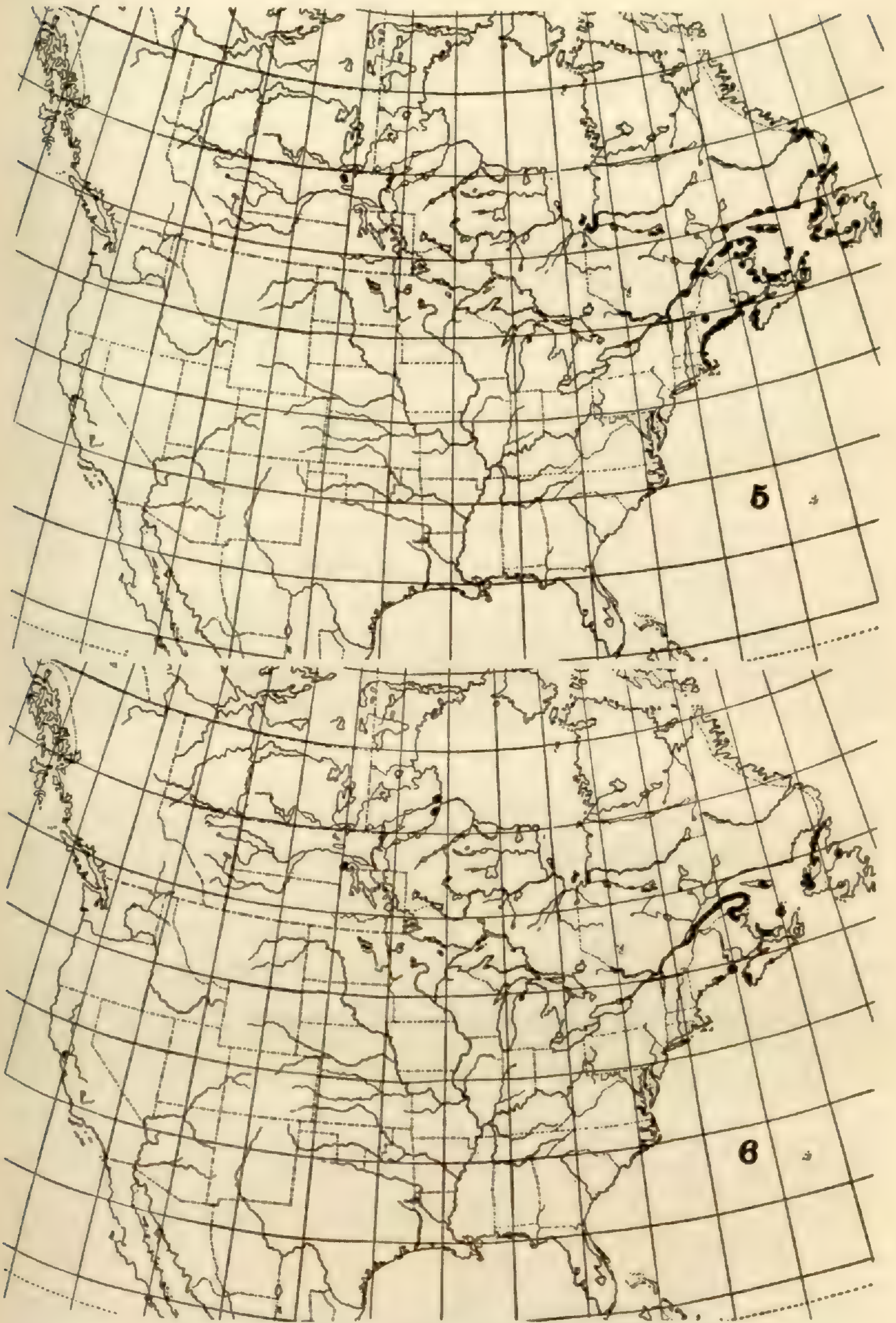


Map 1, Geographic Range of *Carex norvegica*;  
2, of *Zannichellia palustris*, var. *major*.





Map 3, Geographic Range of *Poa eminens*;  
|4 (lower), of *Glaux maritima*, var. *obtusifolia*.



Map 5, Geographic Range of *Carex maritima*;  
6, of *Scirpus rufus*.

halophytes listed above. In addition to their occurrence in the Hudson Bay region, it will be noted that in the cases of *Carex norvegica* (MAP 1) and *Zannichellia palustris* var. *major* (MAP 2) they are restricted to the Atlantic seaboard, extending at least from southern Labrador south along the New England coast, and in the case of *Zannichellia palustris* var. *major* south to Florida. *Poa eminens* (MAP 3) and *Glaux maritima* var. *obtusifolia* (MAP 4) have northeastern ranges somewhat similar to those mentioned above, but they appear also on the Pacific coast. The distribution of *Carex maritima* (MAP 5), *Scirpus rufus* (MAP 6) and *Juncus Gerardi* (MAP 7) varies from the strictly maritime, in that the two former species occur in the region just north and west of Lake Winnipeg, while the latter has been reported from the Finger Lakes district of New York and at the southern tip of Lake Michigan, as well as from the Pacific coast.

In the cases of *Plantago juncoides* var. *decipiens* (MAP 8) and *Carex glareosa* var. *amphigena* (MAP 9), both found farther north along the Labrador coast, they occur also on the southwestern coast of Greenland. *Zostera marina* (MAP 10) occurs from Labrador and the lower St. Lawrence south to North Carolina, in James Bay, along the north Pacific coast and on the southwestern coast of Greenland.

*Bidens hyperborea* (MAP 11), an estuarian species, has been studied by Fassett (29) and Fernald (31) and the data regarding its distribution are taken from their papers. It is interesting to note that this plant occurs exclusively on fresh tidal mud in estuaries from eastern Massachusetts to Quebec, then jumps to Rupert River, James Bay.

Macoun, J., Catalogue of Canadian Plants. Geol. and Nat. Hist. Surv. Can., 1883-1884, pts. 1-4.

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Macoun, J. M., List of Plants in Low's Report of the Mistassini Expedition. Geol. and Nat. Hist. Surv. Can., Ann. Rept., 1885, pt. D.

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Macoun, J. M., List of Plants in Low's Report on Labrador. Geol. Surv. Can., Rept. of Prog. 1895, App. vi.

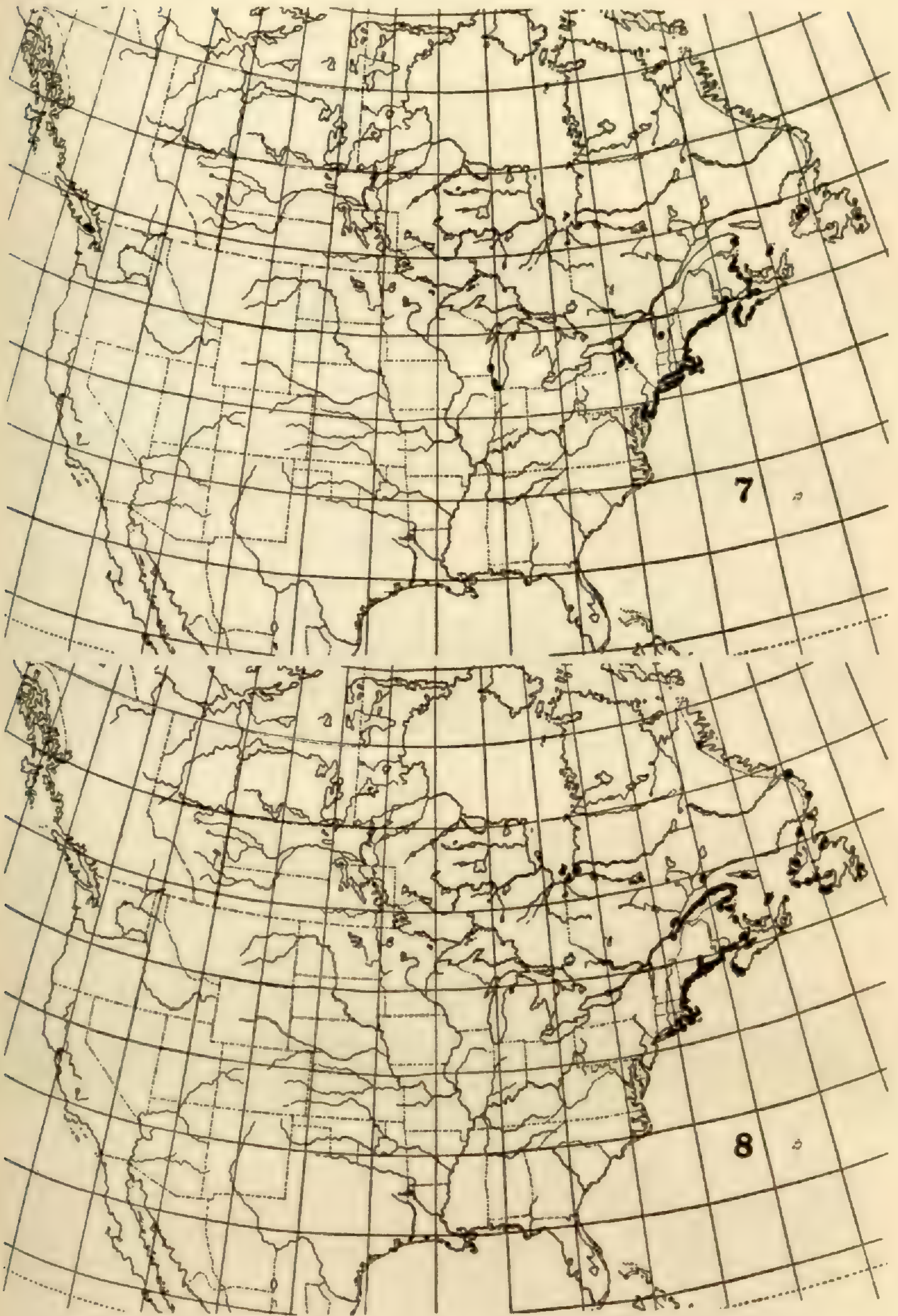
Richardson, Jas., Report on the Country North of Lake St. John. Geol. Surv. Can., Rept. of Prog., 1870-71, pp. 306-308.

St. John, H., A Botanical Exploration of the North Shore of the Gulf of St. Lawrence. Can. Dept. Mines, Mem. No. 126, 1922.

Svenson, H. K., Studies on Interior Distribution of Maritime Plants. I. RHODORA xxix. pp. 41-48; 57-72; 87-93; 105-116.

Tyrell, J. B., Plants Collected Between Lake Athabasca and the West Coast of Hudson Bay, north shore of Hudson Straits and Fort Churchill. Geol. Surv. Can., Ann. Rept. ix. (1896) p. 205 F.

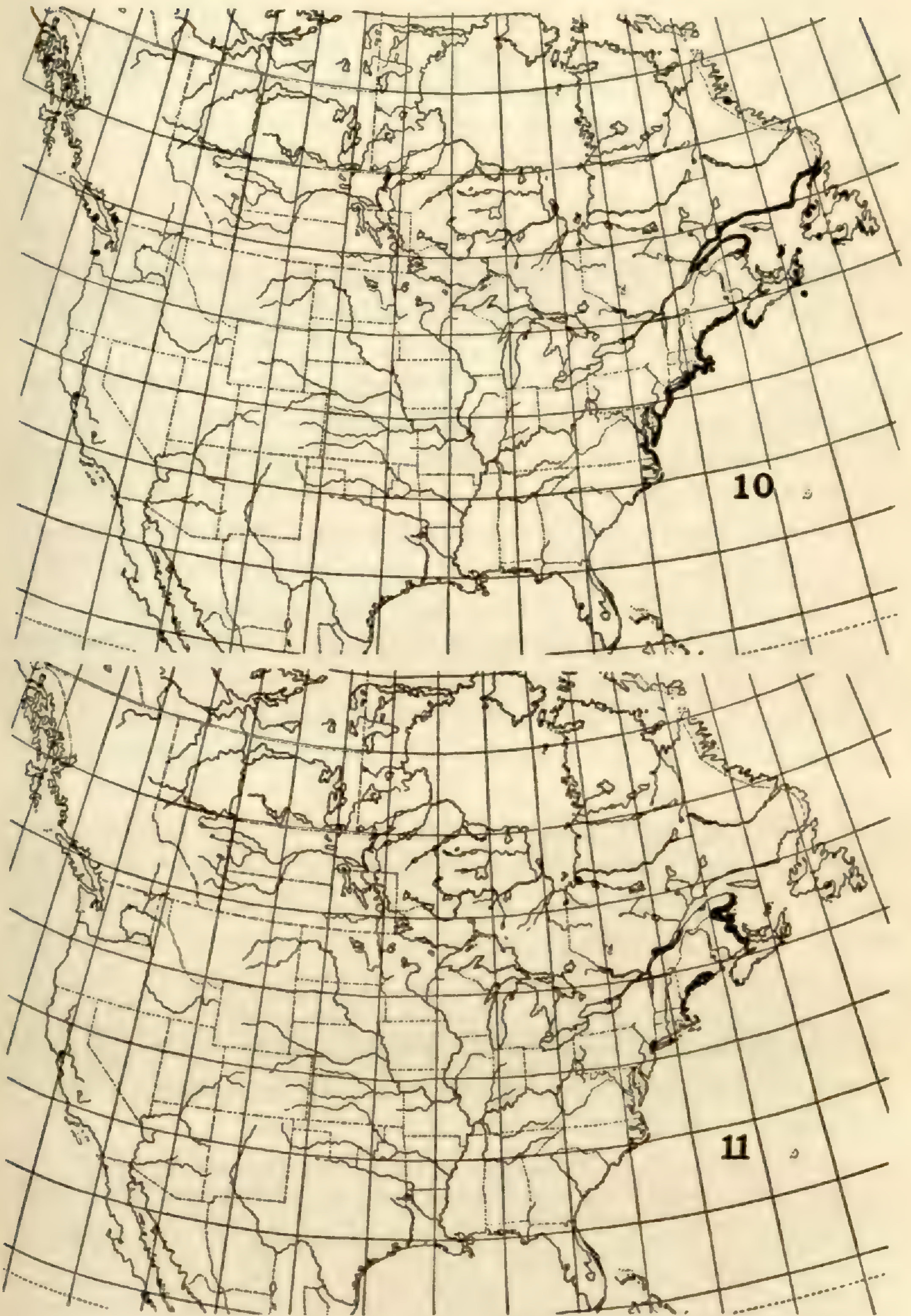
Upham, Warren, Geographic Limits of Species of Plants in the Basin of the Red River of the North. Proc. Boston Soc. Nat. Hist. xxv. (1890) pp. 140-172.



Map 7, Geographic Range of *Juncus Gerardi*;  
8, of *Plantago juncooides*, var. *decipiens*.



Map 9, Geographic Range of *Carex glareosa*, var. *amphigena*.



Map 10, Geographic Range of *Zostera marina*;  
11, of *Bidens hyperborea*.

In no case have these plants been reported as growing along the shores of Hudson Straits or along the northernmost Labrador coast. Four of them have been rarely found north of Hamilton Inlet; two reach their northern limits in Hamilton Inlet; and five are not known north of the Straits of Belle Isle.

Several expeditions<sup>1</sup> have recently gone to Labrador and, as each expedition has had among its members a trained botanist, whose work was to collect and study the flora at points touched, it is reasonable to assume that, since most of these plants have not been reported from far north on the coast, they do not usually occur north of the southern corner of Labrador (except as above stated); and their appearance along the shores of Hudson and James Bays has not been due to a migration along the outer coast of Labrador, thence by way of Hudson Straits to James Bay. Again, in no case have these plants been reported from the region between James Bay and the St. Lawrence River, the most inland point for any of them (*Bidens hyperborea*) along the St. Lawrence being northeast of Montreal. The absence of these plants from inland areas is to be expected, since they are strictly or primarily maritime, and it indicates that the edaphic conditions of the land lying between the St. Lawrence Basin and James Bay are at this time such as not to favor the presence of halophytic species. It is true, however, that much of the country lying north and northwest of the St. Lawrence River has not been carefully botanized and future exploration in this area may possibly reveal the existence of some of these species. If such should prove to be the case, the present problem would be more easily solved as will be later pointed out.

#### POSSIBLE CAUSES OF THIS DISCONTINUOUS DISTRIBUTION

The agencies which might have brought about this peculiar distribution are as follows:

- <sup>1</sup> The reports from some of the recent expeditions referred to are as follows:  
 Fernald, M. L., A Botanical Expedition to Newfoundland and Southern Labrador. *RHODORA*, xiii. pp. 109-157 (1911).  
 Fernald, M. L. and Sornborger, J. D., Some Recent Additions to the Labrador Flora. *Ottawa Naturalist*, xiii. pp. 89-107 (1899).  
 Bishop, Harlow, List of Plants Collected on the Austin Labrador Expedition, 1928. Unpublished list at the Gray Herbarium.  
 Delabarre, E. B., Botanical Report of the Brown-Harvard Expedition to Nachvak, Labrador. *Bull. Geog. Soc. Phila.* iii. pp. 167-201 (1902).  
 Wetmore, R. H., Plants of the Hamilton Inlet and Lake Melville Region, Labrador. *RHODORA*, xxv. pp. 4-12 (1923).  
 Woodworth, R. H., List of Plants Collected on the Iselin Expedition to Northern Labrador, 1926. Unpublished list at the Gray Herbarium.

1. Driftless areas which may have harbored these plants during the Wisconsin glaciation.
2. Dispersal of these plants since the recession of the last ice sheet:
  - a. by means of wind.
  - b. by means of animals, other than birds.
  - c. by means of birds.
  - d. by means of water.
3. Migration of these plants along the shores of a marine connection between the St. Lawrence Basin and James Bay.

These agencies will now be considered in detail.

1. *Driftless Areas.* That driftless areas within the broad region invaded by Pleistocene ice occur is acknowledged by most geologists. The possibility of these areas harboring plants during the period of glaciation is unquestionable, for not only is an analagous condition now prevailing in the case of Greenland with its continental glacier, but, in addition, Fernald (30), in his remarkable studies upon the flora of Newfoundland and the Gaspé Peninsula, has definitely proved that in these regions such was the case. This fact is conceded by the great Canadian Pleistocene geologist, A. P. Coleman (19).

Many explorations have been made by geologists of the Canadian Government in the Northeastern part of Canada and the findings of such men as Bell, Low, Chalmers, Coleman, Tyrell and others largely agree concerning the glaciation of this area. Nowhere along the coasts or on the islands of either James Bay or southern Hudson Bay have areas been discovered which escaped the ruthless work of the Wisconsin ice sheet. The writer visited the region of James Bay during the summer of 1929 and found evidence of glaciation at every point touched: all along the rivers entering James Bay and along the southern and eastern coasts of the Bay itself. The same conditions were found on Charlton Island as also on a number of smaller islands which were explored. Mr. A. E. Porsild, one of the botanists for the Canadian Government, visited a number of the islands in James Bay, including Agamaski, the Twins and one large island off the coast at Fort George, and reported verbally to the writer that all these islands had been severely scoured by ice. In discussing Strutton and Trodely islands, Low (41) speaks of many large boulders strewn over the land.

Thus, the evidence is quite conclusive that driftless areas do not exist in the neighborhood of James Bay, and some other explanation



must be sought to account for the presence of the southern halophytic plants on the shores of this great inland sea.

2 a. *Wind.* Wind plays an important role in the dissemination of plants and plant parts. Seeds, or even plants, are often caught up by winds and carried varying distances before they are dropped or before they strike some obstacle which impedes their progress. Warming (64) claims that relatively heavy fruits may be carried by wind up to distances of at least sixteen miles. Many plants have their seeds modified for dispersal by this means and in the case of the dandelion, Small (51) claims ". . . that so long as the relative humidity of the air remains above 0.77 and so long as the fruit does not encounter an obstacle, a horizontal wind of 1.97 m.p.h. is sufficient for its dispersal to any distance." It is quite conceivable that a seed having once been dropped can again be picked up by wind and this process be repeated over and over again until long distances have been traversed. Again it is possible that a seed falling upon favorable soil might germinate and in succeeding years its seeds be blown to a new region and this process continue until long distances be crossed. There are, however, many elements of chance in such a hazardous mode of transportation, and the mortality in terms of successful germination and maturity, would of necessity be tremendous. In the case of plants establishing intermediate stations between two points it is difficult to apply this method of migration to halophytes over areas not favorable to salt-loving plants.

Fernald (30), in his studies upon the flora of Newfoundland, has furnished us a most striking example in point. To quote Professor Fernald, speaking of the absence from southwestern Newfoundland of many wind-dispersed species of Cape Breton: ". . . the distance across Cabot Strait, the shortest route from the southwestern mainland to Newfoundland is fully 70 miles, and, although this does not seem a forbidding gap, the fact remains that very many common Canadian species with fine spores or with the seeds plumose, feathery or otherwise adapted for wind-transportation, have failed to cross from Cape Breton to southwestern Newfoundland." Svenson (56), in his studies upon the interior distribution of halophytes, reached the conclusion that wind was not a predominant factor in seed-dispersal. Thus, the influence of wind as a primary factor in seed-dissemination (especially in the case of halophytes) over long distances has, perhaps, been overestimated and a more plausible cause for the occurrence of these plants in the Hudson Bay region must be sought.

2b. *Animals (exclusive of birds)*. Animals other than birds are responsible for local dissemination of plants and plant-parts. Those animals with which we need to concern ourselves are restricted to the mammals, for probably fish, amphibia, and reptiles play a very minor part in carrying seeds or plant-parts over such distances as are concerned in the present problem. Many plants have their seeds or fruits so modified as to allow them to cling to the fur of mammals and thus be carried along. In the species of plants under consideration no such modifications are present and the possibility of the seeds of such plants as *Glaux maritima* var. *obtusifolia* and *Zannichellia palustris* var. *major* being transported in this manner is very slight. Human travel has not been great between these two regions and we can scarcely look to this source as the means of introduction. Had these plants any food value or other economic significance, human migrations would of necessity have to be investigated.

2c. *Birds*. With birds, as with wind, there is no question but that they effect seed-dispersal locally. Concerning the distribution of plants or plant parts over long distances by birds, the question is highly debatable. Warming (63) sums up this matter in referring to Knud Anderson's work, supplemented by the conclusions of Winge, as follows: "For a number of consecutive years, thousands of birds, picked up dead at the Danish lighthouses have been sent to the Zoological Museum at Copenhagen, and notes on these dead birds have for many years been published annually by H. Winge. . . . This eminent zoologist writes to me," continues Warming, "as follows: 'In one of the first years, the contents of the stomachs were systematically examined, later on only occasionally, but the stomach has always proved to be empty. . . . Though I have had thousands of dead migratory birds between my hands and have made a habit of examining every single one, I have not as yet found any seeds adhering to the feathers, beaks, or feet.' "

Commenting upon the above observations, Warming continues: "As the above observations are made by so careful and eminent an investigator, I must consequently believe that birds at least very seldom carry seeds and other larger reproductive organs, and small plants, across great distances, and the indisputable evidences of birds carrying seeds either in them or adhering to them mentioned in books evidently apply to birds shot at or not far from, their daily haunts, and not to such as have just made a long journey." This

conclusion seems to be wholly sound and again forces us to seek a better explanation.

2d. *Water*. If the plants in question spread from the Gulf of St. Lawrence after the land to the north and northwest became freed from its burden of ice, only two now existing avenues of water were open for dispersal of seeds; namely, either the marine water along the coast of Labrador and thence through Hudson Straits, or the fresh water ponds and streams lying to the northwest of the St. Lawrence. As to the route via the North Atlantic and Hudson Straits, it seems wholly improbable that the dispersal took place by this route, for Guppy (34) has shown that only a few seeds have sufficient buoyancy to keep afloat in ocean-drift for more than a few days and that in the cooler regions of the globe, seed-drift is usually very scanty. Had seeds been carried short distances along the coast by this agency and in favorable spots established themselves, and had their progeny been transported in the same manner a short distance farther north, there establishing themselves and so on until the goal had been reached, it would be expected that more traces of the parent stock would be found along the outer coast of Labrador. As has been pointed out, no trace of some of these plants has ever been found north of the Straits of Belle Isle, while others are unknown north of Hamilton Inlet; and the few northern stations of the remaining species are exceeding localized.

Separating the St. Lawrence Basin and James Bay there is a divide which results in a double drainage system for this interior region. A large portion of this area drains to the south into the St. Lawrence River, while the remainder is drained to the north. After the recession of the Wisconsin ice-sheet, all the territory in northeastern America stood at a much lower level than at present; yet it is possible that the divide existed in approximately the same relative proportions as at present, and if so, it is difficult to understand how water flowing south could be of assistance in the dispersal of seeds towards the north. If this intermediate water was fresh, migration for any great distance along its shores for strictly halophytic plants would be improbable. On the other hand, if the divide separating these two regions was much lower in proportion to the two adjacent areas, our problem would be simplified, for, as is soon to be pointed out, such a low basin would allow a marine connection between the two areas and thus permit migration of the plants in question along the shores of this inland sea.

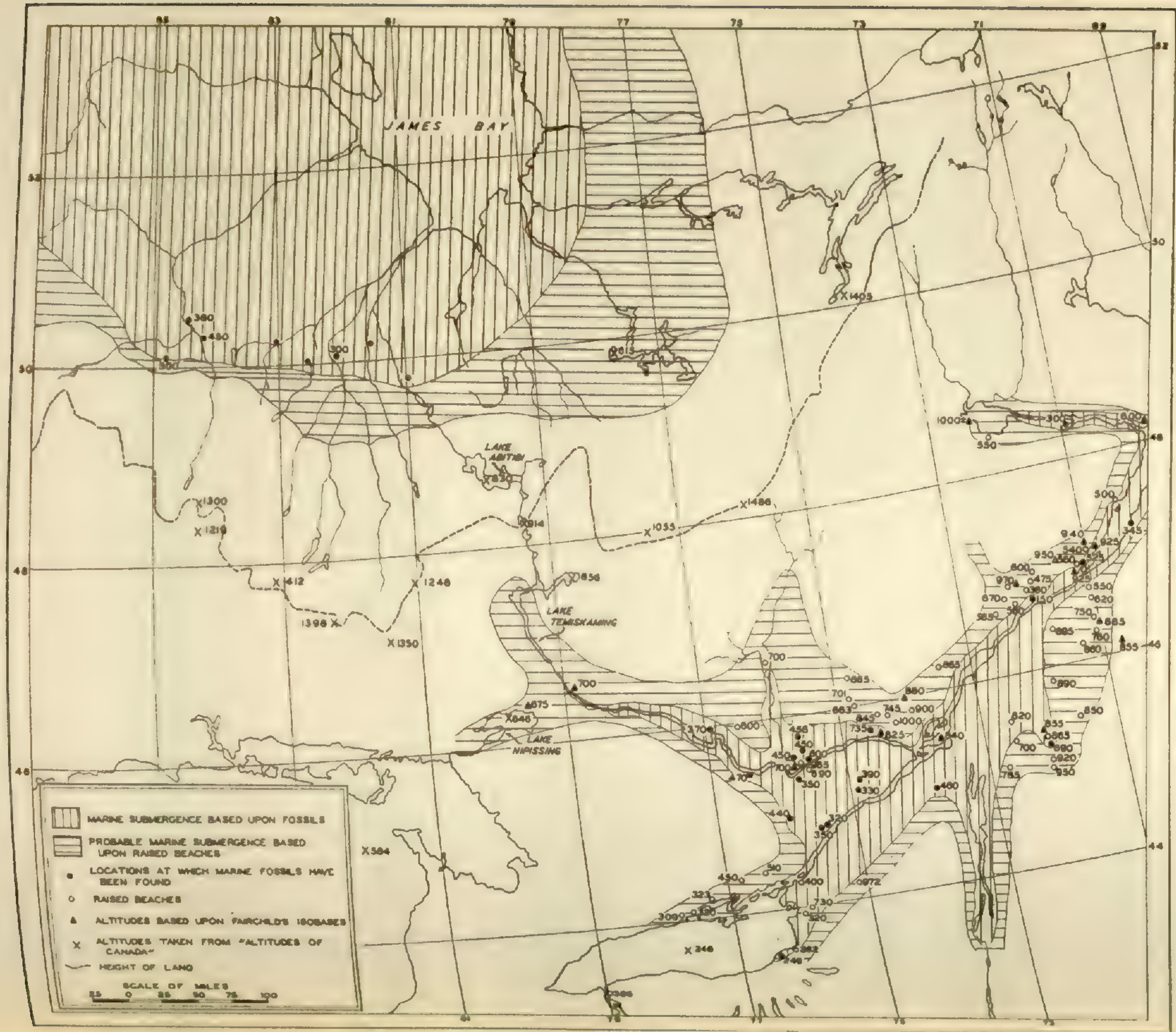
Since the factors of driftless areas, dispersal by means of wind, animals, and water do not solve the present problem of seed dispersal, it is necessary to consider one more agency which, if proved to have existed, will help us out of the present dilemma. This last is the possibility of migration along the shores of a marine connection between the St. Lawrence Basin and James Bay.

#### THE CHAMPLAIN SUBMERGENCE

After the recession of the last ice sheet, as just noted, the north-eastern portion of the North American Continent lay at a much lower level than is the case at present. In support of this statement Taylor (61) says that: “. . . nothing within the realm of Pleistocene geology is more clearly established than the depression of land during the growth of the Wisconsin ice sheet in the region of the Great Lakes. . . .” This lowering of the Continental land mass resulted in the drowning of the St. Lawrence and Ottawa valleys. Chalmers, Dyer, Kindle, Bell, Low, Keele, Coleman, Taylor, Dowling, Tyrell and others all agree that such a submergence took place. Additional evidence of a marine invasion is supplied by the presence in these formerly submerged areas of large deposits of marine clays, many of which bear numerous fossils, such as: *Mya arenaria* Linn., *Mya truncata* Linn., *Saxicava arctica* Linn., *Macoma calcarea* Gmel., *Macoma balthica* Linn., var. *groenlandica* Beck., *Mytilus edulis* Linn., *Serripes groenlandicus* Gmel., *Leda pernula* Müll.

Many localities have been reported for these marine shells and the following TABLE 1 gives a selected list, including only those which show the highest elevation. The localities listed in TABLE 1 have been plotted on the accompanying map and are indicated by solid black circles, together with the elevation in feet above sea level. These points have been connected and the enclosed area filled in by vertical lines. Thus, a clearer conception may be gained of the extent of this so-called Champlain Submergence as based upon the actual finding of marine fossils.

An interesting point to note in this connection is that these fossils are not evenly distributed throughout the known region of submergence. Many areas occur at much lower altitudes than those given in the above list, which are barren as concerns fossil shells. Chalmers (14) has pointed out that no marine shells have been found



■ MARINE SUBMERGENCE BASED UPON FOSSILS  
 ▨ PROBABLE MARINE SUBMERGENCE BASED UPON RAISED BEACHES  
 ● LOCATIONS AT WHICH MARINE FOSSILS HAVE BEEN FOUND  
 ○ RAISED BEACHES  
 ▲ ALTITUDES BASED UPON FAIRCHILD'S ISOBASES  
 X ALTITUDES TAKEN FROM "ALTITUDES OF CANADA"  
 — HEIGHT OF LAND  
 SCALE OF MILES  
 0 25 50 75 100

TABLE 1

## MARINE DEPOSITS

Location	Approx. Latitude	Approx. Longitude	Height in feet above sea level		Authority
North Gower.....	45° 10'	75° 45'		marine shells	Reinecke (48)
Prescott.....	44° 40'	75° 30'	320-350	marine shells	Coleman (20)
Welch's Siding.....	45° 0'	76° 0'	440	whale remains	Taylor (57)
Oswego.....	43° 30'	76° 30'	246	very probable	Taylor (57)
Covey Hill.....	45° 0'	73° 45'	460	very probable	Fairchild (28)
Chelsea.....	45° 30'	75° 40'	450	marine shells	Ells (23, 24)
Cantley.....	45° 30'	75° 40'	450	marine shells	Ells (24)
McGregor Lake.....	45° 30'	75° 40'	450	marine shells	Ells (24)
Arnprior.....	45° 30'	76° 50'	470	marine shells	Low (40)
Glengary County, Ont.....			350	marine shells	Ells (24)
Calumet Island, Que.....			200-500	marine shells	Chalmers (17)
Lake St. John.....			200-300	marine shells	Chalmers (17)
Grenville Dist.....	45° 30'	74° 30'	735	marine shells	Richardson (49)
Buckingham Map Area.....	45° 30'	75° 30'	600	marine shells	Ells (23)
Neapean township (6 miles up Rideau River from Ottawa.....	45° 30'	75° 45'	350	marine shells	Wilson (68)
Brockville.....	44° 45'	75° 30'		marine shells	Coleman (20)
4 miles above Ha Ha Bay on River Ona- bonchbavage.....	48° 20'	71° 0'	300	marine shells	Chalmers (17)
Portneuf.....	46° 45'	71° 50'	150	marine shells	Richardson (49)
Rivière du Loup.....	47° 15'	70° 15'	345	marine shells	Richardson (50)
St. Amboise.....	47° 0'	71° 0'	515	marine shells	Chalmers (15)
Beauport.....	47° 0'	71° 30'	265	marine shells	Low (42)
Little Magog.....	45° 15'	72° 0'	690	marine shells	Low (42)
					Chalmers (14)

in the beds representing Leda clays and Saxicava sands of New Brunswick. He goes on to say that only a few localities on the west coast of Prince Edward Island have Pleistocene marine fossils: " . . . though a large area now forming dry land must have been under the sea, which was doubtless then, as at present, inhabited by marine animals."

Again Ells (24), in speaking of the lower Ottawa and St. Lawrence valleys, says: " . . . throughout the district there are great expanses of marine clays which show no trace of organisms, while very often the overlying sands and gravels hold great quantities of marine fossils." Thus it may be safely concluded that the absence of marine fossils does not necessarily mean the absence of marine waters.

The extent of this post-pleistocene marine submergence has never been definitely shown and at present there is much disagreement among geologists concerning the matter. The presence of marine fossils is reliable evidence as to depth of submergence, but, in addition to this, many raised beaches have been discovered and described. Whether these are of marine or lacustrine origin is still a moot question.

TABLE 2 gives a list of some of these raised beaches together with their approximate location and their altitudes.

TABLE 2

## RAISED BEACHES—PROBABLY MARINE

Location	Approx. Latitude	Approx. Longitude	Height in feet above sea level	Authority
Texas.....	43° 40'	75° 15'	262	Fairchild (28)
Henderson.....	43° 50'	76° 10'	320	Fairchild (28)
Clayton.....	44° 15'	76° 0'	400	Fairchild (28)
Yarker.....	44° 25'	76° 50'	450	Mather (44)
Inverary.....	44° 25'	76° 0'	510	Mather (44)
St. Remi.....	46° 0'	74° 45'	701	Wilson (66)
Rockaway.....	46° 0'	74° 45'	663	Wilson (66)
Ottawa.....	45° 30'	75° 40'	690	Mather (44)
Belleville.....	44° 10'	77° 25'	323	Taylor (57)
Brighton.....	44° 0'	77° 45'	309	Taylor (57)
Trenton.....	44° 10'	77° 30'	320	Taylor (57)
Baie St. Paul.....	47° 30'	70° 30'	500	Mandsley (43)
Sweetsburg.....	45° 10'	73° 40'	610-700	Chalmers (13)
Frelighsburg.....	45° 0'	72° 50'	475-785	Chalmers (13)
Shefford Mt.....	45° 25'	72° 30'	820	Chalmers (13)
St. Charles.....	46° 50'	71° 0'	540-550	Chalmers (12)
St. Anselm.....	46° 40'	71° 0'	620	Chalmers (12)
St. Henedine.....	46° 30'	71° 0'	750	Chalmers (12, 16)
St. Marie.....	46° 25'	71° 0'	760	Chalmers (12)
St. Joseph Lake.....	46° 10'	71° 30'	860	Chalmers (12)
St. Jule Sta.....	46° 20'	71° 40'	895	Chalmers (12)
Dudswell.....	45° 30'	71° 30'	850	Chalmers (12)
Lake Memphremagog.....	45° 20'	72° 0'	865-990	Chalmers (12, 14)
La Chute.....	45° 40'	74° 20'	1000	Ells (24)
Lewiston, N. Y.....	43° 10'	79° 0'	385	Spencer (53)
Watertown, N. Y.....	44° 0'	75° 50'	730	Spencer (53)
Fine, N. Y.....	44° 15'	75° 10'	972	Spencer (53)
Malone, N. Y.....	44° 50'	74° 15'	1100-1200	Chalmers (11)
St. Anne de Beaupré.....	47° 0'	71° 0'	540	Chalmers (11)
North of Quebec.....	46° 50'	71° 10'	560	Chalmers (11)
Lake Maskinong.....	46° 20'	73° 30'	560	Chalmers (11)
St. Jerome.....	45° 45'	74° 0'	900	Chalmers (11)
Kingsmere Mt. (North of Ottawa).....	45° 30'	75° 45'	965	Chalmers (11)
North side of Ottawa River just above Allumette Is.....	46° 50'	76° 50'	800	Chalmers (11)
Brulé Rapid.....	46° 30'	76° 0'	700	Keele (38)
Georgeville.....	45° 10'	72° 0'	920	Spencer (53)
Magoon Point.....	45° 0'	72° 0'	950	Spencer (53)
Danville.....	45° 50'	72° 0'	890	Chalmers (16)

It will be noted from the list in TABLE 2 that these raised beaches range from a few feet above sea level to 1200 feet. Their localities are indicated on the accompanying map by hollow circles, with their altitudes. These points have been connected and the area included filled in by horizontal lines.

Marine fossils have not been found in the Champlain, St. Lawrence, and Ottawa regions above an altitude of approximately 735 feet.



This fact has led some geologists to search for some theory other than marine invasion to account for the non-fossiliferous raised beaches. The theory of Glacial Dams has received considerable support. In discussing the Iroquois beach as having been formed by an arm of the sea, Coleman (20) states, "This conclusion is a very natural one and tends toward simplicity by avoiding the assumption of an ice dam; but the finding of fresh water shells in the Iroquois beach near Toronto seems conclusive as to the character of the water, which could hardly remain fresh or even brackish with an opening seventy or eighty miles wide and four hundred feet deep into the inland sea formed by the enlarged Gulf of St. Lawrence." Spencer (54) is opposed to this view and he states: "As we ascend to the elevation of the higher beaches, the question of glacial dams becomes more and more difficult, for we must assume them to have been hundreds of miles long and at enormous altitudes, damming up waters which had the proportions of inland seas." He then goes on to say, "I am compelled to assume the initial plane of the Algonquin beach to be at sea level." Later in the same paper Spencer says, ". . . there is additional evidence; for crustaceans of marine species have so adapted themselves as to still live in the depths of Lake Superior (55, 52), as also maritime plants along its shores." (36)

Conceding the existence of the glacial dams, which would account for the higher beaches to the north of the Great Lakes, they would not account for the occurrence of the raised beaches found along the valley of the St. Lawrence River. As Chalmers (13) has stated, "All the shore-lines noted face the open plain of the St. Lawrence valley . . . . No barriers exist or could have existed, capable of holding in a body of fresh water at heights sufficient to allow the formation of these shore-lines; and the only reasonable theory as to their origin seems to be that they were formed along the margin of a sea which occupied the St. Lawrence valley in the Pleistocene period." Dr. Ells (24) agrees with Chalmers, for he says "The underlying clays at the higher levels up to nearly one thousand feet, and in places to a height of considerably more than this, are apparently continuous with those of undoubted marine origin to the north and east, and the inference naturally follows that all the deposits were laid down by the same agencies. The absence of marine organisms over a large part of the area is only negative evidence to the contrary, and there are certain facts that go far to establish

this theory of their marine deposition." In the same article, Dr. Ells continues: "There is no break apparent in the deposition of these beds, from the nodule-bearing clays near Ottawa to the most northerly outcrops on the Gatineau and the Lièvre where the clays are, in so far as yet known, all barren."

The question might well be asked as to the relative ages of the different beaches under discussion, and so far as known they seem to be all of post-glacial origin. Taylor (58) has summed up this matter as follows: "I express again, and with increased confidence, the belief that the Iroquois beach and the highest beaches in the lower St. Lawrence, Champlain, Huron, and Ottawa valleys, and in the basins of Lakes Huron, Michigan, and Superior, and also in the valley of the Red river of the North, are all one continuous shore line of the sea."

If these conclusions of Spencer, Ells and Taylor be correct, it would follow that this marine invasion just after the recession of the last ice-sheet was much greater in extent than is indicated by the altitudes at which marine fossils have been found. The same factors which are responsible for the lack of marine fossils in areas unquestionably once covered by the sea, as was pointed out earlier in this paper, may account for the lack of fossils in these raised beaches. Chalmers (14) has suggested "That the arenaceous clays and the sand which together constitute the stratified deposits lying below the uppermost shore line of the Pleistocene submergence, contain minerals destructive to shells and tests of marine animals."

Finally, in James Bay today no living marine mollusks are to be found, except perhaps in the northern part, owing probably to the muddy and brackish nature of the water (9). A similar condition might well have existed during the Champlain Submergence in which the waters were muddy and brackish, not permitting the existence of marine life, yet allowing the existence of plants of maritime habitats along its shores.

If, then, these raised beaches owe their origin to marine water (and there seems to be considerable evidence in support of this hypothesis) the invasion by the sea would have reached the Lake Temiskaming region, involving also Lakes Ontario and Nipissing. Reference to the accompanying large map will show the area involved, which is indicated by horizontal lines.

*(To be continued)*

BOTANICAL EVIDENCE OF A POST-PLEISTOCENE  
MARINE CONNECTION BETWEEN HUDSON BAY AND  
THE ST. LAWRENCE BASIN

DAVID POTTER

*(Continued from p. 89)*

MARINE SUBMERGENCE IN THE HUDSON BAY REGION

Bell, Low, Wilson, Tyrell and others have conclusively proven that a post-glacial submergence occurred in the Hudson Bay region, which covered a vast territory to the east, west, and south. This area is covered by a mantle of marine clays containing many fossils which are identical with those reported from the St. Lawrence Basin.

TABLE 3 gives a list of some of the localities where these marine fossils have been found. The stations of TABLE 3 have been plotted on the accompanying large map and are indicated by solid black circles. Based upon the known fossiliferous areas, the extent of the marine invasion from James Bay has been shown to reach nearly to that of the St. Lawrence Basin. The area indicated is probably not

TABLE 3

Location	Height in feet above sea level		Authority
Round Bay, 125 miles from the mouth of Moose River.....	300	marine shells	Bell (5)
Missinabi Lake and along Missinabi and Moose Rivers.....	300	marine shells	Bell (8) McLean (46)
Nelson river, 54 miles upstream....	200	marine shells	Bell (3, 4)
Nelson river, above the third Lime- stone rapid.....	200	marine shells	Bell (4)
Churchill river, 60 miles from its mouth.....	350	marine shells	McLean (3)
Kenogami river.....	450-500	marine shells	Bell (6, 7)
Little Churchill river.....	60	marine shells	Alcock (1)
Winisk river.....	350	marine shells	McInnes (45)
Mammamemmatawa.....	380	marine silts	Williams (65)

inclusive enough to show the outer margin of submergence, for Low (41), in his work along the east coast of James Bay, discovered sediments and terraces probably of marine origin up to at least 675 feet. In discussing this situation he states: "The evidence of stratified deposits of marine sands and clays along the valleys, near the mouths of the rivers on the east side of Hudson Bay, show that a subsidence of the land over 500 feet (and probably 700) took place after the period of glaciation." Bell (8) further supports this contention, for he says: "On the islands and shores all along the Eastmain coast, the 'raised' beaches are very conspicuous at all heights up to about 300 feet immediately near the sea, but, no doubt, higher ones would be found further inland."

The problem of finding fossil-bearing clays and sands in this region and farther southward is a difficult one due to the ground-cover, which is for the most part boggy or heavily wooded, with considerable accumulation of peat. Even though much of this area has been explored by Canadian geologists, their work has been for the most part concerned with the economic aspects of geology and Pleistocene phenomena have not been thoroughly investigated. Thus, with the difficulties of exploration coupled with lack of interest, it is not surprising that relatively few localities of fossiliferous clays or sands have been reported. For the majority of places given in TABLE 3, we are indebted to the early Canadian geologist, Bell, who, in speaking of the Churchill River says (3): "As the bank continued with the same characteristics for a long distance upstream, I have no doubt that shells may be found at a greater distance inland than that at which they were observed by myself."

It would seem, therefore, justifiable to extend the southern boundary of the marine invasion from the head of Hudson Bay, at least to within a comparatively short distance from the divide. This has been done on the map representing this submergence and the area involved indicated by horizontal lines.

#### DISCUSSION OF THE AREA ACROSS THE HEIGHT OF LAND BETWEEN JAMES BAY AND THE OTTAWA VALLEY

Reference to the accompanying map will show that the region under discussion includes the Lake Temiskaming and Lake Abitibi districts, the two areas separated by the divide, the lowest point of which is 914 feet<sup>1</sup> above sea level and occurs just southwest of Lake Abitibi. Examination of the superficial covering of this intermediate area has shown that the entire region up to altitudes of 1000 feet (35) is overlain by clays which were water-laid, for Coleman (21) has shown that this region was once covered by a vast body of water, which he designated as Lake Ojibway.

On the large map certain elevations are shown which are based upon Fairchild's isobases and which, according to him, are theoretical elevations of marine waters (26, 27). These localities are represented by solid black triangles. TABLE 4 lists the above regions together with their altitudes and approximate locations.

TABLE 4

Location	Approx. Latitude	Approx. Longitude	Height in feet above sea level
Lake St. John.....	48° 30'	72° 15'	1000
Saint Anne River.....	47° 0'	72° 0'	970
Jacques Cartier River.....	47° 0'	71° 30'	950
Saint Lawrence Valley, Quebec.....	46° 50'	71° 10'	925
Montmorency, River Laval.....	47° 0'	71° 0'	940
Chateau Richer.....	47° 10'	70° 50'	925
Montreal.....	45° 30'	73° 50'	840
North River, Sainte Marguerite.....	46° 0'	74° 0'	880
West River, La Chute.....	45° 45'	74° 30'	825
Ottawa.....	45° 30'	75° 50'	700
Mattawa.....	46° 30'	78° 50'	700
North Bay.....	46° 20'	79° 30'	675

The 700-foot isobase extends from the Lake Temiskaming region southeastward along the Ottawa River and passes through Ottawa city. Since marine fossils have been found in the Grenville District, Ontario, up to 735 feet above sea-level (22), it must follow, if Fair-

<sup>1</sup> Elevation taken from "Altitudes in Canada," James White, Commission of Conservation, Canada.

child's isobase for 700 is correct, that the marine waters extended up to and included Lake Temiskaming, since at the present time the altitude of the lake is about 590 feet above sea level. Again, the topography of the Lake Temiskaming region is such as to make this highly probable. The area lies wholly within the Laurentian Plateau and may be divided into three sections: (1), rocky uplands; (2), clay belt; and (3), linear valleys. The linear valleys have been brought about by erosion along planes of faulting, and are probably pre-glacial, for as Wilson says: ". . . they cannot possibly be of post-Glacial origin because stream dissection since the Glacial epoch has been almost insignificant and the valleys are themselves occupied by glacial drift deposited by the ice-sheets. It is also very improbable that they are the result of glacial denudation, for they have no relationship to the character of the rocks they traverse, and they trend, in some cases, at right angles to the direction of ice movement. Since the valleys are neither Glacial nor post-Glacial in their origin, it follows, *a priori*, that they are pre-glacial valleys." The depression occupied by Lake Temiskaming and the Ottawa river between the lake and the village of Mattawa has a length of about 100 miles and a depth, in places, at present only 100 feet above sea level.

The 800-foot isobase extends from the region just north of Lake Temiskaming southeastward, crossing the St. Lawrence just west of Montreal, thence to Sherbrook where the line turns northeast, passing just north of Tring Junction in the Chaudière valley. Between this line and the 900-foot isobase occur many raised beaches, of which the following may be mentioned: that lying slightly to the northeast of Allumette Island at 800 feet; that at Lake Maskinonge at 865 feet; and at St. Jerome at 900 feet. In addition, still higher beaches have been described at Kingsmere Mountain (north of Ottawa) at 965 feet, and at La Chute at 1000 feet above sea level.

The extension of the northern margin of the previously discussed Champlain Submergence toward the north would thus seem justified, if Fairchild's isobases are substantially correct and these raised beaches are of marine origin. In further support of this extension of sea-margin, Taylor says in discussing the limit of post-glacial submergence in the highlands east of Georgian Bay: ". . . the facts show clearly that the same water that filled the ancient channels in the southern highlands extended far to the north and west. It

evidently covered all the lowlands of this region and, as indicated by the altitude of the shore line, made a strait over Lake Nipissing at least twenty-five miles wide and five hundred feet deep, and probably another farther north over the height of land to Hudson Bay." In a later paper Taylor says: "There can be no doubt of the recent presence of wide waters at high levels over Lake Nipissing and the headwaters of the Mattawa river. At the five places seen in the Ottawa valley, however, no clear and certain evidence of high level submergence was found, except, perhaps, the thin silts and clays overlying the drift south of Mattawa, up to about eight hundred feet. This limit for such a deposit would seem to imply a contemporary water surface at a still higher level, and it is more than probable that for a comparatively brief period such an eastward extension actually existed." One more note from Taylor's researches may not be amiss. In speaking of the history of the Great Lakes he says (60): "At their highest level, the Great Lakes had open connection with waters to the east through a broad strait at Nipissing, and it now seems possible that they had another to the northeast. It is not yet proved that these connections were with the ocean, but I believe that the evidence tends more and more strongly toward that conclusion." Coleman (21), in his discussion of Lake Ojibway, admits the possibility of this lake having been united to the sea; for he says ". . . whether any portion of the bed of Lake Ojibway was covered by the sea is uncertain."

#### DURATION OF THE SUBMERGENCES

Antevs (2) has estimated about 30,000 years as necessary for the retreat of the ice sheet from the terminal moraines in New York State to Cochrane, Ontario. The retreat from Stony Lake, Ontario (which on the map included in this paper would be located approximately at latitude  $44^{\circ} 30'$ , longitude  $72^{\circ}$ ) to Mattawa, Ontario, required 13,000 years. According to his map (p. 164), the marine stage in the St. Lawrence Basin was inaugurated at the time the ice sheet stood at Stony Lake. He concludes his studies with the following statement: ". . . the last ice sheets had their greatest extent and began to wane about 40,000 years ago. This figure may be less than 10,000 years too large or too small . . ." If this is approximately correct it may be safely concluded that the ice disappeared from the Hudson Bay region about 35,000 years ago.

Since the retreat of ice from the terminal moraines of New York State to Stony Lake, Ontario, consumed 17,000 years, it follows that the Champlain submergence was inaugurated about 16,000 years B. C. This marine invasion was probably of considerable duration. Taylor (62) has shown in his paper entitled "New Facts on the Niagara Gorge" that the outlet at North Bay, Ontario, was closed by uplift about 3000 years ago. Mather (44) in his studies on the Champlain Sea in the Lake Ontario basin states: "That the uplift of the St. Lawrence region, in greater part at least, lagged considerably after the removal of ice." In further support of the length of life of the Champlain Submergence, Coleman says (20); "This inland sea must have existed for a long period because clay-forming sediments accumulated to a thickness of one hundred and fifty feet or more in some parts of the basin and filled up all the hollows and formed a fairly level sea-floor." Keele (38) substantiates this view, stating that the clay deposits of the St. Lawrence basin vary in thickness up to a maximum of about 200 feet.

In the Hudson Bay region marine fossils have been found up to approximately 500 feet above sea level. The evidence of raised beaches in this area further suggests that the marine waters stood about 700 feet higher than is the case at present. Uplift has thus taken place and, according to Bell (8), at the rate of five to ten feet per century. If uplift has been more or less uniform, the time consumed since this differential elevation began would be between 5000 and 14,000 years. That this land-elevation has been more or less uniform seems to be the case, for Ells (25) found that the thickness of moss and peat increased toward the south as follows: "Eight miles west of Moose Factory the moss and peat was two to three feet thick. Ten miles farther south, two to four feet, forty miles south, four and a half to five feet, sixty miles to eighty miles south, five and a half to six feet and ninety miles south, six to eight feet." It would be fairly safe to conclude, therefore, that at one time during the existence of these two marine invasions they were contemporaneous.

As pointed out earlier in this paper, the Lake Temiskaming and Lake Abitibi regions were also inundated, although perhaps for a shorter period of time than for the two submergences just discussed. Cooke (22) concludes from his studies of the Lake Temiskaming



region that the waters covering this area must have existed at least 2500 years. Furthermore, the clays of the Abitibi district (Lake Ojibway) are, according to Knight, Barrows, Hopkins, and Parsons (39), about seventy feet in thickness. If there is a correlation between the depth of deposition of clay and the length of life of a body of water, it follows that the waters over the height of land existed for a considerable length of time, since as already pointed out, the length of life of the Champlain Submergence was comparatively long, with a clay deposition of about two hundred feet.

From the foregoing discussion it would seem probable that a water-connection existed for at least a short period of time between the St. Lawrence Basin and Hudson Bay.

So far no marine fossils have been found in this intermediate region, although in places diligent search has been made (10). The absence of fossils, however, may be due to the great influx of fresh waters, in this area from the lakes to the west, through the strait at Nipissing and also from the retreating ice front. This influx would have made the waters of the invasion brackish and might have so modified the salt constituents as to have forbidden the presence of marine forms, or at least have reduced their numbers. This fact, supported by the comparatively short life of the probable marine connection, the erosion and the leaching out of the deposits and the possible presence of certain chemicals, which would militate against the preservation of shells, may account for the absence of fossiliferous clays and sands. Furthermore, as already noted, no living marine mollusks have been found in James Bay even though the connection with the sea is direct and the waters of the Bay brackish (9).

From the foregoing studies, it seems evident that it is justifiable to extend the northern margin of the St. Lawrence marine invasion to at least the region of Lake Temiskaming, and the southern margin of the Hudson Bay marine submergence to a point a few miles from the present height of land. Even if the intermediate region was not covered by marine waters, the two sea-margins were close enough to allow ordinary agents of local seed-dispersal to become operative and to bridge the gap, so that plants growing along the shores of the southern waters might establish themselves in the maritime habitats of the northern invasion.

## SUMMARY

If this theory of a marine connection between the St. Lawrence Basin and James Bay is correct, a pathway was open after the recession of the Wisconsin Ice Sheet for the migration of plants of maritime requirements from the south to James Bay along the shores of these inland seas. Two sources of evidence would aid tremendously in establishing this theory: namely, the finding of marine fossils in the intermediate zone and the persistence of some maritime plants in this interior region. As stated above, no fossiliferous marine clays have been found north of Mattawa until the marine deposits are met about one hundred and twenty-five miles south of James Bay.

In only one case have any halophytes been reported from the region under discussion and in this case the identification is open to doubt (35). This lack of halophytes in the interior is more or less to be expected, for unquestionably considerable erosion and leaching of the soil has occurred since the end of the marine stage, which would have changed the edaphic conditions enough to have forced these plants to abandon the region.

Olsson-Seffer (47) has shown that each species of plant has a maximum salt requirement to which it is very accurately adapted and that this maximum cannot be overstepped without fatal results to the plant. Thus, in the case of *Glaux maritima*, 2.7 per cent is the maximum; with *Juncus Gerardi*, 2.2 per cent; with *Triglochin maritima*, 2.6 per cent, and with *Elymus arenarius*, 2.6 per cent. It naturally follows that there must be a minimum salt requirement for halophytes, and since the maximum in most cases is relatively slight, the leaching out of this amount after land-elevation took place would not require a very long period of time. As was noted earlier in this paper, the halophytes under discussion do not now occur in much of the region which was known to have been submerged and whose soil about the margin of the sea unquestionably supported these plants for a time after land-elevation. Svenson (56) has pointed out that the occurrence of several of these maritime plants about the Finger Lakes region of New York State is due to the presence of salt springs, rather than to salt deposits during the Champlain Submergence.

Nevertheless, the occurrence of raised beaches all along the St. Lawrence Basin at altitudes up to 1000 feet, the raised beaches along the east coast of James Bay, the isobases of Fairchild, the depth

of clay-deposits and the occurrence of maritime plants in the Hudson Bay region all lend strong support to the theory that there existed after the Wisconsin glaciation a marine connection between Hudson Bay and the St. Lawrence Basin, and Guppy (34) is probably correct in saying: "The witness of the living plant is often quite as insistent as the testimony of the rocks."

### CONCLUSION

From the above studies the following statements seem justified:

1. A marine invasion occurred in the St. Lawrence Basin after the recession of the Wisconsin Ice Sheet, which probably extended north to include the Lake Temiskaming region.
2. A similar invasion of the sea occurred in the Hudson Bay region contemporaneous with that of the St. Lawrence Basin, which extended southward to within a few miles of the height of land.
3. Evidence seems to indicate that a possible marine connection existed between these two known submergences involving the Lake Abitibi area.
4. Driftless areas have never been found in the Hudson Bay region so that it is improbable that these plants existed within the district during the Wisconsin glaciation.
5. Wind, water and animals do not seem to be the chief factors which brought about the introduction of these halophytes into the Hudson Bay area.
6. The above marine connection (if it existed) would have offered suitable conditions for the migration of halophytic plants along its shores.
7. Undoubtedly the northern margin of the Champlain Sea and the southern margin of the Hudson Bay inundation were relatively close and, even though a marine connection may have been lacking, the factors effecting local plant-distribution may have been sufficient to have bridged the slight gap and thus account for the occurrence of the plants in question in the region of Hudson Bay.

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CONTRIBUTIONS FROM THE GRAY HERBARIUM  
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C.

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BY B. L. ROBINSON.

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RECORDS PRELIMINARY TO A GENERAL TREATMENT  
OF THE EUPATORIEAE—X.

#45850

THERE are here put on record such novelties as have come to the attention of the writer in his further studies of the *Compositae-Eupatorieae* in the course of the past year. To these have been added a few notes on distribution and synonymy. One new species, which is not of the writer's, namely *Stevia setifera* Rusby, hitherto unpublished, is with Dr. Rusby's kind permission here put into print so that it may be duly included in the succeeding revision of the Bolivian members of the genus. Finally, two plants of the Revillagigedo Islands, already described in the Proceedings of the California Academy of Sciences, are here again put on record in order that they may be provided with the Latin diagnoses now essential under the International Rules of Botanical Nomenclature. The sources of the material studied are individually indicated, the well known abbreviations for the different herbaria being the same as those repeatedly employed in earlier papers of this series.

*STEVIA BANGII* Rusby, Mem. Torr. Bot. Club, iv. 209 (1895). In its strikingly unlike yet clearly intergrading forms this constitutes one of the commonest and at the same time most perplexing *Stevias* of the Bolivian Andes. It varies conspicuously in stature, habit, length of internodes, spread of branches, breadth and tothing of leaves, and in the number of pappus-awns. While these features vary somewhat independently, most of the as yet available material of the species (taken in a broad sense) may be divided into two fairly recognizable tendencies, as follows:

Var.  $\alpha$ . **typica**, erecta vel suberecta saepius 2.5–4 dm. alta plerumque multicaulis vel a basi adscendenter ramosa; ramis gracilibus rectiusculis; foliis lanceolatis vel anguste ovato-oblongis plerisque acutis et argute serratis saltem duplo vel triplo longioribus quam latis.—For lit., synonym., exsicc., etc., see *S. Bangii* p. 63.

Var.  $\beta$ . **dyscrita**, var. nov., humilior saepius 1–2 dm. alta; caule flexuoso patenter ramoso; ramis saepius flexuosis vel recurvatis; foliis ovatis obtuse serratis dimidio longitudinis latioribus.—BOLIVIA: near the city of La Paz, alt. 3750 m., *Dr. Otto Buchtien*, nos. 186 in part (TYPE, in Gray Herb.), 3017 (U. S., N. Y.), 3018 at least in large part (U. S.) and 3019 (N. Y., U. S.); on stony hills above La Paz, alt. 3700–3800 m., *Pennell*, no. 14,255 (Gr., N. Y.); on hills, same locality, alt. 4000 m., *Mandon*, no. 246 bis (Gr., N. Y.).

This variety clearly connects on the one hand with the typical upright and narrow-leaved *S. Bangii* and on the other passes con-

tinuously to dwarf high-alpine forms closely simulating both *S. Mandonii* and *S. tarijensis*. While the union of these three species into a confessedly polymorphous aggregate would be a possible solution of the taxonomic problem here presented, they are really too unlike to be convincingly so treated. At least until their geographic relationships are better understood, it seems best to let these species stand. The variety *dyscrita* may be said eminently to justify the name bestowed upon it, which may be rendered as "difficult to define" or "hard to determine."

**S.** (§ **Breviaristatae**) **clivicola**, spec. nov., herbacea perennis suberecta vel paullo basi decumbens 3-4 dm. alta minute incurvo-puberula; caule gracili tereti pallide brunneo inferne simplici mox delapsu foliorum denudato superne ramoso folioso; foliis rameis (caulinis ignotis) oppositis sessilibus vel subsessilibus lanceolatis acutis subintegris chartaceo-membranaceis pallide viridibus 3-nervatis 1.5-2 cm. longis 4-6 mm. latis saepe in axillis proliferis; capitulis 5-floris ca. 12 mm. longis sessilibus vel subsessilibus in glomerulos densos corymbosos aggregatis; involucri squamis lineari-lanceolatis acutis vel subattenuatis purpureo-tinctis dorso incurvo-puberulis; corollis gracilibus, tubo faucibusque vix distinctis atropurpureis glabriusculis ca. 5.2 mm. longis; dentibus limbi ovato-oblongis acutiusculis roseis dorso brevissime strigillosis ca. 1.8 mm. longis; achaeniis subsimilibus 4 mm. longis glabris deorsum decrescentibus; pappo e coronula scariosa dentata 0.5 mm. alta et aristulis 2-4 inaequalibus 1-4 mm. longis composito.—BOLIVIA: La Paz: Prov. Larecaja: temperate region in the neighborhood of Sorata, alt. 3000 m., on the Loma de Canalloquenchana between Laripata and Tani, May 1859, *Mandon*, no. 243 in part (TYPE, in Gray Herb.).

The type number of this species, as issued in the Mandon series, included three clearly diverse species of *Stevia*, the plant here described constituting (in the Gray Herbarium) the major part of the material and being readily distinguished by its narrow gradually pointed and subentire leaves of firm texture. With it are associated scarcely determinate fragments. Of these one has sessile elliptical obtuse entire upper leaves (7-11 mm. long), small heads, obtusish phyllaries with subappressed puberulence, and fully developed pappus-awns about equalling the corolla. The other fragment has shortly petioled crenate-serrate leaves, acute dorsally glandular-puberulent phyllaries, and awnless achenes.

Curiously enough, this number of the Mandon plants was referred without question by Schultz-Bipontinus, Bull. Soc. Bot. Fr. xii. 81 (1865) and *Linnaea*, xxxiv. 535 (1865-66), to *S. suboctoaristata* Lag.,

an alleged Peruvian species said to resemble in habit the Mexican *S. ovata* but to have 7-9-awned pappus. Certainly no part of the confused material which reached the Gray Herbarium under this Mandon number in any way justifies this interpretation of Schultz. No one of the three elements has either habital likeness to *S. ovata* or exhibits a multiaristate pappus.

**S. (§ Multiaristatae) discolor**, spec. nov., verisimiliter herbacea perennis (basi ignota) erecta; caule tereti brunneo-purpureo ca. 4 mm. diametro folioso superne breviter crispeque puberulo tardius glabrato; internodiis plerisque 3-6 cm. longis; foliis (supremis exceptis) oppositis subsessilibus anguste ovatis crenato-serratis vel subintegris ad apicem verum obtusum versus gradatim angustatis basi in partem petioliformem contractis conspicue discoloribus supra viridibus glabris subtus multo pallidioribus fere albidis glabris vel in costa obscure puberulis conspicue punctatis textura firmiter membranaceis 4-5 cm. vel ultra longis 1.5-2 cm. vel ultra latis, parte petioliformi plerumque 5-8 mm. longa; panicula ca. 3 dm. longa 1 dm. vel ultra diametro; capitulis 5-floris ca. 12.5 mm. longis in glomerulos in axi primo et in ramulis adscendentibus gracilibus terminales aggregatis; glomerulis 2.5-3.5 cm. diametro saepius hemisphaericis vel subglobosis; corollis in tubo proprio gracili ca. 2 mm. longo et in faucibus cylindricis ca. 4.5 mm. longis purpureis cum glandulis sparsis subsessilibus ornatis; dentibus limbi lanceolatis ca. 1.5 mm. longis albidis; achaeniis gracilibus 5 mm. longis laeviusculis heteromorphis, eorum 3 (adelphocarpiis) 8-9-aristatis; aristis ca. 5.5 mm. longis paullo hispidulis; achaeniis 2 reliquis (idiocarpiis) squamulis vel aristulis perbrevibus vix 0.2-0.3 mm. longis coronatis exaristatis.—  
BOLIVIA: Prov. Larecaja: "Viciniis Sorata, Iminapi, Milipaya, &c. in silvulis, dumosis, &c., Reg. temp., 2650-3300 m. Jan.-April, 1859," Mandon, no. 242 pro parte (TYPE in Gray Herb., isotype Brl.).

This multiaristate plant was distributed with typical *S. boliviensis* Sch.-Bip. ex Rusby which has pauciaristate achenes, as well as much broader, less discoloured, much more toothed and decidedly petiolate leaves. From the label it is clear that material distributed under this number came from several different stations. The writer is unable to distinguish the *S. Schultzii* of Hieronymus from *S. boliviensis* Sch.-Bip. ex Rusby. Certainly the multiaristate plant here described is quite distinct from both.

**S. (§ Multiaristatae) Herrerae**, spec. nov., habitu et inflorescentia laxa *S. andinae* similis, differt caule folisque glabriusculis nec subvelutinis, foliis rhombeo-ovatis acutis nec obtusis, serratis nec crenatis. Herba 6-9 dm. alta erecta superne glandulari-puberula aliter glabra vel

subglabra; caule (basi paullo lignescenti) subtereti purpurascete brunneo usque ad inflorescentiam foliifero sed inferne aliquando delapsu foliorum nudato; internodiis plerisque 1–2.5 cm. longis; foliis oppositis breviter petiolatis rhombeo-ovatis utroque acutis serratis utrinque glabris 3–3.5 cm. longis ca. 1.5 cm. latis subtus pallidioribus punctatis tenuiter reticulatis a basi 3-nervatis; panicula magna ovoidea folioso-bracteata 3–4 dm. alta. 2 dm. crassa; pedicellis involucrum subaequantibus vel eo 2–3-plo longioribus; capitulis 5-floris ca. 1 cm. longis; involucri squamis anguste oblongis acutis vel acuminatis purpureo-tinctis dorso brevissime (saepe obscure) glandulari-puberulis; corollae tubo et faucibus vix distinguendis gradatim ampliatis ca. 4.5 mm. longis purpureis; limbi lobis oblongis obtusis 1.8–2.5 mm. longis albis dorso hispidulis; achaeniis heteromorphis, eorum 3–4 (adelphocarpis) 8–9-aristatis (aristis purpureis corollam subaequantibus); achaeniis ceteris 1–2 (idiocarpis) 0–1-aristatis.—PERU: Dep. Cuzco: Valle de San Miguel, Machupicchu, alt. 2400 m., *Herrera* (TYPE in Field Mus., phot. and fragm. Gr.). For further exsiccatae see p. 28.

It is a pleasure to name this attractive novelty for its discoverer, Professor F. L. Herrera of Cuzco, who by his personal explorations and by his extensive publications has done much to extend scientific knowledge of the flora of the Department of Cuzco.

**S.** (§ **Multiaristatae**) **Hoppii**, spec. nov., verisimiliter herbacea et perennis (basi ignota); caulibus subteretibus gracillimis (ca. 1 mm. crassis) juventate glanduloso-puberulis; internodiis plerisque 1–3 cm. longis; foliis (supremis reductis exceptis) oppositis lanceolato-ovatis obtusiusculis crenato-serratis basi cuneatim contractis integris subsessilibus utrinque viridibus concoloribus plerisque 2.5–3.5 cm. longis 10–17 mm. latis textura tenuiter membranaceis; corymbis terminalibus planiusculis 2.5–4.5 cm. diametro; capitulis (ca. 14 mm. longis) breviter pedicellatis; involucri squamis oblongo-linearibus viridibus tenuibus glandulari-puberulis 7.5–8 mm. longis; extimis acutiusculis integris; intimis saepius ad apicem subtridentatis (mucro medio in apice retuso); corollae tubo et faucibus vinaceo-purpureis cum glandulis sessilibus instructis; lobis limbi oblongis pallidis; achaeniis heteromorphis 4–5 mm. longis; adelphocarpis 4; aristis pappi 14–16 scabridis purpureo-tinctis ca. 7 mm. longis; idiocarpio exaristato in summo cum corona erosa ca. 0.5 mm. alta ornato.—PERU: Arequipa, on rocks, alt. 2500 m., June 8, 1925, *Werner Hopp*, nos. 3 (TYPE, Brl., phot. Gr.) and 12 (Brl., phot. Gr.). This species in habit somewhat approaches *S. puberula* Hook., but has narrower, thinner, nearly sessile leaves and peculiar slightly trifid inner phyllaries. From *S. Philippiana* Hieron. of northern Chile it differs in its more slender stems and ovate-lanceolate, instead of oblanceolate leaves.

**S.** (§ **Multiaristatae**) **Pearcei**, spec. nov., erecta verisimiliter herbacea et perennis, ca. 0.3–1.8 m. alta (basi ignota); caule tereti purpureo brevissime incurvo-puberulo albo-medullosa folioso; foliis oppositis petiolatis, caulinis ovatis ad apicem obtusiusculum gradatim angustatis crenato-serrulatis supra puberulis subtus incurvo-puberulis utrinque viridibus textura membranaceis ca. 4 cm. longis et 3 cm. latis; petiolo gracili ca. 1 cm. longo; capitulis ca. 9 mm. longis sessilibus in glomerulos plerumque 1–2.5 cm. diametro ad apices ramorum elongatorum paniculae approximatos congestis; involucri squamis lineari-lanceolatis viridibus sed saepe purpureo-tinctis 6 mm. longis acutis et saepe mucronatis dorso incurvo-puberulis et cum glandulis sessilibus ornatis; corollis albis, tubo proprio 1 mm. longo et faucibus subcylindratis 3.5 mm. longis et limbi lobis ovalibus apice rotundatis omnibus cum glandulis sessilibus sparsis instructis; achaeniis heteromorphis; 4 adelphocarpiis quibusque 6–7-aristatis, aristis corollas paullo superantibus, idiocarpio calvo.—PERU: Dep. Huanuco: common on waste ground, dry hillsides, etc., Huanuco, Muña, &c., *R. Pearce*, no. 104 (K., phot. and small fragm. Gr.).

**S.** (§ **Breviaristatae**) **Pennellii**, spec. nov., habitu et pappo *S. anisostemmati* subsimilis, differt foliis grossius et acutius serratis nec crenato-serratis, capitulis majoribus, achaeniis longioribus. Herbacea perennis decumbens; caule tereti gracili folioso atropurpureo ca. 2 mm. diametro incurvo-puberulo et ad corymbum versus etiam glandulari-puberulo; internodiis plerisque 1.5–5 cm. longis; foliis oppositis subsessilibus sed caulinis mediis et inferioribus ad basin versus in partem integram petioliformem cuneato-alatam subabrupte angustatis, margine serratis (dentibus subacutis minutissime ciliolatis); foliis ovatis textura subcoriaceo-membranaceis utrinque glabris vel juventate obsolete hirtellis ca. 3 cm. longis ca. 1.7–1.9 cm. latis acutis vel (inferioribus) obtusis; corymbo terminali trifido; glomerulis campanulatis planiusculis densis 1.5–2.5 cm. diametro; capitulis 12–15 mm. longis 5-floris sessilibus; involucri squamis atropurpureis oblongo-lanceolatis acutis dorso glandulari-puberulis; corollae tubo proprio purpureo gracili 1 mm. longo; faucibus distincte ampliatis subcylindratis ca. 4 mm. longis purpureis; dentibus limbi 5 ovato-oblongis subacutis albis vel roseo-albidis 2–3 mm. longis; achaeniis homomorphis gracilibus 5–6 mm. longis sublaevibus; pappi e squamis paucis scariis exaristatis acutis vix 0.7 mm. longis et squamis 1–2 aristuliferis ca. 2 mm. longis composito.—PERU: Dept. of Cuzco: grassy slope, edge of páramo, alt. 3800–3900 m., Paso de Tres Cruces, Cerro de Cusilluyoc, May 3, 1925, *Dr. Francis W. Pennell*, no. 13,883 (TYPE, in Gray Herb., isotype Field Mus.).

This species must be attractive by reason of its dark purple involucre and conspicuous white or pink corolla-limb. It is a pleasure to name it for its discoverer who has contributed by his indefatigable exploration very extensively to the knowledge of the cordilleran floras of South America.

*S. PHILIPPIANA* Hieron. in Engl. Bot. Jahrb. xl. 364 (1908). *S. menthaefolia* Phil. Fl. Atac. 203 (p. 29 of reprint) 1860, not Sch.-Bip. As pointed out in Contrib. Gray Herb. lxxxv. 123 (1929) this species of northern Chile presents merely the broader-leaved form of a plant which without other change of importance displays a considerable and continuous variation in leaf-breadth and which, as it passes to its narrower-leaved forms, becomes what Philippi, l. c., described as his *S. hyssopifolia*, a name maintained by Robinson, Contrib. Gray Herb. lxxxv. 122 (1929), who was then following the Vienna Rules which still permitted the use of a later homonym in cases where the earlier had been completely abandoned. However, in accordance with the subsequent vote passed at the Cambridge International Congress, it becomes needful to alter this procedure and give up the name *S. hyssopifolia* Phil. (1860) since it was antedated by *S. hyssopifolia* HBK. (1820) even though the latter has at present no validity. Apparently the next available name for the species of northern Chile is *S. Philippiana* Hieron., which must therefore be taken up as above both for the form with oblong-lanceolate leaves which Philippi called *S. menthaefolia* and the linear-leaved form which he named *S. hyssopifolia*.

A pubescence-variation is perceptible and was indicated by Robinson, l. c. With corrected nomenclature the varieties under the specific name *S. Philippiana* are var. **typica** with phyllaries covered with a minute gland-tipped puberulence and ciliation, glandless hairs being few and obscure or none, and var. **panulensis** (*S. hyssopifolia*, var. *panulensis* Robinson, l. c. 123) comb. nov., with phyllaries (at least the outer) sparsely long-pilose with jointed attenuate glandless white hairs, as well as a few practically sessile glands.

**S.** (§ **Multiaristatae**) **punensis**, spec. nov., herbacea perennis, erecta vel paullo decumbens, 2-2.6 dm. alta, obscure brevissimeque glandulari-puberula; caule inferne simplici a delapsu foliorum nudato, superne breviter subfastigiatis paucirameo, folioso; internodiis plerisque 8-20 mm. longis; foliis oppositis breviter petiolatis (supremis sessilibus) rhombeo-ovatis acuminatis basi cuneatis integris aliter serrulatis (dentibus parvis numerosis saepius utroque 12-14) supra vix puberulis infra multo pallidioribus glabris punctatis 3-3.6 cm. longis 1-1.5 cm. latis; inflorescentiae fastigiatis ramosae ramulis

glandulari-puberulis; capitulis sessilibus vel breviter pedicellatis ca. 15 mm. longis; involucri squamis lanceolato-linearibus acutis vel attenuatis dorso vix puberulis sed cum glandulis sparsis sessilibus ornatis ca. 7 mm. longis; corollis albis inferne paullo glandulari-puberulis, lobis limbi ca. 2 mm. longis; achaeniis heteromorphis; adelphocarpis 3, quoque 10-12-aristato, aristis corollas subaequantibus scabridis purpurascensibus; idiocarpis 2, eorum altero exaristato squamulis solis coronato, altero squamulis et 2-3 aristulis inaequalibus corolla distincte brevioribus ornato.—PERU: Dep. Puno: in high meadows with scattered shrubs and locally called "educhuiña," Cuyocuyo in the Prov. Sandia, alt. 3700 m., *Weberbauer*, no. 850 (Brl., phot. and fragm. Gr.).

**S.** (§ **Multiaristatae**) **sarensis**, spec. nov., herbacea erecta perennis superne adscendenter ramosa, habitu *S. breviaristatae* similis sed heterocarpa et multiaristata; radice densissime fasciculata fibris ex caudice brevi lignoso plerisque simplicibus paullo incrassatis; caule tereti folioso ca. 4 mm. diametro pallide brunneo pilis longiusculis moniliformibus albis crispis ornato; internodiis inferioribus saepe brevibus (6-14 mm. longis), mediis et superioribus longioribus (2.5-8.5 cm. longis); foliis oppositis rhombeo-ovatis vel anguste deltoideo-ovatis crenato-serratis (dentibus numerosis parvis 1-2 mm. altis) apice gradatim acutatis ad basin versus integris primo abrupte contractis deinde acuminate in petiolum alatum gradatim angustatis (basi petioliformi inclusa) 6-9 cm. longis 2-4 cm. latis textura membranaceis vix discoloribus utrinque pilosis supra basin 3-nervatis; laminae parte latiori plerumque 5-7 cm. longo, parte petioliformi saepius 1.5-2 cm. longa; capitulis 5-floris sessilibus vel subsessilibus in glomerulos paniculatim dispositos aggregatis 1 cm. longis; involucri squamis linearibus acutis vel acuminatis dorso breviter laxaque pilosis; corollis (post exsiccationem) tubo ca. 2 mm. longo et faucibus ca. 2.5 mm. longis sparse granulatis flavido-brunneis, dentibus limbi ca. 0.8 mm. longis albidis hispidulis; achaeniis gracilibus nigrescentibus 2.6-3.5 mm. longis in angulis paullo hispidulis heteromorphis; eorum 4 (adelphocarpis) ca. 11-aristatis; aristis flavido-albidis breviter barbellatis ca. 6 mm. longis; achaenio quinto (idiocarpio) inaequaliter ca. 4-aristatis et cum squamulis (vix 0.4 mm. longis) coronato, aristo uno corollam subaequante, ceteris multo brevioribus (3-4 mm. longis).—BOLIVIA: Department Santa Cruz: Province Sara: in clearing, Buena Vista, alt. 450 m., Apr. 7, 1925, *Steinbach*, no. 7048 (TYPE, in Gray Herb., isotypes in herb. Bot. Mus. Berlin-Dahlem, Gen., K., Field Mus., Mo.); Buena Vista, alt. 500 m., July 4, 1924, *Steinbach*, no. 6117 (K., Gen., Brl., phot. Gr.); clearings, Buena Vista, alt. 450

m., Mar. 1915, *Steinbach*, no. 1143 (Brl., phot. Gr.); low woods, Buena Vista, alt. 800 m., Dec. 9, 1920, *Steinbach*, no. 5169 p. p. (hb. Osten).

This species of § *Multiaristatae*, with heterocarpous character and many-awned adelphocarps, distinctly recalls the common Argentine *S. breviaristata* Hook. & Arn., but of course is to be readily separated by its very different pappus as well as in various minor traits. It is perhaps even more closely related to *S. menthaefolia* Sch.-Bip. to which its variety of laxer inflorescence was referred by Hieronymus when determining the plants of Kuntze, but it has a looser and usually longer pubescence, somewhat thinner leaves with a more deltoid tendency to the expanded part of the blade and a much longer petioliform base. The leaves are also much more disposed to darken to brown in drying, while in the Brazilian plant they remain green or nearly so. There seems little doubt that the two plants are at present best treated as distinct species and of course they are rather widely separated geographically.

*S. sarensis* shows two varietal tendencies readily distinguishable in most cases.

Var.  $\alpha$ . **typica**, capitulis plerisque sessilibus vel obscure breviter pedicellatis in glomerulos ad apices ramulorum paniculae subcorymbosae aggregatis.—Distribution and exsiccatae as above stated.

Var.  $\beta$ . **dissiticeps**, var. nov., inflorescentia laxiori capitulis plerisque plus minusve evidenter pedicellatis in ramulorum paniculae subracemose dispositis.—*S. menthifolia* of Kuntze's Rev. Gen. iii. 180 (1893), not *S. menthaefolia* Sch.-Bip.—BOLIVIA: Dept. Santa Cruz: Prov. Cercado: in clearings, Bañado del Piray, alt. 450 m., July 16, 1924, *Steinbach*, no. 6248 (TYPE, in herb. Bot. Mus. Berlin-Dahlem, phot. and small fragm. Gr.); Prov. Sara: moist woods of the Pampa, Buena Vista, alt. 500 m., Dec. 9, 1920, "forma raudales sobre arbustos de 2-4 metros," *Steinbach*, no. 5169 p. p. (Gr., N. Y.); Prov. Sara: Pampobosque, alt. 450 m., Apr. 10, 1916, *Steinbach*, no. 2790 (Brl.); Camino, Prov. Buenavista, alt. 450 m., Mar. 1915, *Steinbach*, no. 1126 (Brl.); Dept. Santa Cruz, Apr. 1892, *Kuntze* (N. Y., U. S., phot. Gr.).

**S.** (§ *Multiaristatae*) **setifera** Rusby, in herb., herbacea perennis vel fortasse frutescens (basi ignota); caule tereti medullosa purpureo breviter incurvo-puberulo; inflorescentia dense glandulari-puberula; foliis oppositis, caulinis petiolatis ovatis vel ovato-lanceolatis acutis vel attenuatis serratis (basi rotundata vel gradatim angustata integra excepta) membranaceis supra incurvo-puberulis subtus pallidioribus et laxe in nervis pilosis ca. 4 cm. longis et 2 cm. latis, rameis minoribus



lanceolatis; capitulis 12–15 mm. longis sessilibus vel subsessilibus in glomerulos minores dispositis; his aut in glomerulos majores campanulatos vel hemisphaericos aggregatis aut ad apices inflorescentiae compositae corymboso-paniculatae versus sublaxe segregatis; involucri squamis anguste oblongis acutis vel obtusiusculis saepe purpureo-tinctis dense cum glandulis breviter stipitatis et saepe pilis paucis patentibus eglandulosis ornatis; corollae tubo proprio (ca. 2 mm. longo) et faucibus subcylindricis (ca. 5 mm. longis) purpureis a glandulis subsessilibus instructis; dentibus limbi albis vel fortasse roseis; achaeniis heteromorphis, 3 adelphocarpiis 7–11-aristatis, achaenio intergradienti unico 3–4-aristato, idiocarpio corona scariosa erosa vel dentata instructo.—BOLIVIA: Dep. Larecaja: Prov. Murillo: dry hillside, Pongo, alt. about 3500 m., *Dr. O. E. White*, no. 168 (TYPE, in herb. N. Y. Bot. Gard., isotype, Gr.).

For citation of further exsiccatae see p. 61.

Dr. H. H. Rusby, finding this novelty among the collections secured by the Mulford Expedition, has most kindly permitted its publication in the present paper.

*S. SORATENSIS* Hieron. in Engl. Bot. Jahrb. xxviii. 560 (1901). Of this species three varieties may now be distinguished as follows:

Var.  $\alpha$ . **typica**, involucri squamis dorso dense patentisque glandulari-puberulis; pappo e squamis brevibus solis plus minusve connatis composito omnino exaristato.—For distribution and exsiccatae see pages 26 and 47.

Var.  $\beta$ . **SUBEGLANDULOSA** Hieron., involucri squamis dorso cum pilis albis eglandularibus incurvis vel crispis ornatis cum vel absque glandulis paucis sessilibus vel subsessilibus intermixtis; pappo ut apud var. *typicam* squamiformi et exaristato.—Hieron. in Engl. Bot. Jahrb. xl. 359 (1908).—For further literature, synonymy, distribution and exsiccatae see page 48.

Var.  $\gamma$ . **mecoyensis**, var. nov., involucri squamis dorso ut apud var. *subeglandulosam* cum pilis albis incurvis vel crispis eglandularibus ornatis; pappo cujusque achaenii e squamis brevibus plus minusve connatis et aristis corollas subaequantibus duabus composito.—BOLIVIA: Dept. Tarija: Red Hills, Mecoya, alt. 2745–3050 m., April 1864, *Pearce* (TYPE, in herb. Kew, phot. and small fragm. Gr.).

**Eupatorium** (§ **Cylindrocephala**) **Bartlettii**, spec. nov., fruticosum glaberrimum; ramis ramulisque oppositis flexuosis teretibus post exsiccationem tenuiter multicostulatis; foliis oppositis graciliter petiolatis oblongis vel ovato-oblongis ad apicem verum obtusiusculum vel rotundatum acuminatis integris vel paullo crenato-undulatis basi

obtusis utrinque viridibus et sublucidis a puncto bene supra basin 3-nervatis plerisque 8–11 cm. longis 4–5 cm. latis textura subchartaceo-membranaceis; petiolo 1.3–1.7 cm. longo; capitulis 5-floris sessilibus in glomerulos paucos laxè paniculatim dispositos plerosque 3–10-capitulatos congestis; involucri squamis ca. 15 albido-viridibus obtusis ca. 4–5-seriatim imbricatis dorso glabris striatis ad apicem versus puberulis; corollis albis glabris graciliter cylindratis; achaeniis (valde immaturis) 1 mm. longis ut videtur glabris; pappi setis ca. 45 albis corollas aequantibus vel paullo superantibus.—BRITISH HONDURAS: San Antonio, May 6, 1931, *H. H. Bartlett*, no. 13,068 (TYPE, in herbarium of the University of Michigan, phot. and fragm. Gr.).

So far as known to the writer there are but two other Central American Eupatoriums of § *Cylindrocephala* which have about 5-flowered heads. These are *E. sexangulare* (Klatt) Robinson and *E. psoraleum* Robinson. Both of these have their branches (or at least branchlets) distinctly angled and their leaf-blades acute to acuminate at base, thus being distinguishable from the species here described.

It is a pleasure to associate with this interesting plant the name of its discoverer, Professor H. H. Bartlett of the University of Michigan, whose courage and diligence in penetrating several of the less explored parts of Mexico and Central America have brought to scientific attention this and other novelties.

**E. (§ *Cylindrocephala*) *bathyphelebium***, spec. nov., ut videtur suffruticosum vel vere fruticosum; ramulis teretibus foliosis brevissime fusco-puberulis; foliis oppositis subsessilibus lanceolatis basi subpetioli-forme angustatis integris infra mediam partem latissimis ad apicem (obtusiusculum) gradatim angustatis obscure remoteque crenatis margine valde revolutis 3.5–5.5 cm. longis 6–10 mm. latis rigidule coriaceis supra bullatis utrinque glaberrimis subtus crebre puncticulatis; corymbis paullo convexis densiusculis puberulis; capitulis sessilibus saepissime binis vel trinis gracilibus 8 mm. longis 2.5 mm. crassis ca. 8-floris; involucri cylindrati squamis ca. 5-seriatim imbricatis brunnescentibus apice rotundatis dorso glaberrimis vel obsolete granulato-puberulis; flosculis ex involucrio vix exsertis; corollis ca. 4 mm. longis cylindratis; achaeniis deorsum decrescentibus 3 mm. longis atrobrunneis in angulis parce hispidulis.—VENEZUELA: Amazonas Territory: Cerezo Yapacana, upper Orinoco River, alt. about 1000 m., April, 1931, *E. G. Holt* & *E. R. Blake*, no. 711 (Gr.). This highly characteristic and interesting novelty was submitted by the National Herbarium to which it had been presented by the National Geographic Society. Its small narrow subentire glabrous leaves readily distinguish it from any of the other few-flowered species of § *Cylindrocephala*. The name

alludes to the veins of the leaves, these being conspicuously depressed on the upper surface.

**E. (§ Subimbricata) cuchabense**, spec. nov., herbaceum vel suffruticosum erectum ad 1 m. altum post exsiccationem fuscescens; caule subtereti medullosa mox glabrato post exsiccationem paullo costato-angulato; internodiis plerisque 3.5–14 cm. longis; foliis oppositis ovato-lanceolatis caudato-attenuatis et acuminatis argute serrulatis (dentibus vix 0.5 mm. altis cuspidiformibus inter se 3–6 mm. distantibus) basi gradatim attenuatis subsessilibus anguste perfoliatis 10–16 cm. longis 3–4 cm. latis tenuibus subregulariter penniveniis utrinque glabriusculis vel glaberrimis; inflorescentia terminali subpyramidata multicapitulata minute fulvescente crispe puberula; ramulis et pedicellis saepe arcuatis; capitulis ca. 40-floris ca. 8 mm. altis primo in glomerulos congestis tardius bene pedicellatis; involucri squamis ca. 3-seriatim laxe imbricatis plerisque anguste lanceolatis vel linearibus dorso striatis acutis vel acutiusculis subglabris; corollis gracillimis ad limbum versus laete purpureis; dentibus limbi brevissimis; styli ramis filiformibus; achaeniis glabris nigrescentibus ca. 1.8 mm. longis; pappi setis tenuissimis lutescente albidis corollam aequantibus; disco paullo convexo ut videtur glaberrimo.—ECUADOR: Province of Esmeraldas, on the Cuchabi River, August, 1904, *Father Sodiro*, no. 15 (TYPE, in Bot. Mus. Berlin-Dahlem, phot. and small frag. Gr.).

This plant so closely resembles in general habit *E. nemorosum* Klatt that it was at first regarded as a possible form of that species. However, its heads are about 40-flowered, while in *E. nemorosum* they are mostly 100–200-flowered. The plant is here much smoother, the indument even on the inflorescence being merely a minute fulvescent crisped or incurved puberulence, while in *E. nemorosum* it is a longer, more spreading and much paler pilosity. The leaves are here less definitely provided with a winged petioliform base and are much more finely and sharply toothed than in *E. nemorosum*. The corollas of *E. cuchabense* are clearly purple while in *E. nemorosum* they are white or nearly so. Finally no hairiness, even of the shortest and most obscure, has been found on the disk in *E. cuchabense* while in *E. nemorosum* it is ordinarily to be observed. Therefore, there seems no reason to doubt that the plant represents a distinct species.

**E. (§ Subimbricata) fragile**, spec. nov., habitu laxum, aspectu primo glabrum sed superne obscure minuteque puberulum; caule gracili tereti fragilissimo primo purpureo ad basin lignescenti; internodiis plerisque 1–9 cm. longis; ramis oppositis longis flexuosis foliosis; foliis oppositis graciliter petiolatis subchartaceo-membranaceis ovatis

acutis grosse serratis basi subtruncatis juventate pubescentibus maturitate solum obscure in nervis venisque hirtellis supra aetate rugulosis sublucidis subtus vix pallidioribus opacis impunctatis a basi 3-nervatis 3-4.4 cm. longis 1.5-2.3 cm. latis; petiolo plerumque 8-14 mm. longo; corymbis ramos terminantibus convexis subdensis paucicapitulatis; capitulis ca. 20-floris pedicellatis ca. 7 mm. longis; involucri squamis valde inaequalibus ca. 3-seriatim imbricatis post exsiccationem atropurpureis, extimis brevibus lanceolatis acutis hirtellis, intermediis anguste ovato-oblongis acutis, intimis longioribus lineari-oblongis apice rotundatis glabris; corollis albis glabris 3.2-3.7 mm. longis; achaeniis gracilibus atrobrunneis 2.5 mm. longis, angulis pallidis sursum scabratis; pappi setis 25-30 delicatulis albis corolla brevioribus.—PERU: sunny cañon rock-ledges, alt. about 2750 m., very fragile, from a woody caudex, Mito, July 8-22, 1922, *Macbride & Featherstone*, no. 1585 (TYPE, in Field Mus., isotype Gr.). Style-branches and phyllaries said in nature to be pink, though after drying the former are most often a yellowish or brownish white and the latter a dark violet purple. Perhaps as close to *E. callacatense* Hieron. as to any Peruvian *Eupatorium* heretofore described, but readily distinguished by its acute to acuminate outer phyllaries and its firmer, smaller, at length bullate and nearly glabrate leaves.

**E.** (§ **Subimbricata**) **gentianoides**, comb. nov., *Brickellia gentianoides* Robinson, Contrib. Gray Herb. lxxviii. 42 (1923). Further and manifestly conspecific material of this plant, shown by the subsequent and more copious collections of Bornmüller, no. 515, and of Dusén, no. 14,611, makes clear the fact that the ribs of the achenes examined in the original specimen (collected by Saint-Hilaire) were more numerous than ordinarily occur in the species. The later examined material of the plant has often 5-angled achenes, quite typical of *Eupatorium*, and wholly lacks the intermediate ribs. It thus appears that the greater number of ribs first observed in the Saint-Hilaire material was of an exceptional and non-characteristic nature. The occurrence of intermediate secondary ribs is not without precedent in the great genus *Eupatorium*. As *Brickellia gentianoides* shows no close habital similarity to any other *Brickellia* and is geographically remote from the genus as a whole, it now appears best not to maintain the species longer in that genus, since the single technical character (the number of ribs of the achenes) because of which it was originally referred to *Brickellia*, has proved inconstant and untrustworthy.

**E.** (§ **Subimbricata**) **hosanense**, spec. nov., fruticosum glaberrimum 2-3 m. altum; caule subtereti brunneo post exsiccationem

paullo costulato; internodiis plerisque 3–4.5 cm. longum; foliis oppositis graciliter petiolatis ovatis crenato-serratis vel argute serratis obtusis vel breviter acuminatis basi obtusis vel rotundatis vel subcordatis supra basin pinnatim 5-nervatis textura firmiter membranaceis utrinque glabris viridibus subtus paullo pallidioribus 5–9 cm. longis 3.5–6 cm. latis; petiolo plerumque 2.5–5.5 cm. longo; panicula terminali corymbiformi convexa 15 cm. diametro densiuscula; capitulis ca. 30-floris ca. 8 mm. longis graciliter pedicellatis; involucri brevis campanulati ca. 3-seriatim imbricati squamis ca. 17 ovalibus obtusis glabris dorso striatis margine subscareosis minute erosis; corollis ca. 4 mm. longis roseo-albis; achaeniis gracilibus glabris 2.5 mm. longis; pappi setis ca. 20 albis tenuissimis corollam aequantibus.—BOLIVIA: Department Santa Cruz: Rio Blanco, Cerro Hosana, alt. 1200 m., Aug. 12, 1917, *J. Steinbach*, no. 3368 (TYPE, in herb. Bot. Mus. Berlin-Dahlem, phot. and small fragm. Gr.). This species appears to have no close relative among the Bolivian Eupatoriums thus far recorded, nor has it been possible to place the plant satisfactorily in any of the species of the adjacent countries.

**E. inulaefolium** HBK. forma **lasiophlebium**, forma nova, habitu formis *typicae* et *suaveolenti* simile differt indumento; caule ramisque dense pilosis, pilis tenuissimis moniliformibus attenuatis purpureo-articulatis patentibus vel paullo dejectis; foliis tenuibus utrinque viridibus supra sparse papilloso-hirtellis subtus in nervis venisque lasio-pilosis in areolis glabris.—BRAZIL: in campo, Serra do Itatiaia, ca. 2100 m., May 20, 1902, *P. Dusén*, no. 1161 (TYPE, in herb. Bot. Mus. Berlin-Dahlem). Though closely sharing the habit, inflorescence, and floral characters of the common, widely distributed, and variable species *E. inulaefolium* HBK. (as broadly interpreted by Hieronymus) this plant has a marked difference of indument. The hairs of its stem and branches are much longer, more clearly jointed, and purple-tinged, while on the lower surface of the leaves only the nerves, veins, and veinlets are hairy, the enclosed areolae being entirely glabrous, which is rarely if ever the case in the typical form or in forma *suaveolens*.

**E. (§ Eximbricata) pacificum** Robinson, fruticosum breviter pilosum; caulibus erectis vel saepius curvato-adscendentibus superne ramosis brunneis subteretibus; medulla alba; internodiis 3–10 cm. longis; pilis brevibus patentibus gracilibus attenuatis nodulosis; foliis oppositis graciliter petiolatis deltoideo-ovatis acuminatis patententer dentatis sed ad basem late cordatam vel subcordatam versus integris utrinque viridibus primo aspectu glabris sed in nervis venisque pilosiusculis subtus paullo pallidioribus tenuiter immerseque reti-

culatis membranaceis 2.5–9 cm. longis 2–7 cm. latis, dentibus limbi 1.5–3 mm. altis 2–6 mm. basi latis apice subacutis vel obtusis vel rotundatis; petiolo patenter pilosiusculo 1–5 cm. longo; corymbis compositis oppositirameis foliaceo-bracteatis; capitulis ca. 40-floris; involucri squamis subaequalibus lanceolato-linearibus acutis 2–3-seriatim laxe imbricatis maturitate ca. 5 mm. longis, exterioribus dense pilosiusculis; corollis albis laeviusculis, tubo proprio gracili 2 mm. longo; faucibus anguste campanulatis 1–1.3 mm. altis; achaeniis nigris argute angulatis lucidulis 1.5–2 mm. longis sursum et deorsum paullo attenuatis praecipue in angulis saepe hispidulis; pappi setis ca. 20 albis tenuibus vix scabratis corollam subaequantibus.—Proc. Calif. Acad. Sci. xx. 99 (1931)—SOCORRO ISLAND, May 27–July 3, 1903, *F. E. Barkelew* (Univ. Calif.); shrub at summit of Socorro Island, May 8, 1925, *Herbert L. Mason*, no. 1666 (TYPE, Calif. Acad. Sci., ISOTYPE, Gray Herb.).

For some years this species has been known to the writer from Mr. Barkelew's specimens which were too immature to justify description. The plant has again been collected by Mr. Mason. His material is so overmature as to have shed nearly all its florets. However, it is clearly identical with that previously obtained by Barkelew and together the two collections yield characters sufficient to show the plant an undescribed endemic species. In many respects it is similar to *E. pazcuarensis* HBK. and *E. conspicuum* Kunth & Bouché, both of southern-central Mexico. From the former it differs in its much greater lignescence and its more deltoid-ovate distinctly cordate leaves which are 3-nerved from the very base. From the latter it may be readily distinguished by its somewhat coarser and more spreading pubescence, shorter petioles and by its leaf-blades which are nerved from the very base, much less toothed toward the base, and not disposed to be decurrent upon the petiole.

**E. (§ Campanuloclinium) phlebodes**, spec. nov., ut videtur herbaceum robustum erectum virgatum 7 dm. vel ultra altitudine (basi ignotum); caule tereti post exsiccationem costulato 7 mm. diametro folioso glandulari-puberulo et sparse setuloso; foliis oppositis et saltem in parte superiori caulis alternis sessilibus late ovatis apice subacutis margine crenato-serratis basi cordatis vel rotundatis utrinque scabris fere a basi 5-nervatis venosissimis textura firme coriaceis subtus paullo pallidioribus 6–7.5 cm. longis 3.5–5.2 cm. latis; corymbo terminali convexo ca. 1.4 dm. diametro glanduloso-puberulo; pedicellis saepe curvatis vel paullo flexuosis plerisque 1–2.5 cm. longis, capitulis maturis ca. 1.5 cm. altis et crassis; involucri squamis subaequalibus ca. 2-seriatim laxe imbricatis oblanceolatis

acutis ca. 1 cm. longis et 2–3 mm. latis dorso praesertim ad basin versus hispidulis; corollis gracilibus limbo brevi hispidulis; achaeniis atrobrunneis deorsum attenuatis saepe curvatis ubique paullo granulatis ca. 5.5 mm. longis; pappi setis corollam subaequantibus salmoneo-albidis barbellatis.—PARAGUAY: being a portion of inharmonious material distributed in Dr. Hassler's important series as no. 10,178, said to have been collected by *Mr. T. Rojas*, on the plateau and slopes of the Sierra de Amambay in February, 1908.

This number (10,178) was the one on which Dr. Hassler in Fedde Rep. Spec. Nov. xi. 173 (1912) based his *E. estrellense* which he clearly described as a small-leaved plant of quite different nature and which he later reduced, in Fedde Rep. Spec. Nov. xiv. 289 (1916), to a variety of *E. lysimachioides* Chod. with which it agrees in all essentials. Of no. 10,178 the writer has examined in all three sheets. Of these one, in the herbarium of Mr. Cornelio Osten of Montevideo, corresponds perfectly with Dr. Hassler's characterization of his *E. estrellense*, while the other two, of which one is in the herbarium of the British Museum of Natural History and the other in Mr. Osten's herbarium, are both of the exceedingly different plant here described as *E. phlebodes*. Of these two sheets the one at the British Museum may be selected as the TYPE (phot. in herb. Gray), the one in Mr. Osten's herbarium thus becoming an isotype.

As there evidently has been some confusion in the sorting, numbering, or labeling of these sheets of no. 10,178 there is naturally doubt whether the data on the label applies. However, there can be a reasonable assumption that both elements distributed under this number were collected by Mr. Rojas on his memorable journey into northern Paraguay in 1907–8.

*E. TUCUMANENSE* Lillo & Robinson, Contrib. Gray Herb. xc. 32 (1930). When characterized this species was known only from the Province of Tucumán in Argentina. It is now possible to record a Bolivian station as follows: Rio Blanco, Cerro Hosana, Dept. Santa Cruz, Boliva, alt. 1300 m., Aug. 12, 1917, a plant 2–3 m. high, with pinkish white flowers, *Steinbach*, no. 3367 (Brl.).

**Mikania** (§ **Racemosae**) **chocensis**, spec. nov., fruticosa subscandens ad 6–7 m. longa glaberrima; caule tereti post exsiccationem costulato; internodiis 1–1.4 dm. longis; foliis oppositis petiolatis oblongis integris caudato-acuminatis basi acutis pallide viridibus supra basin pinnatim 5-nervatis subtus paullo pallidioribus 10–11 cm. longis ca. 4 cm. latis; nervis venisque supra subimpressis subtus prominulentibus; petiolo brunneo ca. 2 cm. longo; appendicibus stipuliformibus amplexicaulibus lunulatis ca. 2–3 mm. altis crassius-

culis margine cuspidato-denticulatis; panicula terminali magna diffusa; capitulis maturis 6–7 mm. longis graciliter pedicellatis racemose in ramis ramulisque paniculae dispositis; bracteola ad basin pedicelli affixa subulata brevi saepe recurvata; involucri squamis oblongis apice rotundatis ciliolatis dorso brunnescentibus vix nervatis ca. 3 mm. longis; corollis albis glabris tubo proprio gracili 1.5 mm. longo; faucibus subcylindrati-campanulatis ca. 1.5 mm. longis; dentibus limbi ca. 0.5 mm. longis; achaeniis atrobrunneis glabris 2.5 mm. longis; pappi setis ca. 25 lutescenti-albidis corollam subaequantibus.—COLOMBIA: Intendencia del Chocó: between La Oveja and Quibdó, Apr. 1, 2, 1931, *W. A. Archer*, no. 1706 (TYPE, U. S. Nat. Herb., phot. and fragm. Gr.).

Said to be common and to clamber twenty feet and to bear the local name of "Blumella." This species, belonging to the relatively small series of *Racemosae*, may be placed near the little known *M. fragrans* Klatt of Antioquia, but differs clearly in its caudate-acuminate leaves of paler and duller aspect and somewhat different venation, also by its stipular appendages—structures not present in *M. fragrans* so far as known.

*M. punctata* Klatt, Bull. Soc. Bot. Belg. xxxi. 195 ("1892" [1893]). This name, in recent years, has been applied to a fairly common and widely distributed species of *Mikania* ranging from Mexico to Bolivia and Brazil. The writer noticed some years ago that this somewhat widely used name was, in fact, a later homonym of a *Mikania punctata* Gardner of Brazil (Gard. in Hook. Lond. Journ. iv. 118 (1845)), but as the latter was generally reduced to synonymy it was not felt needful on its account to displace the later name, for the Vienna Rules did not insist upon the renaming of a later homonym if the earlier one had been universally relegated to synonymy. The later rules of nomenclature resulting from the International Congress at Cambridge require such renaming of the later homonym, even where the earlier has been submerged in synonymy. Therefore it becomes necessary to rename *M. punctata* Klatt. For this purpose it is possible to raise *M. boliviensis* Lingelsheim from synonymy, as it seems to have been applied to a plant certainly conspecific with *M. punctata* Klatt. It is true that the types from Mexico and Bolivia, if closely compared, show some minor differences, but these break wholly when the material, now available for the species as a whole, is critically examined.

Hieronimus once referred to the southern Brazilian *M. vitifolia* DC. Lehmann material from Colombia which is clearly identical with *M. punctata* Klatt. After examining the type of the DeCandolleian



species at Geneva the writer is forced to conclude that it is indeed doubtfully distinct from the more northern plant which has long been passing as *M. punctata* Klatt. However, though the inflorescence is very similar, the leaf-contour is rather conspicuously different, being in *M. vitifolia* more numerous and sharply lobed. Furthermore, *M. vitifolia* is geographically removed. Therefore, until some convincing evidence of intergradation has been observed, it seems best to keep these plants separate and adopt for the Cordilleran species the first available name, that is, *M. boliviensis* Lingelsheim.

**BRICKELLIA PENINSULARIS** Brandegee, *Zoe*, v. 160 (1903); Robinson, *Mem. Gray Herb.* i. 108, fig. 84 (1917). In describing this species in my monograph of the genus some years ago I pointed out the fact that material from the island of Socorro, collected by Barkelew, was of more compact habit. At the time the observed differences did not justify any varietal or formal separation of this insular strain. However, the now much more copious material secured by Mr. Mason on both Socorro and Clarion Islands discloses several departures from the mainland type. While these distinctions would be very weak if used for specific segregation, it would seem that they fully warrant a recognition of the following varieties.

Var. **typica**, foliis ovatis vel saepe oblongo-ovatis plerisque saltim quartam partem longioribus quam latis modice tenuiter membranaceis utrinque tenuiter piloso-hirtellis; pedunculis plerisque 2–7 cm. longis; corollis in summa parte post exsiccationem plerumque nigrescentibus.—**LOWER CALIFORNIA:** Cape Region, *Brandegee, Purpus*; Puerto Escondido, *Johnston*, no. 4126 (Gr.).

Var. **amphithalassa** Robinson, foliis subdeltoideo-ovatis vel fere orbicularibus vix longioribus quam latis firmissime membranaceis vel subcoriaceis utrinque tenuissime et densissime puberulo-hirtellis; pedunculis plerisque 8–24 mm. longis; corollis flavidis post exsiccationem vix nigrescentibus.—**Contrib. Calif. Acad. Sci.** xx. 100 (1931).—**REVILLAGIGEDO ISLANDS:** Socorro Island: *Barkelew*, no. 198 (Gr., *Mo., Univ. Wyo., N. Y., Arn. Arb.*); a shrub at Benner's Cove, May 3, 1925, *Mason*, no. 1598 (*Calif. Acad., Gr.*). Clarion Island: shrub 0.6–1.5 m. high, branched from the base, branches erect, very brittle, herbage grayish green, forming dominant cover and giving grayish aspect to the hillsides, Apr. 26, 1925, *Mason*, no. 1555 (TYPE, *Calif. Acad., ISOTYPE, Gr.*).

## THE STEVIAS OF PERU.

THE Genus *Stevia* and its special classificatory difficulties were discussed in some detail by the writer in a former paper (Contrib. Gray Herb. xc. 36-58). Though its pappus is subject to great variability and at times to disconcerting transitions, it forms nevertheless a fairly convenient means of dividing the genus into several for the most part readily recognizable, if not quite mutually exclusive, sections. Of these three occur in Peru. The first may appropriately be called § *Eustevia* since it is nomenclaturally the typical series of the genus. In it the pappus is prevailingly of a symmetrical nature being either exaristate, and composed of short subequal often connate scales alone, or it may be pauciaristate and made up of few (usually 3-5, more rarely 1-8) awns, with or without some scales, the awns being about as long as the corolla. These pappus-forms are illustrated in Contrib. Gray Herb. xc. Pl. I. Figs. I-IV. The transition between the awned and awnless conditions seems very facile for both are often found in the same species. Therefore this distinction has little if any classificatory value as a group character. The actual differential traits are that 1) its pappus tends strongly to be symmetrical, 2) its awns, when present, are few (rarely over 5), and 3) its awns when they occur are about the length of the corolla.

The second section has a pappus which is usually unsymmetrical, being composed of scales of conspicuously unequal length, the longest rarely over a fourth to half the length of the corolla. Sometimes one or two of these longer scales become awn-tipped or developed into actual awns. This second section may appropriately be called the § *Breviaristatae* after its earliest recorded and perhaps most characteristic species *S. breviaristata* Hook. & Arn. The types of pappus to be found in this section are illustrated by Robinson, l. c., Figs. V-VI and XII-XIII.

In the third section the pappus is symmetrical and multiaristate (at least in the adelphocarps), the awns being normally 10-25 (-30) in number and about equalling the corolla in length. This section was called *Multiaristatae* by DeCandolle, Prod. v. 122 (1836) and is appropriately typified by *S. multiaristata* Spreng.

For a satisfactory phylogenetic interpretation and arrangement of these sections we must await a very much better knowledge of the genetic and geographic factors in the origin and development of the genus than is now at hand. As to the most logical sequence of the sections, it may be noticed that *Stevia* is ordinarily placed between *Ageratum* and *Eupatorium*. This being the case and *Stevia*, as to

pappus, being somewhat intermediate between these genera, it is clear that § *Eustevia*, with its pappus of few and subsymmetrically arranged scales, should be placed next (i. e. on the side toward) *Ageratum* and that § *Multiaristatae*, which at times suggests actual transition to *Eupatorium* should be placed as close as feasible to that genus.

The literature of the Peruvian Stevias is of slight extent and exceedingly scattered. In no work hitherto published have more than four members of the genus been attributed to the country and no attempt has thus far been made to contrast or key any of the Peruvian species.

The treatment here presented, though the result of considerable study and the examination of most of the pertinent types, as well as the *Stevia* material in several of the most important herbaria both in Europe and in America, is confessedly tentative. While it has seemed best to distinguish on more or less convincing evidence no less than twenty-four species of *Stevia* as native in Peru, several of these are still very inadequately known—in some cases from a single specimen each. On this account it is often impossible to indicate the natural ranges or to estimate the degree of variability occurring in the entities characterized and likely to obliterate at least some of their distinctions, when these plants have received the needful representation in herbaria and, if feasible, comparison in living material.

However, notwithstanding its limitations from lack of adequate material, the present paper not only brings together information previously available only after prolonged search in scattered literature, but furnishes what has not heretofore existed, namely a specific key to the Stevias of Peru in which the more obvious of their distinctions are brought out. It is therefore hoped that it will prove helpful and stimulating to further study of this difficult but highly interesting group.

#### KEY TO THE STEVIAS OF PERU.

- a. Pappus (mostly symmetrical or nearly so) sometimes exaristate and composed solely of subequal short scales, sometimes pauciaristate with at least the adelphocarps (1-) 3-5 (-7)-awned, the awns about equalling the corollas § 1 *EU-STEVIAS*. . . . . b.
- b. Inflorescence lax, mature pedicels as long as or often much longer than the involucre. . . . . c.
- c. Pappus merely coroniform. . . . . 1. *S. urticaefolia*.
- c. Awns present (at least in the pappus of the adelphocarps), about equalling the corollas. . . . . 2. *S. cathartica*.
- b. Inflorescence or its parts denser; pedicels none or shorter than the involucre. . . . . d.
- d. Leafblade (exclusive of the cuneately winged petiole) broadly ovate. . . . . e.

- e. Heads in 2-5-headed fascicles; these rather loosely corymbose at the ends of elongated panicle-branches; leafblade round-ovate. . . . . 3. *S. pabloensis*.
- e. Heads in dense many-headed and rather closely clustered glomerules; leafblade subdeltoid-ovate. Here may be sought specimens of no. 9 (*S. galeopsidifolia*) with subequal pappus-scales
- d. Leafblade rhombic-ovate to oblong, rarely more than half as wide as long. . . . . f.
- f. Phyllaries dorsally covered with short incurved or crisped glandless hairs with some sessile glands interspersed. . . . . 4. *S. rhombifolia*.
- f. Phyllaries dorsally beset with short straight spreading gland-tipped hairs or stipitate glands. . . . . g.
- g. Leaves gradually narrowed to an acute apex but abruptly contracted to an obtusish or rounded or even subcordate base. . . . . 5. *S. soratensis*.
- g. Leaves rhombic-ovate to lanceolate-oblong or narrowly elliptical, cuneate at base. . . . . h.
- h. Leaves at full maturity finely white-punctate above; heads in fastigiately branched clusters; phyllaries green; corolla-tube and throat white. . . . . 6. *S. leucosticta*.
- h. Leaves not white-punctate; heads in dense many-headed glomerules; corolla-tube and throat red to deep purple. . . . . 7. *S. Macbridei*.
- a. Pappus asymmetrical, composed of conspicuously unequal scales 1-2 of them longer than the others and often awn-tipped; these awned scales rarely more than half as long as the corollas § 2 BREVIARISTATAE. . . . . i.
- i. Heads 12-15 mm. long; leaves rhombic-ovate, nearly glabrous, about 2 cm. wide, firmly membranaceous. . . . . 8. *S. Pennellii*.
- i. Heads about 10 mm. long; leaves subdeltoid-ovate, finely pilose on both surfaces, thin-membranaceous. . . . . 9. *S. galeopsidifolia*.
- a. Pappus (at least of the adelphocarps) symmetrical, composed of many, normally 10-25 (-30) awns about equalling the corollas § 3 MULTIARISTATAE. . . . . j
- j. Inflorescence lax; mature pedicels about equalling or often much exceeding the involucre. . . . . k.
- k. Leaves (in well separated pairs) ovate. . . . . l.
- l. Stem and leaves pilose (hairs white and jointed); leaves broadly ovate and obtuse. . . . . 10. *S. andina*.
- l. Stem and leaves glabrous or nearly so; leaves rhombic-ovate, acutish to acuminate. . . . . 11 *S. Herrerae*.
- k. Leaves (crowded) linear. . . . . 12. *S. multiaristata*.
- j. Inflorescence or its parts much denser; heads sessile, subsessile or on pedicels shorter than the involucre. . . . . m.
- m. Leaves linear, very numerous and crowded, the main cauline often proliferous in the axils. . . . . 13. *S. polyphylla*.
- m. Leaves lanceolate-ovate to oblong, obovate or suborbicular. . . . . n.
- n. Erect or suberect, mostly 3 dm. or more in height. . . . . o.
- o. Leaves amplexicaul by a broadly petioliform base of the ovate or obovate blade. . . . . 14. *S. melissaefolia*.
- o. Leaves not amplexicaul. . . . . p.
- p. Inner phyllaries obscurely 3-toothed at summit (a perceptible mucro being developed in the middle of a slightly retuse tip) . . . . . 15. *S. Hoppii*.

- p.* Inner phyllaries entire or nearly so. . . . . *q.*
- q.* Outer phyllaries dorsally covered with incurved or crisped white glandless hairs (some sessile glands being often interspersed) or rarely subglabrous. . . . . *r.*
- r.* Stem-leaves narrowly ovate to elliptical, mostly less than half as wide as long. . . . . *s.*
- s.* Stems many-branched above; branches (10–13 cm. long) bearing 6–8 elliptical round-tipped often alternate bracteal leaves; corollas apparently white. . . . 16. *S. petiolata.*
- s.* Stems mostly 3–5-branched at summit; branches (3–7 cm. long) bearing 1–2 pairs of lanceolate acutish bracts. . . . . *t.*
- t.* Leaves subconcolorous, obtuse or merely acutish, mostly 6–10-toothed on each side; phyllaries acutish to mostly obtuse; corolla-throat purple. . . . . 17. *S. cuzcoensis.*
- t.* Leaves markedly paler beneath, acuminate, about 12-toothed on each side; phyllaries acute to attenuate; corollas white. . . . . 18. *S. punensis.*
- r.* Stem-leaves broadly ovate, mostly about two-thirds as wide as long. . . . . *u.*
- u.* Heads 12–15 mm. long, in rather loose subfastigate glomerules; stems in clumps from a woody caudex, loosely ascending from an often decumbent base; awns of the adelpocarps mostly 9–12, scarcely equalling the corollas. . . . . 19. *S. puberula.*
- u.* Heads 9–11 mm. long, practically sessile in dense glomerules; stem herbaceous apparently single and erect; awns of the adelpocarps 6–8, slightly exceeding the corollas. . . . . 20. *S. Pearcei.*
- q.* Outer phyllaries closely beset with short spreading gland-tipped hairs (a few glandless hairs sometimes also present). . . . . *v.*
- v.* Leaves lanceolate to narrowly rhombic-ovate, usually less than half as wide as long. . . . . *w.*
- w.* Leaves membranaceous, sparsely but permanently short-pilose on both surfaces, subconcolorous. . . . . 21. *S. Weberbaueri.*
- w.* Leaves chartaceo-subcoriaceous, glabrous or nearly so, conspicuously paler beneath. . . . . 7. *S. Macbridei* var. *anomala.*
- v.* Leaves more broadly ovate, usually more than half as wide as long. . . . . *x.*
- x.* Leaves chartaceous, bluntly serrate, the teeth directed forward, rarely over 0.5 mm. high. . . . . 22. *S. Lechleri.*
- x.* Leaves membranaceous, deeply and often doubly crenate; teeth spreading, rounded at tip, the largest as much as 2 mm. high. . . . . 23. *S. cajabambensis.*
- n.* Dwarf, matted, not over 1 dm. high, with short procumbent or prostrate stems and small sessile elliptical leaves (about 1 cm. long). . . . . 24. *S. Mandonii.*

1. ***S. urticaefolia*** Billb. Slender erect ascendingly much branched herbaceous perennial, 7–12 dm. high, sometimes a little woody at the base, sparingly pilose; leaves opposite (except the uppermost), short-petioled, rhombic-ovate, usually acute at both ends, membranaceous; panicle diffuse; corollas in the typical variety (the only one thus far seen from Peru) with violet-purple tube and throat, the teeth white or roseate; achenes alike, awnless, surmounted by a crown of short often somewhat connate scales.—Billb. in Thunb. Pl. Bras. Dec. i. 13 (1817); Herrera, Estud. Fl. Dep. Cuzco, 187 (1930).

CUZCO: Prov. Quispicanchi: Distr. Oropesa, at Huasao, alt. 3200 m., *Herrera*, no. 893 (Brl.)

[BRAZIL, BOLIVIA.]

2. ***S. cathartica*** Poepp. Suffruticose, erect, 4 dm. or more in height; stems slender, leafy, unbranched up to the rounded to ovoid loose leafy-bracted inflorescence; leaves opposite, ovate-oblong, narrowed at both ends, serrate, pubescent, the cauline very short-petioled; the branches of the panicle corymbose at the summit; mature pedicels about equalling the involucre; involucre scales acute, dorsally pubescent; pappus said to be 5-awned, the awns equalling the corollas and alternating with as many short scales. Nov. Gen. ac Spec. iii. 55 (1845).

DEPARTMENT NOT ASCERTAINED: Cassapi, on subandine calcareous mountains, *Poeppig* (Nat. Hist. Mus. Vienna, phot. Gr.).

Known as yet only from the type-specimen, this species appears suspiciously close to awn-bearing forms of *S. urticaefolia* occurring in Bolivia and Brazil. However, the leaves are somewhat narrower and more oblong in outline and the cauline more shortly petioled. Rediscovery and more copious material will be essential before the real status of this plant can be confidently determined.

3. ***S. pabloensis*** Hieron. Perennial herb or undershrub, erect, 0.7–1.5 m. high, sparingly hirtellous to villous below, glandular-puberulent in the inflorescence; leaves opposite, the main cauline with the expanded portion of the blade broadly ovate, obtusish, crenate-serrate, half to more than two-thirds as wide as long, sparingly glandular-villous on both surfaces, raised on a slender cuneately winged petioliform base; panicle-branches ascending; heads 10–12 mm. long, sessile to shortly pedicelled; corollas deep purple as to tube and throat, the limb roseate to white; achenes alike, crowned by a short awnless scale-pappus.—Hieron. in Engl. Bot. Jahrb. xl. 364 (1908).

CAJAMARCA: below San Pablo in grassy and shrubby places in a gorge, alt. 2200–2400 m., *Weberbauer*, no. 3860 (Brl., phot. Gr.).

4. **S. rhombifolia** HBK. Erect perennial, herbaceous or at times frutescent, from incurved-puberulent to somewhat conspicuously and densely pilose; leaves (except the uppermost) opposite, sessile or short-petioled, rhombic-ovate, acutish to acuminate; heads small, 6–9 mm. long, sessile or shortly pedicellate in dense corymbously disposed glomerules; phyllaries narrowly oblong, acute, usually pale green, incurved-puberulent; corollas mostly white or pink, rarely a rather deep purple; achenes crowned by a scale-pappus with or without 1–4 awns about equalling the corollas.—Nov. Gen. et Spec. iv. 143 (1820); Robinson, Contrib. Gray Herb. xc. 132 (1930), which see for further literature, synonymy and varietal subdivision.

A highly variable species, probably the most widespread and abundant of the genus though relatively rare in the Southern Hemisphere. The typical variety with most of its achenes 3 (1–4)-awned has thus far not been verified as occurring in Peru, where, however, the following varieties are of at least occasional occurrence.

Var. **uniaristata** (DC.) Sch.-Bip. Most of the achenes awnless and crowned merely with a scale-pappus, but a few single awns to be found in each inflorescence.—Linnaea, xxv. 279 (1853); Robinson, Contrib. Gray Herb. xc. 134 (1930), xcvi. 41 (1931). *S. uniaristata* DC. Prod. v. 120 (1836).

PERU: without locality, *Mathews* (BM., Gen.).  
[MEXICO, VENEZUELA.]

This variety, though early given a certain nomenclatural status, is probably only the expression of an occasional intermediate tendency between the typical awn-bearing variety of the species and the following awnless variety.

Var. **stephanocoma** Sch.-Bip. Achenes all exaristate, crowned merely by a scale-pappus.—Linnaea, xxv. 279 (1853); Robinson, Contrib. Gray Herb. xc. 134 (1930), xcvi. 34, 41 (1931).

AMAZONAS: Chachapoyas, *Mathews* (K., phot. Gr., Gen.).

CUZCO: valley of the Rio Apurímac, *Herrera* (Field Mus.).

DEPARTMENT NOT INDICATED: *McLean* (K.).

[MEXICO, CENTRAL AMERICA, VENEZUELA, COLOMBIA and ECUADOR.]

5. **S. soratensis** Hieron. Erect perennial, herbaceous or nearly so, 4–10 dm. high, sparingly glandular-pilose; leaves opposite, petioled, lanceolate-ovate, gradually narrowed from near the base to an acute or attenuate apex, serrate-dentate, obtuse, rounded or even subcordate at base; petiole about 1 cm. long, scarcely if at all winged; heads (about 1 cm. long) sessile in dense convex corymbously disposed glomerules; phyllaries (about 7 mm. long) densely beset dorsally

with stoutish-stiped glands, often purple-tinged; corollas deep purple; achenes unlike, four of them bearing a short scale-pappus, the fifth (idiocarp) wholly destitute of pappus.—Hieron. in Engl. Bot. Jahrb. xxviii. 560 (1901).

Cuzco: Paucartambo, alt. 3000–3100 m., *Weberbauer*, no. 6920 (Gr., Brl.); Checacupe, on open rocky bank, alt. 3400–3450 m., *Pennell*, no. 13,536 (Gr., N. Y., Field Mus.).

[BOLIVIA.]

With its copious deep purple flowers this must be a rather handsome species. The leaves, of a shape rather unusual in the genus, are commonly (though not always) reflexed, the point being toward the ground. The Peruvian material examined agrees admirably with the typical (i. e. the more glandular) form of this Bolivian species.

6. ***S. leucosticta*** Robinson. Weak, rather slender, loosely and flexuously branched glabrous perennial herb, 8–10 dm. high; leaves (except the bracteal) opposite, sessile or subsessile, lanceolate, acute or gradually narrowed to a rounded tip, shallowly crenate-serrate to subentire, finely sprinkled with sessile at length chalky-white glands; heads (about 12 mm. long) sessile or nearly so, somewhat fastigiately clustered at the ends of long slender flexuous panicle-branches; phyllaries lanceolate-linear, acute, green, gland-sprinkled; achenes 1–3-awned, bearing also some scales and often an awn or two much shorter than the others.—Contrib. Gray Herb. xcvi. 8 (1931).

HUANUCO: on a southwestern slope, alt. about 2750 m., *Macbride & Featherstone*, no. 1382 (Field Mus., Gr.).

7. ***S. Macbridei*** Robinson. Erect perennial herb, a little woody toward the base, finely glandular-puberulent, 6–12 dm. high; leaves opposite or in part alternate, oblong-ovate, obtuse, crenate-serrate to subentire, shortly petioled or subsessile, glabrous or inconspicuously hirtellous above, paler and glabrous or obscurely hirtellous on the nerves beneath, at full maturity apt to become chartaceo-membranaceous; heads (about 12 mm. long) sessile in dense corymbously disposed clusters; phyllaries mostly dark purple, about 7 mm. long, acute, densely glandular-hispid; corolla-throat dark red, the lobes white.—Contrib. Gray Herb. xcvi. 9 (1931).

Var.  $\alpha$ . ***typica***. Achenes alike, all awnless and crowned only by a scale-pappus (0.2–0.4 mm. long).

HUANUCO: on "grass-shrub slope," Mite, alt. about 2750 m., *Macbride & Featherstone*, no. 1613 (Field Mus., Gr.).

LIMA: steep grassy northwestern slope, Rio Blanco, alt. about 3660 m., *Macbride & Featherstone*, no. 663 (Field Mus., Gr.); open hillsides, Rio Blanco, alt. 3000–3500 m., *Killip & Smith*, no. 21,768 (Gr., N. Y.).



JUNÍN: Tarma, *Espesto*, no. 127 (Brl.); open rocky hillside, Mantaro Canyon, south of Huancayo, between Viques and Ingahuasi, *Killip & Smith*, no. 22,158 in part (Gr.).

WITHOUT EXACT LOCALITY: *Gay*, no. 355 (Par., phot. and fragm. Gr.); *Wilkes Exped.* (U. S.).

Var.  $\beta$ . **anomala** Robinson, l. c. Heterocarpous, the achenes unlike, four of them 7–10-awned, the awns about equalling the corollas, the fifth achene (idiocarp) crowned by scales (0.2–0.4 mm. long) and 1–3 awnlets much shorter than the corollas.

LIMA: Oroya, *Townsend*, no. 1521 (U. S.).

JUNÍN: open rocky hillside, Mantaro Canyon, south of Huancayo, alt. 3150 m., *Killip & Smith*, no. 22,158 in part (Gr.).

CUZCO: Ollantaytambo, alt. about 3000 m., *Cook & Gilbert*, no. 363 (U. S., fragm. Gr.).

DEPARTMENT NOT INDICATED: *Gay* (Par., phot. and fragm. Gr.); Piñasniocj, Panticalla Pass, alt. 3000 m., *Cook & Gilbert*, no. 1849 (U. S., fragm. Gr.).

This is a species in which the usually practicable and convenient distinction between §§ *Eustevia* and *Multiaristatae* breaks down. Without apparent change in any of its other traits this plant occurs either in the homocarpous awnless state or the heterocarpous condition with many-awned adelphocarps.

8. **S. Pennellii** Robinson. Decumbent perennial herb about 3–4 dm. high; stem purple, hirtellous, glandular-puberulent in the inflorescence; leaves opposite, petiolate, obtuse to acutish, serrate, ciliolate, the expanded part of the blade raised on a cuneately winged petioliform base, firmly membranaceous, 3-nerved, nearly or quite glabrous on both surfaces; heads (12–15 mm. long) sessile in dense somewhat corymbously disposed clusters; phyllaries dark purple, oblong-lanceolate, acute, delicately glandular-puberulent; corollas with short proper tube and much longer subcylindric throat both dark purple, the lobes of the limb pinkish-white; achenes subequal; pappus of few short awnless scales and 1–2 shortly awned scales (about 2 mm. in length).—*Contrib. Gray Herb.* c. 7 (1932).

CUZCO: on grassy slope, Paso de Tres Cruces, Cerro de Cusilluyoc, *Pennell*, no. 13,883 (Gr., Field Mus.).

9. **S. galeopsidifolia** Hieron. Upright perennial herb, finely pilose; leaves opposite, slender-petioled, the blades subdeltoid-ovate, acute, coarsely crenate-dentate, nearly truncate to subcordate at base; phyllaries pale green, subscarious, nearly smooth; achenes all bearing a short scale-pappus, the scales at first appearing subequal but at full maturity definitely unequal, the shorter about 0.4 mm. long, but 1–2 of the others nearly twice this length and slightly aristulate.—*Hieron. in Engl. Bot. Jahrb.* xxii. 719 (1897).

Cuzco: Ollantaytambo, alt. about 3000 m., *Cook & Gilbert*, nos. 408 (U. S., fragm. Gr.) and 414 (U. S., fragm. Gr.).  
[BOLIVIA.]

10. **S. andina** Robinson. Herbaceous perennial, 5–9 dm. high, pilose; leaves opposite, petiolate (or raised on a slender cuneate petioliform base of the blade) broadly ovate, obtuse; inflorescence a lax compound corymb; pedicels at maturity usually longer than the involucre; corollas with red-purple tube and throat and white lobes; achenes unlike, four of them 9–12-awned, the fifth awnless or with but a single awn.—*Contrib. Gray Herb.* xcvi. 3 (1931). *S. elatior* as used by Hieron. in *Engl. Bot. Jahrb.* xxxvi. 463 (1905), not HBK.

AMAZONAS: Chachapoyas, *Mathews* (K., phot. Gr.).

CAJAMARCA: Callate, *von Jelski*, no. 669 (Brl.).

[ECUADOR.]

11. **S. Herrerae** Robinson. Habit of the preceding but with stem and leaves nearly or quite glabrous; leaves rhombic-ovate, acutish to acuminate; inflorescence tending to be even more lax than in the preceding, pedicels at full maturity often 2–3 times as long as the involucre; corollas with throat deep purple and lobes white; achenes unlike, adelphocarps (3–4) each 8–9-awned, idiocarps (1–2) awnless or 1-awned.—*Contrib. Gray Herb.* c. 5 (1932).

Cuzco: Valle de San Miguel, Machupicchu, alt. 2400 m., *Herrera* (Field Mus., phot. and fragm. Gr.); Valley of the Apurímac, *Herrera* (Field Mus.), the latter (exhibiting only inflorescence and the uppermost leaves) is doubtful but probably represents only a slightly puberulent but scarcely glandular form of this species with less diffuse inflorescence.

AYACUCHO: Cearrapa, between Huanta and Rio Apurímac, alt. 2800 m., on wooded hillside, *Killip & Smith*, no. 22,288 (Gr., N. Y.).

WITHOUT INDICATION OF DEPARTMENT: *Mathews* (N. Y.).

12. **S. multiaristata** Spreng. Erect very leafy-stemmed perennial, 4–6 dm. high, grayish-puberulent with fine white incurved or crisped glandless hairs but the inflorescence and phyllaries closely beset with short straight gland-tipped hairs; leaves lanceolate-linear, acute at both ends, entire or obscurely few-toothed; achenes alike or nearly so, 18–25-awned.—*Syst.* iii. 449 (1826); Robinson, *Contrib. Gray Herb.* xc. 71 (1930), which see for further lit., synonym. etc.

PERU: without locality, *Mathews* "ex herb. Lambert" (K.).

[URUGUAY and eastern ARGENTINA.]

Unfortunately the *Mathews* specimen which stands for the Peruvian occurrence of this species is quite without more exact data. Until the plant, otherwise known only from Uruguay and eastern Argentina, has been rediscovered in Peru, its presence as a native in the country must be regarded as doubtful.

13. **S. polyphylla** DC. Slender erect virgate perennial, about 3 dm. high; stem densely incurved-puberulent (the hairs glandless), very leafy; leaves (often proliferous in the axils) linear, entire, shortly and closely pubescent-tomentellous and punctate; heads sessile in corymbously disposed glomerules; phyllaries broadly oblong, slightly toothed at the rounded summit, dorsally spreading-pubescent; corollas purplish; achenes unlike, the adelphocarps 16–20-awned, the idiocarp (single) crowned with linear scales and about 4 awns.—Prod. v. 123 (1836).

PERU ? “inter Peruvianas et Panamenses herb. Haenke.” (Gen., phot. and trac. Gr.).

This plant, excellently preserved in the Prodromus herbarium at the Geneva Conservatory of Botany, seems never to have been rediscovered in nature. In habit it rather closely simulates the Argentine *S. mercedensis* Hieron. but has almost twice as many pappus-awns and has broader, blunter and somewhat toothed phyllaries.

14. **S. melissaefolia** (Lam.) Sch.-Bip. Perennial herb or under-shrub; stem decumbent, curved-ascending, often flexuous, very leafy, densely glandular-puberulent; leaves opposite, sessile by a narrowed but somewhat amplexicaul base, membranaceous, oval to more often obovate, obtuse or rounded at apex, crenate-serrate; heads sessile in hemispherical to subglobose glomerules; these single or clustered (mostly by 3's) at the ends of the branches; corolla-throat purple, the lobes white or pink; achenes unlike; adelphocarps (usually 4) 9–12 awned; idiocarp (mostly single) awnless but crowned by a scale-pappus.—*Linnaea*, xxv. 291 (1853). *Eupatorium melissaefolium* Lam. Encl. ii. 411 (1786). *Mikania melissaefolia* (Lam.) Willd. Spec. Pl. iii. 1747 (1804). *Nothites latifolia* Cass. Dict. xxxv. 163 (1825). *Stevia dodecachaeta* DC. Prod. v. 122 (1836). *Nothites melissaefolia* (Lam.) DC. l. c. 186 (1836).

LIMA: *Abadia* (Gen., phot. Gr.); stony ground on slopes of mountains, on granite, alt. 300–750 m., *Weberbauer*, no. 35 (Brl., fragm. Gr.); on stony ground of the loma formation, Amancaes Mountains, alt. 200–400 m., *Weberbauer*, no. 1591 (Brl., fragm. Gr.); sandy lomas along the sea, Lurin, *Macbride*, no. 5965 (Field Mus., Gr.); on the Lima-Oroya road, southwest of Matucana, *Weberbauer*, no. 198 (Brl., fragm. Gr.).

WITHOUT INDICATION OF DEPARTMENT: *Dombey* acc. to Lamarck.

15. **S. Hoppii** Robinson. Probably herbaceous and perennial (the base unknown); stems very slender, erect, glandular-puberulent when young; leaves (except the uppermost) opposite, subsessile, lanceolate-ovate, obtusish, crenate-serrate; heads (about 14 mm. long) shortly pedicelled in flattish somewhat fastigate terminal corymbs;

phyllaries thin, green, glandular-puberulent, the outer acute, entire, the inner usually subtrifid at the apex, a small mucro being perceptible in the middle of a somewhat retuse summit; corollas claret-colored at least as to the subcylindrical throat, the lobes pale, probably pink; achenes unlike, the 4 adelphocarps 14-16-awned, the idiocarp awnless and crowned merely by an erose scarious border (0.5 mm. high).—Contrib. Gray Herb. c. 6 (1932).

AREQUIPA: on rocks, alt. 2500 m., Arequipa, *Hopp*, nos. 3 (Brl., phot. Gr.) and 12 (Brl., phot. Gr.).

While not strongly marked, this very slender plant of the Arequipa region cannot be as yet connected satisfactorily with any other species.

16. ***S. petiolata*** (Cass.) Sch.-Bip. Smoothish much branched herb; leaves opposite and (the upper) alternate, short-petioled, oval to elliptical or obovate, obtuse to rounded at the tip, serrate from about the middle, subglabrous to finely incurved-puberulent at least on the nerves beneath, 2.5 cm. long, 8-15 mm. wide, cuneate and entire toward the base; branches many, ascending, their terminal glomerules of heads together forming a convex or flattish compound corymb; heads sessile or nearly so, about 1 cm. long; phyllaries oblong-lanceolate, obtuse, very finely (sometimes obsoletely) incurved-puberulent; corollas apparently white; achenes unlike, the 4 adelphocarps 12-16-awned, the idiocarp awnless but crowned by a scale-pappus.—*Linnaea*, xxv. 291 (1853). *Nothites petiolata* Cass. Dict. xxxv. 166 (1825); DC. Prod. v. 186 (1836). *Stevia* ———? *Ball*, Journ. Linn. Soc. xxii. 43 (1885).

LIMA: near the city of Lima, *Dombey* acc. to Cassini (Dombey material of this plant has been found (without data) in the herbarium of the Mus. Nat. Hist. at Paris bearing the number 507 (Par., phot. and fragm. Gr.), being presumably a part of the original collection from which Cassini drew his description); Chicla, in stony places, alt. 3650-3800 m., *Ball* (Gr.).

CUZCO: Prov. Canchis: Sicuani, alt. 3550 m., *Hicken*, acc. to Herrera, Contrib. Fl. Dep. Cuzco 198 (1921), also Chlor. Cuzc. 85 (1926). The writer has had no opportunity to verify this record, first published by Hicken, Apunt. Hist. Nat. i. 176 (1909).

WITHOUT EXACT LOCALITY: *von Besser* (Brl., trac. Gr.).

Under the genus *Stevia*, to which the plant manifestly belongs, this species is very unhappily, indeed misleadingly, named. Its petioles (rarely as much as 6-8 mm. long) while significant to Cassini in differentiating his novelty from the other species of *Nothites* as he was then limiting that genus, become a relatively obscure feature in *Stevia*, where petioles are often much more conspicuously developed.

17. **S. cuzcoensis** Hieron. Herbaceous or suffruticose, shortly incurved-puberulent, usually branched from the base, the branches often virgate, leafy, erect or ascending, 2–5 dm. high; leaves (except sometimes the uppermost) opposite, rhombic-ovate to -lanceolate, acutish, serrate except for the cuneately narrowed entire shortly petioled base, 0.5–4 cm long, 10–18 (–20) mm. wide; corymbs rather dense; heads 10–12 mm. long, sessile in closely clustered glomerules; phyllaries green or often purple, acutish to rounded at apex, incurved-puberulent; corollas mostly with deep purple tube and throat and with roseate lobes; achenes unlike, the (3–)4 adelphocarps each 12–18-awned, the awns purple, about equalling the corollas, the 1 (–2) idiocarps crowned by a scale-pappus (1–1.5 mm. high).—Hieron. in Engl. Bot. Jahrb. xl. 363–364 (1908); Herrera, Contrib. Fl. Dep. Cuzco, 198, also Chlor. Cuzc. 85 (1926) and Estud. Fl. Dep. Cuzc. 187 (1930).

Cuzco: hills, Sacsahuamán, alt. 3500–3600 m., *Weberbauer*, no. 4851 (Brl., phot. Gr.), same locality, *Herrera*, no. 2353 (Field Mus., fragm. Gr.), *Pennell*, no. 13,553 (Gr., Field Mus.); rocky slope of cañon, San Sebastián, *Pennell*, no. 13,622 (Gr., Field Mus.); slopes of the Cerro de Mesa Redonda, *Herrera*, no. 1475 (Gr.); Ollantaytambo, alt. about 3000 m., *Cook & Gilbert*, nos. 362 (U. S., fragm. Gr.) and 489 (U. S., fragm. Gr.); *Pennell*, no. 13,675 (Gr., Field Mus.), likewise from Ollantaytambo, probably consisting of weak lateral branches, also doubtfully referred to this species.

18. **S. punensis** Robinson. Erect herbaceous perennial, smoothish, 2–2.5 dm. high; stem (denuded below by the falling of the leaves) very leafy above; leaves opposite, the cauline shortly petiolate, rhombic-ovate, acuminate, serrulate, cuneate and entire toward the base, 3–3.6 cm. long, 1–1.5 cm. wide; inflorescence subfastigiately branched, the branchlets very finely glandular-puberulent; heads sessile or shortly pedicelled, 15 mm. long; phyllaries acute to attenuate, almost glabrous dorsally except for a few scattered sessile glands; corollas white; achenes unlike, the 3 adelphocarps each 10–12-awned, the awns purplish and about equalling the corollas, of the 2 idiocarps 1 crowned only with scales, the other with scales and about 3 unequal awns all much shorter than the corollas.—Contrib. Gray Herb. c. 8 (1932).

PUNO: Prov. Sandia: Cuyocuyo, in high loosely shrubby meadows, alt. 3700 m., *Weberbauer*, no. 850 (Brl., phot. and fragm. Gr.).

This plant when examined by the writer many years ago was referred with much hesitation to the little known *S. Lechleri* Hieron., under which name it may have been distributed. Subsequent study has clearly demonstrated that the plant is not *S. Lechleri*, nor apparently any other hitherto described species.

19. **S. puberula** Hook. Decumbent or suberect herb or under-shrub, 0.3–2 m. high, finely puberulent with white incurved or crisped glandless hairs; leaves (except sometimes the upper ones) opposite, shortly petioled, the mature cauline broadly ovate to suborbicular, crenate-serrate; heads (about 15 mm. long) sessile or shortly pedicelled in dense corymbously disposed glomerules; phyllaries (8 mm. long) incurved-puberulent to smoothish except for sessile glands; corollas white or pink (Barclay); achenes unlike, the 4 adelphocarps each about 10-awned, the single idiocarp crowned by a scarious border of connate scales and 1–2 awnlets (1–1.2 mm. long).—Bot. Miscel. ii. 225 (1831); DC. Prod. v. 123 (1836).

LIMA: Valley of Canta, *Cruckshanks* (K., phot. Gr.), *Wilkes Exped.* (U. S.); open rocky banks along Rio Chillón, above Obrajillo, *Pennell*, no. 14,367 (Gr., Field Mus.); open rocky slope, Canta, *Pennell*, no. 14,336 (Gr., N. Y., Field Mus.); Matucana, *Martinet* (Par., phot. and fragm. Gr.), *Macbride & Featherstone*, nos. 157 (Gr., N. Y., Field Mus.), 314 (Gr., Field Mus.) and 482 (Field Mus.); Yanahuanca, *Macbride & Featherstone*, no. 1288 (Gr., Field Mus.).

HUANCAVELICA: above Huaytará, Prov. Castro-Virreyna, *Weberbauer*, no. 5418 (Gr., Brl., Field Mus.).

DEPARTMENT NOT INDICATED: Serra de Puruchucas, *Barclay*, no. 2266 (K.).

20. **S. Pearcei** Robinson. Tall erect herbaceous perennial with round purple shortly incurved-puberulent and leafy stem; leaves opposite, the cauline slender-petioled, ovate, narrowed to an obtusish tip, crenate-serrulate, green on both surfaces, above at first incurved-puberulent, later glabrescent except for the depressed nerves, below finely incurved-puberulent, membranaceous in texture; heads (9–11 mm. long) sessile in dense paniculately disposed glomerules; corollas white, covered even to the oval obtuse lobes of the limb with sessile glands; achenes unlike, the 4 adelphocarps each 6–8-awned, the awns slightly longer than the corollas, the idiocarp nearly or quite destitute of pappus.—Contrib. Gray Herb. c. 7 (1932).

HUANUCO: common on waste land, dry hillsides, etc., Huanaco, Muña, &c., *Pearce*, no. 104 (K., phot. and small fragm. Gr.).

A species named for its discoverer, Richard William Pearce, an English horticultural explorer employed by Veitch.

21. **S. Weberbaueri** Robinson. Procumbent or ascending under-shrub, glandular-puberulent above, 3 dm. high; leaves opposite, sessile or nearly so, lanceolate to narrowly rhombic-ovate, acute to obtuse, serrate except for the entire cuneate base, membranaceous, 2–3 cm. long, 6–10 mm. wide, shortly puberulent; heads 14–16 mm. long, sessile or nearly so in dense corymbously disposed clusters; phyllaries narrowly oblong, shortly pointed, 8–8.5 mm. long, dorsally glandular-puberulent; corollas slender, roseate with paler lobes;

achenes unlike, the 4 adelphocarps each 10–16-awned (awns about equalling the corollas), the idiocarp awnless, coronulate with short more or less connate scales.—Contrib. Gray Herb. xevi. 16 (1931).

MOQUEGUA: rainy-green formation, alt. 3200 m., Carumas, *Weberbauer*, no. 7293 (Field Mus., Gr.).

LIMA: Rio Blanca, open hillsides, alt. 3000–3500 m., *Killip & Smith*, no. 21,673 (Gr.); near Oroya, alt. 3000–4000 m., *Kalenborn*, no. 18 (U. S., Mo.).

22. **S. Lechleri** Hieron. Perennial, herbaceous or perhaps suffruticose; stem simple to the inflorescence, leafy, glabrate below, finely glandular-puberulent above; leaves opposite, broadly though rhombically ovate, obtusish, crenate-serrate except for the cuneate petioliform basal portion, nearly glabrous except for scattered hairs on the nerves beneath; heads sessile in close clusters; these terminating the curved-ascending branches of the rather loose inflorescence; phyllaries 6 mm. long, acutish, subscarious, purplish toward the tip, dorsally glandular-puberulent; achenes unlike, the 3 adelphocarps 6–11-awned, the 2 idiocarps exaristate but surmounted by a coroniform pappus.—Hieron. in Engl. Bot. Jahrb. xxii. 727 (1897).

DEPARTMENT NOT INDICATED: in grassy places, Tabina, *Lechler*, no. 1882 (Brl., phot. Gr.).

With this little known plant, it has not been found possible exactly to match any subsequently collected material. A more satisfactory knowledge of the species must await its rediscovery and the examination of further specimens.

23. **S. cajabambensis** Hieron. Suffruticose, 5–6 dm. high, erect or curved-ascending; leaves (except the uppermost) opposite, the lower cauline broadly ovate, obtuse, coarsely and irregularly crenate-dentate except for the entire cuneate petioliform base, membranaceous, above sparingly and very shortly puberulent and sprinkled with sessile glands, beneath sparsely villous; heads closely sessile to distinctly pedicelled in rather small loosely and corymbously disposed sometimes subfasciculate clusters; phyllaries narrow, acutish to shortly acuminate, about 9 mm. long, densely beset on the back with stipitate glands; corollas probably roseate; achenes unlike, the 4 adelphocarps each 8–10-awned, the idiocarp awnless and crowned by somewhat connate scales.—Hieron. in Engl. Bot. Jahrb. xl. 367 (1908).

ANCACHS: below the Hacienda Cajabamba, *Weberbauer*, no. 3124 (Brl., phot. Gr.).

LIMA: Huamantanga, *Mathews*, no. 563 (Gr., N. Y.).

This is very close to *S. puberula* Hook. and may well prove only a glandular form of that plant. However, until these species are

better known and transition has been demonstrated, they may be maintained.

24. **S. Mandonii** Sch.-Bip. Dwarf matted high Andean perennial; stems prostrate or ascending, rarely over 1 dm. long, leafy; leaves opposite, sessile or nearly so, elliptical, obtuse or mostly rounded at tip, shallowly 1-3-toothed on each side above the middle, entire and cuneately narrowed toward the base, subcoriaceous, 1-1.5 cm. long, 5-7 mm. wide; heads (about 12 mm. long) closely clustered in single terminal sessile glomerules; corollas with red-purple tube and throat and pink or white lobes; achenes unlike, the 4 adelphocarps each about 19-awned, the idiocarp about 9-awned and crowned also by 1-3 short scales.—Bull. Soc. Bot. Fr. xii. 81 (1865) and Linnaea, xxxiv. 535 (1865-6), both without char.; Robinson, Contrib. Gray Herb. lxxvii. 6 (1926), where characterized.

PUNO: in open mats, common, alt. 3700 m., *Weberbauer*, no. 431 (Brl., phot. Gr.); Juliaca, alt. about 3675 m., *R. S. Williams*, no. 2504 (N. Y., fragm. Gr.); Chuquibambilla, rocky clay slope over limestone, alt. 3900-4000 m., *Pennell*, no. 13,372 (Gr., N. Y., Field Mus.).

[BOLIVIA.]

#### EXCLUDED, TRANSFERRED OR DOUBTFUL SPECIES.

**S. BREVIPAPPOSA** Hieron. in Engl. Bot. Jahrb. xxii. 718 (1897). This species, of which the writer has examined authentic material both at New York and Berlin, seems to him to be conspecific with **S. BOLIVIENSIS** Sch.-Bip. *S. brevipapposa* is reported by Herrera, Chlor. Cuzc. 183 (1926) and Estud. Fl. Dep. Cuzc., 186 (1930), as occurring near the city of Cuzco. The writer has had no opportunity to verify this record.

**S. CORIACEA** Lag. Gen. et Spec. Nov. 28 (1816). This species was described as follows: "pappo paleaceo mutico: foliis lato-lanceolatis argute serratis oppositis ternisve subcoriaceis."

"*Pedunculus* communis terminalis, apice umbellatus, radiis 3-5 apice corymbosis, corymbis multifloris, compactis, foliosis. *Folia* floralia ad pedunculorum pedicellorumque basim linearia, acutissima integerrima."

"Hab. in Peruviae Regno, ubi legit. D. Ludovicus Neé. b "

No *Stevia* corresponding to the brief character here given is known to the writer, nor so far as he is aware has any such plant been subsequently reported from Peru. Unfortunately there is evidence that the collections of Neé were geographically confused. So the localities attributed to his specimens are always subject to doubt. Under these circumstances it has seemed best to omit *S. coriacea* from the foregoing treatment of the Peruvian *Stevias*.



*S. CRENATA* Benth. Pl. Hartw. 197 (1845). The Peruvian plant referred to this species by Hieronymus in Engl. Bot. Jahrb. xxxvi. 463 (1905), namely *von Jelski*, no. 668, has not been available for study during the preparation of the present paper. The writer has seen no evidence that the real Ecuadorian *S. crenata* Benth. extends to any part of Peru and is disposed to think that the plant so recorded by Hieronymus may well have been a form of the later characterized and habitally similar *S. andina* Robinson.

*S. ELATIOR* HBK. Nov. Gen. et Spec. iv. 144 (1820). The multi-  
aristate plant referred to this species by Hieronymus in Engl. Bot. Jahrb. xxxvi. 463 (1905), namely *von Jelski*, no. 669, is *S. ANDINA* Robinson.

*S. TRACHELIOIDES* DC. Prod. v. 115 (1836). This plant of Mexico appears to the writer to be indistinguishable from the earlier *S. MONARDAEFOLIA* HBK. By an unfortunate error the name *S. trachelioides* DC. was used by Gray when attempting to identify some rather poorly prepared specimens of Peruvian plants collected by the Wilkes Expedition. Apparently from this early misidentification the binomial *S. trachelioides* has to some extent persisted on herbarium sheets and is applied to some Peruvian plant by Professor Herrera in his Estud. Fl. Dep. Cuzc. 187 (1930).

## EXSICCATAE OF PERUVIAN STEVIAS

**Abadia**

— *melissaefolia* (Lam.) Sch.-Bip.

**Ball**

— *petiolata* (Cass.) Sch.-Bip.

**Barclay**

2266 *puberula* Hook.

**Besser, von**

— *petiolata* (Cass.) Sch.-Bip.

**Cook & Gilbert**

362 *cuzcoensis* Hieron.

363 *Macbridei* v. *anomala* Robinson

408 *galeopsidifolia* Hieron.

414 *galeopsidifolia* Hieron.

489 *cuzcoensis* Hieron.

1849 *Macbridei* v. *anomala* Robinson

**Cruckshanks**

— *puberula* Hook.

**Dombey**

507 *petiolata* (Cass.) Sch.-Bip.

— *melissaefolia* (Lam.) Sch.-Bip.

— *petiolata* (Cass.) Sch.-Bip.

**Espesto**

127 *Macbridei* Robinson

**Gay**

355 *Macbridei* Robinson

— *Macbridei* v. *anomala* Robinson

**Haenke**

— *polyphylla* DC.

**Herrera**

893 *urticaefolia* Billb.

1475 *cuzcoensis* Hieron.

2353 *cuzcoensis* Hieron.

— *Herrerae* Robinson

— *rhombofolia* v. *stephanocoma* Sch.-Bip.

**Hicken**

— petiolata (Cass.) Sch.-Bip.

**Hopp**

3 Hoppii Robinson  
12 Hoppii Robinson

**Jelski, von**

669 andina Robinson

**Kalenborn**

18 Weberbaueri Robinson

**Killip & Smith**

21,673 Weberbaueri Robinson  
21,768 Macbridei Robinson  
22,158 (in part) Macbridei Robinson  
22,158 (in part) Macbridei v. anomala Robinson  
22,288 Herrerae Robinson

**Lechler**

1882 Lechleri Hieron.

**Macbride**

5965 melissaefolia (Lam.) Sch.-Bip.

**Macbride & Featherstone**

157 puberula Hook.  
482 puberula Hook.  
663 Macbridei Robinson  
1288 puberula Hook.  
1382 leucosticta Robinson  
1613 Macbridei Robinson

**McLean**

— rhombifolia v. stephanocoma Sch.-Bip.

**Martinet**

— puberula Hook.

**Mathews**

563 cajabambensis Hieron.  
— andina Robinson  
— Herrerae Robinson

— multiaristata Spreng.  
— rhombifolia v. stephanocoma Sch.-Bip.  
— rhombifolia v. uniaristata (DC.) Sch.-Bip.

**Pearce**

104 Pearcei Robinson

**Pennell**

13,372 Mandonii Sch.-Bip.  
13,536 soratensis Hieron.  
13,553 cuzcoensis Hieron.  
13,622 cuzcoensis Hieron.  
13,675 cuzcoensis Hieron.  
13,883 Pennellii Robinson  
14,336 puberula Hook.  
14,367 puberula Hook.

**Poeppig**

— cathartica Poepp.

**Townsend**

1521 Macbridei v. anomala Robinson

**Weberbauer**

35 melissaefolia (Lam.) Sch.-Bip.  
198 melissaefolia (Lam.) Sch.-Bip.  
431 Mandonii Sch.-Bip.  
850 punensis Robinson  
1591 melissaefolia (Lam.) Sch.-Bip.  
3124 cajabambensis Hieron.  
3860 pabloensis Hieron.  
4851 cuzcoensis Hieron.  
5418 puberula Hook.  
6920 soratensis Hieron.  
7293 Weberbaueri Robinson

**Wilkes Exped.**

— Macbridei Robinson  
— puberula Hook.

**Williams, R. S.**

2504 Mandonii Sch.-Bip.

## THE STEVIAS OF BOLIVIA.

FOR some ten or twelve years there has been accumulating at the Gray Herbarium a considerable mass of undetermined Bolivian Stevias. This has been due on the one hand to accessions, received by purchase or exchange, and on the other to loans of *Eupatorieae* most

kindly permitted by several of the larger herbaria, both of Europe and America.

Attempts to classify this unnamed material have been made at different times, but have, until recently, led to exceedingly unsatisfactory results. It became clear that the species were numerous, Bolivia having, in fact, a richer *Stevia*-flora than that of any other country except Mexico. Some of these species were evidently undescribed and several were represented only by tantalizingly fragmentary specimens, sufficient to show their probable novelty, but inadequate for use as taxonomic types. Though a high endemism was to be expected, there was unavoidable suspicion that some of these plants might well be merely the Bolivian representatives of species or varieties already based on extra-limital material. The literature relating to the Bolivian Stevias was scanty and furnished no keys and few carefully worked out contrasts even among the better known species.

On the whole it seemed best to defer further attempts at revision of the Bolivian members of the genus until those of surrounding countries, notably of Peru, Argentina and Paraguay, could be given at least preliminary elaboration. Thus, for some years, the best that could be accomplished was to make such preparations as were feasible. In the first place, needful photographs of the types of the Bolivian Stevias were obtained as far as possible by purchase and exchange. During the writer's journeys to Europe in 1927 and 1928 he was able to visit, at least briefly, several of the leading herbaria of the world, notably those of Kew, the British Museum (both including the collections of Bridges and of Pearce), the Museum of Natural History at Paris (rich in the collections of Mandon and including the herbarium of Schultz-Bipontinus), the herbaria of both the Conservatory and University at Geneva, the Botanical Museum at Zurich, and the Botanical Museum at Berlin-Dahlem, where Hieronymus worked and most of his numerous types are preserved. At these establishments the *Stevia* material was examined and many dissections, kindly allowed by the management, were made and recorded by sketches and notes. Through lack of time the work had to be done hurriedly, but loans of much critical material were amiably permitted so that it could receive more leisurely study at Cambridge.

The larger American herbaria have shown also great readiness to place their *Stevia* material at the service of the writer. Especially important in this connection was the New York Botanical Garden, with its unexcelled representation of the notable Bolivian collections

of Rusby, Bang, R. S. Williams, and of the Mulford Expedition, as well as the herbarium of Kuntze, including the types of the Bolivian species based on his collections. The United States National Herbarium lent, together with much other material, an extended series of the Bolivian *Stevias* collected by Dr. Otto Buchtien, Dr. Erik Asplund and Mr. Ernesto Günther. Mr. Cornelio Osten of Montevideo was so kind as to lend the entire representation of the *Eupatorieae* in his large private herbarium, exceptionally rich in extra-tropical South American plants. Dr. H. H. Rusby with great generosity lent for study, criticism, and publication if desired, the types of several *Stevia* novelties which he had observed. The Missouri Botanical Garden and the Field Museum of Natural History have also lent their *Stevia* material both of Peru and Bolivia.

From these various sources it seemed likely that the writer had seen a high percentage of the *Stevia* specimens thus far deposited in herbaria. But, as above indicated, preliminary studies of the genus as represented in the surrounding countries had to be made. These have now been completed and, in part, published, at least as to those of the Argentine Republic, Paraguay and (in the present paper) of Peru.

Notwithstanding this preliminary work, extending over some years, an elaboration of the Bolivian *Stevias* has proved, during the last few months, a task of a very discouraging nature. In no country previously studied did the *Stevias* show such perplexing inconstancy and transition. Thus, for instance, between such very diverse types as those of the upright, narrow-leaved, mesophytic *S. Bangii* and the low, matted, elliptic-leaved alpine xerophyte *S. Mandonii*, a practically complete series of intermediates can be demonstrated. The monographer is thus confronted by a serious dilemma: on the one hand, the extreme elements are here far too unlike to be convincingly united as conspecific ecological phases of the same plant, and on the other hand, their separation seems, at best, vague and artificial.

The treatment of the Bolivian *Stevias* here presented is confessedly unsatisfactory, but it is put forth in the confident hope that it will prove useful. Its key should be followed with all due caution, and the user should bear in mind that at almost any point he is likely to encounter exceptions of a perplexing nature. If he becomes disgusted, let him try to identify his Bolivian *Stevias* by reference to previous literature, and, if he has the same experience as the writer, he will return to the key with the feeling that even an obscurely blazed trail is better than no guidance at all through this taxonomic jungle.

Of the 41 species and 7 (non-typical) varieties here recognized, no less than 39, that is to say about 81%, are, to our present knowledge, endemic to the country. Of the rest only 3 extend into Peru and 6 into northern Argentina. Strangely enough, even the Bolivian representatives of such widely distributed species as *S. urticaefolia* and *S. elatior* are endemic varieties.

Notwithstanding this high endemism and the exceptionally rich representation of *Stevia* in Bolivia, the country cannot be regarded as a natural center or distributional area for the genus. This becomes evident on study of internal distribution. The *Stevias* fall with astonishingly few exceptions into three well nigh mutually exclusive groups, as follows: 1) those of central and western Bolivia (Departments Cochabamba and La Paz); 2) those of extreme southern Bolivia (Departments Potosi, Tarija and Gran Chaco); and 3) those of eastern Bolivia (Department Santa Cruz). To the surprise of the writer, he has been thus far unable to find any conclusively identical elements between the known *Stevia* floras of Bolivia, on the one hand, and of Paraguay or Brazil, on the other. Obviously this must be due solely to our very imperfect knowledge of campestrine eastern Bolivia and of the adjacent portions of Brazil and Paraguay.

It has seemed best to include in the present treatment some two or three species, founded by Hieronymus upon plants of Fiebrig and attributed by him to Bolivia, which, however, coming from Toldos were, as it now appears, collected just across the southern frontier of the country, and actually in the Argentine Republic. Their inclusion seems justifiable on the ground that future exploration is almost certain to show their presence on both sides of this botanically artificial, and even politically somewhat vague line.

In conclusion it must be said that the extent of Bolivia is little realized by most Europeans and North Americans. For the former it may be stated that the country about equals the joint area of France, Germany and Italy; and for the latter that it somewhat surpasses the combined extent of California, Nevada, Utah and Arizona. With the highest appreciation of the courage, energy and diligence of those who have taken part in its botanical exploration, and the value, as well as the extent, of their services, it must be admitted that we as yet know relatively little of the floral wealth of this great country with its vast diversity of altitude, humidity and varied terrain.

#### KEY TO THE STEVIAS OF BOLIVIA.

- A. Pappus either awnless and composed of short sub-equal usually somewhat connate scales or (at least in the adelphocarps) 1-5-awned, the awns about as long as the corollas  
 § 1 EUSTEVIA. . . . B.

- B. Inflorescence loose; pedicels at maturity equalling or often much exceeding the involucre. . . . C.
- C. Leaves (mostly alternate) linear-lanceolate. . . . 21. *S. Fiebrigii*.
- C. Leaves (chiefly opposite) ovate or rhombic. . . . D.
- D. Achenes usually homomorphic and all awnless, but occasionally heteromorphic with 1-2 achenes each 1-2-awned; corolla-throat greenish-white.  
1. *S. urticaefolia* v. *pallidiflora*.
- D. Achenes heteromorphic; adelphocarps 2-4-awned; corolla-throat deep rose to purple. . . . E.
- E. Leaves membranaceous, 2.2-3.2 cm. wide, shortly setose-pilose on the veins beneath, the veinlets not exserted. . . . F.
- F. Suberect; main cauline leaves rhombic-ovate, the blade gradually narrowed to the base; outer phyllaries glandular-puberulent.  
1. *S. urticaefolia* v. *boliviensis*.
- F. Markedly decumbent; main cauline leaves deltoid-ovate, the blade rounded or abruptly contracted to a scarcely winged petiole. . . 2. *S. elatior* v. *austrina*.
- E. Leaves subcoriaceous, 1-1.8 cm. wide, only obsoletely hirtellous on the veins beneath, the veinlets exserted. . . . 3. *S. filipes*.
- B. Inflorescence or its parts much more compact; heads sessile or on pedicels shorter than the involucre. . . . G.
- G. Achenes of the same head alike as to pappus. . . . H.
- H. Pappus coroniform of short subequal scales without awns. . . . I.
- I. Phyllaries beset with short straight spreading gland-tipped hairs; heads densely clustered. . . . J.
- J. Leaves at most 2.5 cm. long and 12 mm. wide, obscurely 3-nerved, short-pilose on both surfaces. . . . 4. *S. tunariensis*.
- J. Leaves becoming 5 cm. long and 2.5-3 cm. wide, with 3 strongly exserted nerves; the surface subglabrous, the nerves slightly villous. . . . 5. *S. Stuebelii*.
- I. Phyllaries subappressed- or incurved-puberulent with glandless hairs; heads more loosely clustered or somewhat scattered along the inflorescence-branches. . . . 6. *S. neglecta*
- H. Pappus of both scales and awns. . . . K.
- K. Plant low, decumbent; leaves small, elliptic-oblong, obtuse, sessile. . . . 7. *S. Chamaedrys*.
- K. Plant erect, 3 dm. or more in height; leaves acute, petiolate. . . . L.
- L. Leaves deltoid-ovate, about two-thirds as wide as long; phyllaries beset with straight spreading gland-tipped hairs. . . . 8. *S. glomerata*.
- L. Leaves likewise deltoid-ovate and about two-thirds as wide as long but phyllaries subappressed- or crisped-puberulent with glandless hairs. . . . 9. *S. triaristata*.
- L. Leaves lanceolate-ovate, mostly less than half as wide as long; phyllaries subappressed- or crisped-puberulent with glandless hairs. 10. *S. soratensis* v. *mecoyensis*.
- G. Achenes of the same head diverse as to pappus. . . . M.
- M. Achenes all awnless, 4 of them bearing a scale-pappus, the fifth calvous. . . . N.

- N.* Leaves ovate, petiolate, serrate.....10. *S. soratensis.*  
*N.* Leaves lanceolate, subsessile, entire.....11. *S. cardiatica.*  
*M.* Some of the achenes awned....*O.*  
*O.* Leaves elliptic-obovate, mostly obtuse or even rounded at tip; stems subsimple, almost naked above.....24. *S. obovata* v. *aristifera.*  
*O.* Leaves ovate or lanceolate, acute or acutish; stems usually much branched and leafy to the summit....*P.*  
*P.* Leaves small, mostly less than 1.5 cm. wide....*Q.*  
*Q.* Leaves lanceolate, membranaceous, hispid-hirtellous, the rameal oblong-lanceolate, subentire; phyllaries closely beset with spreading gland-tipped hairs; adelphocarps mostly 2-awned.....12. *S. Bridgesii.*  
*Q.* Leaves ovate, subcoriaceous, subglabrous; the rameal ovate-lanceolate, sharply serrate; phyllaries dorsally covered with subsessile glands; adelphocarps mostly 5-awned.....13. *S. santacruzensis.*  
*P.* Leaves larger, the cauline mostly 2-4 cm. wide....*R.*  
*R.* Leaves closely sessile and clasping by a subcordate base.....14. *S. fruticosa.*  
*R.* Leaves distinctly petioled or sessile by a narrow base....*S.*  
*S.* Leaves suborbicular-ovate, obtuse or barely acutish. Here may be sought occasional longer-awned forms of the Southern Bolivian.....27. *S. camachensis.*  
*S.* Leaves ovate or more often rhombic-ovate or -lanceolate, acute or attenuate....*T.*  
*T.* Heads mostly pedicelled, borne in loose glomerules or fastigiately branched inflorescences....*U.*  
*U.* Leaves sparingly and shortly crisped- or appressed-pilose on nerves and chief veins beneath; corollas not dark-punctate.....31. *S. boliviensis.*  
*U.* Leaves copiously setose-villous beneath; corollas dark-punctate toward the limb.....15. *S. chacoensis.*  
*T.* Heads nearly or quite sessile in dense glomerules....*V.*  
*V.* Leaves firmish, chartaceo-membranaceous; veins and veinlets exerted on both surfaces....*W.*  
*W.* Corollas reddish-violet; phyllaries densely granulated with subsessile glands, usually purplish; leaves 2-3.5 cm. long.....16. *S. totorensis.*  
*W.* Corollas white; phyllaries pale green, sparingly incurved-puberulent, gland-dotted; leaves 5-7 cm. long.  
 17. *S. reclinata.*  
*V.* Leaves membranaceous, not prominently reticulated....*X.*  
*X.* Glomerules clustered at the tips of the branches and surpassed by the surrounding leaves....18. *S. glanduloso-pubescens.*

- X. Glomerules pedunculate, loosely disposed in nearly naked corymbs, not equalled by the surrounding leaves . . . . Y.
- Y. Leaves ovate-lanceolate, sessile by a gradually narrowed base; involucre half to two-thirds as long as the florets; phyllaries beset with short spreading gland-tipped hairs. . . . . 19. *S. cochabambensis*.
- Y. Leaves ovate, rounded or abruptly narrowed to a scarcely winged petiole; involucre nearly as long as the florets; phyllaries spreadingly villous with white jointed glandless hairs. . . . . 20. *S. kuhnioides*.
- A. Pappus (at least of the adelphocarps) a crown of scales with 1-3 longer and firmer ones; these mostly unequal and much shorter than the corollas; true awns not normally present. . . . Z.
- Z. Inflorescence a diffuse panicle; pedicels equalling or exceeding the involucre. . . . a.
- a. Leaves (mostly alternate) linear to linear-lanceolate, 8-12 times as long as wide. . . . . 21. *S. Fiebrigii*.
- a. Leaves (chiefly opposite) rhombic-lanceolate, 2-3 times as long as wide. . . . . 22. *S. yaconensis*.
- Z. Inflorescence or its parts much denser; pedicels none or normally shorter than the involucre. . . . b.
- b. Leaves sessile or nearly so, rarely as much as 1.5 cm. wide. . . . c.
- c. Leaves lanceolate, attenuate; plant suberect, 3-4 dm. high. . . . . 23. *S. clivicola*.
- c. Leaves obovate to elliptical, rounded or obtuse at tip; plant decumbent, 1-2 dm. high. . . . . 24. *S. obovata*.
- b. Stem-leaves ovate, petiolate or provided with a cuneate usually petioliform base, the blade rarely less than 2 cm. wide. . . . d.
- d. Many-stemmed or abundantly branched from the base; stems and branches slender, pale or whitish; Southern Bolivia. . . . . 25. *S. Benderi*.
- d. Stems usually solitary, frequently branched but not from the base, green to deep violet-brown, 3 mm. or more in diameter. . . . e.
- e. Leaves said to be very glabrous on both surfaces; Southern Bolivia. . . . . 26. *S. bermejensis*.
- e. Leaves always somewhat pilose either above or (at least along the nerves) beneath. . . . f.
- f. Expanded part of the leaf-blade in mature cauline leaves passing abruptly into a very narrowly winged or wingless petiole. . . . g.
- g. Leaves 3-nerved from above the base of the blade, slightly carneous; Southern Bolivia. . . . h.
- h. Phyllaries sparingly setulose or villulose, not stipitate-glandular. . . . i.
- i. Leaves suborbicular-ovate, obtuse or barely acutish, at most 5 cm. long; florets much exerted; corollas deep rose or purple; phyllaries often purple-tinged, gradually narrowed to a point. . . . . 27. *S. camachensis*.



- i.* Leaves subdeltoid-ovate, often 6–7 cm. long, usually acute to acuminate; florets little exserted; corollas white; phyllaries greenish-stramineous, rather abruptly sharp-pointed. . . . . 28. *S. eclipses*.
- h.* Phyllaries (at least the outer) beset with stipitate glands; corollas deep rose to violet. . . . . 29. *S. calderillensis*.
- g.* Leaves 3-nerved from the very base of the blade, thin-membranaceous; Central Bolivia. . . . . 30. *S. galeopsidifolia*.
- f.* Expanded part of the leaf-blade in mature cauline leaves gradually contracted below to a cuneate petioliform base. . . . . *j.*
- j.* Phyllaries obtuse, erose-denticulate at summit, sparsely glandular-puberulent dorsally; Southern Bolivia. . . . . 18. *S. glanduloso-pubescens*.
- j.* Phyllaries acute or acuminate, finely incurved- or crisped-puberulent or subglabrous; Western Central Bolivia. . . . . 31. *S. boliviensis*.
- A.* Pappus (at least of the adelphocarps) multiaristate, the (6–) 9–20 awns about as long as the corollas § 3 MULTIARISTATAE. . . . . *k.*
- k.* Leaves narrowly oblanceolate to linear, 7–20 times as long as wide. . . . . *l.*
- l.* Leaves (in Bolivian forms) linear or nearly so, acutish, membranaceous; internodes mostly 1.5–2.5 cm. long; glomerules disposed in an open spreadingly branched corymb; heads about 1 cm. long; achenes 3.2 mm. long. . . . . 32. *S. mercedensis*.
- l.* Leaves oblanceolate, thickish; internodes mostly less than 1 cm. long; glomerules closely packed in a fastigate corymb; heads 8–9 mm. long; achenes about 2.7 mm. long. . . . . 33. *S. samaipatensis*.
- k.* Leaves lanceolate to broadly ovate or elliptical, mostly 1.5–5 times as long as wide. . . . . *m.*
- m.* Outer phyllaries closely beset with short-stiped glands often accompanied by a few longer glandless trichomes. . . . . *n.*
- n.* Leaves small, even the main cauline only 2–3 cm. long, sessile, chartaceo-coriaceous, obtuse; reticulated veinlets prominent on both surfaces. . . . . 34. *S. Kuntzei*.
- n.* Leaves larger, the main cauline mostly 4–6 cm. long, petioled, membranaceous, acute; veinlets not conspicuously exserted. . . . . 35. *S. setifera*.
- m.* Outer phyllaries incurved-puberulent or spreading-villulose with glandless hairs; glands if present closely sessile. . . . . *o.*
- o.* Petioles together with the contracted petioliform bases of the main cauline leaves mostly 2–3 cm. long. . . . . 36. *S. sarensis*.
- o.* Petioles together with the contracted petioliform bases of the main cauline leaves about 5–8 mm. long. . . . . *p.*
- p.* Heads on short pedicels (1–3 mm. in length) in a flattish fastigiate branched rather dense compound corymb; leaves subconcolorous, nigrescent in drying. . . . . 37. *S. melancholica*.
- p.* Heads sessile in paniculately disposed glomerules; leaves strongly discolorous, almost white beneath. . . . . 38. *S. discolor*.

- o. Leaves (neither nigrescent in drying nor whitish beneath, nor raised on a conspicuously narrowed petioliform base) sessile or on petioles rarely more than 1–4 mm. long. . . . *q*.
- q*. Leaves lanceolate to ovate, acute or somewhat narrowed to an obtuse apex, at least the main cauline serrate, membranaceous or nearly so. . . . . 39. *S. Bangii*.
- q*. Leaves prevailingly elliptic to obovate-oblong, usually very obtuse or rounded at tip, obscurely crenate, slightly fleshy or subcoriaceous. . . . *r*.
- r*. Glomerules disposed in a more or less expanded corymb, the heads much exceeding the mostly lanceolate or narrowly oblong surrounding bracts; stems assurgent, often 2 dm. or more in length. Southern Bolivia. . . . . 40. *S. tarijensis*.
- r*. Glomerules closely aggregated into a subglobose terminal cluster, often equalled or even exceeded by the broadly ovate or elliptical bracts; stems procumbent, matted, mostly about 1 dm. in length. Western Central Bolivia and adjacent Peru. . . . . 41. *S. Mandonii*.

1. ***S. urticaefolia*** Billb. For description see p. 24 —Billb. in Thunb. Pl. Bras. Dec. i. 13 (1817).

Of this species the typical variety, with awnless pappus and purple corolla-throat, does not seem yet to have been found in Bolivia, though the following varieties occur there at least sparingly.

Var. ***pallidiflora*** Robinson. Pappus a short erose or toothed crown of connate scales, uniform in all 5 achenes or in 1–2 supplemented by 1–2 awns; corolla-throat yellowish or greenish.—Contrib. Gray Herb. xcvi. 16 (1831). Listed by Rusby, Bull. N. Y. Bot. Gard. iv. 377 (1907), as *S. urticifolia* Thunb.

LA PAZ: Prov. Larecaja: sunny slopes at Hacienda Casana, Tipuani Valley, alt. 1400 m., *Buchtien*, no. 7544 (U. S., Gr.).

DEPARTMENT NOT INDICATED: without data of collection, *Bang*, no. 2877 (Gr., N. Y.); at Nequejahuira, alt. about 2440 m., *Tate*, no. 669 (N. Y., phot. Gr.).

Var. ***boliviensis*** (Hieron.) Robinson, comb. nov. Corollas with violet throat and roseate lobes; achenes unlike, some bearing merely a short toothed crown of connate scales, and others provided both with a short scale-pappus and 1–3 awns (about equalling the corollas or some of them shorter).—*S. Claussenii* var. *boliviensis* Hieron. in Engl. Bot. Jahrb. xxii. 723 (1897).

COCHABAMBA: Prov. Chapare: at Barbechos Incachaca, alt. 2250 m., *Steinbach*, no. 9147 (Gr., Mo.).

DEPARTMENT NOT INDICATED: alt. 2600 m., *Kuntze* (Brl., phot. Gr.; N. Y., phot. Gr.).

2. ***S. elatior*** var. ***austrina*** Robinson. Loosely decumbent and curved-ascending, hirsute with long white jointed hairs (at maturity

glandless); the lax inflorescence both hirsute and glandular-puberulent; corolla-throat dark, probably purple, the lobes pink or white; achenes unlike, the 4 adelphocarps each 5-awned (their awns about as long as the corollas), the idiocarp awnless.—Contrib. Gray Herb. xcvi. 7 (1931). *S. elatior* HBK. as reported by Hieron. in Ktze. Rev. Gen. iii. pt. 2, 180 (1898), but by no means typical.

SANTA CRUZ: Sierra de Santa Cruz, alt. 1600 m., Kuntze (N. Y., U. S., phot. Gr.).

This puzzling plant differs strikingly from any form of the common *S. elatior* HBK. known to the writer from north of the equator, being weaker, more decumbent, and much more coarsely pubescent. However, its characters are not really strong and it may stand provisionally as a geographically isolated variety of the widespread and more northern plant.

3. ***S. filipes*** Rusby. Slender perennial herb, slightly lignescent toward the mostly inclined base; the loosely paniculate inflorescence with filiform dark purple glandular-puberulent branches and pedicels; internodes short, mostly exceeded by the leaves; leaves opposite, the main cauline rhombic-ovate, crenate-serrate except on the contracted cuneate-winged petioliform base; blades subcoriaceous, sparingly hirtellous on both surfaces, plane or nearly so above, slightly paler and conspicuously reticulate with prominent nerves and veins beneath; heads about 1 cm. long; phyllaries linear-lanceolate, acute, dark purple, finely glandular-puberulent; corolla-throat deep purple, the lobes nearly white; achenes unlike, the 4 adelphocarps each 3-4-awned, the idiocarp awnless, surmounted by a shallow erose or denticulate cup of connate scales (about 0.3 mm. high).—Bull. N. Y. Bot. Gard. viii. 126 (1912).

LA PAZ: Prov. Caupolican: on hills near Apolo, alt. 1830 m., R. S. Williams, no. 124 (N. Y., phot. Gr.; U. S., fragm. Gr.).

4. ***S. tunariensis*** Hieron. Curved-ascending perennial herb with slender leafy crisped-puberulent to shortly pilose at length glabrate stem; leaves opposite, sessile or nearly so, acute, serrate except at the entire cuneate base, membranaceous, shortly crisped-pilose on both surfaces, 1.5-2.5 cm. long, 8-11 mm. wide; heads about 1 cm. long, sessile in dense pedunculate glomerules; these rather closely clustered in a small terminal corymb; achenes alike, crowned by a short hyaline laciniate-toothed border of connate scales.—Hieron. in Engl. Bot. Jahrb. xxii. 713 (1897).

COCHABAMBA: Prov. Tunari: at Tunari, alt. 3000 m., Kuntze (N. Y., phot. Gr., fragm. Brl., tracing Gr.).

5. **S. Stuebelii** Hieron. Erect opposite-branched glandular-puberulent perennial herb; leaves opposite, subsessile or shortly petiolate, lanceolate-ovate, narrowed to an elongate but at tip obtusish apex, crenate-serrate except for the entire cuneate base, 3-ribbed from above the base, sparingly puberulent but finally glabrescent; heads sessile or shortly pedicelled in small glomerules; these disposed in somewhat fastigiately and irregularly branched terminal corymbs; phyllaries dark purple, narrowly oblong-lanceolate, obtuse to shortly pointed, dorsally beset with spreading straight gland-tipped hairs; corolla-throat purple, the lobes much paler, probably roseate, hispid on the back; achenes alike, crowned by a laciniate border of more or less connate scales (0.5–0.8 mm. high).—Hieron. in Engl. Bot. Jahrb. xxi. 328 (1895).

LA PAZ: Prov. Yungas: above Taca in the valley of the Yungas, *Stübel*, no. 52d (Brl., phot. and fragm. Gr.).

6. **S. neglecta** Rusby. Tall perennial herb; stem terete, bright red to brownish-purple, pithy, incurved-puberulent, becoming as much as 7 mm. thick; internodes mostly 3–8 cm. long; leaves opposite, rhombic-ovate, acute, serrate, the main cauline rather abruptly contracted to an entire narrowly cuneate petioliform base; heads (about 9 mm. long) mostly short-pedicelled, in small rather loose terminal glomerules or somewhat scattered along the branchlets of subfastigiate panicles; phyllaries linear-oblong, acute, substramineous, incurved-puberulent with glandless hairs interspersed with some sessile glands; corollas with slender fuscous proper tube and ochroleucous throat and limb; achenes alike, crowned with minute scales (0.2 mm. high) somewhat connate into a lacerate-dentate border.—Mem. Torr. Bot. Club, iv. 209 (1895). *S. stenocephala* as used by Rusby, Mem. Torr. Bot. Club, iii. no. 3, p. 52 (1893), not Sch.-Bip.

LA PAZ: vicinity of La Paz, alt. 3050 m., *Bang*, no. 611 (Gr., N. Y., U. S., Field Mus., Mo.).

7. **S. Chamaedrys** Griseb. Low perennial herb, several-stemmed or branched almost from the usually decumbent base; stems slender, flexuous, leafy, mostly 1–2 dm. long; leaves opposite, sessile or nearly so, rhombic-ovate to elliptic-oblong, obtuse to rounded at tip, shallowly crenate to entire, 1–2 cm. long, 5–8 (–12) mm. wide, membranaceous; heads (about 12 mm. long) sessile or subsessile in terminal solitary or clustered glomerules; phyllaries lanceolate-oblong, acute, dorsally pubescent; corollas with purple tube and throat, the limb pink or white; achenes crowned by a scale-pappus (0.4 mm. high) with or without 2–3 delicate bristle-like awns (sometimes as long as

the corollas).—Goett. Abh. xxiv. 167 (1879); Hieron. in Engl. Bot. Jahrb. xxii. 729 (1897); Robinson, Contrib. Gray Herb. xc. 68 (1930).

TARIJA [?]: alt. 3000 m., *Fiebrig*, no. 3423 in part (Brl., phot. and small fragm. Gr.).

[ARGENTINA.]

8. **S. glomerata** Hieron. Suffruticose, probably 4 dm. or more in height; stems leafy, glandular-puberulent and villous; leaves opposite, sessile, acute, crenate-serrate, the main cauline ovate or subrhombic-ovate, more or less cuneate and entire at the base, puberulent above, somewhat pubescent beneath, 3–4 cm. long, 1.8–2.5 cm. wide; heads sessile or nearly so in close glomerules; these shortly stalked, calyculate-bracteate, and disposed in a dense rounded terminal corymb; phyllaries lanceolate-linear, acuminate, 8 mm. long, pale and greenish-substramineous toward the base, purple near the tip, densely beset dorsally with gland-tipped hairs; corollas deep purple; achenes crowned with short connate scales and about 2 unequal purple awns.—Hieron. in Engl. Bot. Jahrb. xl. 357 (1908).

TARIJA: Prov. Arce: Camacho, *Fiebrig*, no. 2868a in part (Brl., phot. Gr.).

DEPARTMENT [probably Tarija] NOT VERIFIED: Calderillo, alt. 3000 m., *Fiebrig*, no. 3423 in part (Brl.), poorly developed and doubtful.

9. **S. triaristata** Hieron. An erect perennial herb, 6 dm. or more in height, very similar to the preceding but having the pedicels and branches of the corymb somewhat lanate, the stem-leaves much more definitely petioled, and the achenes all 3-awned as well as crowned by a short scale-pappus.—Hieron. in Engl. Bot. Jahrb. xl. 358 (1908).

SOUTHERN BOLIVIA [probably Tarija]: *Fiebrig*, no. 3541 (Brl., phot. Gr.).

10. **S. soratensis** Hieron. For description see p. 25 —Hieron. in Engl. Bot. Jahrb. xxviii. 560 (1901). *S. grandidentata* Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865) and *Linnaea*, xxxiv. 535 (1865–66), without char. in either place; first described by Hieron. l. c. xxii. 714 (1897) but then antedated by the homonym of Sch.-Bip. in *Klatt, Leopoldina*, xx. 75 (1884). *S. micropappa* Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865), *micropappea* Sch.-Bip. *Linnaea*, xxxiv. 535 (1865–6), and *stenocephala* Sch.-Bip. ll. cc.—all being nomina nuda uselessly put on printed record merely to become burdens on synonymy. *S. glandulifera* as used by Klatt, l. c., but not of Schlecht.

Three varieties may be distinguished as follows.

Var.  $\alpha$ . **typica**. Phyllaries densely beset with spreading gland-tipped hairs; pappus awnless.

LA PAZ: Prov. Larecaja: dry places in copses, Quincocirca, vicinity of Sorata, in the temperate region, alt. 2650 m., *Mandon*, no. 245 in part (Gr.,

N. Y., Gen.); also at Sorata, *Günther*, no. 8, being no. 12,015 of Buchtien's distrib. (U. S., fragm. Gr.).

[PERU.]

Var.  $\beta$ . **subeglandulosa** Hieron. Phyllaries dorsally covered with incurved or crisped white glandless hairs, a few scattered sessile glands being sometimes interspersed; pappus awnless.—Hieron. in Engl. Bot. Jahrb. xl. 359 (1908); Robinson, Contrib. Gray Herb. xcvi. 15 (1931). *S. grandidentata* as used by Rusby, Mem. Torr. Bot. Club, vi. 55 (1896), but of Sch.-Bip. only in small part. *S. grandidentata* var. *subeglandulosa* Hieron. in Engl. Bot. Jahrb. xxii. 798 (1897).

LA PAZ: Prov. Larecaja: dry places in copses, Quincocirca, vicinity of Sorata, in the temperate region, alt. 2650 m., *Mandon*, no. 245 in part (N. Y.). Prov. Murillo: Rio Palca Valley, base of Mt. Illimani, alt. 2300 m., *Bro. Julio*, no. 70 in part (U. S., fragm. Gr.).

COCHABAMBA: Vicinity of Cochabamba, *Bang*, no. 1149 (Gr., N. Y., U. S., Mo.).

Var.  $\gamma$ . **mecoyensis** Robinson. Phyllaries as in the preceding variety, but achenes each provided with 2 well developed awns as well as the usual scale-pappus.—Contrib. Gray Herb. c. 11 (1932).

TARIJA: Red Hills, Mecoya, alt. 2745–3050 m., April 1864, *Pearce* (K., phot. and small fragm. Gr.).

11. **S. cardiatica** Perkins. Slender, suffruticose, erect, 3 dm. or more in height, branched from near the base, densely glandular-puberulent; leaves opposite below, scattered above, sessile, lanceolate, attenuate, entire, membranaceous, glandular-puberulent; heads (about 13 mm. long) shortly pedicelled or sessile in dense terminal solitary or corymbously disposed glomerules; phyllaries dorsally beset with sessile glands and spreading glandless hairs; corollas with tube and throat deep purple, the lobes pale (probably white or nearly so in nature); achenes unlike but all of them awnless, the 4 adelphocarps crowned by a toothed border of more or less connate scales (about 0.4 mm. high), the idiocarp destitute of pappus.—Perkins in Engl. Bot. Jahrb. xlix. 222 (1913).

POTOSI: Quechisla (lat. 20° 30' S., long. 66° 20' W.) on slaty ground, alt. 3450–3500 m., *Bender*, no. 22 (Brl., phot. Gr.); at same locality, *Cárdenas*, no. 89 in part, that is to say as to element with narrow entire leaves (Gr.).

Though this species was originally described as having 3-flowered heads, they are, at least the heads (even of the type-material) so far as examined by the writer, 5-flowered, as is normal throughout most of the genus. The plant is reported by Bender as being valued locally as a remedy for heart disease.

12. **S. Bridgesii** Rusby. Erect or curved-ascending, copiously branched, probably herbaceous and perennial (the base unknown); stem rather weak, pithy, green to somewhat purplish above, densely glandular-puberulent, leafy; leaves opposite or (many of the upper) alternate, oblong-lanceolate, acute, serrate except at the cuneate base, sessile or shortly petioled, hispid-puberulent on both surfaces (the hairs short, white, slightly thickened at base, at first gland-tipped, soon glandless), mostly 2–3 cm. long and 6–10 (–12) mm. wide, the rameal smaller, often entire; heads (12–12.5 mm. long) sessile or shortly pedicelled in subfastigate corymbously or paniculately disposed glomerules; phyllaries lanceolate-linear, attenuate, about 8 mm. long, spreading-hispidulous (the hairs white, stout-based, fugaciously if at all gland-tipped); corollas with deep purple tube and throat, the lobes white or roseate; achenes unlike, the 4 adelphocarps crowned by scales and 2–3 awns (mostly about equalling the corollas), the idiocarp bearing a scale-pappus only.—Bull. N. Y. Bot. Gard. iv. 377 (1907).

COCHABAMBA: Vicinity of Cochabamba, *Bang*, no. 2047 (N. Y., phot. Gr.).  
WITHOUT INDICATION OF DEPARTMENT: *Bridges* acc. to Rusby, l. c.

In habit this suspiciously approaches some forms of the Argentine *S. vaga* Griseb., particularly the one described by Hieronymus in Engl. Bot. Jahrb. xxii. 709 (1897) as *S. diversipapposa* var. *longiarsistata*, but that has somewhat smaller heads, a less copious inflorescence, and a pubescence inclined to be incurved or crisped, and therefore appears to be a different plant.

13. **S. santacruzensis** Hieron. Much branched suberect under-shrub; stem and curved-ascending leafy branches brown, finely puberulent, the hairs being very short, incurved, rarely and fugaciously if at all gland-tipped; leaves opposite, sessile, ovate, acute to obtusish, serrate except at the entire cuneate base, subcoriaceous, the cauline 1.5–2.5 cm. long, 1–1.5 cm. wide, the rameal smaller, mostly 1–1.5 cm. long; nerves and chief veins prominent on the lower surface; heads (about 13 mm. long) sessile or shortly pedicelled in rather small glomerules; these borne at the tips of the branches and together forming an ovoid or subpyramidal inflorescence; phyllaries oblong, acute, mucronulate, very finely puberulent, the hairs mostly incurved and glandless but interspersed with sessile or scarcely stiped glands; corollas deep reddish purple, the lobes of the limb rather narrow, linear-lanceolate; achenes unlike, the 4 adelphocarps each 5-awned, with some scales or slight scarious expansions at base, the idiocarp awnless, bearing a toothed scarious cup (about 1 mm. high).—Hieron. in Engl. Bot. Jahrb. xxii. 731 (1897).

SANTA CRUZ: Sierra de Santa Cruz, alt. 2600 m., *Kuntze* (N. Y., phot. Gr.).

14. **S. fruticosa** Griseb. Shrub about 2 m. high, much branched and leafy above; leaves (except some of the uppermost) opposite, closely sessile by a rounded or subcordate entire base, acute, sharply serrate, mostly 2–3 cm. long and 1–2 cm. wide, of firm texture, the nerves and veins prominent beneath; heads (10–11 mm. long) subsessile in bracteate corymbously disposed glomerules; bracts ovate-lanceolate, acute, subentire, equalling or often exceeding the glomerules; phyllaries lanceolate-oblong, acute, dorsally scabrid-puberulent; achenes unlike, the 4 adelphocarps each 1–3-awned and provided also with a short crown of toothed scales, the idiocarp bearing a similar crown (about 0.6 mm. high) but no awns.—Goett. Abh. xxiv. 167 (1879); Hieron. in Engl. Bot. Jahrb. xxii. 731 (1897).

TARIJA: on the Cuesta del Tambo, between El Tambo and Narvaez, *Hieronymus & Lorentz*, no. 876 (Brl., phot. Gr.).

15. **S. chacoensis** R. E. Fries. Perennial herb about 1 m. high, pilose, leafy to the rather loose inflorescence; leaves subopposite or (especially the rameal) alternate, softly membranaceous, ovate-lanceolate, consisting of an expanded serrate attenuate portion and an abruptly contracted then cuneately narrowed entire petioliform basal part, conspicuously pilose on both surfaces, yellowish green, the largest about 1 dm. long and 3.8 cm. wide; heads sessile or more often short-pedicelled and somewhat scattered on the branches of a subfastigiate inflorescence; phyllaries narrowly oblong, acute and cuspidate, dorsally covered by jointed white glandless hairs interspersed with some sessile glands; corollas white; achenes unlike, the 3 adelphocarps crowned by a scale-pappus and 2–3 well developed stramineous awns (about equalling the corollas), the 2 idiocarps bearing a similar scale-pappus with or without a rudimentary awn (much shorter than the corollas).—Ark. Bot. v. no. 13, p. 7, t. 3, ff. 1–6 (1906).

GRAN CHACO: open place in dense forest at Tatarenda, *Fries*, no. 1388 (U. S., phot. and fragm. Gr.).

16. **S. totorensis** Robinson. Erect virgate perennial herb, 1.5–4 dm. high, slightly scabrid; leaves opposite, sessile, ovate, acute, serrate except at the entire cuneately narrowed base, subglabrous, 2.5–3.2 cm. long, 1.5–2 cm. wide, of rigid texture, the nerves and veins prominent on both surfaces; glomerules few, rather dense, borne in a flattish corymb; phyllaries (about 6.5 mm. long) lanceolate-oblong, acute, firmish in texture, dorsally beset with subsessile glands; corollas violet; achenes unlike, the 4 adelphocarps each crowned by scales



and 3-5 awns (as long as the corollas), the idiocarp bearing similar scales and 2-3 awnlets much shorter than the corolla.—Contrib. Gray Herb. xcvi. 16 (1931).

COCHABAMBA: Prov. Totorá: alt. 3000 m., at Bucona, *Steinbach*, no. 3953 (Brl., phot. and small fragm. Gr.).

Habitally similar to but clearly not identical with the Brazilian *S. myriadenia* Sch.-Bip.

17. ***S. reclinata*** Rusby. Probably suffruticose and about 1 m. high (the base unknown), spreading-pubescent; stem apparently curved-ascending, leafy to the inflorescence; leaves opposite, petiolate, ovate, acute, sharply and rather coarsely serrate except for the abruptly contracted then gradually cuneate entire base, chartaceo-coriaceous, slightly hirtellous, 6-7.5 cm. long, 3-4 cm. wide; veins rather closely reticulated and exerted on both surfaces; heads (about 11 mm. long) subsessile in somewhat loose often nodding glomerules; phyllaries green, linear-lanceolate, acute, dorsally beset with delicate white incurved or crisped glandless hairs interspersed with sessile or subsessile glands; corollas white; achenes unlike, the 4 adelphocarps surmounted by a very narrow scarious border together with 1-3 fully developed awns (about equalling the corollas), the idiocarp bearing a similar scarious border but no awns.—Bull. N. Y. Bot. Gard. viii. 127 (1912).

LA PAZ: Prov. Caupolicán: near Apolo, about 1770 m. alt., *R. S. Williams*, no. 1468 (N. Y., phot. Gr., U. S.).

18. ***S. glanduloso-pubescens*** Hieron. Suffruticose, erect, upwardly branched above; leaves opposite, subsessile (on a cuneately narrowed entire base), rhombic-ovate, acuminate, rather deeply crenate-serrate, glandular-puberulent above, glandular-pubescent beneath, the largest about 5.5 cm. long, 2.5 cm. wide; heads sessile or nearly so in clustered glomerules surpassed by the foliaceous bracts; phyllaries lanceolate-linear, obtuse, erose-denticulate at the summit, the outer sparingly glandular-pubescent dorsally; achenes unlike though all bearing some muticous denticulate more or less connate scales; 3 achenes also provided with awnlet-tipped scales as much as 1.5 mm. long; the 2 remaining achenes bearing usually at least 1 fully developed awn (4.5 mm. long) and a shorter awnlet as well as the muticous scales.—Hieron. in Engl. Bot. Jahrb. xl. 360 (1908).

SOUTHERN BOLIVIA [probably Dep. Tarija]: without indication of locality, *Fiebrig*, no. 3486 (Brl., phot. Gr.).

19. **S. cochabambensis** Hieron. Erect, herbaceous perennial, 4–5 dm. high, densely spreading-pubescent, the hairs white, stoutish-based and in the inflorescence gland-tipped; leaves ovate-lanceolate, sessile by a gradually narrowed entire base, finely and rather sharply serrate, acute to acuminate, pale green (sometimes purple-tinged), the largest cauline 4–4.5 cm. long, 1.2–1.7 cm. wide; the rameal smaller, subentire; heads (10–14 mm. long) sessile or nearly so in dense glomerules terminal upon the filiform ascending branches of a loose flattish-topped corymb; phyllaries deep purple, shortly acuminate, dorsally stipitate-glandular; florets much exerted; corollas as to tube and throat deep purple, the lobes paler, probably pink or white; achenes usually unlike, the 4 adelphocarps bearing a short scale-pappus (about 0.5 mm. high) and 3–5 slender purple awns (about equalling the corollas), the idiocarp crowned merely with the scale-pappus or rarely awn-bearing like the others.—Hieron. in Engl. Bot. Jahrb. xxii. 726 (1897).

COCHABAMBA: near the city of Cochabamba, alt. 3000 m., *Kuntze* (N. Y., phot. Gr.).

20. **S. kuhnioides** Rusby. In most respects exceedingly similar to the preceding, but much less glandular, the branches of the inflorescence as well as the backs and margins of the phyllaries covered with spreading or crisped grayish glandless hairs interspersed with some sessile glands, the florets scarcely exceeding the involucre, and the main cauline leaves at first rounded at base then cuneately narrowed to a definite and almost wingless petiole.—Rusby in Robinson, Contrib. Gray Herb. xcvi. 7 (1931).

LA PAZ: Prov. Larecaja: Cordillera Real on the road from Okara to Ancoma, alt. about 3350 m., *Tate*, no. 870 (N. Y., phot. Gr.).

21. **S. Fiebrigii** Hieron. Perennial, herbaceous or slightly lignescent toward the base, 3–8 dm. high, subglabrous, diffusely branched above; leaves chiefly alternate, sessile or shortly petioled, linear-lanceolate, entire or obscurely 1–3-toothed near the acute apex, yellowish-green, paler beneath, the largest about 5 cm. long and 5 mm. wide; heads loosely paniculate, borne singly on filiform pedicels (5–10 mm. long); corollas as to tube and throat purple, limb paler, probably pink; achenes crowned with more or less connate and toothed scales (about 0.6 mm. high), with or without 1–2 awnlets (about 1–1.5 mm. long) or more rarely 2 fully developed awns.—Hieron. in Engl. Bot. Jahrb. xl. 365 (1908); Robinson, Contrib. Gray Herb. xc. 61 (1930).

TARIJA: Red Hills, Mecoya, *Pearce* (K., phot. and small fragm. Gr.), a form with part of the achenes in some of the heads 2-awned.

The type-locality for this species, namely on steep grassy slopes, alt. 1800 m., near Toldos not far from Bermejo, where the plant was collected by *Fiebrig*, no. 2330a (Brl., phot. Gr.), though cited by Hieronymus as in Bolivia, appears from the best available maps to be in the Argentine province of Salta slightly to the south of the Bolivian boundary. From the earlier collection of *Pearce* showing conspecific material from Mecoya, the species may, however, be definitely included in the Bolivian flora.

22. ***S. yaconensis*** Hieron. Erect or ascending herbaceous or suffruticose perennial, 3–9 dm. high; stem leafy, simple below, much branched above; leaves (except some of the upper ones) opposite, lanceolate-ovate, acute, rather coarsely serrate except at the entire cuneately narrowed petioliform base, the largest cauline 6–8 cm. long, nearly half as wide; inflorescence a diffusely branched panicle; heads borne singly on filiform pedicels (1–1.5 cm. long); corollas as to tube and throat deep purple, the limb pink; achenes unlike, the 4 adelphocarps crowned by a narrow scarious somewhat toothed border (0.5 mm. high) and 2–3 awnlets (1–1.5 mm. long) or 2–3 fully developed awns, the idiocarp destitute of pappus.—Hieron. in Engl. Bot. Jahrb. xxii. 724 (1897).

An Argentine species, running into several varieties (regarding which see Robinson, Contrib. Gray Herb. xc. 61) of which the following approaches so close to the frontier of Bolivia that its presence in the flora of the country seems exceedingly probable.

Var. ***subeglandulosa*** Hieron. Pedicels and outer phyllaries covered with short incurved glandless puberulence, with or without some sessile glands interspersed.—Hieron. in Engl. Bot. Jahrb. xl. 366 (1908); Robinson, l. c. 62 (1930).

TARIJA ? alt. 1800 m., Toldos slightly southwest of Bermejo and probably in the Argentine province of Salta, *Fiebrig*, no. 2330 (Gr.).

[ARGENTINA.]

23. ***S. clivicola*** Robinson. Suberect herbaceous perennial, 3–4 dm. high, finely incurved-puberulent; stem terete, brown, at anthesis denuded below by the fall of the leaves, branched from near the middle; rameal leaves opposite, sessile or nearly so, narrowly lanceolate, acute or attenuate, entire or subentire, firmly membranaceous, 3-nerved, often proliferous in the axils; heads sessile or subsessile in dense glomerules; these terminal on the ascending branches and subcorymbously disposed; phyllaries deep purple, finely incurved-puberulent on the back; corollas deep purple with roseate limb;

achenes nearly alike, the pappus composed of an erose or denticulate scarious border (about 0.5 mm. high) and 2–4 mostly unequal awnlets (1–4 mm. long).—Contrib. Gray Herb. c. 4 (1932).

LA PAZ: Prov. Larecaja: on the Loma de Canalloquenchana, alt. 3000 m. in the vicinity of Sorata, *Mandon*, no. 243 in part (Gr.).

24. **S. obovata** Rusby. Low herbaceous perennial usually branched from near the base, the branches curved-ascending, mostly 1–2 dm. high; leaves sessile, chiefly opposite and crowded on the lower part of the branches, obovate or elliptical, mostly obtuse or rounded at tip, crenate-serrate from about the middle, chartaceo-subcoriaceous, 1.5–3 cm. long, about half as wide, the nerves and veins exerted on both surfaces; heads (about 1 cm. long) sessile or very shortly pedicelled in dense short-stalked glomerules; these mostly clustered by 3's in a small terminal corymb; phyllaries (chiefly dark purple) lanceolate, acute to acuminate, loosely pilose dorsally, the hairs white, tapering, glandless but interspersed with some sessile glands; corollas dark purple, with much paler lilac or roseate lobes.—Mem. Torr. Bot. Club, vi. 55 (1896).

A species of characteristic habit, but in pappus varying as follows:

Var. **typica**. All the achenes crowned by a short scale-pappus (mostly about 0.4 mm. long) with 1–3 awnlets (about 1–1.5 (–3) mm. long).—Robinson, Contrib. Gray Herb. xc. 17 (1930). *S. obovata* Rusby, l. c. *S. humilis* Hieron. in Engl. Bot. Jahrb. xxii. 730 (1897); Kuntze, Rev. Gen. iii. 180 (1898), merely a dwarf state.

COCHABAMBA: near the city of Cochabamba, *Bang*, no. 1027 (N. Y., Gr., U. S., Field Mus., Mo.); same locality, alt. 3660 m., *Cárdenas*, no. 59 (N. Y.).

DEPARTMENT NOT STATED: Cuchicanchi Pass, *Kuntze* (N. Y., phot. Gr., U. S.).

Var. **aristifera** Robinson. Adelphocarps each crowned by a short scale-pappus together with 3–5 well developed purple awns about equalling the corollas.—Contrib. Gray Herb. xc. 17 (1930).

COCHABAMBA: Prov. Chapare: grassy places near Aduana, Colomi, alt. 2800 m., *Steinbach*, no. 8831 (Gr., Mo.).

25. **S. Benderi** Perkins. Erect herbaceous or suffruticose perennial, branched from near the base or several-stemmed, spreading-puberulent; stems slender, pale green, leafy; leaves opposite, ovate, acute, crenate-serrate except at the entire at first abruptly then cuneately narrowed petioliform base, thin-membranaceous, hirtellous on both surfaces, the largest cauline 3–3.7 cm. long, nearly half as wide; heads sessile or nearly so in dense corymbously disposed glomerules; phyllaries lanceolate-linear, acute, about 8 mm. long, dor-

sally glandular-puberulent; corollas deep purple with roseate or white limb; achenes nearly uniform, each bearing a shallow border of connate scales (0.3 mm. long) and mostly 3 usually unequal teeth or short awns (0.6–1.4 mm. long).—Perkins in Engl. Bot. Jahrb. xlix. 221 (1913).

POTOSI: Quechisla, alt. 3450–3500 m., *Bender*, no. 24 (Brl., phot. and sketches of details, Gr.); at same locality, *Cárdenas*, no. 89 in part (Gr.).

26. **S. bermejensis** Hieron. Erect or ascending perennial herb, slightly lignescent toward the base, about 4 dm. high, nearly glabrous; leaves opposite, rhombic-lanceolate, acute or narrowed to an obtuse tip, crenate-serrate except for the entire at length cuneate-attenuate petioliform base, subchartaceous, stated to be quite glabrous on both surfaces, the largest cauline nearly 1 dm. long and 2.5 cm. wide; heads subsessile or on short pedicels (1–2 mm. long) in dense bracteate glomerules; these disposed in a flattish 3-branched compound corymb; phyllaries linear-lanceolate, acute, about 5.5 mm. long, substramineous, the outer gland-sprinkled, the inner glabrous; corollas pale, probably yellowish or greenish white; achenes unlike, all bearing at the summit a low continuous border (scarcely 0.2 mm. high), the 4 adelphocarps provided also with 1–2 teeth or awnlets (0.5–1 mm. long), the idiocarp without these rudimentary awns.—Hieron. in Engl. Bot. Jahrb. xl. 361 (1908).

#### TARIJA ?

Though stated by Hieronymus to have come from Bolivia and by him named for the Bolivian village of Bermeja, this plant was collected (*Fiebrig*, no. 2326, Brl., phot. Gr.) at Toldos (alt. 1800 m.), a locality which appears to be across the international boundary from Bermeja and in the Argentine province of Salta. However, as the station is so slightly extra-limital and the presence of the plant within the boundaries of Bolivia so probable, the species is included in the present treatment.

27. **S. camachensis** Hieron. Perennial herb, erect or ascending, 5–6 dm. high, loosely and rather shortly spreading-pubescent, leafy to the summit; leaves (except some of the uppermost) opposite, suborbicular-ovate, obtuse to subacuminate, coarsely crenate except for the entire rounded base, 3–5.5 cm. long, 2.4–4 cm. wide, thin, green on both surfaces though slightly paler beneath; petiole 8–28 mm. long, scarcely winged except for a slight expansion at its attachment to the blade; heads about 11 mm. long, closely sessile in dense broadly campanulate corymbously disposed glomerules; phyllaries

narrowly lanceolate, acute, green, sparingly incurved- or spreading-pilose dorsally; corollas deep purple; achenes unlike, the 4 adelphocarps bearing a narrow scarious erose border of connate scales (about 0.3 mm. high) and 1-3 usually unequal awnlets (0.5-3.7 mm. long), the idiocarp destitute of pappus.—Hieron. in Engl. Bot. Jahrb. xl. 359 (1908).

TARIJA: Camacho, *Fiebrig*, no. 2868a in part (Gr., U. S.).

28. **S. eclipses** Robinson. Probably an herbaceous perennial; stem thickish but weak, pithy and fistulose; leaves opposite, the main cauline clearly petioled, broadly ovate, obtuse to acuminate, serrate to coarsely crenate, 5-7 cm. long, 4-5 cm. wide, subtruncate at base, membranaceous, green and appressed-hirtellous above, scarcely paler and setulose-pilose on the nerves and chief veins beneath; petiole 1.5-2.5 cm. long, slender below, cuneately winged toward the summit; heads (about 9 mm. long) closely sessile in dense glomerules; these crowded at the ends of curved-ascending branches of the compound corymb; phyllaries greenish-substramineous, shortly pointed; corollas white; achenes rather similar, the 4 adelphocarps bearing at the summit a low erose border and usually 2 awnlets, the idiocarp being destitute of the scarious border but bearing similar awnlets (only about 0.1-0.2 mm. long).—Contrib. Gray Herb. xcvi. 5 (1931).

TARIJA: Pinos near Tarija, alt. 2300 m., *Fiebrig*, no. 3126 (Gr., Field Mus., Gen., Mo.).

29. **S. calderillensis** Hieron. Erect upwardly branched perennial herb, becoming 5 dm. high; leaves opposite, the main cauline deltoid-ovate, acuminate, crenate-serrate except for the subtruncate base, glaucescent green and sparingly puberulent above, paler and pubescent on the nerves and veins beneath; petioles 1-2 cm. long, slender; rameal leaves ovate-lanceolate to elliptic, much smaller, sessile or nearly so, often obtuse to rounded at the tip; heads sessile or subsessile in dense corymbously disposed glomerules; phyllaries subacute, 6.5 mm. long, densely glandular-puberulent on the back; corollas violet-purple; achenes similar, surmounted by a low erose scarious border and 1-3 usually unequal awnlets (1.5-2 mm. long).—Hieron. in Engl. Bot. Jahrb. xl. 356 (1908).

SOUTHERN BOLIVIA [presumably TARIJA]: near Calderillo, alt. 3400 m., *Fiebrig*, no. 2959 (Brl., phot. Gr.).

Two fragmentary bits, one of *Fiebrig*, no. 3425 (Gen.) and the other separated from *Fiebrig*, no. 2214 (K., phot. Gr.), both lacking precise data of collection, have been doubtfully referred to this species.

30. **S. galeopsidifolia** Hieron. Erect perennial herb; stem densely glandular-puberulent and also beset with longer spreading attenuate jointed glandless hairs; leaves opposite, deltoid-ovate, acuminate, coarsely crenate except for the subtruncate base, thin, 3-nerved from the very base, finely pubescent and dark green above, somewhat paler and pilose especially along the nerves and chief veins beneath, the largest about 8 cm. long and 5 cm. wide; petioles 1–2.5 cm. long, slender, almost wingless; heads sessile or nearly so in hemispherical to subglobose glomerules; these aggregated in a rather dense terminal corymb; phyllaries pale green, substramineous, linear-oblong, tending at maturity to be blunt and erose at the tip, dorsally almost smooth; corollas white or nearly so; achenes alike or similar, each bearing at the summit a low denticulate scarious border (0.4 mm. high) and 1–3 longer toothlike processes or undeveloped awns (0.7–1.5 mm. long).—Hieron. in Engl. Bot. Jahrb. xxii. 719 (1897).

COCHABAMBA: Prov. Ayopaya: Tunari, *Kuntze* (N. Y., phot. Gr., fragm. Brl., tracing Gr.).

[PERU.]

31. **S. boliviensis** Sch.-Bip. Erect perennial herb, finely and often inconspicuously pubescent, mostly simple below and branched above; stem usually reddish brown or purple, pithy and fistulose, leafy; middle internodes 6–10 cm. long; leaves opposite, rhombic-ovate, acute or acuminate, crenate-serrate except for the entire basal portion, membranaceous, green on both surfaces, somewhat paler beneath, the main cauline 6–9 cm. long, 2–4.5 cm. wide, the base at first gradually or somewhat rapidly contracted then merging into a long, rather broadly and cuneately winged petioliform portion; heads (about 1 cm. long) sessile or nearly so in small clusters; these somewhat fastigiately grouped at the ends of the branches in a compound corymb; phyllaries narrowly oblong-lanceolate, acute to acuminate, usually pale green and almost glabrous; corollas chiefly white; achenes all surmounted by a narrow erose scarious border and bearing 1–2 awnlets (0.2–1.2 mm. long) or 1–3 of the achenes provided each with 1–3 fully developed awns (3–5 mm. in length).—Bull. Soc. Bot. Fr. xii. 81 (1865), and *Linnaea*, xxxiv. 535 (1865–66), both without char.; Rusby, Mem. Torr. Bot. Club, iii. no. 3, p. 61 (1893), where described from material collected by Bang. *S. Schultzii* Hieron. in Engl. Bot. Jahrb. xxii. 721 (1897), at least as to Bolivian element. *S. brevipapposa* Hieron. l. c. 718 (1897). *S. breviaristata* as used by Hieron. in Ktze. Rev. Gen. iii. 180 (1898), not Hook. & Arn.

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LA PAZ: Prov. Larecaja: in clayey soil of the temperate region in the vicinity of Sorata, *Mandon*, nos. 242 in part (Gr., N. Y., Gen., Brl.) and 244 in part (Gr., N. Y.); Sorata, *Holway*, no. 542 (Gr.), *Günther*, nos. 7 (U. S.) and 25 (U. S.); on road from Ocara to Ancoma, alt. about 3800 m., *Tate*, no. 874 (N. Y.); La Joya, alt. about 1800 m., *Tate*, no. 1049 (N. Y.); hacienda above road to Tipuani, alt. 1400 m., in subtropical region, *Buchtien*, nos. 5611 (U. S., Gr.), 7542 (Gr.), 7543 (U. S., Gr.) and 7545 (U. S., Gr.). Prov. Yungas: *Rusby*, nos. 1614 (Gr., N. Y., U. S., Field Mus., Mo.) and 1614B (N. Y.), *Bang*, no. 260 (Gr., N. Y., Mo.). Prov. North Yungas: Unduavi, alt. about 2440 m., *Rusby*, no. 1615 (N. Y.); same locality, alt. 3200 m., *Buchtien*, no. 693 (U. S.); Pitiguaya, valley of the Unduavi River, alt. about 1775 m., *Tate*, no. 749 (N. Y.); Polo-Polo near Coroico, alt. 1100 m., *Buchtien*, no. 5728 (Gr., U. S., N. Y.); Millugnaya, alt. 1200–1300 m., *Buchtien*, nos. 387 (Gr., Mo.), 746 (Gr.), 4414 (U. S., Gr.), 4748 (U. S., Gr.) and 4749 (U. S., fragm. Gr.). Prov. South Yungas: Hacienda "La Florida," *Holway*, no. 665 (Gr.); Sirupaya near Yanacachi, alt. 2100 m., *Buchtien*, no. 293 (U. S.); Chimasi near Chulumani, alt. 1400 m., *Buchtien*, nos. 2435 (U. S.) and 2436 (U. S., N. Y.). Prov. Inquisivi: deep shady ravine, Cañamina, *White*, no. 267 (Gr., N. Y.).

COCHABAMBA: near the city of Cochabamba, *Kuntze* (N. Y., phot. Gr., U. S.).

SANTA CRUZ: alt. 1600 m., *Kuntze* (N. Y., U. S.). Prov. Vallegrande: Samaipata, alt. 1200 m., *Steinbach*, no. 3715 (Brl., phot. Gr.).

This is apparently the commonest *Stevia* of the Bolivian Andes and has a considerable altitudinal as well as geographic range. It preserves a fairly constant habit, though showing often a disconcerting inconstancy in several of its characters. Thus its pappus varies from the form quite typical of § *Breviaristatae* (with narrow erose or denticulate scarious border together with 1–3 somewhat longer teeth or awnlets) to others in which at least 2–3 of the achenes bear not merely the scarious crown but 1–3 (–5) fully developed slender usually purplish awns nearly as long as the corollas. Indeed, this transition takes place so easily that heads of both kinds sometimes occur on the same individual. Consequently these pappus-differences, although often striking, fail to yield any secure basis even for varietal classification.

Similarly the inflorescence, which usually consists of small but rather dense and closely aggregated glomerules, not rarely develops a looser condition in which the heads are borne in more open and fastigiately branched partial corymbs, as for instance in *Buchtien*, nos. 387 (Gr.) and 5611 in part (Gr.), and *Tate*, no. 749 (N. Y.). One of these plants with lax inflorescence if placed by the side of others in which the heads are much more densely aggregated may easily suggest the need of at least varietal recognition, but the examination of more material will quickly show that the laxer state must be easily derived from the denser both being sometimes found in the same colony or even on different branches of the same inflorescence.

Hieronimus and some others have attempted to place certain



specimens of this Bolivian plant in the Argentine *S. breviaristata* Hook. & Arn., but that species has several differences which thus far permit its pretty ready separation. Its heads are a trifle larger, its phyllaries are much more closely incurved-puberulent, and its corollas are normally purple at least as to tube and throat.

Of *S. boliviensis*, Buchtien, no. 4413 (U. S., Gr.) from Millugnaya in North Yungas, presents a probable variety with thicker nearly entire leaves more than usually pale beneath, but the material at hand for study is inadequate, showing only the upper part of the plant and not even well developed cauline leaves below the inflorescence. As technical differences in the heads seem to be lacking, this plant may well await further examination when more complete material is available.

Similarly, a marked variety or possibly distinct species is represented by specimens collected by Buchtien at Unduavi, North Yungas, alt. 3200 m., Feb. 1914 (Gr., N. Y.). These are unnumbered and were distributed as *S. menthaefolia* Sch.-Bip., a wholly different Brazilian species. They show a plant manifestly close to *S. boliviensis* but differing from its typical form in having slightly thicker and smaller leaves, at maturity practically glabrous beneath and sessile by a gradually narrowed blade rather than a petioliform base, purple-tinged phyllaries, deep purple corolla-throat, and somewhat more developed scarious portion of the pappus. No one of these distinctions seems absolute and as the specimens at hand have only rameal and no cauline leaves, it is felt desirable not to name or give formal description to the plant until it can be studied from further material showing at least the nature of the stem foliage. The group to which *S. boliviensis* belongs is even now too difficult in the matter of specific limits to encourage the publication of further supposed novelties except on very complete and convincing material.

32. ***S. mercedensis*** Hieron. Slender erect or curved-ascending perennial herb, stems mostly single and simple to the ascendingly branched inflorescence; leaves (often proliferous in the axils) opposite or in part alternate, sessile by a gradually narrowed base or the larger shortly petioled, narrowly lanceolate to linear, rather obscurely few-toothed or entire; heads sessile in turbinate or campanulate corymbously disposed glomerules; phyllaries oblong-lanceolate, acute; corollas as to throat usually purple, the limb pink to white; achenes mostly unlike, the 4 adelphocarps 6-13-awned, the idiocarp with short scale-pappus and 1-3 (-6) awns.—Hieron. in Engl. Bot. Jahrb. xxii. 735 (1897); Robinson, Contrib. Gray Herb. xc. 73 (1930).

Of the three recorded varieties of this species two are now known from Bolivia, namely:

Var. **typica**. Phyllaries dorsally incurved-puberulent; adelphocarps each 7-13-awned.—Robinson, l. c.

TARIJA: hills, Mecoya, alt. 2440-2745 m., *Pearce* (BM., phot. and small fragm. Gr.); slightly extralimital and beyond the southern border, at Toldos near Bermejo, *Fiebrig*, no. 3418 (Brl., phot. and small fragm. Gr.).

[ARGENTINA.]

Var. **glanditecta** Robinson. Phyllaries dorsally beset with short spreading stipitate glands; adelphocarps each 6-13-awned.—Robinson, l. c. 74.

BOLIVIA: without exact locality, *Bridges* (K., phot. and small fragm. Gr.).

33. **S. samaipatensis** Robinson. Erect, virgate, leafy-stemmed perennial, incurved-puberulent, 2-3 dm. high; leaves both opposite and alternate, sessile, rather crowded and often proliferous in the axils, narrowly oblanceolate, crenate-serrate toward the obtuse tip, attenuate and entire toward the base, subcoriaceous; heads 8-9 mm. long, sessile or nearly so in small glomerules; these disposed in a dense somewhat fastigiately branched terminal corymb; phyllaries oblong, short-pointed, incurved-puberulent on the back, often purple-tinged; corollas as to tube and throat dark purple, the limb white or nearly so; achenes unlike, the 4 adelphocarps each 9-11-awned, the idiocarp awnless but surmounted by a short denticulate border of somewhat connate scales (about 0.7 mm. high).—Contrib. Gray Herb. xcvi. 15 (1931).

SANTA CRUZ: Prov. Vallegrande: Samaipata, alt. 2000 m., *Steinbach*, no. 3761 (Brl., phot. and small fragm. Gr.).

34. **S. Kuntzei** Hieron. Frutescent, several-stemmed or branched from near the base, about 3 dm. high; stems and branches purplish-brown, flexuous, leafy, shortly incurved-puberulent and toward the summit obscurely stipitate-glandular; leaves opposite and alternate, sessile or nearly so, oblanceolate or oblong, obtusish, crenate-serrate toward the tip, gradually narrowed and entire toward the base, firmly chartaceo-subcoriaceous, mostly 2-3 cm. long, 4-8 mm. wide, nearly glabrous, the nerves and veins prominent on both surfaces; heads (about 8.5 mm. long) sessile in subhemispherical glomerules, these clustered at the tips of the slender erect branches; corollas as to the subcylindrical throat purple, the limb probably pale pink; achenes unlike, the 4 adelphocarps each 7-11-awned, the idiocarp awnless or 1-awned but surmounted by a scale-pappus (0.4 mm. high).—Hieron. in Engl. Bot. Jahrb. xxii. 733 (1897); Kuntze, Rev. Gen. iii. pt. 2, p. 180 (1898).

COCHABAMBA: Prov. Ayopaya: Tunari, alt. 3000 m., *Kuntze* (N. Y., phot. Gr.).

35. **S. setifera** Rusby. Perennial, herbaceous or perhaps frutescent below (the base unknown); stem terete, pithy, purple, finely incurved-puberulent; inflorescence closely beset with stipitate glands; leaves opposite, the cauline distinctly petioled, ovate, acutish to attenuate, serrate except at the rounded or somewhat gradually contracted base, membranaceous, finely incurved-puberulent above, paler and loosely pilose beneath, about 4 cm. long and half as wide; the rameal leaves narrower and lanceolate; heads (12–15 mm. long) sessile or shortly pedicelled in dense glomerules; these either closely aggregated in hemispherical clusters or scattered toward the ends of the branches of a compound corymb; phyllaries narrowly oblong, acute to obtusish, usually purple-tinged and beset with short spreading stiped glands with or without some longer spreading glandless hairs; corollas gland-sprinkled on the proper tube and purple subcylindrical throat, the lobes white or nearly so; achenes unlike, the 3 adelphocarps each 7–11-awned; 2 idiocarps surmounted by a toothed crown of connate scales (0.4 mm. high) and awnless or not more than 3-awned.—Contrib. Gray Herb. c. 10 (1932).

LA PAZ: Prov. North Yungas: Unduavi, alt. about 2440 m., *Rusby*, no. 1615 in part (Field Mus.); same locality, alt. about 3300 m., *Buchtien*, nos. 189 (Gr.), 3020 (N. Y., U. S.) and 3021 (U. S.); Unduavi Valley, *Bro. Julio*, no. 315 (U. S.). Prov. South Yungas: among bushes, alt. 2100 m., Sirupaya near Yanacachi, *Buchtien*, no. 293 in part (U. S.); base of Mt. Illimani, Rio Palca Valley, alt. 2360 m., *Bro. Julio*, no. 70 in part (U. S., Gr.); Irupana, alt. about 1680 m., *McCarty*, no. 120 (Gr., N. Y.). Prov. Inquisivi: dry hillsides, Pongo de Quime, alt. about 3500 m., *Dr. O. E. White*, no. 168 (TYPE in herb. N. Y. Bot. Gard., isotypes Gr., Field Mus.).

ORURO: Oruro, alt. 3900 m., *Asplund*, no. 5723 (no. 12,020 of *Buchtien's* distrib.), U. S.

Dr. Rusby has kindly permitted the publication of this novelty in the present paper. It is rather closely related to *S. Kuntzei* Hieron. but has larger, thinner, more definitely petiolate and much less prominently reticulate-veiny leaves.

36. **S. sarensis** Robinson. Erect perennial herb, 7–10 m. high, spreadingly branched from near the middle to the summit; stem terete, brown, spreadingly crisped-pilose with white jointed glandless hairs; leaves opposite, the main cauline rhombic-ovate or narrowly deltoid-ovate, gradually narrowed to an acute or sometimes obtuse apex, crenate-serrate except for a more or less abruptly contracted then cuneately narrowed petioliform base, membranaceous, green on both surfaces, subappressed-pubescent above, rather densely spreading-pilose particularly on the nerves and chief veins beneath, 6–9

cm. long (the petiole-like base included), 1.8–3.5 cm. wide; heads (1 cm. long) sessile or distinctly pedicelled; phyllaries acute to acuminate, shortly and rather loosely pilose on the back; corollas (yellowish-brown in dried specimens) probably white or at least pale in nature; achenes unlike, the 4 adelphocarps each about 11-awned, the idiocarp crowned with more or less connate scales (0.4 mm. long) and bearing 1–4 usually unequal awns.—Contrib. Gray Herb. c. 9 (1932).

Var. **typica**. Heads rather closely sessile in glomerules; these terminal on the branches of a corymbiform panicle.—See p. 10.

SANTA CRUZ: Prov. Sara: in clearing, Buena Vista, *Steinbach*, nos. 1143 (Brl., phot. Gr.), 5169 in part (hb. Osten), 6117 (K., Gen., Brl., phot. Gr.), and 7048 (Gr., Brl., Gen., K., Field Mus., Mo.).

Var. **dissiticeps** Robinson. Inflorescence looser; heads more or less evidently pedicelled and subracemosely arranged on the branches of the panicle.—Contrib. Gray Herb. c. 10 (1932). *S. menthifolia* of Kuntze, Rev. Gen. iii. pt. 2, p. 180 (1898) not *S. menthaefolia* Sch.-Bip.

SANTA CRUZ: Prov. Cerecado: in clearings, Bañado del Piray, alt. 450 m., *Steinbach*, no. 6248 (Brl., phot. and small fragm. Gr.). Prov. Sara: moist woods of the Pampa, Buena Vista, alt. 500 m., *Steinbach*, no. 5169 (Gr.); Pam-pobosque, alt. 450 m., *Steinbach*, nos. 1126 (Brl., phot. and fragm. Gr.), 2790 (Brl., phot. and small fragm. Gr.) and 5169a (Gr., N. Y.). Dept. Santa Cruz without indication of province or locality, *Kuntze* (Brl., N. Y., phot. Gr., U. S.).

37. **S. melancholica** Robinson. Probably an herbaceous or suffrutescent perennial, 4 dm. or more in height (the base unknown), minutely crisped-puberulent, blackening in drying; leaves opposite, petiolate, at maturity often deflexed, rhombic-ovate, acutish, crenate-serrate except at the entire cuneate base, above at first obscurely hirtellous, below a little paler, glabrescent, punctulate, firmly membranaceous, 4–5.5 cm. long, 2–3.6 cm. wide; petiole 5–8 mm. long; corymb flattish, rather dense, fastigiately branched; pedicels mostly about 3 mm. long; heads about 12 mm. long; phyllaries narrowly oblong, shortly pointed, 5–6 mm. long, sparingly crisped-puberulent on the back; corolla-throat deep purple, the lobes probably white or roseate; achenes unlike, the mostly 3 adelphocarps each 6–8-awned and provided also with some short scales; idiocarps (usually 2) awnless but surmounted by a scale-pappus (about 0.3 mm. high).—Contrib. Gray Herb. xc. 15 (1930).

BOLIVIA: without exact locality, *Bridges* (BM., phot. Gr.).

38. **S. discolor** Robinson. Probably an upright perennial herb at least 6–8 dm. high (the base unknown); stem terete, leafy, above

shortly crisped-puberulent, at length glabrate; internodes 3–6 cm. long; leaves (except the uppermost) opposite, subsessile, narrowly ovate, crenate-serrate or subentire, gradually narrowed to an obtusish tip, the main cauline contracted at base to a cuneate base, conspicuously discolorous, above green and glabrous, below very pale almost whitened, glabrous or but obscurely puberulent on the mid-nerve, punctate, firmly membranaceous, 4–5 cm. long, 1.5–2 cm. wide; panicle about 3 dm. long and 1 dm. thick; heads (about 12–13 mm. long) subsessile, closely aggregated in glomerules terminal on the panicle-branches; phyllaries lanceolate-oblong, acute, crisped-puberulent and beset with some sessile glands; corollas with purple throat and whitish limb; achenes unlike, the 3 adelphocarps each 8–9-awned; the 2 idiocarps awnless but crowned by very short scales and awnlets (0.2–0.3 mm. in length).—Contrib. Gray Herb. c. 5 (1932).

LA PAZ: Prov. Larecaja: in low woods and thickets at Iminapi, Milipaya, &c., in the neighborhood of Sorata, alt. 2650–3300 m., *Mandon*, no. 242 in part (Gr., Brl.).

39. **S. Bangii** Rusby. Several-stemmed or much branched herbaceous or suffrutescent perennial, finely incurved-puberulent but not stellate-puberulent as originally described; leaves chiefly opposite, lanceolate to ovate, serrate except at the entire cuneate sessile or shortly petioled base, the main cauline 1.5–3 cm. long 5–12 (–18) mm. wide, the rameal much smaller, subentire; heads (about 1 cm. long) sessile in corymbously or paniculately disposed glomerules; phyllaries narrowly oblong, obtuse or merely acutish, incurved-puberulent dorsally; corollas as to tube and throat deep reddish purple, the limb somewhat paler, probably roseate; achenes unlike, the 4 adelphocarps each (6–) 12–15-awned, the idiocarp crowned by a scarious border of toothed and somewhat connate scales with or without 1–3 awns.—Mem. Torr. Bot. Club, iv. 209 (1895). *S. compacta* as used in Bull. Torr. Bot. Club, xviii. 333 (1891) and as doubtfully employed by Rusby, Mem. Torr. Bot. Club, iii. no. 3, p. 51 (1893) but very unlike the real *S. compacta* Benth. *S. tapacariensis* Hieron. in Engl. Bot. Jahrb. xxii. 734 (1897).

An exceedingly puzzling species, falling into the following very unlike yet certainly intergradient varieties.

Var. **typica**. Erect or nearly so, several-stemmed or for the most part uprightly branched from near the base, mostly 2.5–4 dm. high; leaves lanceolate to narrowly ovate-oblong, normally more than twice as long as wide.—Literature and synonymy as above.

LA PAZ: Prov. Murillo: neighborhood of the city of La Paz, alt. 3050 m., *Bang*, no. 86 (N. Y., Gr., U. S., Mo.); same locality, alt. 3750 m., *Buchtien*,

nos. 186 in part (N. Y., Gr.) and 3018 in part (N. Y.); near La Paz, alt. about 3355, *Rusby*, no. 1613 (N. Y., Gr., U. S., Field Mus., Mo.), a collection in part typical but in part broader-leaved, more spreadingly branched and passing to the following variety.

COCHABAMBA: Prov. Tapacari: on the River Tapacari, alt. 3000 m., *Kuntze* (N. Y., phot. Gr.); Cochabamba, *Holway*, no. 381 (Gr.).

DEPARTMENT NOT INDICATED: Chiguana, *Asplund*, no. 5726 (U. S.) being no. 12,023 of Buchtien distrib.

With this species and indeed with its narrow-leaved and more typical variety there may be doubtfully associated an unnumbered Bolivian plant collected by *Bridges* (K., BM., phot. Gr.). Closely similar in habit, foliage, involucre, etc., it differs in having the adelphocarps only 6-7-awned.

Var. **dyscrita** Robinson. Stem mostly flexuous and decumbent, much branched (often throughout its length), seldom over 2 dm. high; the branches widely spreading; leaves ovate, less than twice as long as wide.—Contrib. Gray Herb. c. 3 (1932).

LA PAZ: Prov. Murillo: near the city of La Paz, alt. 3750 m., *Buchtien*, nos. 91 (U. S.), 186 in part (Gr.), 234 (U. S.), 3017 (N. Y., U. S.), 3018 in part (U. S.) and 3019 (N. Y., U. S.); on stony hills above La Paz, alt. 3700-3800 m., *Pennell*, no. 14,255 (Gr., N. Y.); on hills, alt. 4000 m., *Mandon*, no. 246 bis (Gr., N. Y.); base of Mt. Illimani, alt. 3400 m., *Bro. Julio*, no. 57 (U. S.). Prov. Larecaja: Sorata, *Günther*, nos. 9 (U. S.), 26 (U. S.), 27 (U. S.) these being nos. 12,016, 12,018 and 12,013 respectively of the Buchtien distrib. Prov. North Yungas: Unduavi Valley, *Bro. Julio*, no. 365 (U. S.).

ORURO: Pazña, alt. 3900 m., *Asplund*, no. 5725 (U. S.) being no. 12,022 of Buchtien series; Challapata, alt. 3900 m., *Asplund* no. 5724 (U. S.) being no. 12,021 of Buchtien series.

Very near to *S. Bangii*, of which it may well prove a form or variety, must be placed a still problematic plant, namely *Mandon*, no. 244 in part (N. Y., fragm. Gr., Brl.) from a point between "Munaypata" and "Luc Mapampa," in clayey soil of the temperate region, alt. 2650 m., in the vicinity of Sorata in the Prov. Larecaja. Erect and 3-4 dm. tall in the manner of *S. Bangii* var. *typica*, it has larger and relatively broader leaves and very copious inflorescence, though no significant differences in the heads have been detected. A further investigation of this plant must await its rediscovery and the collection of better material.

Certain forms of the aggregate here classified as *S. Bangii*, for instance *Mandon*, no. 246 bis and *Pennell*, no. 14,255, show a close approach on the one hand to *S. tarijensis* Hieron. of extreme southern Bolivia and on the other hand to *S. Mandonii* Sch.-Bip. from Sorata and the puno region of Peru.

40. **S. tarijensis** Hieron. Decumbent but assurgent perennial herb, 1-2 dm. high, very finely incurved-puberulent; branches numerous, widely spreading; leaves opposite, sessile or shortly petioled,

elliptic-oblong, crenate toward the rounded apex or subentire, slightly fleshy, green on both surfaces, the main cauline caducous, about 2 cm. long and 8–10 mm. wide, the rameal smaller, mostly 1–1.5 cm. long and 4–7 mm. wide, inflorescence a dense terminal corymb of closely aggregated glomerules or these terminal on up-curved branches and forming an ovoid panicle; heads (10–12 mm. long) sessile or very shortly pedicelled in dense clusters; phyllaries oblong, obtuse, mostly dark purple, dorsally incurved-puberulent, about 5.5 mm. long; corollas with dark purple tube and throat, the lobes roseate or nearly white; achenes unlike, the 4 adelphocarps each about 15-awned, the idiocarp awnless but surmounted by a scale-pappus (about 1 mm. high).—Hieron. in Engl. Bot. Jahrb. xl. 362 (1908).

TARIJA: near the town of Tarija, alt. 3000 m., *Fiebrig*, no. 2647 (Gr.); Escayache [Dept. Tarija?], alt. 3500 m., *Fiebrig*, no. 3416 (Gr., Gen.)

DEPARTMENT NOT INDICATED: Bolivia but without further data, *Bridges* (K.).

41. **S. Mandonii** Sch.-Bip. For description see p. 34 —Bull. Soc. Bot. Fr. xii. 81 (1865) and *Linnaea*, xxxiv. 535 (1865–66), both without char.; Robinson, *Contrib. Gray Herb.* lxxvii. 6 (1926), where described.

LA PAZ: Prov. Larecaja: on hills near Ancohumá, in the alpine region, alt. 3800 m., *Mandon*, no. 246 (Gr., N. Y., Gen., Par., BM., K.); Guaqui, *Buchtien*, nos. 4827 (U. S.) and 12,012 (U. S.). Isla del Sol, Yumani, alt. 3850, *Asplund*, no. 5727 (U. S.) being no. 12,024 of *Buchtien* distrib. Prov. Murillo: alt. 3750, La Paz, *Buchtien*, no. 709 (Gr., U. S., N. Y.).

#### SYNONYMIC OR DOUBTFUL NAMES APPLIED TO BOLIVIAN STEVIAS.

*S. amplexicaulis* as used by Herzog, *Veg. d. Erde*, xv. 144, 150 (1923), is merely a casual mention unaccompanied by description. The name is antedated by a homonym of Hassler, applied to a small-leaved species of Paraguay. The writer has seen no Bolivian material in the remotest degree similar to this Paraguay species of Hassler.

*S. breviaristata* as used by Hieron. in *Ktze. Rev. Gen.* iii. pt. 2, p. 180 (1898) not Hook. & Arn. = *S. BOLIVIENSIS* Sch.-Bip.

*S. brevipapposa* Hieron. in *Engl. Bot. Jahrb.* xxii. 718 (1897) = *S. BOLIVIENSIS* Sch.-Bip.

*S. Claussenii* var. *boliviensis* Hieron. in *Engl. Bot. Jahrb.* xxii. 723 (1897) = *S. URTICAEFOLIA* var. *BOLIVIENSIS* (Hieron.) Robinson.

*S. compacta* as used in *Bull. Torr. Bot. Club*, xviii. 333 (1891) and as more doubtfully employed by Rusby, *Mem. Torr. Bot. Club*, iii. no. 3, p. 51 (1893) but by no means of Benth. = *S. BANGII* Rusby.

*S. elatior* as used by Hieron. in *Ktze. Rev. Gen.* iii. pt. 2, p. 180 (1898) = *S. ELATIOR* var. *AUSTRINA* Robinson.

*S. grandidentata* Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865) and Linnaea, xxxiv. 535 (1865-66) without char., and Hieron. in Engl. Bot. Jahrb. xxii. 714 (1897), where first described but already antedated by homonym of Sch.-Bip. in Klatt, Leopoldina, xx. 75 (1884) = *S. SORATENSIS* Hieron.

*S. grandidentata* var. *subeglandulosa* Hieron. in Engl. Bot. Jahrb. xxii. 798 (1897) = *S. SORATENSIS* var. *SUBEGLANDULOSA* Hieron.

*S. HAENKEANA* var. as used by Sch.-Bip. Bull. Soc. Bot. Fr. xii. 82 (1865) and Linnaea, xxxiv. 535 (1865-6). The writer has had no opportunity to confirm or disprove this reference to *S. Haenkeana*. It was applied by Schultz to a portion of the mixed material distributed under Mandon's no. 259. Regarding *S. Haenkeana* DC., a multiaristate species credited to Mexico but presumably from some part of South America, see Contrib. Gray Herb. xc. 146 (1930).

*S. humilis* Hieron. in Engl. Bot. Jahrb. xxii. 730 (1897) and Kuntze, Rev. Gen. iii. pt. 2, p. 180 (1898) appears to be merely a dwarf state of *S. OBOVATA* Rusby.

*S. MENTHAEFOLIA* Sch.-Bip. Linnaea, xxv. 282 (1853). This name (of a Brazilian species) has been at various times employed by persons identifying Bolivian material of or closely related to *S. boliviensis* Sch.-Bip., but the writer has thus far found no evidence that the true *S. menthaefolia* of Brazil occurs in Bolivia.

*S. micropappa* Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865) and *S. micropappea* Sch. Bip. Linnaea, xxxiv. 535 (1865-6) = *S. SORATENSIS* Hieron.

*S. multiaristata* as used by Herzog, Veg. d. Erde, xv. 143, 146 (1923). The writer has had no opportunity to check Herzog's application of this name. No evidence has been seen to indicate that the real *S. multiaristata* Spreng. occurs within the limits of Bolivia, though this is by no means unlikely.

*S. nepetaefolia* as used by Herzog, Veg. d. Erde, xv. 143, 144, 146 (1923). The writer has every reason to infer that this record rests upon a mistaken identification. The real *S. nepetaefolia* HBK. is a Mexican plant.

*S. Schultzii* Hieron. in Engl. Bot. Jahrb. xxii. 721 (1897), at least as to the Bolivian (typical) element = *S. BOLIVIENSIS* Sch.-Bip. as described by Rusby. It has been quite impossible to find differences of significance between the plant characterized by Rusby, namely Bang's no. 260 and those portions of the Mandon material called *S. boliviensis* by Schultz, that is to say, when the manifestly extraneous elements have been removed from the much mixed material so distributed in the Mandon series. Certainly it was unfortunate that



Schultz did not describe his own species. It was further unusual that the character of the species, when Rusby (who conscientiously and with entire correctness attributed the origin of the binomial to Schultz) finally described the species, was drawn from a later specimen and not from the Mandon material seen by Schultz. However, as they prove essentially identical and certainly conspecific, Rusby's interpretation of the Schultz name has every right to stand and Hieronymus's renaming of the plant finds no justification.

*S. stenocephala* Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865) and Linnaea, xxxiv. 535 (1865-6) = *S. SORATENSIS* Hieron.

*S. suboctoaristata* as used by Sch.-Bip. Bull. Soc. Bot. Fr. xii. 81 (1865) and Linnaea, xxxiv. 535 (1865-6), but probably not of Lag. = *S. BANGII* Rusby. The original characterization of *S. suboctoaristata* by Lagasca, stating merely that it resembled the Mexican *S. ovata* but had 7-8-awned achenes, and had been collected in Peru, is far too vague to be taken up on the basis of Bolivian material which has no close similarity with the Mexican *S. ovata* and which for the most part has more numerously awned achenes.

*S. tapacariensis* Hieron. in Engl. Bot. Jahrb. xxii. 734 (1897) = *S. BANGII* Rusby.

*S. urticifolia* as used by Rusby, Bull. N. Y. Bot. Gard. iv. 377 (1907) = *S. URTICAEFOLIA* var. *PALLIDIFLORA* Robinson.

## EXSICCATAE OF BOLIVIAN STEVIAS

**Asplund**

- 5723 setifera Rusby
- 5724 Bangii v. dyscrita Robinson
- 5725 Bangii v. dyscrita Robinson
- 5726 Bangii Rusby
- 5727 Mandonii Sch.-Bip.

**Bang**

- 86 Bangii Rusby
- 260 boliviensis Sch.-Bip.
- 611 neglecta Rusby
- 1027 obovata Rusby
- 1149 soratensis v. subeglandulosa Hieron.
- 2047 Bridgesii Rusby
- 2877 urticaefolia v. pallidiflora Robinson

**Bender**

- 22 cardiatica Perkins
- 24 Benderi Perkins

**Bridges**

- Bangii Rusby
- Mandonii Sch.-Bip.
- melancholica Robinson

**Buchtien**

- 91 Bangii v. dyscrita Robinson
- 186 in part Bangii Rusby
- 186 in part Bangii v. dyscrita Robinson
- 189 setifera Rusby
- 234 Bangii v. dyscrita Robinson
- 293 in part setifera Rusby
- 293 in part boliviensis Sch.-Bip.
- 387 boliviensis Sch.-Bip.
- 709 Mandonii Sch.-Bip.
- 746 boliviensis Sch.-Bip.
- 2435 boliviensis Sch.-Bip.
- 2436 boliviensis Sch.-Bip.
- 3017 Bangii v. dyscrita Robinson
- 3018 in part Bangii Rusby
- 3018 in part Bangii v. dyscrita Robinson
- 3019 Bangii v. dyscrita Robinson
- 3020 setifera Rusby
- 3021 setifera Rusby
- 4413 boliviensis Sch.-Bip. var. ?
- 4414 boliviensis Sch.-Bip.
- 4748 boliviensis Sch.-Bip.
- 4749 boliviensis Sch.-Bip.

- 4827 Mandonii Sch.-Bip.  
 5611 boliviensis Sch.-Bip.  
 5728 boliviensis Sch.-Bip.  
 7542 boliviensis Sch.-Bip.  
 7543 boliviensis Sch.-Bip.  
 7544 urticaefolia v. pallidiflora  
 Robinson

- 12,012 Mandonii Sch.Bip.  
 12,013 Bangii v. dyscrita Robinson  
 12,015 soratensis Hieron.  
 12,016 Bangii v. dyscrita Robinson  
 12,018 Bangii v. dyscrita Robinson  
 12,020 setifera Rusby  
 12,021 Bangii v. dyscrita Robinson  
 12,022 Bangii v. dyscrita Robinson  
 12,023 Bangii Rusby  
 12,024 Mandonii Sch.-Bip.

**Cárdenas**

- 59 obovata Rusby  
 89 in part Benderi Perkins  
 89 in part cardiatica Perkins

**Fiebrig**

- 2214 in small part calderillensis  
 Hieron.  
 2326 bermejensis Hieron.  
 2647 tarijensis Hieron.  
 2868a in part camachensis Hieron.  
 2868a in part glomerata Griseb.  
 2959 calderillensis Hieron.  
 3126 eclipses Robinson  
 3416 tarijensis Hieron.  
 3418 mercedensis Hieron.  
 3425 calderillensis Hieron.  
 3423 in part Chamaedrys Griseb.  
 3423 in part glomerata Hieron. ?  
 3486 glanduloso-pubescens  
 Hieron.  
 3541 triaristata Hieron.

**Fries, R. E.**

- 1388 chacoënsis R. E. Fries

**Günther**

- 7 boliviensis Sch.-Bip.  
 8 soratensis Hieron.  
 9 Bangii v. dyscrita Robinson  
 25 boliviensis Sch.-Bip.  
 26 Bangii v. dyscrita Robinson  
 27 Bangii v. dyscrita Robinson

**Hieronymus & Lorentz**

- 876 fruticosa Griseb.

**Holway**

- 381 Bangii Rusby  
 542 boliviensis Sch.-Bip.  
 665 boliviensis Sch.-Bip.

**Julio, Bro.**

- 57 Bangii v. dyscrita Robinson  
 70 in part setifera Rusby  
 70 in part soratensis v. sube-  
 glandulosa Hieron.  
 315 setifera Rusby  
 365 Bangii v. dyscrita Robinson

**Kuntze**

- Bangii Rusby  
 — boliviensis Sch.-Bip.  
 — cochabambensis Hieron.  
 — elatior v. austrina Robinson  
 — galeopsidifolia Hieron.  
 — Kuntzei Hieron.  
 — obovata Rusby  
 — santacruzensis Hieron.  
 — sarensis v. dissiticeps Rob-  
 inson  
 — tunariensis Hieron.  
 — urticaefolia v. boliviensis  
 (Hieron.) Robinson

**Mandon**

- 242 in part boliviensis Sch.-Bip.  
 242 in part discolor Robinson  
 243 in part clivicola Robinson  
 243 in part different but inde-  
 terminate fragments  
 244 in part Bangii Rusby ?  
 244 in part boliviensis Sch.-Bip.  
 245 in part soratensis Hieron.  
 245 in part soratensis v. sube-  
 glandulosa Hieron.  
 246 Mandonii Sch.-Bip.  
 246 bis Bangii v. dyscrita Rob-  
 inson

**McCarty**

- 120 setifera Rusby

**Pearce**

- Fiebrigii Hieron.  
 — mercedensis Hieron.

**Rusby**

- 1613 Bangii Rusby  
 1614 boliviensis Sch.-Bip.  
 1614B boliviensis Sch.-Bip.  
 1615 in part boliviensis Sch.-Bip.  
 1615 in part setifera Rusby

**Steinbach**

- 1126 sarensis v. dissiticeps Robinson  
 1143 sarensis Robinson  
 2790 sarensis v. dissiticeps Robinson  
 3715 boliviensis Sch.-Bip.  
 3761 samaipatensis Robinson  
 3953 totorensis Robinson  
 5169 in part sarensis Robinson  
 5169 in part sarensis v. dissiticeps Robinson  
 5169a sarensis v. dissiticeps Robinson  
 5835 *Stevia* n. sp.? but material teratological  
 6117 sarensis Robinson  
 6248 sarensis v. dissiticeps Robinson  
 7048 sarensis Robinson  
 8831 obovata v. aristifera Robinson

- 9147 urticaefolia v. boliviensis (Hieron.) Robinson

**Stübel**

- 52d Stuebelii Hieron.

**Tate**

- 669 urticaefolia v. pallidiflora Robinson  
 749 boliviensis Sch.-Bip.  
 870 kuhnioides Rusby  
 874 boliviensis Sch.-Bip.  
 1049 boliviensis Sch.-Bip.

**White**

- 168 setifera Rusby  
 267 boliviensis Sch.-Bip.

**Williams, R. S.**

- 124 filipes Rusby  
 1468 reclinata Rusby  
 — Mandonii Sch.-Bip.