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VOL. XXVIII

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CONTENTS

Errata

Page 69, line 14 from bottom, for Antiles read Antilles.

Page 75, line 3 from bottom, for advanced read advancing.

Page 83, line 9 from top, for *Spatina* read *Spartina*.

Page 445, line 13 from top, for views read veins.

Pages 441, 442 and 444, for *Dictyocephalos* read *Dictyocephalus*.

Page 454, line 2, omit and.

Page 456, line 22, for shale read Shale.

Page 456, lines 24, 25 and 27, for coal measures read Coal Measures.

Page 456, line 30, for carboniferous read Carboniferous.

Page 460, line 21, for One read On.

Page 468, line 34, omit the.

Page 481, line 10, omit the first in.

Page 498, line 5, for nat. size read ½ nat. size.

Page 536, after *Thrinax Ponceana*, for 43 read 45.

Page 548, after *Aeria attenuata*, for 45 read 47, fig. 1.

Page 552, after *Roystonea Borinquena*, for 45 read 47.

Page 557, after *Acrista monticola*, for 44 read 46.

Page 561, after *Curima colophylla*, for 46 read 48.

Plate 30, for *Vincetoscicum* read *Vincetoxicum*.

Plates 39, 40, for *Dictyocephalos* read *Dictyocephalus*.

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LANCASTER, PA.

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Memoirs. (See last page of cover.)

VOL. 28 No. 1

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TORREY BOTANICAL CLUB

JANUARY 1901

Life History of Schizaea pusilla

BY ELIZABETH G. BRITTON AND ALEXANDRINA TAYLOR

(WITH PLATES 1–6)

The material on which these studies were based was collected at Forked River, New Jersey, on the third of July, 1900. The plants were abundant, but only half grown, the sporophylls being only five centimeters high. They were found around the base of small white cedars (*Chamaecyparis thyoides*) kept moist by hummocks of *Sphagnum*, and surrounded by *Lycopodium Carolinianum*, *Juncus pelocarpus*, *Drosera rotundifolia* and *Utricularia cleistogama*. Young plants were found, ranging from two to ten millimeters in height, growing in depressions of moist sandy loam, or even perched upon the roots of sedges and *Sisyrinchium Atlanticum*. Several sods were taken with the plants in various stages, and a large number of young plants were collected and preserved in alcohol. With a magnification of fifteen diameters, it was discovered at the time of collection that they originated from a filamentous protonema, consisting of a tangled mass of dark green filaments, spreading around the base of the young circinate leaf, and that these filaments were persistent, even after some of the leaves were 10–15 mm. high. Entangled with the filaments, in such a manner as to render it necessary to clean them with a camel's-hair brush, there were three species of hepatics (*Odontoschisma sphagni* (Dicks.) Dumort; *Lophozia inflata* (Huds.) M. A. Howe; and *Cephalozia catenulata* (Hübn.) Spruce; also a slender fresh-water alga, *Rhizoclonium hieroglyphicum* (Ag.) Kütz.

A complete or correct description of *S. pusilla* cannot be found in any manual or monograph. In several the spores are said to be smooth, and the glandular hairs borne by the leaves are not mentioned, though they are known on other species of this genus.

The gametophyte is composed of numerous, erect, branching, dark green protonemal filaments; monoicous, bearing from 5–12 archegonia, usually on a slightly thickened and expanded series of cells in the nature of an archegoniophore (?) or directly on the filaments; antheridia more numerous, often on separate branches and nearer the extremities of the filaments; radicles seldom borne on the filament but produced from specially modified, large spherical cells, apparently in symbiotic relation with a fungus. Sporophyte perennial, from a short erect or horizontal rootstock, 5–10 mm. long, sterile leaf 2–5 cm. long by 0.5 mm. broad, circinate, bearing small club-shaped hairs, nearly 1 mm. long, occurring in three longitudinal rows on the dorsal surface, alternating with two rows of stomata. Sporophyll 3–13 cm. long, divided at summit into 14–16 fertile pinnae; sporangia ovoid, with a terminal ring: spores reniform, pitted, 76–84 μ, maturing in autumn.

On low wet banks with sphagna or in sandy swamps, in the shade of larger plants; known from numerous scattered stations in the Pine Barrens of New Jersey, in Newfoundland (De La Pylaie, Waghorne), and in Nova Scotia (E. G. Knight). The station credited to New York by Prantl from the Berlin Herbarium, is probably a mistake, though there is no reason why it should not be found on the sandy plains of Long Island and Rhode Island.

According to Prantl there are nineteen species of *Schizaea*, of which five are Polynesian, eight are found in Brazil, and five in the West Indies; all are of restricted distribution, and in most species they are known from few stations. Of *Lygodium* he records twenty-two species, of which five are Mexican and Central American, four West Indian and only one from northeastern North America, *L. palmatum*. Of the forty-six species of *Ornithopteris* and *Anemia* known, Brazil has thirty-five, Mexico nine, the West Indies six and only two extend into the United States, *O. adiantifolia* (L.) Bernh., and *O. Mexicana* (Kl.) Underw.

The Schizaeaceae are represented in the Tertiary by several species of *Lygodium*, and by *Anemia* in the Cretaceous. Thus far *Schizaea* is unknown in the fossil state. We may safely conclude, however, that its maximum development in North America must have been reached previous to the Glacial period, and that it is in a degenerate condition and retrograding distribution in the only surviving species, *Schizaea pusilla*, whose larger and more highly developed relatives exist now only in the tropics.

SPORES

The spores of *Schizaea pusilla* measure 76–84 μ, are nearly reniform (Fig. 1), and have a cuticularized exospore which is alveolate (Figs. 2, 3); on the concave side there is a ridge extending nearly two thirds the length of the spore, formed by the exospore having a fissure nearly its whole length (Fig. 4). It is through this slit in the exospore that the young tube emerges when the spore germinates.

The development of the gametophyte from the spore to the first archegonium could not be followed in the laboratory; but from the laboratory cultures and the different stages of spore germination found in the soil brought up from New Jersey a fairly good idea of the manner and rate of growth may be drawn.

Spores, from the plants collected in July and matured in the greenhouse, were sown on September 5th; on the 14th they were found to be slightly green; the first signs of germination were seen on the 27th, when the spores contained some chlorophyl, and two had started to send out a tube which extended 27 μ beyond the aperture (Fig. 5); chlorophyl was visible in the lengthening tube on the 8th and rhizoids were also found on that date; the first cross-wall was formed on the 10th; on October 1st the second wall was formed making a filament of two cells (Figs. 9, 10).

On August 28th a spore was found in the sod of young plants which had germinated and formed a small rhizoid, slightly brown, with a curved apex and contained some chlorophyl, and a filament, 115 μ in length, of two cells (Fig. 19), the cell at base was shorter, about twice as long as broad, containing chlorophyl with no special arrangement; the other cell was nearly four times as long as broad, the chlorophyl denser at the apex and a newly formed wall (Fig. 19, *a*). The density of the chlorophyl increased at the apex. On August 30th the chlorophyl showed a tendency to assume its final arrangement in the filament, being very dense in the center, radiating toward the walls in rather thick bands and connecting with a layer next to the wall through the whole length of the cell; on August 31st the filament had lengthened to 126 μ and one more cell had been cut off (Fig. 21), no further change in the rhizoid having taken place. The filament consisted of five cells by September 2d. On September 4th the filament had increased to six cells, and a partial division of the contents of the apical cell had taken place (Fig. 22). The tip of the filament was very much curved and densely packed with chlorophyl; the basal cell of the filament had become slightly swollen near its apical end. The filament measured 146 μ.

On September 5th the filament consisted of six cells (Fig. 23); the first walls formed were very nearly as thick as the cross-walls of the older filaments.

The older filaments generally grow erect, and this tendency toward an upward growth is plainly shown even as early as the third cell of the filament; the rhizoid also showed geotropic curvature. One tube, issuing from the fissure of an exospore, was directed downward; but soon began a curvature which was continued until the filament occupied a vertical position; the rhizoid, first directed horizontally, soon curved downward. The filaments, for the most part, did not show the tendency to upward growth until two or three cells had been formed, but the rhizoid took a downward direction much earlier.

On September 5th another spore was found in the soil consisting of one filament of six cells (Fig. 24); at the base of the filament, at its connection with the spore, there was a cell which had evidently been the basal cell of another filament. The remaining filament had given rise to two antheridia, which though not dried up were empty; one antheridium arose from a short branch from the second cell, occupying the terminal cell of the branch; the other originated from the terminal cell of the filament.

A spore with a healthy filament of four cells (Fig. 26) had borne an antheridium in which the mother cells of the antherozoids could be easily seen.

The attachment of the spore appears to be of long duration, as antheridia are formed while the filament is still attached.

A sporangium (Fig. 27) filled with spores was sown at the same time with the free spores on September 5th, and a great number of the spores germinated inside the sporangium sending out filaments through a basal break; when the spores were removed from the sporangium they were found to be more advanced than those germinating outside, the rate of growth of the spores in the sporangium in a given time being almost twice that of the other spores.

Branches were given off from the basal cells of the filaments, sometimes from apical portions of young filaments, and in a few cases the spore cell was found to divide into three primary cells (Fig. 17).

Intermediate stages between the earliest developed filament from the spore and the much-branched protonema are lacking.

PROTONEMA

The protonema occurs on the substratum, or on rootstocks of other plants, as small tufts of a dark green color, growing to a height of 2 mm. and a breadth of 4 mm.

The protonemal filaments are larger than the protonema of mosses. A comparison was made with *Pogonatum brevicaule* and *Mnium punctatum* with the following results:

	Length	Breadth
Cells of *Pogonatum brevicaule*	46 μ	
	76.9 μ	7 μ
Cells of *Mnium punctatum*	115 μ	15 μ
	96 μ	23 μ
Cells of *Schizaea pusilla*	192 μ	
	173 μ	92 μ
	134 μ	38 μ

It is also seen from the above that the cells of the filaments of *Schizaea pusilla* are fairly uniform in dimensions. They are densely filled with chlorophyl; starch is present. The cells are cylindrical, sometimes flattened near the base, in the region of the archegonia. Some few of the cross-walls were found to be perforated.

The protonema is copiously branched, the branches being generally single from each of the cells of the filament, generally near the upper end of the cell (Figs. 72, 73). Occasionally three or four in succession will give rise to two branches from opposite sides, but maintain the same relative position (Fig. 30). The branches, which give rise to the spherical cells to be described below, divide in the same manner as the main filaments. The division of other branches is very irregular (Figs. 29, 30, 31). The rhizoids are not usually formed directly from the ordinary cells, but from specially modified cells (Fig. 38, *a*); in three instances only were rhizoids found directly on the filaments, and in one case one cell gave rise to two rhizoids. They arise as lateral branches, at right angles to the long axis of the filament and taking the place of branches (Figs. 38, 39). There were two cases found (Figs. 32, 33) where the cells of a branch, near the apex, had formed partition walls. In Fig. 32 the third cell from the apex had divided up into four cells, showing a tendency to form a flat prothallus. Three cells showed signs of division (Fig. 33): these two instances were the only ones found. Bower speaks of flattened expansions on the filamentous protonema of *Trichomanes alatum* and *Trichomanes sinuosum* as described by Mettenius. These are much more rudimentary in *Schizaea pusilla*.

Some cells of the filament have been found to undergo division in the later stages, into a number of disk-shaped cells which do not increase in the axial diameter. Constrictions sometimes follow such divisions at the older cross walls; the cell walls were a light brown and showed signs of decay. Fig. 35 shows the cells of the filament undergoing the same process, but these were as healthy as the rest of the filament and densely filled with chlorophyl. Bower refers (Ann. Bot. 1: *pl. 1. f. 8*) to a similar development in *Trichomanes pyxidiferum* and says that "* * * possibly the moniliform development is merely a pathological condition; its appearance, however, is suggestive of that segmentation of the protonema into spherical cells which is recorded as a mode of vegetative propagation for the protonema of *Funaria hygrometrica*."

After some of the filaments have formed several cells the apical cell cuts off a new cell, which, after the first partition wall, that is transverse septum, divides longitudinally, forming two cells (Figs. 36, 37). These cells become large and round, each cell containing chlorophyl, and giving rise to one, or generally two, rhizoids (Fig. 37, *a*). The rhizoids also contain chlorophyl and early take on a dark yellow color. The original cell of the filament from which these cells arise either continues its growth normally (Fig. 36), or by a lateral innovation (Fig. 37). This new filament, after the formation of two or three cells, may form spherical cells at its apex (Fig. 39), or continue for some time before doing so, or it may send off a branch at once, which in its turn forms spherical cells. Generally a filament forming the spherical cells once does so at intervals throughout its whole length (Figs. 72, 73). These branches early bend to the substratum. If examined at this stage they will be found to have lost their former contents and to be filled with fungal hyphae (Fig. 43). This fungus does not injure its host, but sets up a symbiotic connection by which it functions as an absorbing organ to supply the gametophyte. So the spherical cells are undoubtedly formed by the gametophyte for the reception of the fungus, which enters as soon as the rhizoids touch the substratum (Fig. 41). While above ground and filled with chlorophyl they do not show any evidence of the presence of a fungus. The rhizoids wither early and absorption is carried on almost entirely by the fungal hyphae. The lack of rhizoids on the filament is thus explained by the presence of this fungus symbiont. The rhizoids formed from these spherical bodies appear to be the only channels through which the fungus enters the chambers built for it.

As to the nature of the fungus it is at present impossible to give it a permanent place in any of the series because of lack of evidence in regard to its method of reproduction. Perithecia have been found with asci and also what was probably a conidial stage; fruit bodies of other forms have also been found among the filaments; however, none of these were connected with the fungal hyphae under discussion. The young filament shortly after germination was in some few cases attacked by a fungus (Fig. 17, *d*), and this fungus is found wrapped around many of the cells of the older filaments, several instances having been found where haustoria had penetrated into the cells. Some of the plants are so infected by fungi after the growth of the sporophyte has begun that all the filaments have thickened walls and are pierced by three or four haustoria in each cell; they have turned brown and lost their contents. This fungus not only clings to the gametophyte of *Schizaea pusilla* but attacks the sporophyte also, though it does not appear on the sporophyte until the first leaf has reached a height of 1 mm. It resembles the one referred to by Bower in his work on *Trichomanes*. No connection has yet been made between these hyphae and those of the fungus symbiont. As far as is known at present, the fungus which wraps itself around the protonemal filaments is the same or at least bears a very close resemblance to that which attacks the sporophyte both on the rhizome and leaf.

The hyphae of the symbiotic fungus penetrates the rhizoid generally a short distance back from the tip (Fig. 41, *c*). These hyphae sometimes branch in the rhizoid and their cross-walls are more numerous, and in many cases the hyphal threads appeared narrower. They enter the large spherical cells where they form bladders or granulated swellings in these cells, sometimes nearly filling them (Figs. 42, 43). The fungus sometimes penetrates the ordinary cells of the filament, entirely changing the shape of these cells. Pale brown bodies were found of irregular outline attached to the hyphae which were apparently sporangia.

ANTHERIDIA

The antheridia are produced laterally on the protonema, occupying the terminal cell of the lateral branch or more rarely the terminal cell of a filament, which continues its growth laterally or ends with the formation of the antheridium. They are found either singly or in groups; and may be considered as metamorphosed branches as in Fig. 44. They may either be formed from the terminal cell of a short lateral branch (Fig. 44) or from the terminal cell of a branch given off from the basal cell (Figs. 44, 48) or from the second or any other cell of a lateral branch (Fig. 44) or rarely they may be formed on the terminal cell of a short lateral branch given off from the same cell of the filament as a previous antheridial branch (Fig. 46). Occasionally these groups are borne on a branch of the filament which bears only antheridia (Fig. 48) and for the most part in groups, sometimes from both sides of a branch. These branches which bear the antheridia, whether it is a branch of two cells with the apical one becoming an antheridium, or one of the groups, occupies the same relative position on the filament as do the branches of the main filament.

One or two were found to start out from the center of a cell of a filament. The antheridia are produced in great quantities but a great number of them are aborted, and the majority of antheridia terminate a branch of two cells. They occur nearer the apex of the filaments than the archegonia, and sometimes on the same filament with the archegonia (Fig. 57). They also occur on a branch from the filament which gives rise to the archegonia; when they are borne on a separate filament they are generally formed in larger quantities. The cells of a filament which give rise to the antheridial clusters are often broader and sometimes shorter than the ordinary cells.

The antheridium is formed by a cell of a filament sending out a cell which divides by a partition wall near the apex (Figs. 49, 50). This apical cell enlarges and soon cuts off another cell by a wall parallel with the first (Fig. 51). This small cell does not elongate but always remains short and forms the pedestal for the antheridium; the apical cell becomes large and globular and cuts off a cap cell at the summit, with the wall oblique (Fig. 52); the large cell divides up into the mother cells of the antherozoids (Figs. 52, 53, 54) and one ring cell. In some cases there appear to be a single layer of two or three peripheral cells. The ring cell (or cells) contain chlorophyl though they lose this before the antherozoids are matured. Dehiscence takes place by the swelling of the ring cell and the rupture of the cap cell. The antherozoids appear to be surrounded by a very fine membrane when they escape from the antheridium (Fig. 55); they are spirally coiled, with cilia at their anterior ends. Very few ripe antheridia were found. The antherozoids do not seem to be produced in large quantities.

ARCHEGONIA

The archegonia occur nearer the base of the filaments than the antheridia (Fig. 57) on cells of the filaments which have become more than one cell wide through division. They generally bear the same relation to the original cell of the filament as do the branches from other cells; they are borne singly or in pairs (Fig. 63), sometimes in groups of three or four (Fig. 58) often on both sides of the protonema. One filament was found which gave rise on six consecutive cells to two archegonia each; two cells above the sixth cell there was another archegonium formed, and a cell above this another one, and branches also gave rise to archegonia. There is no filament that is specially reserved for the formation of archegonia as is sometimes the case with the antheridia. Each archegonium is derived from a single superficial cell.

The archegonia are formed by the division of the initial cell into three cells; the basal cell forms the venter which may or may not be imbedded in the cell of the filament. Some of the division cells of the original cell of the filament grow up around it in such a way as to make it appear as if imbedded (Fig. 65). From the neck cell arises the neck of the archegonium, consisting of four rows of cells, of four cells each (Figs. 60, 62, 63); a uniformity which produces a straight neck to the archegonium.

Occasionally the cells of the two rows on the posterior side, though they do not increase in number, become larger than those on the anterior side (Fig. 62) thus slightly bending the neck toward the anterior side. From the middle cell of the superficial mother cell arises the central cell and the canal cell; the middle cell becomes sharply pointed on the upper end and forces itself between the neck cells; this point is cut off, forming the canal cell; the larger cell divides again into two cells of unequal size: the smaller and upper one forms the ventral canal cell, the lower and larger one forms the egg cell (Fig. 59). When this is mature the canal cells dissolve into mucilage. When the archegonium opens, the four stigmatic cells, which in this species are very large, are not thrown off but fold back (Fig. 63). It is at this stage that the curve in the neck occurs in some archegonia due possibly to the fact that as the filaments grow erect or nearly so, the archegonia occupy the portion of the filaments below the antheridia, and by bending the neck they bring the canal to the oösphere in a more direct line for the capture of the antherozoids, an adaptation tending to secure fertilization. Generally several archegonia are present, but only one seems to give rise to a sporophyte.

The cushion of cells on which the archegonia are borne can hardly be called an archegoniophore as some of these cells give rise to vegetative branches (Fig. 65). Three cases were found where an archegonium arose directly from a cell of the filament without any partition other than that of the formation of the archegonium. Bower (*l. c.*, Figs. 11, 12) says in his description of the archegonia of *Trichomanes pyxidiferum*, "The archegonia are borne on massive growths (archegoniophores). * * * In one case, however which has a special interest the mass of tissue on which the archegonia are produced is obviously the result of partition of a single cell of a filament, without any marked increase in size having taken place (Fig. 13). This may be regarded as the simplest form of an archegoniophore hitherto described in any fern or even in any Bryophyte and it approaches near to that suggested by Goebel as the simplest possible, in which the sexual organs would be inserted directly on the protonemal threads."

The act of fertilization was not seen, nor the direction of the first wall, but, from later stages they appear to be formed as is common with most ferns; a wall is formed parallel with the long axis of the archegonium, then a cross-wall is formed.

Foot

The foot is in most cases extremely large, and is in every case a well-defined organ, consisting of a great mass of cells which for the most part contain chlorophyl (Figs. 69, 70, 71). It remains attached to the protonema for some time, having been found in connection with it after the formation of the third leaf (Fig. 75, *a*), and even here it appeared to be in a healthy condition as did also that part of the protonema on which the foot was borne. It grows down into the cushion of the gametophyte (some of the cushion cells appear to grow up around it). The venter cells grow and form a calyptra around the embryo covering it for some little time; remnants of it were found still clinging around the first root after the formation of three leaves (Fig. 75, *b*).

Root

The primary root is a prolongation of the main axis of the sporophyte (Figs. 71, 72, 73), while the ultimate roots are always adventitious and produced in acropetal succession. They arise from all sides of the erect rhizome (Fig. 79), the epidermis of which sends out rhizoids. The primary root is persistent and becomes quite long. The second and third roots have a vestigial structure which covers them as the coleorhiza of some endogens

(Fig. 76). The roots are fully formed and have root caps (Fig. 75, *d*). This root cap (Fig. 76) consists of four large pear-shaped cells, inflated on one side; the inflated side is away from the root, the concave side rests on the root tip. They are developed before the root sheath splits. The cells are replaced from the tip and, as the older ones do not always fall off when the new ones have been formed, there have been seen as many as five series (Fig. 77), though they show their age by the partial discoloration of their walls.

The epidermal cells are large and thin-walled; the outer walls often bend into the cavity of the cell and frequently break. The cortex consists of two layers; the cells of the inner layer are very large and have the walls that lie next to the endodermis thickened; but in no instance was the thickening found to be as great as that figured for *Schizaea Pennula.* There is an endodermis of two layers, and the central cylinder (Fig. 78) is like that described by Prantl (Untersuch. Morph. Gefässkrypt., *pl. 4*) for *Schizaea Pennula.*

Sclerosis takes place in all the layers without any marked increase in the thickness of the walls.

RHIZOME

The rhizome is erect (Fig. 79), occasionally creeping. It always forms a protective covering of trichomes over the growing end (Fig. 74, *d*); these trichomes consist of from two to five cells (Fig. 75, *h*), measuring 1 mm. in length which soon turn brown and are persistent. The internodes are of varying lengths. One rootstock (8 mm.) had borne nineteen sterile and two sporophylls, all dead except the five sterile leaves last formed. The fertile leaves measured 6.5 cm., the longest sterile leaf 4.5 cm. Another rhizome of the same length had twenty-two sterile leaves, six green and two nearly brown, with two fertile; these were 7 cm. high, the base of the fertile leaves was green, the sporangia brown and mature. There were twenty-two roots—six short and young; one root was 25 mm. long and had branched; the branches were 5 mm. long.

A cross-section near the young tip shows a central bundle with a well developed endodermis (Fig. 80). Sclerosis takes place in the entire cortex; the different stages are beautifully shown in young sections; these cells, including the epidermis, are filled with starch. The epidermis and cortex are often invaded by fungal hyphae.

The vascular bundle is concentric; the xylem portion is enveloped in the phloem. The central cylinder is surrounded by a well-defined endodermis and phloem sheath, the radial walls of which are thin and fragile; the phloem elements are represented by two or three imperfect rows of narrow parenchymatous cells and sieve tubes; the xylem consists of scalariform tracheids with occasionally small spiral tracheids close to the phloem. The medullary parenchyma is composed of large, thick-walled cells, pitted, and early showing sclerosis, but not as early as the fundamental tissue outside the bundle.

STERILE LEAVES

The sterile leaves are linear, slender and tortuous. The development of the leaf is very slow, the lower portions having long been fully formed while the apex is still unfolding. The vernation is circinate (Fig. 79). Owing to the more rapid growth of the cells on the dorsal side than those on the ventral, the leaf is rolled up on the ventral side. When fully developed they bear on their dorsal side two rows of stomata alternating with three rows of glands (Fig. 81), sometimes four or more rows of glands. The glands seem to originate from special cells cut off from the epidermis; these epidermal cells frequently do not lengthen, keeping very nearly an isodiametric shape; when they do lengthen the glands remain at or near the upper wall.

The young leaves and the tip of the stem are more or less completely clothed with trichomes early turning brown. These are not to be confounded with the glandular hairs. They are composed of two or more cells and are extremely long, measuring in some instances 1 mm. to 3 mm. or perhaps more. The longest glands of the leaf measured nearly 100 μ, others 76 μ and in width 31 μ. Some are composed of one cell, others of two cells; they are all club-shaped and contain granular protoplasm. These glands were rarely found on the ventral surface, and sometimes they did not appear to follow any law as to their formation on the dorsal surface, though, for the most part, they were formed in alternate rows with the stomata.

The stomata are restricted to two rows of epidermal cells and almost every epidermal cell in these rows gives rise to one (Fig. 82). A cell of the epidermis before it has lengthened forms a U-shaped wall at the upper end of the cell (Figs. 86, *a*, *b*); the points of the U meet the radial wall which separates this cell from the one next above (Fig. 86, *b*); this cell becomes the mother cell of the stoma, and by growth presses the partition wall back a short distance into the upper epidermal cell (Fig. 86, *e*). This cell divides by a tangential wall into two cells of equal size; these become the guard cells (Fig. 86, *c*, *d*) each containing abundant chlorophyl. These guard cells enlarge considerably (Fig. 86, *d*, *e*) so that they are raised above the epidermis as shown in an oblique view (Fig. 83). The wall between the guard cells splits along its central portion making an opening to the space below; the epidermal cell meanwhile has lengthened and the cell above has formed a stoma in the same way. The leaf bundle is more nearly collateral than that of the stem; the xylem faces the ventral, the phloem the dorsal surface of the leaf (Figs. 88, 90). There is a two-rowed endodermis around the bundle; the epidermal cells are large and in some instances occupy one half of the cross section. The ground tissue is made up of thin-walled parenchyma with numerous air spaces (Fig. 89) and the cells contain chlorophyl.

Sporophyll

The sporophyll is very similar to the sterile leaf with the exception of the formation at its apex of pinnae bearing the sporangia; these have been carefully studied by Prantl and others in several species of *Schizaea*, the descriptions of which, from present observations, appear to hold good for *Schizaea pusilla*. One of the largest sporophylls measured 13 cm. from base to apex, the portion bearing the pinnae was 6 mm. long and eight pinnae were formed on one side and seven on the other; the longest pinna measured 4 mm., of this 2⅔ mm. is the portion which bore the sporangia. The lowest pinna on each side had formed four sporangia each, the others eight each. Prantl figures six sporangia for *Schizaea dichotoma*, and sixteen for *Schizaea Pennula*. The edge of each pinna rolls up over the sporangia, forming an indusium, and the end cells at the summit and also along the margin produce trichomes which also cover the sporangia. These trichomes are often composed of more than one cell, and resemble the trichomes formed by the rhizome and are in some instances as long as 134 μ, 345 μ, 461 μ, the width being 38 μ, and 30 μ.

A surface view of the dorsal side of the sporophyll shows two rows of stomata alternating in some cases with rows of glands, though these sometimes are not in rows, and occasionally only two glands were found. These glands are smaller than those generally found on the sterile leaf measuring only 38 μ.

The stomata appear sunk below the epidermis, but a cross-section showed them to be the same as in the sterile leaf. The two rows of stomata continue up the leaf from the base to the pinnae, where they are lost in a great number of stomata which cover the dorsal surface of the pinnae with no special arrangement. No glands were found on any of the pinnae examined.

The warts or swellings from the epidermal cells are far more numerous in the sporophyll, though they are found on the sterile leaf (Fig. 93, *a*). They do not appear to follow any law as to their arrangement on either leaf, though they appeared to be more numerous on the ventral side. The epidermal walls are thicker than the epidermal walls of the sterile leaf, some of which had extremely thin walls and a rudimentary bundle (Fig. 90).

The bundle has a well-marked endodermis; it appeared from the cross-section to be collateral as did all the bundles with the exception of that of the rhizome (Fig. 94). The elements of the bundle were not traced out, but reticulated and ring tracheids were found in the xylem. The mesophyll tissue of the sporophyll (Fig. 89) is composed of thin-walled cells with numerous air spaces: these cells seem to be branched in a stellate manner in both sterile leaves and sporophylls.

SUMMARY

The spores are small, are nearly reniform, and have a cuticularized exospore which is alveolate. There is a ridge along the concave side having a fissure nearly its whole length through which the young tube emerges when the spore germinates. Out of a great number sown at one time only two had germinated by the end of the third week, the others taking a longer time. The spore remains attached for some time after the formation of antheridia.

The gametophyte is a filamentous protonema, irregularly branched, bearing both antheridia and archegonia on the same filaments; and producing rhizoids from specially modified cells which are inhabited by a symbiotic fungus.

The antheridia occur singly, or in groups on special branches bearing antheridia alone. They are produced in great numbers though but few ripen. They are simple in their structure and the first wall formed in the antheridium is parallel with the wall cutting it off from the lateral branch, forming a pedicel. A small number of antherozoids are produced in an antheridium, which are enclosed in a membrane when they escape from the antheridium.

The archegonia arise at, or near, the base of the filaments, either directly on the filament or, more often, on cushions formed by the division of the cell of the filament. They are characterized by the uniformity of the neck rows and the large size of the stigmatic cells.

The foot is a large, well-defined organ, remaining attached to the protonema for some time after the formation of the third frond, carrying nourishment from the gametophyte to the embryo which is far advanced before it breaks through the calyptra.

The primary root is persistent. The second and third roots have a vestigial sheath through which they do not break until after the development of the root-cap. The root-cap consists of four large pear-shaped cells inflated on the side away from the root tip.

The rhizome is erect, always forming a protective covering over the growing end; the trichomes are large, turn brown early, and are persistent.

There is a central concentric bundle with a well-marked endodermis. Sclerosis takes place in the entire cortex, the cells of which, with the epidermis, are filled with starch. The epidermis and cortex are often invaded by a fungus hypha.

The sterile and fertile leaves have two rows of large stomata, on the dorsal side, alternating with two or more rows of glands; these glands are small and sometimes wanting on the fertile leaf. The young leaves are more or less completely clothed with trichomes. Warts or swellings occur from the epidermal cells on both surfaces, though more numerous on the ventral side.

The bundles appear collateral with a well-marked endodermis. The mesophyll tissue is composed of thin-walled cells, branched in a stellate manner.

Explanation of Plates

Plates 1, 2, 3 and 4 were drawn from a magnification three times as great as expressed in the numbers which represent the magnification of the figures as they stand in the reproduction.

PLATE 1

1. Different views of the spore, × 80.

2. Spore, × 140.

3. Portion of exospore, × 333⅓.

4. Ridge and fissure in exospore seen from above, × 195.

5–17. Different stages in the germination of the spore, × 58⅓. *a*, filament; *b*, rhizoid; *c*, *c*, new branch.

18. Germinating spore of *Botrychium obliquum*, two weeks and five days, × 58⅓. Sown at same time as *Schizaea* spores. The last-named did not start to germinate until after three weeks.

19. Germinating spore found in soil on August 28, × 80. *a*, Indication of cross-wall.

20. The same on August 29. *a*, cross-wall formed.

21. The same on August 31, × 30.

22. On September 4, × 30.

23. On September 5, × 30.

24. Spore found in soil on September 5, × 30. *a*, antheridia; *b*, swelling at base of terminal antheridium.

25. The same with wall formed at *a*.

26. Filament of four cells with antheridium showing mother-cells of antherozoids (*a*). *b*, Rhizoid, × 80.

27. Sporangium with spores germinating inside, × 30. Owing to position in which the sporangium fell when sown—the filaments from the spores are not sent out though the regular fissure at *a*.

PLATE 2

28, 29, 30 and 31. Methods of branching of the protonemal filaments.

32 and 33. Cells of the filament dividing.

34 and 35. Cells of the filament becoming moniliform.

36. Young spherical cells with the longitudinal wall (*a*) just forming, × 80.

37. Older stage of the same showing young rhizoids (*a*, *a*) and young branch starting from filament at base of spherical cells *b*, × 80.

38. Portion of filament showing spherical cells, antheridia, and archegonia. *a*, spherical cells; *b*, rhizoids; *c*, fungus in spherical cells; *d*, antheridia; *e*, archegonium, × 30.

39. Shows position of spherical cells, × 30.

40. Abnormal condition. One cell of the filament giving rise to one spherical cell, and a cell of the filament next above giving rise to two, × 30.

41. End of rhizoid showing fungus penetrating into the cell. Shaded portions are hyphae which are inside the rhizoid, × 195.

42. Upper part of same showing portion of spherical cell with the bladder-like hyphae (*b*). A hypha in rhizoid, × 195.

43. Spherical cells filled with fungus *a*, × 140.

PLATE 3

44, 45, 46 and 47. Different ways of branching of antheridial filament.

48. One of the antheridial branches with antheridia in different stages of completion. *a* shows one filament giving rise to three, × 30.

49, 50, 51, 52, 53, 54, 55 and 56. Stages in formation of the antheridium. Fig. 49, × 80, first cell sent out from main filament. Fig. 50, × 30, later stage showing first wall cut off near tip. Fig. 51, × 80, older stage. Terminal cell *a* becomes the antheridium; cell *b* the pedestal. Fig. 52, × 140, *a*, cap cell; *b*, mother cells of the antherozoids. Fig. 53, × 140, later stage. Fig. 54, × 140, ripe antheridium before splitting cap-cell. Fig. 55, × 333⅓, antherozoids still in membrane. Fig. 56, empty antheridium.

57. Branch showing antheridia and archegonia. All the antheridia but *a* are aborted, × 16⅔.

58. Young archegonia, × 140.

59. Young archegonium, × 30. *a*, canal cell; *b*, ventral canal cell; *c*, egg cell.

60. Older stage of same before opening, × 80.

61. Looking down on the four stigmatic cells of the archegonium, × 80.

62. Archegonium opening, × 80.

63. Showing large stigmatic cells (*a*) folding back, × 80.

64. Cell of the filament dividing up before the formation of the archegonia, × 140.

65. The same with an archegonium, × 30.

PLATE 4

66 and 67. Upper and under view of egg cell after fertilization enclosed in the calyptra, × 30.

68. Young embryo, × 30.

69. *a*, gametophyte wlth archegonium. *b*, foot; *c*, leaf; *d*, stem of sporophyte, × 30.

70. Young sporophyte. *a*, foot; *b*, leaf; *c*, stem; *d*, trichomes; *e*, gland on rond; *f*, calyptra, × 80.

71. Young sporophyte. *a*, foot; *b*, root; *c*, frond; *d*, calyptra.

72 and 73. Two stages in the growth of the sporophyte showing curled tip of frond. Marking the same in both. *a*, gametophyte; *b*, sporophyte; *c*, calyptra, × 12⅓.

74. *a*, Rhizome; *b*, root; *c*, first leaf; *d*, trichomes.

Plates 5, and 6 were drawn from a magnification twice that expressed in the numbers which represent the magnification of the figures as they stand in the reproduction.

PLATE 5

75. Sporophyte still attached to gametophyte after the formation of the third leaf. *a*, foot; *b*, portion of calyptra; *c*, root; *d*, young root, the dotted lines indicate root-cap which can be seen through the vestigeral covering; *f*, leaf; *g*, rhizome; *h*, trichomes which cover tip of young leaf and rhizome; some have been removed to show glands on leaf; *i*, gametophyte, × 45.

76. Young root just emerging from its covering, × 87½.

77. Root-cap; here shown in five series.

78. Cross-section of root. *a*, thickened inner walls of cells of the ground tissue next to endodermis (*b*); *c*, phloem; *d*, xylem, × 292½.

79. Showing rhizome with four leaves and five roots; *a*, rhizome; *b*, roots; *c*, trichomes (the internode here represented is unusually long and distinct), × 8.

80. Cross-section of rhizome not far from tip, × 120. *a*, cells filled with starch; *b*, endodermis; *c*, phloem; *d*, xylem; *e*, fungus hyphae entering epidermal cells.

PLATE 6

81. Surface view of dorsal side of sterile leaf, showing the two rows of stomata with the glands alternating with them, × 120.

82. Portion of epidermis of sterile leaf with three stomata, *a*, *b*, *c*. *a*, shows the chlorophyl grains; in *b* the contents have been removed to show the original cross-wall (*d*) between the epidermal cells, and the way the guard cells (*e*) rest on epidermis at *c*, × 210.

83. Oblique view of sterile frond showing raised stomata (*a*).

84. Longitudinal section of same. *a*, epidermal cells; *b*, one guard cell of stoma; *c*, air cavity.

85. Cross-section of same. *a*, guard cells; *b*, air cavity, × 210.

86. Five diagrams showing development of stoma. 1 *b*, cross-wall between epidermal cells; 2 *b*, mother cell of stoma with U-shaped wall; *c*, formation of longitudinal wall through mother cell dividing it into the two guard cells; *d*, shows curve in original cross-wall, and the splitting of the longitudinal wall. The dotted line indicates the relative size of the guard cells which have started to swell. In *e*, the stoma is complete; 1 *e*, original cross-wall; 2 *e*, guard cells.

87. Diagram of cross-section of sterile leaf showing the two rows of stomata (*c*). *a*, bundle; *b*, endodermis, × 45.

88. Bundle from sterile leaf. *a*, endodermis; *c*, phloem; *d*, xylem, × 210.

89. Mesophyll tissue from sterile leaf, × 210.

90. Cross-section of a young sterile leaf with a rudimentary bundle, marking as in Fig. 88, × 210.

91. Diagram of cross-section of fertile leaf, marking as in Fig. 87, × 45.

92. Stoma seen in cross-section of sporophyll, × 210. *a*, stoma; *b*, air space.

93. Two epidermal cells from cross-section of sporophyll showing warts (*a*), × 210.

94. Cross-section of bundle in sporophyll, marking as in Figs. 88, 90, × 210.

Studies on the Rocky Mountain Flora.—IV

By P. A. Rydberg

Arnica tomentulosa sp. nov.

A leafy perennial with slender horizontal rootstock. Stem villous, about 4 dm. high: leaves oblanceolate, obtuse, sessile or the lower with short-winged petioles, denticulate, finely villous-pubescent, almost tomentulose, with two pairs of stronger veins, the larger 13 dm. long, somewhat yellowish: heads few, hemispherical; disk about 15 mm. high and 2 cm. broad: bracts ovate or ovate-oblong, obtuse, villous, 12–16 in number: rays light yellow, over 1 cm. long, 4 mm. wide.

This species is nearest to *A. mollis*, but differs in the broad obtuse involucral bracts. It grows at an altitude of about 2700 m.

Wyoming: Buffalo Fork, 1897, *F. Tweedy, 523.*

Arnica tenuis sp. nov.

A low slender perennial with horizontal rootstock. Stem sparingly villous pubescent, about 2 dm. high, monocephalous: leaves usually 3 pairs, sparingly villous when young, entire; the lower two pairs oblanceolate or spatulate, the upper lanceolate: involucre turbinate-campanulate, villous, about 13 mm. high, 10–12 mm. broad: bracts linear, 1–1.5 mm. wide, green; rays orange, 16–18 mm. long and 4 mm. wide.

This species resembles *A. gracilis* in the size of the plant and form of the head, but the leaves are much narrower and the heads solitary. It is intermediate between that species and *A. fulgens*. It grows at an elevation of about 2200 m.

Wyoming: Big-Horn Mountains, 1899, *F. Tweedy, 2094.*

Artemisia diversifolia sp. nov.

A white tomentose perennial with horizontal rootstock. Stems simple, leafy, white-tomentose, 5–10 dm. high: leaves densely tomentose on both sides, subsessile, 5–10 cm. long: the lower pinnately cleft into 3–5 narrowly lanceolate acuminate lobes, which are directed forward: the upper entire, linear-lanceolate, passing into the bracts of the inflorescence: inflorescence a narrow panicle, 1.5–3 dm. long: heads numerous, conglomerate, sessile, 3–4 mm. high and 3 mm. broad: bracts oblong or ovate-oblong, scarious-margined, densely villous-tomentose: flowers heterogamous, but all fertile, light yellow: receptacle glabrous.

This species belongs to the *A. Ludoviciana* group, and in many respects agrees with the original description thereof. It is, however, a western species, not growing near the region from which *A. Ludoviciana* was described. What the latter really is I have been unable to settle. The one that I think is the only one that has any claim for the name, is a lower plant from Missouri to Colorado, with shorter leaves, more green above, with more divergent lobes and brownish flowers. *A. diversifolia* grows on sandy beaches up to an altitude of 2200 m.

IDAHO: Priest River, 1900, *D. T. MacDougal, 190* (type); Farmington Landing, Lake Coeur d'Alene, 1892, *Sandberg, MacDougal & Heller, 509.*

WASHINGTON: 1889, *G. R. Vasey, 479.*

WYOMING: Yellowstone Lake, 1899, *Aven & Elias Nelson, 6603.*

Picradenia helenioides sp. nov.

A comparatively tall, finely pubescent plant with apparently only biennial root. Stem leafy, about 5 dm. high, with several to many erect branches: leaves rather firm, distinctly ribbed, finely pubescent; the lower petioled and with half clasping bases: basal leaves entire, very narrowly linear-oblanceolate; middle stem-leaves erect, fully 1 dm. long, parted into 3–5 linear divisions: upper stem-leaves linear, entire: heads corymbose: involucre somewhat tomentose, 8–10 mm. high and often 15 mm. broad; outer bracts united only at the base, lanceolate, longer than the inner, 14–18 in number: rays orange, about 1 cm. long, 2–3 mm. wide, 3-toothed at the apex: achenes silky: scales of the pappus broadly lanceolate, acuminate.

It is nearest related to *P. biennis* (A. Gray) Greene; but differs in the yellowish green herbage, the erect branches, the broader segments of the leaves and the darker flowers. It grows in mountain valleys at an altitude of about 2700 m.

COLORADO: On Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 5495.*

Antennaria Piperi sp. nov.

Somewhat surculose-rosuliferous: basal leaves 2–4 cm. long, obovate or oval with a short petiole, densely floccose on the lower surface, only slightly so on the upper surface when young, but soon glabrate, 1-ribbed or indistinctly 3-ribbed, generally distinctly mucronate: flowering stems 1–1.5 dm. high, somewhat glanduliferous above; its leaves small and bractlike, oblanceolate or linear; heads 5–7 in a short raceme: fertile heads 7–8 mm. high and 6–7 mm. in diameter; its bracts imbricate in about 4 series, slightly floccose, green at the base, purplish in the middle and with a light brownish scarious margin above; the outer short and ovate; the inner lanceolate, acute: pappus very slender, filiform, dirty white; sterile heads about 5 mm. high and about as broad; its bracts broadly oblong, more floccose, brown and with a broader scarious margin of the same color as in the fertile head, obtuse or truncate; pappus only slightly broadened above, white.

It is nearest related to *A. racemosa*, but differs in the more copious and more persistent tomentum, in the broader and brighter colored bracts of the fertile head and the broad scarious margins of those of the sterile one.

OREGON: Olympic Mountains, 1895, *C. V. Piper* (fertile plant in herbarium of Washington Experiment Station, Pullman); mountains of northern Oregon, *Wilkes Expedition* (sterile plant in the Torrey herbarium).

Aster mollis sp. nov.

A strict perennial with a horizontal rootstock. Stem densely villous, almost tomentose, or in age more glabrate, 4–8 dm. high, simple below, with short flowering branches above; leaves obovate to oblanceolate, 5–10 cm. long, densely and softly grayish pubescent on both sides, sessile, slightly clasping, and occasionally a little auricled at the base: heads terminating the short branches, hemispherical; disk about 15 mm. high and broad; bracts herbaceous, oblong, obtuse, villous-pubescent; rays numerous, bluish purple, about 1 cm. long and 2 mm. wide.

This species reaches an elevation of 2200 m.

WYOMING: Big-Horn Mountains, 1899, *F. Tweedy, 2029* (type).

WASHINGTON: Pullman, 1893, *C. V. Piper, 1604.*

Townsendia Vreelandii sp. nov.

A dark green biennial, branching near the base. Stems and branches simple, erect, 1.5–4 dm. high, mostly erect, sparingly villous. Leaves numerous, all oblanceolate, short-petioled, glabrous, mucronate, 4–8 cm. long, 5–8 mm. wide: involucre about 15 mm. high and 25–30 mm. broad: bracts lanceolate, acuminate, scarious, light green with dark green center: rays bluish purple, 12–15 mm. long, 2 mm. wide: achenes thin, oblong, truncate: pappus of 2 subulate bristles, with a few intermediate squamellae.

It is nearest related to *T. eximia*, but has larger heads, is more leafy, and even the upper leaves are oblanceolate. It grows at an altitude of 2500–3000 m.

COLORADO: Side of Veta Mountain, 1900, *F. K. Vreeland, 639* (type); Veta Pass, 1900, *Rydberg & Vreeland, 5404 and 5405;* West Spanish Peak, *5406*.

Erigeron leucotrichus sp. nov.

Perennial with a somewhat branching rootstock. Stems about 2 dm. high, sparingly villous below, more copiously so above: basal leaves oblanceolate or spatulate, 3–5 cm. long, short-petioled, bright green and sparingly hairy: stem-leaves oblanceolate to linear, 1–2 cm. long; head solitary; involucre white-villous with multiceptate hairs; bracts very numerous, lanceolate, almost black, acuminate with spreading tips: rays very numerous, about 6 mm. long and 1 mm. wide, light purplish pink or white.

This species is nearest related to *E. melanocephalus*, but easily distinguished from it by the white, not black, hairs of the involucre. It differs from *E. simplex* in the taller habit, the larger heads and the darker bracts of the involucre. It grows at an altitude of about 2500 m.

WYOMING: Big-Horn Mountains, July, 1899, *Frank Tweedy, 2003*.

Erigeron incanescens sp. nov.

(?) *Erigeron glabellus* var. *mollis* A. Gray, Proc. Acad. Phil. 1863: 64, in part.

A densely and finely cinereous pubescent plant with perennial rootstock. Stem simple, 1.5–3 dm. high, mostly ascending, striate densely pubescent, leafy: basal leaves oblanceolate or spatulate: stem-leaves about 5 cm. long and 1 cm. wide, oblong, oblanceolate or the upper lanceolate, sessile and somewhat clasping: heads 1–4; disk about 8 mm. high and 15 mm. broad: bracts very numerous in one series, narrowly linear, cinereous as the rest of the plant; rays pale blue or violet, very numerous, about 15 mm. long and less than 1 mm. wide.

From Dr. Gray's description, this species must have been included in *E. glabellus* var. *mollis;* but all specimens that I have seen under that name belong to *E. subtrinervis* Rydb., which is its nearest relative. From this it differs in the dense grayish pubescence, the narrower stem-leaves, which are not 3-ribbed, and the lower habit. *E. incanescens* grows in rocky places at an altitude of about 3000 m.

COLORADO: West Spanish Peak, 1900, *Rydberg & Vreeland, 5415.*

Erigeron viscidus sp. nov.

A low cespitose perennial. Stems ascending, a little over 1 dm. high, more or less hirsute and glandular-puberulent, especially above; leaves 3–5 cm. long, oblanceolate, dark green, sparingly hirsute and ciliate on the entire margins: heads few: disk about 1 cm. high and 15 mm. broad: bracts very numerous, subequal in one series, narrowly linear, fuscous, acuminate, glandular-puberulent, but not hirsute: rays very numerous, pale blue, about 8 mm. long and .5 mm. wide.

This species is intermediate between *E. glandulosus* and *E. macranthus.* It has the habit of the former, although larger, and the large heads and numerous narrow rays of the latter. It grows in wet ground, at an altitude of about 2700 m.

COLORADO: Near the Gray-Back Mining Camps, 1900, *Rydberg & Vreeland, 5416.*

Valeriana acutiloba sp. nov.

A bright green plant with horizontal or ascending rootstock and polygamo-dioecious flowers. Fertile plant 4–5 dm. high: basal leaves entire with a short wing-margined petiole, 5–7 cm. long; blade spatulate or obovate, acute: stem-leaves usually 3 pairs, pinnately divided; lateral divisions lanceolate to linear, long-acuminate; the terminal one large, oblanceolate or of the uppermost very small leaves linear-lanceolate, entire or saliently toothed: cyme dense, contracted, 2–5 cm. long and about as wide; glandular-puberulent: bracts linear subulate, about 1 cm. long: flowers perfect; corolla funnelform, about 4.5 mm. long; tube proper about 1 mm.; fruit broadly ovate, about 4 mm. long: pappus about 7 mm.: staminate plant lower, 3–4 dm. high, with more sterile shoots, which have much longer leaves: stem-leaves usually only 2 pairs, less divided, with only 1–2 pairs of lateral divisions: cymes denser, flowers all or nearly all staminate: their corollas larger, 5–6 mm. long, more oblique; the limbs about 5 mm. wide.

This species has the dense cyme of *V. capitata;* but the plant is taller, the corolla shorter and is easily distinguished from all its

American relatives by the narrow, long-acuminate divisions of its stem-leaves. It grows in wet places, especially under snowdrifts, at an altitude of 2500–3300 m.

COLORADO: Near Gray-Back Mining Camp, Sangre de Christo Range, 1900, *Rydberg & Vreeland, 5576* (type, fertile plant); Mountain near Veta Pass, *5575* (staminate plants); Bear Creek Cañon, 1895, *Ernst A. Bessey* (fertile); Pagosa Peak, 1899, *C. F. Baker, 620.*

Campanula MacDougalii sp. nov.

A slender glabrous perennial, about 3 dm. high with slender horizontal rootstock. Leaves very thin: the basal ones and lower stem-leaves with slender petioles 2–4 cm. long: blades broadly ovate, 2–3 cm. long, coarsely sinuate-dentate: upper stem-leaves lanceolate to linear, entire; the largest 5–6 cm. long: sepals linear subulate, 10–12 mm. long, at last reflexed: corolla 13–15 mm. long, nearly of the same shape as that of *C. rotundifolia:* style exserted, straight: fruit not seen.

The species is nearest related to *C. Scouleri;* but is easily distinguished from that species by the lack of the sharp toothing of the leaves. The lower leaves resemble somewhat those of *C. rotundifolia*, and were it not for the exserted style and the smaller corolla it may be referred to the var. *Alaskana* of that species.

IDAHO: Priest Lake, 1900, *D. T. MacDougal, 66.*

Castilleja linearis sp. nov.

A rather slender perennial, with a rootstock. Stem simple, 3–4 dm. high, finely villous pubescent: leaves narrowly linear, about 5 cm. long and 2 mm. wide, pubescent, entire or the upper with a pair of narrowly linear lobes: bracts broader, deeply cleft into three linear lobes, tipped with brick-red: calyx villous, 2–2.5 cm. long, cleft almost equally deeply in front and behind, more than half way down: lateral lobes linear, 8–10 mm. long: corolla 2.5–3 cm. long, greenish yellow: galea about 12 mm. long, with red margins: lower lip dark green, about 3 mm. long, 3-lobed.

This species resembles in habit most the subarctic *C. pallida*, but has the corolla of *C. mineata.* It grows in meadows at an altitude of about 2500 m.

COLORADO: Near West Spanish Peak, 1900, *Rydberg & Vreeland, 5619.*

Castilleja trinervis sp. nov.

A tall perennial with rootstock. Stem more or less villous, especially the upper portion, solitary, simple or branched, 3–6 dm. high: leaves dark green, finely puberulent, entire, acute, usually 3-ribbed; the lower linear, 5–8 cm. long and about .5 cm. wide; the upper lanceolate and often 15 mm. wide: lower bracts green, similar but shorter and broader and usually 3–5-lobed: the upper with almost crimson tips: calyx densely white villous, about 3 cm. long, equally cleft in front and behind, each division laterally cleft into two oblong lobes, 5–8 mm. long, tipped with the same color as the bracts: corolla about 4 cm. long, slightly curved, green, but the galea with almost crimson margins: galea about 15 mm. long: lower lip 4–5 mm. long, dark green, with three narrow lobes: style about 5 mm. longer than the corolla.

This species is nearest related to *C. rhexifolia* and *C. confusa*, but is characterized by the copious white villous pubescence of the upper part of the stem and the calyx. It grows in open woods at an altitude of 2700–3000 m.

COLORADO: Headwarters of Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 5620* (type); Gray-Back Mining Camps, *5621*.

Castilleja luteovirens sp. nov.

A simple perennial with rootstock, often turning black in drying. Stem 3–4 dm. high, leafy, slightly pubescent when young, soon glabrate, except the upper portion which is slightly villous: leaves lanceolate to almost linear, 3–4 cm. long, 3–9 mm. wide, finely puberulent, 3-ribbed, acute, entire, or rarely the upper 3-lobed: lower bracts ovate, obtuse, entire, tipped with light greenish yellow or greenish white; the upper ones 3-toothed at the apex and greenish yellow throughout: calyx villous, 15–17 mm. long, almost equally cleft in front and behind, laterally cleft about 3 mm.; lobes lanceolate: corolla 22–24 mm. long, greenish; galea 6–7 mm. long with yellow margins; lower lip 2.5–3 mm. long, bluntly 3-lobed.

This species has been referred to *C. septentrionalis* and *C. pallida*, but differs from both in the broader, less acuminate leaves and broader, more entire yellowish bracts. Neither of the two species mentioned is found in the southern Rockies. Mostly all the material that has been determined as either belongs to the present species. This grows in meadows at an altitude of 1200–2700 m.

COLORADO: Sangre de Christo Creek, 1900, *Rydberg & Vree-*

land, 5616 (type) and *5617;* Wahatoya Creek, *5618;* Middle Park, 1861, *C. C. Parry, 241;* Chicken Creek, 1898, *Baker, Earle & Tracy, 374;* near Denver, 1869, *B. H. Smith;* Ford of Chama, 1859, *Newberry*, in Macomb's Expedition; Seven Lakes, Pikes Peak, 1894, *Ernst A. Bessey.*

WYOMING: Big-Horn Mountains, 1899, *F. Tweedy, 2340;* Laramie Plain, 1884, *C. S. Sheldon, 80.*

UTAH: Salt Lake City, 1879, *M. E. Jones, 1051.*

Mimulus gratioloides sp. nov.

A low, branched annual of more or less reddish color, generally less than 1 dm. high, somewhat viscid puberulent especially above. Leaves oblong-lanceolate, sessile, about 1 cm. long, sinuate-dentate: pedicels slender, in fruit 15–20 mm. long; calyx 7–8 mm. long, cylindraceous in fruit: lobes subequal, short, broadly ovate, acute, ciliate on the margins; corolla yellow, about 1 cm. long and 3 mm. broad, only slightly bilabiate: throat beardless.

This species is nearest related to *M. rubellus* and the specimens from Colorado referred to that species may belong here. *M. gratioloides* differs, however, in the smaller yellow corolla and the acute calyx-lobes. It grows in exposed places among rocks and gravel at an altitude of about 2300 m.

COLORADO: Butte, 5 miles southwest of La Veta, 1900, *Rydberg & Vreeland, 5660.*

Pedicularis lunata sp. nov.

A perennial, perfectly glabrous up to the inflorescense, with a rather stout, but simple rootstock: stem about 4 dm. high, slightly striate and purplish: leaves alternate, dark green, 5–12 cm. long, pinnately divided to near the midrib; segments linear or linear-oblong, crenate: spike 15–20 cm. long, rather lax; bracts pectinately divided with prolonged endlobes, the lower often equaling the flowers in length, slightly arachnoid villous: calyx about 9 mm. long; its teeth broadly lanceolate, about 3 mm. long: corolla pinkish, over 2 cm. long; its tube about twice as long as the calyx, strongly curved; galea strongly arcuate, produced into a rather long beak and almost crescent-shaped; lower lip almost meeting the beak of the upper, very broad, indistinctly 3-lobed with large rounded lateral lobes.

The very broad lower lip, and long-beaked galea suggest somewhat *P. contorta* and *P. ctenophora*, but the corolla-tube is much longer and the beak not spirally twisted. The species may therefore be placed with *P. Canbyi*, *P. Parryi* and *P. Hallii*, but the corolla and beak are much more arcuate. It is a handsome species growing at an altitude of nearly 2800 m.

WYOMING: Big-Horn Mountains, 1899, *F. Tweedy, 2317* (type).

Pentstemon erosus sp. nov.

A glabrous cespitose perennial, 2–4 dm. high. Basal leaves oblanceolate, short-petioled, 3–5 cm. long, entire, mostly acute: stem-leaves opposite, sessile, oblong or lanceolate, entire, acute or the uppermost acuminate: flowers in a dense interrupted spikelike inflorescence: calyx-lobes broadly ovate, almost cuspidate-acuminate, tinged with dark purple and white and with an erose-dentate margin: corolla purple with very dark limb: lower lip broad with 3 rounded reflexed lobes, bearded on the inside: upper lip with 2 erect narrower lobes: sterile stamens narrowly clavate, short-bearded.

This species is nearest related to *P. procerus*, but easily distinguished by the erose sepals and more reflexed lower lip. It grows at an altitude of 2000–2700 m.

COLORADO: Indian Creek Pass, 1900, *F. K. Vreeland, 615* (type); South Park, 1873, *John Wolfe* (Wheeler Expedition), *293*; Chicken Creek, West La Plata Mountains, 1898, *Baker, Earle & Tracy, 658*.

Pentstemon Wilcoxii sp. nov.

An almost glabrous perennial with a cespitose caudex. Stems 3–6 dm. high, glabrous or slightly puberulent above, simple: leaves opposite, glabrous and somewhat glaucous, dentate with small sharp callous teeth, acute: the basal ones petioled, lanceolate: the lower stem-leaves sessile, oblanceolate or oblong, 3–5 cm. long; the upper lanceolate and slightly clasping: inflorescence an elongated interrupted thyrse: branches 1–2 cm. long, fastigiate-cymose: calyx glabrous, about 4 mm. long, cleft ¾ its length: lobes lanceolate, acute, slightly margined below and there often sinuately toothed: corolla straight, purple, glabrous on the outside, about 15 mm. long; the lower lip longer than the upper, slightly bearded within: sterile stamen club-shaped, with a short dense brown beard.

This species is probably nearest related to *P. humilis*; but easily distinguished by the tall stems, the sharper toothed leaves and the numerous purple flowers.

MONTANA: Kalispell, 1900, E. V. *Wilcox, 370* (type in United States National Herbarium) and *368*.

Polemonium delicatum sp. nov.

A small glandular perennial with slender horizontal rootstock. Stem very slender, about 1 dm. high: leaves 3–8 cm. long; leaflets 5–11 pairs, very thin, ovate, ovate-lanceolate or oblong, mostly acute, 3–10 mm. long: inflorescence usually branched; branches 3–4-flowered; pedicels slender, 5–15 mm. long; calyx glandular, 4–5 mm. long: lobes lanceolate, acute: corolla blue, open-campanulate, about 7 mm. high and 8 mm. broad: stamens about equalling the corolla.

This is nearest related to *P. parviflorum* Nutt., but is still smaller and characterized by its slender pedicels, small flowers and acute calyx-lobes. It grows at an altitude of over 3000 m.

COLORADO: West Spanish Peak, 1900, *Rydberg & Vreeland, 5720* (type).

COLORADO OR NEW MEXICO: Canadian?, *Dr. James.*

Polemonium speciosum sp. nov.

A low viscid-villous plant, cespitose with a perennial rootstock. Stem 1–2 dm. high with 2–3 leaves: basal leaves numerous, 8–15 cm. long with wing-margined rachis; leaflets opposite, 7–9 pairs, ovate, 6–12 mm. long, acute: stem-leaves similar but smaller: inflorescence capitate: calyx viscid-villous, 15–20 mm. long, cleft to about the middle: lobes lanceolate, acute: corolla pale blue, deeply campanulate-funnelform, 2–2.5 cm. long: limb about 1.5 cm. broad.

The form of the corolla, the dense capitate inflorescence and the viscid pubescence place this species nearest *P. viscosum*, and *P. comfertum*, but the leaflets are not verticillate, the corolla is larger than that of the former and broader than in the latter.

COLORADO: Mount Garfield, 1900, *Fred. Clements.*

Gilia candida sp. nov.

A glandular perennial with short caudex. Stems often more than one, ascending or erect, simple, 4–6 dm. high, leafy: leaves rather fleshy, divided into linear-filiform, spinulose-tipped segments; the upper gradually smaller: inflorescence a very narrow panicle: branches usually very short and few-flowered: flowers subsessile: calyx glandular-pubescent, about 8 mm. long; its lobes lanceolate, bristle-tipped: corolla white, or rarely pale pink, 2–3 cm. long, salverform: its lobes oval or obovate, obtuse: stamens inserted unequally below the throat, included.

This species is nearest related to *G. aggregata;* but differs in the white corolla and its rounded obtuse lobes. It is also lower and the upper leaves more reduced. It grows on dry hillsides at an altitude of 2000–2700 m.

COLORADO: Mesas near La Veta, 1900, *F. K. Vreeland, 602* (type); Veta Pass, 1900, *Rydberg & Vreeland, 5730;* Calham, 1893, *De A. Saunders.*

Phacelia alba sp. nov.

A viscid-villous annual or biennial, 2–4 dm. high. Stem leafy, strict and simple viscid-villous and glandular above: leaves twice interruptedly pinnatifid, about 1 dm. long, glandular-puberulent, hispid ciliolate on the margins and veins; ultimate segments ovate or oblong, 3–6 mm. long: inflorescence branched, dense, in flowers almost capitate, but branches in fruit spiciform: flowers nearly sessile, 2-ranked: calyx glandular, cleft to near the base; sepals broadly linear, obtuse, about 2 mm. long, about one third shorter than the white corolla: the lobes of the latter rounded, crenate: appendages 10, broadly ovate: stamens and style much exserted: capsule ovoid, about 6 mm. long: seeds often solitary in each cavity, finely pitted.

This species is nearest related to *P. Neo-Mexicana* and *P. Popei,* resembling the latter most in habit, but having the viscid-pubescence and the crenate corolla-lobes of the former. It differs from both in the small white corolla and the long-exserted stamens. It grows in mountain valleys at an altitude of 1800–3000 m.

COLORADO: Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 5755* (type); Valley of Upper Arkansas River, 1873, *John Wolfe* (Wheeler Expedition), 99; Headwaters of Clear Creek, 1861, *C. C. Parry, 314.*

NEW MEXICO: Ruidoso Creek, White Mountains, 1895, *E. O. Wooton.*

Lappula calycosa sp. nov.

A hirsute annual, simple below, branched above with long virgate branches. Stem hirsute, 3–4 dm. high: leaves oblong, obtuse, 3–4 cm. long, 7–8 mm. wide; those of the branches smaller: pedicels short, in fruit 2–3 mm. long, generally 4 mm. below the leaves; corolla pale blue, about 1.5 mm. long and 1 mm. broad: calyx-lobes enlarged in fr it, foliaceous, 4–6 mm.

long and reflexed: fruit about 4 mm. in diameter: nutlets surrounded by a single row of subulate glochinate prickles, somewhat flattened at the base but not united into a wing-border: back of the nutlets strongly muricate.

It is nearest related to *L. occidentalis* (Wats.) Greene, but differs in the oblong obtuse leaves, the enlarged and reflexed fruiting calyx-lobes, and the virgate branches. It grows in deserted fields at an altitude of about 2000 m.

COLORADO: Walsenburg, 1900, *Rydberg & Vreeland, 5715.*

Lappula cupulata (A. Gray)

Echinospermum Redowskii var. *cupulata* A. Gray, Bot. Calif. 1: 530. 1876.

I think that this should be regarded as distinct from *L. Texana* (Scheele) Britton, as the habit is quite different. *L. cupulata* is diffuse, branching at the base, with elongated branches, while *L. Texana* is simple at the base, and branched above with short branches.

L. Texana is a southern plant, ranging from Texas to New Mexico. The range of *L. cupulata* is from Nevada to Nebraska, south to Colorado.

Cryptanthe minima sp. nov.

A dwarf hirsute annual, beginning to bloom when only 1 cm. high. Stems several, erect, in the specimens seen only 1–4 cm. high, long hirsute: leaves spatulate or oblanceolate obtuse, hirsute on both sides, 5–15 mm. long and 2–3 mm. wide: flowers crowded, 2.5–3 mm. long, subsessile: lobes of the calyx linear, hispid: corolla white; limb a little over 1 mm. broad; nutlets whitish, about 1 mm. long, dissimilar; 3 ovoid, strongly muricate; the fourth somewhat larger, smooth; the inside edge with a slender groove, triangular-dilated at the base.

In size and general habit, this species is strikingly like *C. pusilla;* but the fruit is different; the nutlets being dissimilar, one of them smooth, and all with rounded lateral angles and more rounded backs. The specimens of our collection are rather young and only two fully developed fruits were found. *C. minima* was found on dry hillsides at an altitude of about 2200 m.

COLORADO: Cucharas River, above La Veta, 1900, *Rydberg & Vreeland, 5697.*

Mertensia leariloba sp. nov.

A slender perennial with glabrous simple stem, 2–3 dm. high, basal leaves 5–15 cm. long, long-petioled; blades oblanceolate, obtuse; stem-leaves subsessile, linear or linear-lanceolate, acute, 3–6 cm. long, 4–9 mm. wide, strigose above, glabrous beneath: flower clusters 3–4-flowered in the axils of the upper leaves; pedicels very slender, 2–6 mm. long, strigose: calyx divided to near the base; lobes linear, acute, 3–4 mm. long, almost equaling the tube of the corolla, glabrous on the back, but hispid ciliate on the margins: corolla blue, 7–8 mm. long, tube nearly of the same length as the throat and limb; the latter 4–5 mm. long: stamens almost equaling the corolla; filaments dilated, and broader than the anthers.

It is nearest related to *M. linearis*, but characterized by the narrow, strongly ciliate calyx-lobes and the filiform pedicels. It grows in shaded situations at an altitude of 2500–2700 m.

COLORADO: West Indian Creek, Trichera Range, 1900, *Rydberg & Vreeland*, *5691* (type); near Empire, 1885, *H. N. Patterson*, *115*.

Mertensia ovata sp. nov.

A low cespitose, somewhat fleshy perennial. Stems 1–1.5 dm. high, glabrous: leaves 2–5 cm. long, 1–1.5 cm. wide, minutely strigose above, glabrous beneath; the lower obovate and short-petioled; the upper broadly ovate and sessile: flower-cluster dense; pedicels very short: calyx cleft to near the base: sepals lanceolate, ciliate on the margin, about 4 mm. long and one third shorter than the corolla-tube: corolla 10–12 mm. long; its tube nearly one half longer than the throat and limb: the latter about 7 mm. broad: stamens nearly equaling the corolla; filaments dilated and broader than the anthers.

This species is probably nearest related to *M. lanceolata;* but differs in the stunted habit and the broad leaves. It grows among rocks, at an altitude of 2800–3500 m.

COLORADO: West Spanish Peak, 1900, *Rydberg & Vreeland*, *5690* (type) and *5690a*.

Mertensia obtusiloba sp. nov.

A low cespitose perennial. Stems ascending, glabrous, 1–2 dm. high: lower leaves spatulate or oblanceolate, obtuse, tapering into a winged petiole, dark green, glabrous beneath, minutely strigulose above, glabrate in age, 3–5 cm. long; the upper broadly lanceolate, sessile: flower-clusters several from the axils of the upper leaves: pedicels very short, often sparingly strigulose: calyx divided to near the base; sepals oblong, obtuse, ciliate on the margins, 2–3 mm. long, scarcely more than half as long as the tube of the corolla: corolla dark blue, about 7 mm. long: tube nearly equaling the throat and limb: stamens short, included in the tube, filaments very short, not broader than the anthers.

This species is nearest related to *M. Tweedyi*, but differs in the shorter, obtuse calyx-lobes, the broader and thinner leaves and the stem which is not depressed or prostrate. It grows at an altitude of 2000–3500 m.

COLORADO: Pikes Peak, 1900, *Fred. Clements* (type); Garden of the Gods and Pikes Peak, 1894, *Ernst A. Bessey*; Argentine Pass, 1878, *Marcus E. Jones, 54.*

Mertensia membranacea sp. nov.

A tall erect perennial with a rather thick tap-root. Stem glabrous or sparingly hirsute above, 6–8 dm. high: leaves all petioled, or the upper sessile; blades ovate, acute or more often short acuminate, 4–8 cm. long, 1.5–4 cm. wide, very thin, hispid-stringulose on both sides: flower-clusters terminal and in the axils of the upper leaves, branched and many-flowered: pedicels 5–10 mm. long, hispidulous: calyx-lobes 2–3 mm. long, hispidulous, lanceolate, acute, one-third or one-fourth as long as the tube of the corolla: corolla about 1 cm. long; the pale blue or almost white tube longer than the dark blue limb and throat: limb about 4 mm. broad: stamens much shorter than the limb; filaments dilated and broader than the anthers: nutlets strongly rugose and spotted.

This species is related to *M. paniculata.* Mr. Bessey and myself collected it in 1897, but as the specimens were rather poor, they were referred doubtfully to that species. As more and better specimens have now been received, it has been possible to draw a description. It differs from *M. paniculata*, in the thinner leaves which almost always show an acumination, in the short calyx-lobes which scarcely enlarge in fruit and the smaller and numerous flowers. It grows in moist places at an altitude of 300–2000 m.

IDAHO: Priest River, 1900, *D. T. MacDougal, 3* (type); Cedar Mountain, 1892, *Sandberg, MacDougal & Heller, 420.*

MONTANA: Electric Peak, 1897, *Rydberg & Bessey, 4864.*

Mentzelia ctenophora sp. nov.

A diffuse cespitose scabrous perennial. Stems 3–6 dm. long, branched, in age straw-colored: lower leaves linear or linear-lanceolate in outline, tapering at both ends, often 2 dm. long: the upper lanceolate with a broad base: all pectinately laciniate with linear-oblong divergent obtuse lobes; hypanthium cylindrical, 15–18 mm. long; sepals ovate-lanceolate, acute, 4–5 mm. long: petals obovate, light yellow, about 8 mm. long: seeds irregularly angled, but not winged, finely muricate.

This species is perhaps nearest related to *M. albicaulis*, but differs in the large size of the plant, the diffuse habit, and the larger flowers. It was collected on railroad banks and in loose barren soil on hillsides, at an altitude of 1800–2100 m.

COLORADO: On Cucharas River, below La Veta, 1900, *Rydberg & Vreeland, 5769* (type); near Walsenburg, *5768*.

Impatiens aurella sp. nov.

A slender glabrous annual, about 6 dm. high. Petioles 1.5–3 cm. long: leaf-blades ovate or oval, thin, bright green, a little paler beneath, 4–5 cm. long, coarsely toothed, acute; teeth and apex finely mucronate: peduncles ascending, mostly 2-flowered: bracts minute, linear, about 2 mm. long: flowers orange, not mottled: sack conical, about 1 cm. long and 6 mm. broad at the base; its spur recurved, about 8 mm. long.

This is nearest related to *I. biflora*, but differs in the much smaller flowers, which are scarcely more than half the size of that species and without any spots, the comparatively longer spur and less pale leaves. It grows in swamps at an altitude of about 600 m.

IDAHO: Priest River, 1900, *D. T. MacDougal, 20*.

Geranium nervosum sp. nov.

A tall perennial with thick root and short caudex. Stems 4–8 dm. high, minutely retrorsely strigose, in age more glabrate: basal leaves with petioles 2–4 dm. long; blades reniform in outline, 8–12 cm. in diameter, finely strigose on both sides, divided to near the base into 5–7 obovate-cuneate or oblanceolate-cuneate divisions which are again 2–3-cleft and coarsely toothed: stem-leaves none, except those subtending the inflorescence; these sessile, 3–5-cleft; branches of the cymes and calyx very densely glandular pubescent: sepals oval, 8–9 mm. long, terminated by a filiform tip, 1–2 mm. long: petals broadly obovate, 15–18 mm. long, pale violet or almost white, with dark purple streaks: carpels as well as their column densely glandular; the latter nearly 2 cm. long: style beyond the column about 5 mm.: seeds glabrous, minutely reticulate.

This species is somewhat intermediate between *G. viscosissimum* and *G. Richardsonii*, having the general habit, the leaves and pubescence of the stem of the latter, but the densely glandular pubescence of the inflorescence and the calyx and carpels of the former. The color of the flower is most like *G. Richardsonii*, but scarcely pure white and with much more prominent veins. It grows at an altitude of 1800–2700 m.

WYOMING: Fish Creek, Teton Forest Reserve, 1897, *F. Tweedy*, *494* (type).

COLORADO: Continental Divide, Routt County, 1894, *C. S. Crandall.*

Lupinus candicans sp. nov.

A low cespitose perennial, densely white-silky throughout. Stems ascending, 1.5–2 dm. high, 3–4-leaved, often branched: stipules linear subulate, 5–8 mm. long: petiole 3–8 cm. long: leaflets about 7, densely white-silky and shining, 1.5–2.5 cm. long, oblanceolate, acute, mucronate, mostly conduplicate: raceme rather dense, 3–8 cm. long on a peduncle 2–5 cm. long: bracts small and early deciduous: calyx densely silky-villous, only slightly saccate on the upper side; lower lobe about 4 mm. long: banner dark blue with a light brown spot, about 7 mm. long, very broad, and with the sides strongly reflexed; wings dark blue, as well as the banner glabrous, about 9 mm. long and about equaling the keel: the latter whitish, tipped with dark purple: pod densely white-silky, 3–4-seeded.

This species has the white pubescence of *L. sericeus* and *L. Hellerae*; but is in every way a much smaller and more cespitose plant: the flowers are much smaller and of a darker and more intense blue.

MONTANA: (locality not given), 1900, *E. V. Wilcox*, *451* (type in U. S. Nat. Herb.); Boulder, *125* and *129*, in part; Big Timber, *385*; Highwood Mountains, *42*; Columbia Falls, 1897, *R. S. Williams.*

Lupinus cyaneus sp. nov.

A stout and tall perennial with rather simple caudex. Stem 4–9 dm. high, densely villous, but not white, very leafy and in age somewhat branched: stipules subulate, over 1 cm. long: petioles 5–10 cm. long: leaflets 7–11, oblanceolate, 3–9 cm. long, glabrous above, almost velvety beneath, acute: raceme long and dense, 1.5–2 dm. long: bracts rather persistent, often over 1 cm. long: flowers very numerous, 2–4 in each verticil, very short-pediceled: calyx white-velvety, somewhat saccate above: lower lobe about

8 mm. long: banner slightly hairy on the back, light blue, with a light brownish spot at the center, about 8 mm. long: wings light blue, about 1 cm. long, equaling the keel, which is whitish with purple tip: pod densely silky-villous, about 25 mm. long and 8 mm. wide, 4–5-seeded.

This species has the general habit and the long dense raceme of *L. leucophyllus*, but is much greener and the flowers are much smaller and lighter in color. No. 435, cited below, is referred here doubtfully. It is more silvery and more branched and had apparently almost white flowers.

MONTANA: (locality not given), 1900, *E. V. Wilcox, 446* (type in U. S. Nat. Herb.); Coal Spur, *435* (?) and *449* (the latter in fruit); Gallatin Valley, 1896, *J. H. Flodman, 617*.

Astragalus sulphurescens sp. nov.

A light green cespitose perennial. Stems ascending, about 4 dm. high, angled, glabrous, somewhat branched: stipules ovate to lanceolate, membranaceous, free from the petioles: leaflets 13–19, elliptic, obtuse or acutish, mucronulate, 12–30 mm. long, with a few scattered strigose hairs: spike dense and elongated: flowers ascending: bracts lanceolate-subulate, about 8 mm. long: calyx white-strigose with scattered black hairs: tube about 5 mm. long: lobes almost filiform, fully 5 mm. long: corolla light yellow: banner narrow, 15–18 mm. long, much exceeding the wings and keel: wings very narrow, only about 1.5 mm. wide: pod 2-celled, with dorsal suture deeply inflexed, deeply obcordate in section, about 1 cm. long, 3–4 mm. wide, strigose, with black hairs.

This species is closely related to *A. adsurgens*, but differs in the yellow, ascending flowers, narrow petals, more scant pubescence, the long slender calyx lobes and the black hairy pod. It grows at an altitude of 1600–3000 m.

COLORADO: Georgetown, 1895, *P. A. Rydberg* (type); along Platte River, Denver, 1878, *M. E. Jones, 851*.

Aragallus villosus sp. nov.

Densely and intricately cespitose perennial. Leaves basal, numerous, 5–10 cm. long: leaflets 25–31, rather crowded but not verticillate, 1–1.5 cm. long, lanceolate, very acute, densely but somewhat loosely silky: scape about 1.5 dm. long, loosely silky, almost hirsute, with spreading hairs: spike dense, 4–5 cm. long: bracts linear or narrowly linear-lanceolate, 8–10 mm. long: calyx white-silky villous; lobes very short, about 2 mm. long: corolla ochroleucous without any purple, 12–15 mm. long: keel very short and round, abruptly tipped with a small tip: pod thin, perfectly 2-celled, white-silky, about 1.5 cm. long, more than twice as long as the calyx, tipped with a slender beak which is abruptly hooked at the apex.

This belongs to the *A. campestris* group and is characterized by the coarse spreading pubescence of the scape and the ochroleucous flowers without any trace of purple.

MONTANA: Craig, 1900, *E. V. Wilcox, 378* (type in U. S. Nat. Herb.).

Trifolium lilacinum sp. nov.

A densely cespitose dwarf subscapose perennial with very deep root. The short branches of the caudex covered with the scarious stipules and remains of old leaves: leaves 3-foliolate, bright green; petioles 2–6 cm. long, strigose: leaflets elliptic or lanceolate-oblong, acute at each end, 1–2.5 cm. long, strigose: peduncle 5–12 cm. long, bracts minute, less than 1 mm. long, 3-toothed: flowers reflexed in fruit: calyx densely strigose; tube 3 mm. long; teeth subulate-filiform, 4–6 mm. long: corolla pale rose-purple or lilac, in age turning light brownish, about 1 cm. long; banner straight and obtuse.

This species is related to *T. dasyphyllum*; differing in the minute 3-toothed bracts and their shorter and comparatively broader leaflets. It is still nearer related to *T. acuminatus* Greene; from which it is distinguished by the smaller flowers and the not acuminate banner. It is an alpine plant growing among rocks at an altitude of about 3000 m.

COLORADO: West Spanish Peak, 1900, *Rydberg & Vreeland, 5950* (type), *5951* and *5952*.

Lathyrus leucanthus sp. nov.

A glabrous or slightly pubescent perennial with a very slender rootstock. Stem about 3 dm. high, angled: stipules very narrow, semi-sagittate: leaflets 2–4 pairs, elliptic, veiny, glaucous, acute, mucronate, 1–3 cm. long, 3–10 mm. wide: tendrils of the lower leaves mere tips; of the upper elongated and sometimes 3-divided: racemes short, in the axils of the middle leaves, 3–4 cm. long, 2–4-flowered: calyx glabrous, cleft to about the middle: lobes lanceolate, acuminate: corolla white, about 15 mm. long: banner broad.

This is nearest related to *L. Arizonicus*, but differs in the broader leaves and banner. It grows at an altitude of 2400–3000 m.

COLORADO: Ojo, 1900, *Rydberg & Vreeland, 6020* (type); Pass Creek, *6021;* West Indian Creek, *6022;* mountain near Veta Pass, *6023;* Veta Pass, 1890, *Mr. and Mrs. G. H. Hicks, 19;* Ridgway, 1895, *F. Tweedy, 239.*

New and noteworthy Northwestern Plants.—V.

By C. V. Piper

Arabis Whitedii

Perennial from a simple or more or less branched caudex, the tap-root rather slender: flowering stems one to several, usually few-branched from the lower part, sparsely and rather coarsely stellate pubescent throughout, but the plant greenish in appearance: branches erect, virgate, in fruit 2–5 dm. long: radical leaves tufted, oblanceolate or spatulate, entire or with a few coarse teeth, mostly obtuse, equally pubescent on each side, 2–6 cm. long, the margined petiole about equaling the blade: cauline leaves several, sessile, not auriculate, 2–4 cm. long, oblanceolate, obtuse, mostly entire: flowers white, at length forming racemes 2–3 dm. long, the pedicels 1 cm. long, spreading: sepals greenish, 3 mm. long: petals white, obovate, oblong, obtuse, usually faintly dentate at apex: filament narrowly triangular, broader than the anthers: stigma bilobed: pods striately erect, stellate, 2–3 cm., long, 1 mm. wide, the style short and stout, the seeds making prominent swellings: perfectly formed mature seeds not seen.

Type specimens collected at Wenatchee, Wash., by *Whited*, no. 1057, April and May, 1899; also collected by *Sandberg & Leiberg*, no. 275, at Junction of Crab and Wilson Creeks, Duylos Co., Wash., June 22, 1893. Nearest *A. Nuttallii* Rob.

Trifolium arcuatum

Stems one or several from a stout vertical root, erect or somewhat divergent, simple, striate, terete, nearly glabrous or the whole plant weakly hirsute, 2–3 dm. high: cauline leaves two or three, the leaflets elliptic or oblong, obtuse, 1–3 cm. long, usually shorter than the petioles; leaflets of the radical leaves shorter and broader, sometimes retuse; all minutely serrulate or the lower nearly or quite entire; stipules large, 1–3 cm. long, lanceolate, adnate for two thirds their length, entire or nearly so: heads globose, 1–3 cm. in diameter: flowers numerous, ochroleucous, soon reflexed, 10–12 mm. long, nearly sessile: calyx-tube campanulate, 2 mm. long, the anterior lobe about twice as long, the four others scarcely exceeding the tube, all linear-subulate, more or less strongly curved especially at the tip: corolla about 12 mm. long, three times as long as the longest calyx-lobe: ovary

2-ovuled: pod lenticular, 1-seeded, villous near the base of the style on the anterior face with long hairs.

Nearest related to *T. eriocephalum* Nutt. but with a very different calyx. Specimens examined:

WASHINGTON: Simcoe Mountains, *Suksdorf*, no. 270, 6 June 1884 (type); Blue Mountains, Columbia County, *Horner*, no. 278.

OREGON: Blue Mountains, *Douglas, Nevius* in 1874; Union County, *Cusick*, no. 943 in 1881.

Astragalus sinuatus

Apparently decumbent, a decimeter or so high, the stems 3 dm. or more long, somewhat zigzag: whole plant pubescent with short curved white hairs: leaves 4–5 cm. long, the petiole short; leaflets about six pairs, 10–12 mm. long, elliptic, truncate or slightly retuse at apex, broadest just below the middle, attenuate into an acute base, very shortly petiolulate; stipules small, deltoid-acuminate: peduncles axillary, about 6 cm. long, exceeding the leaves: flowers not seen: pedicels in fruit 4 mm. long: pods thick-walled, curved, stipitate, 3–3.5 cm. long, including the 1 cm. long stipe which is included in the calyx, turgid, rugulose, pubescent like the rest of the plant, sharply acuminate at apex, dehiscing for one fourth its length, the sutures not at all inflexed; before dehiscence the outer layer of the pod becomes loosened in short sinuous folds along the dorsal suture.

Eastern Washington, without definite locality, Brandegee, no. 739 in 1883.

This species is nearest *A. sclerocarpus* Gray, but its very different leaves and shorter stiped pods mark it as distinct.

Solidago caurina

Stems 6–8 dm. tall, terete, sparsely puberulent with white curved hairs, or below quite glabrous: leaves numerous, lanceolate, sessile, scarcely triple-nerved, little reduced above, 5–6 cm. long, 1–2 cm. wide, entire or little serrate, acute or sometimes cuspidate, glabrous except the scabridulous margins, and the nerves beneath, which are slightly puberulent: panicle virgate, narrow, 1.5–2 dm. long, rather loosely flowered; branches of the lower half or two thirds from the axils of slightly reduced leaves; heads 4–5 mm. high, about 15-flowered: involucre glabrous, the bracts loosely two-ranked, lanceolate, not flaccid, broadest at base, acute, more or less ciliate with rather coarse hairs, the midrib prominent: outer bracts decidedly shorter: branches and peduncles pubescent with short curved hairs.

Klikitat Co., Wash., *Suksdorf*, no. 30, August 31, 1881; Cascade Mts., Wash., above Lake Chelan, *Lake & Hull*, no. 818, 25 August, 1892 (type).

Nearest *S. elongata* Nuttall, differing in its leafy bracted, less densely flowered, narrower panicle, and the stiffer broader involucral bracts which are inclined to be of two lengths.

Erigeron Leibergii

Perennial from a stout usually multicipital caudex, sparsely hirsute and glandular throughout: stems slender, 10–15 cm. high, erect or spreading, mostly simple and monocephalous: radical leaves tufted, broad spatulate or oblanceolate, 4–9 cm. long, 1–2.5 cm. wide, obtuse, entire; cauline leaves rather many, oblong, usually acute, sessile, 1–2 cm. long: peduncle short: heads rather small, 6–7 mm. high; involucral bracts linear, acuminate, not more pubescent than other parts of the plant, in about two series: rays pale violet, 20 to 25 in number, 1 cm. long: pappus simple: akenes hispidulous.

Mt. Stuart, Wash., 8000 feet alt., *Sandberg & Leiberg*, no. 810, 28 Aug., 1893.

This species is not very close to any described in the Synoptical Flora, nor does it seem referable to any of the numerous species published since then.

Antennaria latisquama

Apparently densely tufted from stout, subterranean multicipital caudexes, the pistillate plants 6–10 cm. tall: the staminate somewhat shorter: radical leaves lanceolate-spatulate, 2–4 cm. long, 3–5 mm. wide, in the widest part, mostly acute, appressed pubescent on each side: cauline 2–4, narower and more acute, the uppermost equaling or exceeding the head: pistillate heads oblong, 12–13 mm. long, 6 mm. wide, its bracts closely imbricate, the outer ovate to ovate-oblong, acuminate, lanate on the exposed parts, hyaline tinged with pale brown and pink, the inner paler, glabrous, linear, acuminate, all entire: staminate head broadly turbinate, lanate especially at base, about 8 mm. long, the dark-brown bract in four successively shorter ranks, mostly obtuse and entire: ♀ pappus of sparsely denticulate bristles: ♂ pappus not rarely branched, denticulate, not enlarged at apex: immature akenes glabrous.

Collected in Klikitat Co., Wash., by *Howell*, no. 417, May, 1882, and by *Suksdorf* near Columbus, 13 April, 1886.

Apparently nearest *A. dimorpha* T. & G., from which its taller habit and very different heads easily separate it.

Artemisia Suksdorfii

Artemisia heterophylla Nutt. Trans. Am. Phil. Soc. II, 400. 1841. Not Besser. 1834.

Artemisia vulgaris var. *Californica* Besser, Linnaea, **15**: 91. 1841, and Gray, Syn. Fl. **2**[1]: 373, in part. Not *A. Californica* Lessing. 1831.

Herbaceous perennial, the numerous usually simple stems in large tufts, 1–1.5 meters high: stems terete, coarsely striate, sparsely pubescent when young, glabrate: leaves numerous, mostly lanceolate, but sometimes broader, acute, entire or sparingly dentate or even laciniate, 6–10 cm. long, bright green and glabrate above, densely tomentose beneath with a permanent white tomentum: panicle pyramidal or elongate, 3–6 dm. long, the lower suberect branches from the axils of scarcely reduced leaves, the upper branches short and densely congested: heads cylindrical-oblong, small, 3–4 mm. long, 5–8-flowered: involucre pale green, shining, sparsely floccose, pubescent when young, glabrate: bracts obtuse, with a very narrow hyaline margin: flowers glabrous or with but few glands.

This *Artemisia* is common on the bluffs of Puget Sound and ranges from British Columbia to north California, apparently always in the immediate proximity of the sea. It has been distributed by Suksdorf under another varietal name that has already been used. The following specimens have been examined:

BRITISH COLUMBIA: Burrard Inlet, *Macoun*, 27 July, 1887.

WASHINGTON: Fairhaven, *Suksdorf*, no. 980, 5 July, 1890 (type); *Piper*, no. 2508; *Henderson*, in 1892; Seattle, *Piper*, in 1897; Montesano, *Heller*, no. 3976.

OREGON: Chetco, "by the sea," *Howell*, no. 147, June, 1884.

CALIFORNIA: Sea coast, Shelter Cove, Humboldt Co., *Bolander*, no. 6482.

Crepis glareosa

Perennial, tufted, with one to five stems from a stout caudex, 8–12 cm. high, sparsely white tomentose throughout, not at all hirsute: stems stout, scarcely striate, bearing one to three heads: leaves oblanceolate, 4–7 cm. long, usually deeply pinnatifid into acute slender lobes, rarely nearly entire: heads 2 cm. high, on stout peduncles about 3 cm. long; involucre of about 12 acute hyaline-margined bracts, 10–12 mm. long, these pubescent along the middle with long curled white hairs, and tomentose at base: flowers about 15: mature akenes cylindric, slightly constricted at the apex, not beaked, pale greenish or yellowish, 10-striate, not costate, 7 mm. long, the copious white pappus 5 mm. long.

Collected by the writer at Ellensburg, Wash., 20 May, 1897, no. 2704. The pubescence of the involucre is just that of *C. rostrata* Coville, but the present plant differs in its smaller size, its very different akenes, and in the absence of hirsute pubescence.

Dodecatheon viscidum

Whole plant even to the calyx and capsule viscid puberulent with stipitate glands: caudex short, bearing many coarse fibrous roots: leaves lanceolate or oblong, obtuse, entire, 3–6 cm. long, narrowed at base into a petiole half as long: scapes usually single, stoutish, erect, 3–4 dm. high: umbel one- to several-flowered: calyx-lobes narrowly triangular, attenuately acute, four times as long as the tube, about one half as long as the capsule: corolla reddish: stamens free to the very base, the flat filaments short and included in the throat of the corolla: capsule cylindric, narrow, 10–15 mm. long, tipped by a style of nearly equal length, circumsessile near the apex when ripe.

Collected by the writer ten miles west of Spangle, Wash., 24 May, 1898. The specimens are in fruit, only a few shrivelled flowers being found. The species is nearest *D. conjugens* Greene, from which its glandular character easily distinguishes it. The plant was found on a grassy hillside in one spot only, and is apparently very rare.

Gilia Klikitatensis Suksdorf in herb.

§ Navarretia. Annual, erect, slender, strict, 5–20 cm. tall, the stem merely puberulent: cauline leaves frequently opposite, 1–2 cm. long, pinnately 5–7-divided into filiform acerose segments, these again more or less pinnately spinescent, puberulent, becoming glabrate: flowers densely glomerate in a single terminal cluster, rarely two or three, the heads 1–2 cm. in diameter; bracts like the leaves but rather more spinescent, especially the caudal termination, the whitish rhachis more or less broadened and flattened, its dorsal surface and edges covered with soft retrorse white hairs, the segments merely puberulent: calyx-tube largely scarious, pilose, the unequal more or less spinose lobes and the veins greenish: corolla pale (lavender?), 8 mm. long, its slender tube equaling or exceeding the calyx-lobes, its own lobes obovate, distinctly narrowed below: stigmas and ovary-cells always three: ovules solitary in the cells.

WASHINGTON: Klikitat County, near the mouth of Klikitat River, *Suksdorf*, no. 991, May and June, 1890.

OREGON: Waldo, *Howell*, no. 204, June, 1884.

This species is rather intermediate between *G. cotulaefolia* Steud. and *G. intertexta* Steud. but nearer the latter.

Phacelia lenta

Erect, stout, 2 dm. tall, densely glandular-puberulent throughout and sparsely hirsute: radical leaves oblong in outline, 5–6 cm. long, pinnately parted into about 9 lobes, these coarsely few-toothed, the stout petioles nearly equaling the blade; cauline leaves few, similar, but short-petioled; inflorescence a panicle of rather loose secund false racemes, 8 cm. long, by half as broad, the lateral racemes about 5-flowered; calyx-lobes somewhat unequal, rather broadly oblong or oblanceolate, obtuse, ciliate as well as glandular, 6 mm. long: corolla apparently white, campanulate, cleft to the middle: stamens, pistil and capsule just as in *P. sericea* Gray.

Bare hills of the Columbia River, Wash., *Brandegee*, no. 976, May, 1883.

Very closely related to *P. sericea* Gray, from which its much broader calyx-lobes, looser inflorescence and glandular pubescence seem clearly to distinguish it. The single specimen examined is rather fragmentary.

Lappula arida

Perennial, erect, 3–5 dm. tall, branched above, canescently hirsute throughout, the pubescence mostly appressed: radical leaves linear or narrowly lanceolate, acute, attenuate into a petiole, 8–20 cm. long, 5–8 mm. wide; cauline linear, 4–12 cm. long, 5 mm. wide, sessile by a broad base, all more or less hirsutely ciliate: racemes loosely flowered, 5–10 cm. long: calyx-lobes linear-oblong, very obtuse, 2 mm. long: corolla white, rotate, 10–12 mm. in diameter; the fornices broader than long, not retuse, short pilose: marginal prickles of the nutlets united at base, all glochidiate at apex, one-half as long as the width of the nutlet, usually more or less incurved; the dorsal surface muriculate and with 6–10 centrally placed short glochidiate bristles; inner face minutely hispid or muriculate, the scar central.

This species has quite the aspect of *L. ciliata* Greene, which is abundant on gravelly hillsides near Spokane. The latter species has larger blue flowers, nearly smooth obcordate formices, and the nutlets smooth on the back.

The following specimens of the new species have been examined all from Washington: Ellensburg, *Piper*, no. 2676, May, 1897 (type); *Whited*, no. 325; *Elmer*, no. 385; Wenatchee, *Whited*, June, 1896; Peshastin, *Sandberg & Leiberg*, no. 595; Junction Crab and Wilson Creek, *Sandberg & Leiberg*, no. 277; Douglas County, *Spillman*, 27 May, 1896; Clemens Mountain, Yakima County, *Henderson*, in 1892; "E. Washington," *Vasey*, no. 419.

Mimulus breviflorus

Annual, the slender stems simple, or more commonly branched from the base, erect, 4–20 cm. high, minutely puberulent throughout, or nearly glabrous above: leaves lanceolate, rarely oblanceolate or ovate, acute, or inconspicuously few-toothed, narrowed at base into a short petiole, or subsessile, usually shorter than the internodes, gradually reduced above, mostly about 1 cm. long: flowers solitary in the axils on slender pedicels which about equal the leaves: calyx narrowly campanulate, somewhat constricted above, 2–3 mm. long in flower, 6–8 mm. in fruit: the short acute triangular teeth nearly equal: corolla pale yellow, tubular, 4–5 mm. long, the lobes short and rounded: stigma scarcely protruding beyond the calyx.

Nearest to *M. Pulsiferae* Gray, which has a much larger corolla, 10–12 mm. long, a style twice as long as the calyx, more conspicuously petioled leaves, and longer and more viscid puberulence. *M. Pulsiferae* ranges from northern California to Klikitat Co., Wash. *Flett*, *Suksdorf*. The new species seems confined to the Columbia plateau. It has been collected as follows:

WASHINGTON: Pullman, *Piper*, no. 1858, 3 July, 1894 (type); *Piper*, no. 1826, 15 June, 1894; Wawawai, *Elmer*, no. 774; W. Klikitat Co., *Suksdorf*, no. 203, Sept., 1883; *Suksdorf*, no. 485, 2 July, 1885; Ellensburg, *Whited*, no. 652; Waitsburg, *Horner*, no. 592; Blue Mts., *Piper*, no. 2440; Spokane, *Piper*, no. 2640 and 2764.

IDAHO: Juliaetta, *Sandberg, Heller & MacDougal*, no. 347, 8 June, 1892.

OREGON: Hood River, *Henderson*, in 1883; Hood River, *Mrs. Barrett*, in 1884; E. Oregon River, *Cusick*, no. 1195, in 1884.

This seems to be *M. inconspicuus* in part as understood by Greene, Bull. Cal. Acad. Sci. **1**: 116. 1885; not however Gray's species.

A new Adiantum from New Mexico

By Lucien Marcus Underwood

In a small collection of ferns made by Professor F. S. Earle, in New Mexico, there is one *Adiantum* that has been confused with *A. capillus-veneris* of Europe. I find fragmentary specimens of the same plant in Wright's New Mexican collections of 1851–52 as represented in the Columbia Herbarium. I have called the fern

Adiantum modestum

Rootstock widely creeping, often 10–12 cm. long, covered with slender narrow pale brown scales; leaf-stalks scattered, slightly scaly at the base, purplish like the rachises; lamina bi-tripinnate, triangular-ovate, 10–12 cm. or more long, by 5–8 cm. or more wide; leaflets 6–8 mm. wide, nearly as long as wide, 2–5-lobed, but mainly 3-lobed, the incisions narrow and very shallow, the margin in sterile leaflets evenly serrate, those bearing sori similarly serrate between the sori; basal angle ranging from 90°–180°, the stalk and basal veins greenish white, or the former slightly tinged with brownish; sori oblong, 2–3 times as long as wide; veins 3–5 times forked, conspicuous; texture firm.

Roswell, New Mexico. "Abundant on rocks and grassy points overhanging the water of North Spring River," 3 August, 1900, *F. S. Earle*, no. 261 (type). New Mexico, *Wright*, no. 2123, 1851–52.

A plant related to *A. capillus-veneris* but differing from it in the smaller, less incised leaflets, their more rounded compact shape, in the fewer narrower sori, in the light-colored stalks to the leaflets, and in general habit.

The European specimens of *A. capillus-veneris* are usually much more laciniate than the American, but in *A. modestum* the leaflets are barely trilobed with very shallow sinuses.

Professor Eaton in his Ferns of the Southwest called attention to the fact that the Southwestern forms of *A. capillus-veneris* were less divided and more rounded than the typical form of the species and may have had in mind Wright's New Mexican plant which was one of the few cited in that work. That character, however, is not seen in plants collected in Texas by Newberry and by Holden (C), nor in those collected by Hall (Y), nor in those collected in southern California by Stout (Y), and by Thayer (U), nor in those collected by MacDougal in Arizona in 1891 (U), which agree more nearly with the common European forms of *A. capillus-veneris*. Professor Earle has fortunately collected this fern in some quantity.

COLUMBIA UNIVERSITY, 1 Jan. 1900.

A new Sophia

BY T. D. A. COCKERELL

Sophia andrenarum

Allied to *S. halictorum* and *S. canescens* (*pinnata*), with which it has been confused; greener than *halictorum*, and more erect, with the lateral stems more ascending, not purple at base: flowering stem glabrous, with a very few gland-hairs: flowers yellow, conspicuous, though the color is mostly in the stamens, the petals being like those of *halictorum*, but a little larger and yellower, and as long as the sepals: upper stem-leaves once pinnatifid, with very long linear divisions: green pods about 12 mm. long, on pedicels about 10.5 mm., both pods and pedicels being distinctly longer than in *halictorum*.

From *S. canescens* or *pinnata* it differs by the bushy habit, with lateral stems, and the character of the upper cauline leaves.

Var. **osmiarum** *

Foliage a little coarser, segments of leaves larger, segments of uppermost leaves broader: flowering stems purplish, white-hairy, without gland-hairs (a character of *ochroleuca*): flowers as in *andrenarum*: a coarser plant than *andrenarum*, with the central axis more developed. The ultimate divisions of the lower leaves and broad-spatulate.

Habitat.—Mesilla Park, New Mexico, flowering in March and April, both growing in dry ground, with *S. halictorum*; very abundant this year on the campus of the N. M. Agricultural College. There can be no doubt that this is distinct from *S. halictorum*, which differs constantly in its foliage and its inconspicuous flowers. It has not been thought necessary to repeat in the description the numerous characters common to all species of this immediate group.

The following table separates the species of *Sophia* which I have found commonly in New Mexico. I have not seen *S. Cumingiana*, reported from New Mexico, but it differs from *halictorum* and *andrenarum* by its larger pods, which are pubescent. In our

* Possibly a hybrid with *S. ochroleuca* (?).

plants the pods are strictly glabrous. Professor E. O. Wooton has an apparently new species, allied to *S. ochroleuca*, which he collected at Pescado Spring, N. M.

Seeds in one row in a cell; petals bright yellow; plant tall; living in the mountains (Sapello Cañon, etc.). *incisa* (Engelm.) Greene.

Seed in two rows of cell; petals pale; plant not so tall; living in the Middle Sonoran zones.

- Pods and pedicels ascending; flowers whitish; even the uppermost leaves bipinnatifid; pubescence of stems above dense, of white branched hairs, none glandular; living in irrigated fields and bottom lands. *ochroleuca* Wooton.
- Pods ascending from strongly divergent pedicels; flowers yellow or yellowish; living in dry ground.
  - Flowers inconspicuous; plant spreading from the base; upper stems densely glandular-pubescent; uppermost leaves more or less bipinnatifid, but quite different from those of *ochroleuca*. *halictorum* Cockerell.
  - Flowers conspicuous, yellow; plant much less spreading; upper leaves once pinnatifid, with long linear divisions; pedicels longer.
    - Upper stems glabrous, with a very few gland-hairs. *andrenarum* Cockerell.
    - Upper stems white-hairy, the hairs branched. *andrenarum osmiarum* Cockerell.

On March 18, 1900, at Mesilla Park, I saw *Sophia ochroleuca* freely visited by the honey bee (*ligustica* variety) and by *Halictus amicus* Cockerell.

N. M. AGR. EXP. STA.

Thomas A. Williams

Professor Thomas A. Williams, Assistant Chief of the Division of Agrostology, Department of Agriculture, died suddenly of heart failure, Sunday, 23d December, 1900, at his residence at Takoma Park, D. C. The following resolutions were passed by his associates in the Department:

It is with feelings of profound sorrow and regret that we, the employes of the Department of Agriculture, learn that death has removed from among us our beloved companion and coworker, Thomas A. Williams, a classmate and intimate associate of many of our number. His broad knowledge of scientific matters, his keen appreciation of nature, his kind and forbearing disposition has endeared him to all. He was known to his associates as an indefatigable worker and investigator.

Resolved, that in the death of Professor Thomas A. Williams, Science and Agriculture have suffered a great loss, and we, his associates, a dear friend, whose self-forgetfulness in his kindly consideration for the feelings of others, and uniform cheerfulness, often under conditions of severe physical suffering, revealed a lovable character of the highest Christian type. The loss to the Division of Agrostology is irreparable. In the performance of his official duties he had proved himself an excellent executive and an organizer of unusual merit and his relations with his associates in office were always such as to command the highest esteem and respect. He never shirked a duty, and however difficult the undertaking the work performed by him was done most creditably. His loss will be felt most keenly by his associates in the Division, and his memory will remain with them as one whose exemplary life and steadfastness of purpose they should strive to emulate.

Resolved, further, that we tender to his bereaved family our heartfelt sympathy in their great loss and invoke for them the blessing of the Heavenly Father, who alone can heal the broken heart and give lasting comfort.

Resolved, that copies of these resolutions be sent to the family of the deceased and to the various daily and scientific journals.

Committee on Resolutions for the
Department of Agriculture.

Report of the Committee of the Society of Plant Morphology and Physiology on Securing better Reviews of Botanical Literature

A committee consisting of W. G. Farlow, D. T. MacDougal, and H. von Schrenk was appointed at the meeting of the Society at New Haven, Dec. 28, 1899, to consider and report upon the best method of securing more adequate notice of American botanical literature. The committee was instructed to open negotiations with the editors of the *Botanische Centralblatt*, and ascertain if it would be possible to have certain changes made in the method of publishing that journal which would meet the views of the Society. The committee followed instructions and was able to report substantial progress at a special meeting of the Society in New York, June 27, 1900. In accordance with further instructions given the Committee, negotiations were continued with the result that the following letter was received by Dr. Ganong, acting as Secretary of the Committee, on Nov. 28th.

CASSEL, 14–11, 1900.

Sehr verehrter Herr Professor!

Längeres Unwohlsein sowie eine plötzlich nothwendig gewordene Reise nach Berlin tragen die Schuld, dass ich erst heute die so liebenswürdige und für das Centralblatt schmeichelhafte Zuschrift Ihres Comittees beantworten kann.

Nach reiflicher Prüfung Ihrer Vorschläge, gegen deren Richtigkeit wir von Anfang an nichts einzuwenden hatten, sind wir zu dem Entschlusse gekommen, vom 1 Januar 1901 an in dem Hauptblatte des Botanisch. Centralblattes, welches in bisheriger Stärke und zu demselben Preise wie bisher erscheinen soll und natürlich für sich abonnirt werden kann, nur noch Referate und die Neue Litteratur zu bringen. Die Beihefte aber, welche in zwanglosen Heften erscheinen und ebenfalls für sich allein bezogen werden sollen, würden dann nur noch die Originalarbeiten bringen. Auf die pecuniäre Untersützung seitens der Herren Amerikaner, um die wir übrigens nur gebeten hatten, weil wir aus Ihrer ersten Zuschrift geschlossen hatten, dass Sie beträchtliche Erhöhung des Umfanges des Centralblattes wünschten, verzichten wir natürlich unter den obwaltenden Umständen gern, würden aber sehr zu Danke verpflichtet sein, wenn Ihr Comittee und namentlich die beiden Herren, welche Sie aus Ihrer Mitte zu Mitherausgebern erwählen wollen, uns Ihre Unterstützung durch rege Mitarbeit zu theil werden lassen wollten und das C. Bl. in Amerika etc. weiter empfehlen würden.

Ich denke mir die Thätigkeit der Herren Mitherausgeber, deren Namen natürlich mit auf dem Titel des C. Bl. geführt werden würden, in der Weise, dass die Herren selber viele Referate anmelden, resp. andere Herren zur Anmeldung solcher Berichte bei ihnen veranlassen. Eine Liste der so mit Beschlag belegten Arbeiten und Bücher senden Sie mir dann immer möglichst umgehend zu, damit nicht Doubletten einlaufen. Die Herren Mitherausgeber erhalten für die für sie entstehende Mehrarbeit für die von ihnen gelieferten Referate ein Vorzugshonorar von 75M, die anderen Referenten aber wie bisher 45M. für den Druckbogen.

Vor allen Dingen liegt mir natürlich daran, in Zukunft die neue amerikan. Litteratur so schnell und vollständig wie möglich unseren Lesern bieten zu können. Gerade hierfur aber muss ich um die Unterstützung Ihrerseits bitten, die Sie mir dadurch bethätigen könnten, dass Sie die amerikanischen Autoren, Institute, Gesellschaften und Zeitschriften veranlassen, mir von allen neu erscheinenden Schriften etc. so schnell wie möglich ein Exemplar zur Aufuahme in die Neue Litteratur zu schicken. Nur geschriebene Titel führen, wie ich aus langjähriger Erfahrung als Bibliothekar und Redacteur weiss, nur zu unangenehmen Irrthümern und Verwechselungen.

Hoffentlich führt die Vereinigung der amerikan. und europäischen Botaniker zu einem wirklichen Fortschritte des C. Bl. An mir soll es nicht fehlen! Ich werde Alles aufbieten, um die gemeinsame Arbeit zu einer recht segensreichen zu gestalten. Hoffentlich gelingt es mir, in den anderen Ländern ähnliche Einrichtungen wie in Amerika zu treffen.

In der Hoffnung, dass Sie selber eine der Mitherausgeberstellen annehmen werden und Ihnen nochmals für das bewiesene Interesse dankend

hochachtungsvollst ergebenst.

Ihr

DR. UHLWORM.

The following paragraphs quoted from the text of the report summarize the changes which the editors of the *Centralblatt* propose to carry into effect:

"The changes, as will be seen from Dr. Uhlworm's letter, are in conformity with the suggestions made by the committee in its report and will meet with the approval of all American botanists. *It is proposed to include in the Centralblatt proper only reviews and the index of literature; the Beihefte will contain only original articles; the Centralblatt may be subscribed for without also subscribing for the Beihefte;* and, lastly, the price of the *Centralblatt* is to remain as at present. On these points, therefore, the letter of Dr. Uhlworm is entirely satisfactory.

"The suggestion that American editors be nominated by a representative body of American botanists seems to be excellent and likely to prove helpful to the *Centralblatt* by stimulating our botanists to make a determined and combined effort to do all in their power to enable the editors of the *Centralblatt*, so far, at least, as American botanical literature is concerned, to make their journal indispensable to all botanists. Hereafter it will be a matter of pride to us to show that our interest is not merely passive, but that we are ready to make active individual and collective effort to secure a desirable result.

"The committee feels that in offering the following recommendations to the Society, its work is brought to an end and that it may ask to be discharged from further service. There are other subjects mentioned in Dr. Uhlworm's letter which the Society will probably wish to discuss at their meeting, but they are matters of detail which it seems to us had better be referred, so far as any action is needed, to a special committee.

"It is recommended:

"First, that the secretary be directed to write to Dr. Uhlworm and express our hearty approval of the changes proposed and our readiness to coöperate.

"Secondly, that a committee of three be appointed by the Society with full power to represent the Society in further negotiations with the management of the *Centralblatt* up to such time as the selection of American editors shall have been definitely made, the committee to report to the Society at its next annual meeting.

"Thirdly, that the committee thus appointed be requested to invite one botanist from the Central States and one botanist resident on the Pacific Coast to serve with them in the selection of American editors and in such preliminary business as may be necessary for the furtherance of the plans proposed by the editors of the *Centralblatt.*

"Fourthly, that a copy of this report, or of such parts of it as may seem desirable in order to call the attention of our botanists to the changes to be made in the *Centralblatt,* be sent to the *Botanical Gazette*, the *Bulletin of the Torrey Club* and to *Science*."

The report of the committee was accepted and its action approved unanimously in all particulars. The new committee appointed consists of W. G. Farlow, D. T. MacDougal, and W. F. Ganong in place of H. von Schrenk, who resigned after reappointment. The action of the committee in selecting editors and arranging details of coöperation will complete the most important step yet made toward proper bibliographical treatment of American botanical literature.

Index to recent Literature relating to American Botany

Andrews, A. L. Ferns of a deep Ravine in Thetford, Vermont. Rhodora, **2**: 229, 230. D. 1900.

Atkinson, G. F. Studies of American Fungi.—Mushrooms, edible, poisonous, etc. 8vo. i–vi, 1–275. *pl. 1–76. f. 1–222.* Ithaca, N. Y., 20 O. 1900.

New species in *Hypholoma*, *Amanita* (3), *Lepiota*, *Mycena*, *Bolbitius*, *Paxillus*, and *Hydnum*.

Brainerd, E., Jones, L. R. & Eggleston, W. W. Flora of Vermont. A list of the Fern and Seed Plants growing without Cultivation. i–xii, 1–113. Burlington. 15 D. 1900.

Includes *Agropyron Novae-Angliae* Scribner, sp. nov., *Prenanthes altissima hispidula* Fernald, var. nov., and a new hybrid, *Carex stricta* × *torta* Fernald.

Briquet, J. Espèces nouvelles ou peu connues de l'Herbier Delessert. Ann. Conserv. & Jard. Bot. de Genève, **4**: 213–243. 1900.

Includes new species in *Seguieria*, *Xylosma* (2), *Banara*, *Phyllanthus*, *Hieronymia*, *Croton* (2), *Acalypha*, *Jatropha* (2), *Sebastiania*, *Dalechampia*, *Cyrilla*, *Verbena-Lippia* (5,) *Scutellaria*, and *Hyptis* from Mexico and South America.

Briquet, J. Labiatae et Verbenaceae Wilczekianae, ou Énumération des Labiées et des Vérbénacées récoltées par E. Wilczec en janvier et février 1897 dans la République Argentine. Ann. Conserv. & Jard. Bot. de Genève, **4**: 14–22. 1900.

Includes five new species of *Verbena*.

Brown, N. E. *Acicarpha rosulata* N. E. Brown, sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2636. f. 5–11.* May, 1900.

Native of southern Patagonia.

Brown, N. E. *Benthamiella Nordenskioldii* Dusen, sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2636. f. 1–4.* May, 1900.

Native of southern Patagonia.

Cheney, L. S. An historical Review of the Work done on the Flora of the Territory now included within the Limits of Wisconsin. Pharmaceutical Review, **18**: 557–565. D. 1900; **19**: 2–15. Ja. 1901.

Cogniaux, A. *Laelio-Cattleya Binoti* hyb. nat. nov. Gard. Chron. III. **28**: 370. 24 N. 1900.

Native of Brazil.

Collins, G. N. An ornamental Species of *Bidens*. Plant World, 3: 161–163. *pl. 6, 7*. N. 1900.

Bidens heterophylla.

Coulter, J. M. & Rose, J. N. Monograph of the North American Umbelliferae. Contr. U. S. Nat. Herb. **7**: 1–256, i–vii. *pl. 1–9. f. 1–65*. 31 D. 1900.

New species in *Hydrocotyle*, *Bowlesia*, *Sanicula*, *Eryngium* (5), *Chaerophyllum*, *Washingtonia* (4), *Drudeophytum* n. g., *Ammoselinum*, *Cicuta*, *Aletes* (4), *Ligusticum* (7), *Coelopleurum*, *Oreoxis*, *Phellopterus*, *Pteryxia*, *Aulospermum* n. g. (2), *Rhysopterus* n. g. (2), *Pseudocymopterus*, *Oxypolis*, *Leptotaenia* (2), *Lomatium* (7), *Euryptera*, *Cynomarathrum* (2).

Coulter, S. Some unrecognized Forms of native Trees. Proc. Indiana Acad. Sci. 1899: 112–116. 1900.

Coulter, S. Contributions to the Flora of Indiana. VI. Proc. Indiana Acad. Sci. 1899: 104–112. 1900.

Dorner, H. B. The resin Ducts and strengthening Cells of *Abies* and *Picea*. Proc. Indiana Acad. Sci. 1899: 116–129. 1900. [Illust.]

Driggs, A. W. Notes on the Flora of Connecticut. Hartford, Litchfield and Tolland counties. 4 pp. Hartford. 1 Ja. 1901.

Eaton, A. A. The genus *Isoetes* in New England. Fernwort Papers, 1–16. 20 D. 1900.

I. heterospora, *I. hieroglyphica*, *I. Harveyi*, and *I. Gravesii* sp. nov.

Ellis, J. B. & Everhart, B. M. The North American Phyllostictas with Descriptions of the Species published up to August, 1900. 1–79. Vineland, N. J. D. 1900.

Includes *P. erratica*, *P. Fraserae*, *P. minor*, *P. decipiens*, *P. acanthospermi*, *P. consimilis*, *P. nymphaeacea*, *P. pallens*, and *P. fusispora*, new species.

Fernald, M. L. The Representatives of *Scirpus maritimus* in America. Rhodora, **2**: 239–241. D. 1900.

S. robustus paludosus and *S. robustus campestris*, new combinations.

Fernald, M. L. Two northeastern Thalictrums. Rhodora, **2**: 230–233. *pl. 21*. D. 1900.

Thalictrum confine sp. nov.

Gilbert, B. D. *Athyrium* as a genus. Fernwort Papers, 25–29. 20 D. 1900.

Golden, K. E. *Saccharomyces anomalus* Hansen (?). Proc. Indiana Acad. Sci. 1899: 141–144. 1900. [Illust.]

Golden, K. E. A proteolytic Enzyme of Yeast. Proc. Indiana Acad. Sci. 1899: 129–140. 1900. [Illust.]

Gould, C. N. Jack Oaks in Oklahoma. Plant World, **3** : 165–167. N. 1900.

Graves, C. B. Some Observations upon the early Growth of *Impatiens biflora*. Rhodora, **2** : 234, 235. D. 1900.

Greene, E. L. A Fascicle of new Arnicas. Pittonia, **4** : 159–174. 8 D. 1900.

Twenty-four new species proposed.

Greene, E. L. A Decade of new Gentianaceae. Pittonia, **4** : 180–186. 8 D. 1900.

New species in *Gentiana*, *Swertia*, and *Frasera*.

Greene, E. L. Studies in the Cruciferae.—III. Pittonia, **4** : 187–207. 8 D. 1900.

New species in *Arabis* (17), *Cheiranthus*, *Sophia*, *Thelypodium*, *Thysanocarpus*, and *Cardamine* (4). A new genus *Abdra* proposed, founded on *Draba brachycarpa* Nutt.

Greene, E. L. Neglected generic Types.—II. Pittonia, **4** : 207–212. 8 D. 1900.

Halerpestes, *Peritoma*, *Celome*, *Carsonia*, and *Aldenella*, new genera.

Greene, E. L. Some Rocky Mountain Asters. Pittonia, **4** : 212–224. 8 D. 1900.

Eighteen new species proposed.

Greene, E. L. Corrections in Nomenclature.—III. Pittonia, **4** : 224–226. 8 D. 1900.

Greene, E. L. A Fascicle of Senecios. Pittonia, **4** : 108–110. 2 Ja. 1900 ; 111–124. 10 Ja. 1900.

Sixteen new species and several new names and combinations proposed.

Greene, E. L. New species of *Coleosanthus*. Pittonia, **4** : 124–126. 10 Ja. 1900.

Four new species proposed.

Greene, E. L. A Decade of new Pomaceae. Pittonia, **4** : 127–131. 2 Mr. 1900.

New species in *Amelanchier* (5) and *Sorbus* (5).

Greene, E. L. A Fascicle of new Papilionaceae. Pittonia, **4** : 132–139. 2 Mr. 1900.

New species in *Lupinus* (9), *Trifolium* (3), *Hedysarum* and *Thermopsis*.

Greene, E. L. Notes on Violets. Pittonia, **4** : 139–142. *pl. 12.* 2 Mr. 1900.

Viola Missouriensis, sp. nov.

Greene, E. L. Some new or critical Ranunculi. Pittonia, **4** : 142–146. 2 Mr. 1900.

Four species and two varieties proposed as new.

Greene, E. L. New or Noteworthy Species.—XXVII. Pittonia, **4**: 146–158. 2 Mr. 1900.

New species in *Cyrtorhyncha*, *Clematis*, *Geum*, *Androsace* (5), *Physalis*, *Castilleia*, *Verbena* (2), *Chrysothamnus*, *Chrysopsis* (3), *Grindelia*, *Erigeron* (3), *Eucephalus*, *Townsendia*, *Machaeranthera* and *Alisma*.

Halsted, B. D. American and English Weeds compared. Plant World, **3**: 171–173. N. 1900.

Hemsley, W. B. *Zschokkea utilis* Hemsl. nom. nov. Hook. Ic. Plant. IV. **7**: *pl. 2637*. My. 1900.

Native of British Guiana.

Hemsley, W. B. *Eryngium Goldmani* Hemsl. sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2638*. My. 1900.

Native of northern Mexico (Chihuahua).

Hemsley, W. B. *Sapium verum* Hemsl. sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2647*. My. 1900.

Native of Colombia.

Hemsley, W. B. *Sapium ? paucinervium* Hemsl. sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2648*. My. 1900.

Native of British Guiana.

Hemsley, W. B. *Sapium Jenmani* Hemsl. sp. nov. Hook. Ic. Plant. IV. **7**: *pl. 2649*. My. 1900.

Native of British Guiana.

Hemsley, W. B. *Sapium aucuparium* Jacq. Hook. Ic. Plant. IV. **7**: *pl. 2650*. My. 1900.

Native of British Guiana.

Hemsley, W. B. *Moquilea platypus* Hemsl. Hook. Ic. Plant. IV. **7**: *pl. 2618, 2619*. Je. 1899.

Native of Central America.

Hemsley, W. B. *Couepia dodecandra* Hemsl. nom. nov. Hook. Ic. Plant. IV. **7**: *pl. 2620, 2621*. Je. 1899.

From Mexico and British Honduras.

Hervey, E. W. Yellow-fruited *Ilex verticillata*. Rhodora, **2**: 242. D. 1900.

Hochreutiner, B. P. G. Revision du genre Hibiscus. Ann. Conserv. & Jard. Bot. de Genève, **4**: 23–191. 1900.

Includes *H. pseudo-ferox* sp. nov. from U. S. of Colombia.

Jones, L. R. & Orton, W. A. Report of the Botanists. Rep. Vt. Exper. Sta. **12**: 151–188. 1900.

Discusses diseases of potatoes and apples and second list of Vermont parasitic fungi. Pp. 165–182; also issued as contributions to the Botany of Vermont, VII.

Kränzlin, F. *Stanhopea stenochila* Lehm. & Krzl., sp. nov. Gard. Chron. III. **28**: 369, 370. 24 N. 1900.
Native of Colombia.

Lagerheim, G. Mykologische Studien. II. Untersuchungen über die Monoblepharideen. Bihang Svenska Vet.-Akad. Handl. **25**^{8}: 1–42. *pl. 1, 2.* 1899.

Leavitt, R. G. Polyembryony in *Spiranthes cernua.* Rhodora, **2**: 227, 228. D. 1900.

Lindman, C. A. M. Vegetationen i Rio Grande do Sul. 1–239. *f. 1–64.* Stockholm. 1900.

Malme, G. O. A:N. Ex Herbario Regnelliano, Adjumenta ad floram phanerogamicam Brasiliae terrarumque adjacentium cognoscendam. III. Leguminosae Vochysiaceae, etc. Bihang Svenska Vet.-Akad. Handl. **25**^{11}: 1–60. *pl. 1, 2.* 1900.
New species in *Dalbergia, Drepanocarpus, Cenostigma, Bauhinia, Mimosa* (2), *Pithecolobium.*

Malme, G. O. A:N. Beiträge zur Stictaceen-Flora Feurlands und Pata-goniens. Bihang Svenska Vet.-Akad. Handl. **25**^{5}: 1–36. *pl. 1, 2.* 1899.

Malme, G. O. A:N. Brasilianska Akarodomatieförnde Rubiaceer. Bihang Svenska Vet.-Akad. Handl. **25**^{9}: 1–21. 1900.

Maxon, W. R. Notes on American Ferns.—III. Fern Bull. **8**: 84, 85. O. 1900.

Maxon, W. R. On the occurrence of the Hart's Tongue in America. Fernwort Papers, 30–46. 20 D. 1900.

Moore, T. V. Some *Rudbeckia* Segregates. Pittonia, **4**: 174–180. 8 D. 1900.
Seven species and one variety proposed as new.

Pollard, C. L. A new *Helianthus* from Florida. Proc. Biol. Soc. Washington, **13**: 184. 30 N. 1900.
H. agrestis.

Rehm, H. *Ascomyces Fuegiani* A. P. Dusén Collecti. Bihang Svenska Vet.-Akad. Handl. **25**^{6}: 1–22. *pl. 1.* 1899.
Includes numerous new species.

Robinson, B. L. *Polygala polygama* var. *abortiva,* merely an autumnal State. Rhodora, **2**: 242, 243. D. 1900.

Robinson, B. L. The Nomenclature of the New England Agrimonies. Rhodora, **2**: 235–238. D. 1900.
Four changes in the names of the five New England species.

Rolfe, R. A. *Catasetum labiatum* Rodr. Hook. Ic. Plant. IV. **7**: *pl. 2617*. Je. 1899.

Native of Brazil.

Scribner, F. L. & Merrill, E. D. Agrostological Notes. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 1–10. 4 D. 1900.

Review of grasses in Muhlenberg's herbarium; new species and names in *Eatonia Panicum*, *Agropyron*, *Elymus*, *Melica*, and *Stipa*.

Slosson, M. Experiments in Hybridizing Ferns. Fernwort Papers, 19–25. 20 D. 1900.

Starbäck, K. Ascomyceten der ersten regnellschen Expedition.—I. Bihang Svenska Vet.-Akad. Handl. **25**[1]: 1–68. *pl. 1, 2*. 1899.

Many new species; *Nostocotheca*, *Ophiomeliola*, *Ijuhya*, *Malmeomyces* and *Actiniopsis*, new genera; and Myriangiales a new order.

Suksdorf, W. N. Washingtonische Pflanzen. Deutsche Bot. Monatsschrift, 18: 97–99. Jl. 1900; 132–134. S. 1900; 153–156. O. 1900.

New species and varieties in *Viburnum*, *Valerianella*, *Artemisia*, *Troximon*, *Dodecatheon*, *Phlox*, *Gilia*, *Nemophila*, *Amsinckia*, *Pentstemon*, *Mimulus*, *Castilleia*.

Thomas, M. B. Some Problems in *Corallorrhiza*. Proc. Indiana Acad. Sci. 1899: 145. 1900.

Thomas, M. B. The Disappearance of *Sedum ternatum*. Proc. Indiana Acad. Sci. 1899: 145. 1900.

Warburg, O. Einführung einer gleichmässigen Nomenclatur in der Pflanzen-Geographie. Engler's Bot. Jahrb. (Beiblatt, 66) **29**: 23–30. 4 D. 1900.

Webster, H. *Tricholoma portentosum*. Rhodora, **2**: 243–246. D. 1900.

White, C. A. The varietal Fruit Characters of Plants. Plant World, **3**: 168–171. N. 1900.


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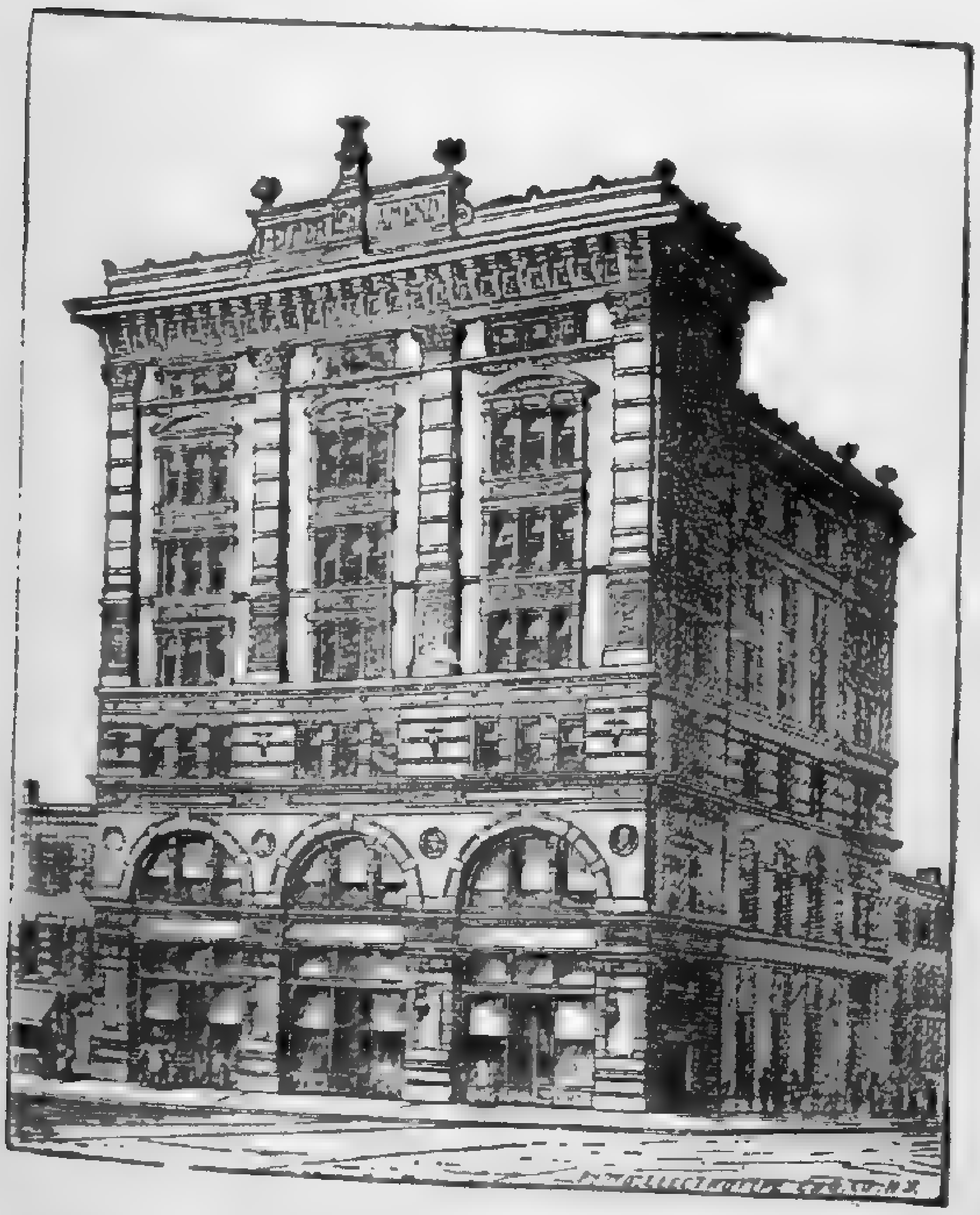

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Memoirs. (See last page of cover.)

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BULLETIN

OF THE

TORREY BOTANICAL CLUB

FEBRUARY 1901

The insular Flora of Mississippi and Louisiana

BY FRANCIS E. LLOYD AND S. M. TRACY

(WITH PLATES 8–11)

During the summer of 1900 the writers made a brief ecological survey of the more westerly islands of the Mississippi Sound Islands and Delta. The islands visited were Ship Island, Ile à Pitre, Sundown Island, Sam Holmes Island, Mitchell Key, Brush Island, Battledore Island, the Hog Islands, Breton Island, the Bird Islands, and the Mud Lumps. The Delta proper was visited at two points in the South Pass, namely, at Port Eads and at a point a few miles north of that place. The field work was done during the three weeks between the 10th of August and the 1st of September, at a time when the summer vegetation is at its height.

In order that the present avowedly brief and imperfect study may be made of definite interest, a comparison has been instituted between the region here considered and the island of Ocracoke, the only point on the coast of North America which has so far received careful ecological study, and which, according to Kearney's results, lies "well within the lower austral life zone in North America." (5) The region here considered occurs in the longitudinal center of the Gulf Strip of the Austro-riparian. Between the two regions the difference of longitude is about thirteen degrees, of latitude five degrees. What the significance of this difference is will be seen the better by a comparison of the climatic conditions.

CLIMATE

The data here used have been derived from the Annual Report of the Monthly Weather Review for the past eight years, the New Orleans data being used.

TEMPERATURE

The mean annual temperature of the Delta is near 21.1° C., while that of Ocracoke is 16.3° C., a mean difference of nearly 4.9° C. (9.0° F.). The maximum temperature is 36.1° C. (97.0° F.), and the minimum — 16.1° C. (7.0° F.), the lowest and highest points registered in eight years. In this regard the two places differ but

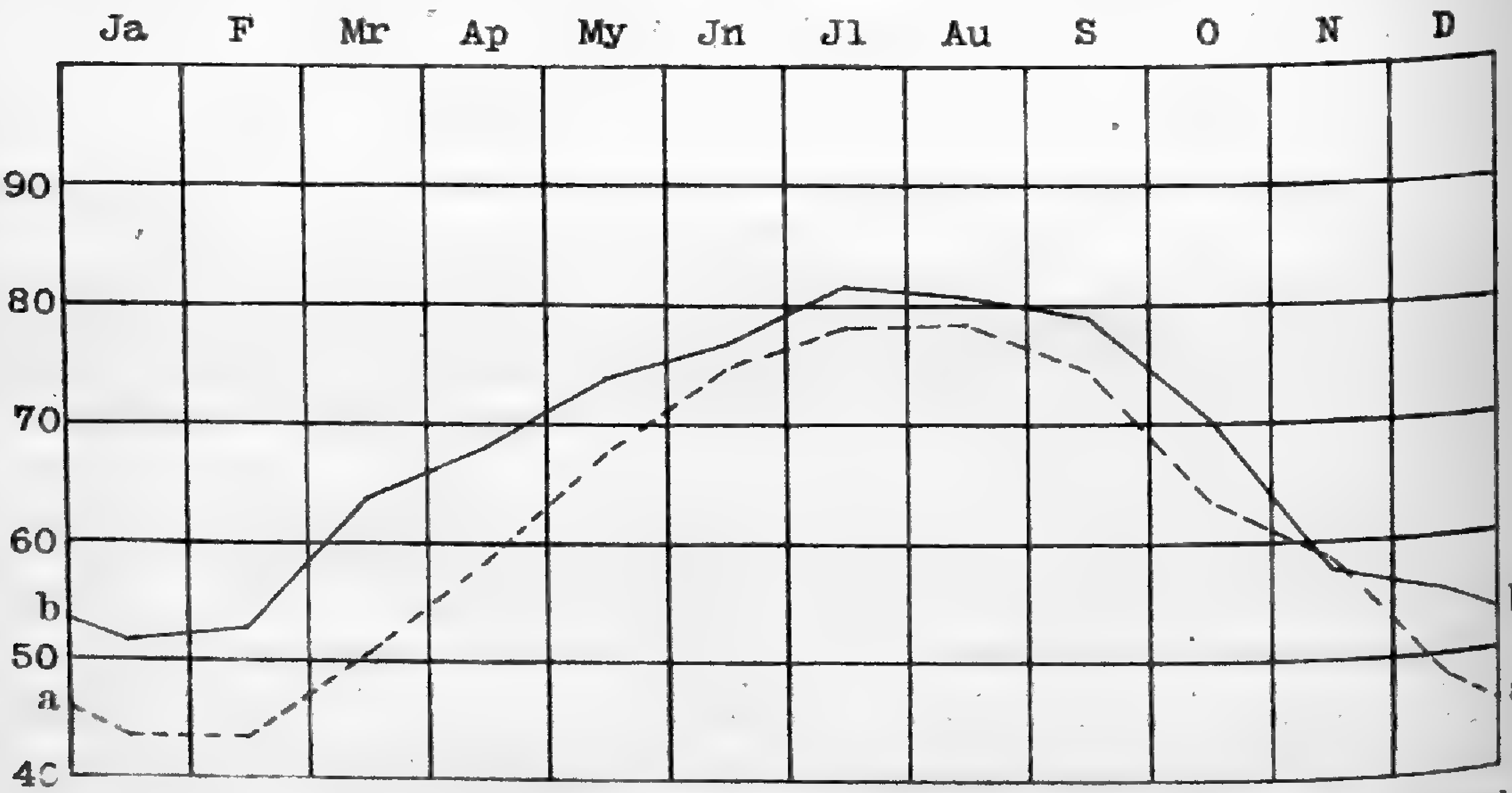

FIG. 1. Curves showing the mean monthly temperatures of Hatteras (*a–a*) and the Mississippi Delta (*b–b*).

little. As the accompanying curves (Fig. 1) will show, however, the general temperature is higher, and the growing season longer, at the more southern point, as shown by the more rapid rise of the curve after the middle of February, and the steady maintenance of an effective growing temperature in the earlier and later months of the growing season. And in this lies the chief climatic difference of physiological moment between the two places here under consideration.

One might readily suspect that the meteorological observations made at New Orleans would show some variation from the conditions found on the small islands of the Delta and adjacent parts. A comparison of data taken at New Orleans and the rather fragmentary official collection of data from Port Eads, at the southern end of the South Pass, indicates that the temperature variations between these two places are slight. As the latter place may thus be taken as a criterion of the conditions on the islands, we may regard the New Orleans data as fairly close to the truth.

It may, however, be mentioned in passing that our own observations during two weeks of August spent among the islands proper showed a range of temperature between 26.6° C. and 30° C. and a maximum daily range of only 3.4° C., the readings being taken in the shade. It may also be mentioned in this connection that the water temperatures showed about the same amount of variation (27.1°–30.5° C.), and a mean temperature higher than that of the air by 0.5°–1° C. This continual high temperature of the waters is due undoubtedly to their extreme shallowness over large areas.

PRECIPITATION

The precipitation of this region is heavy and is composed almost entirely of rain. The records show a mean annual rainfall of about 154.94 cm. (61 inches), less by 16.51 cm. (6½ inches) than than that of Ocracoke. This difference is of little or no physiological importance because the vegetation is near the water table, and because of the continuous high relative humidity. Only one other region on the Atlantic Coast has as great a rainfall as the Hatteras region and the one here considered, namely a part of southern Florida. The Delta region, however, is somewhat more subject to sudden storms than Hatteras as is indicated by the relative frequency of thunder storms in the ratio of 4 to 3. Droughts do not occur, as the rainfall is pretty evenly distributed throughout the year, and there appears to be little or no tendency to concentrate it at any season of the year. Thus a given month which shows six or seven inches in one year may show as low an amount as one or two in another year.

ATMOSPHERIC HUMIDITY

The percentage of possible saturation of the air may vary between 66 and 84, the annual average being 77, less by 4.4 per cent. than that of Ocracoke. The degree of humidity is however, high, and varies but little from month to month.

SUNSHINE

The data available are those based upon six years' observation. These show that the average number of cloudless days per annum in this region is 154 against 141 at Hatteras, while the average number of totally cloudy days for the two places is very nearly the same. The average total number of partly cloudy days is accordingly less for the Delta region (117 to 130) giving that region an amount of sunshine greater by about 21 days. This and the lower relative humidity of the atmosphere, indicate an amount of energy available in the form of light considerably greater than at the more northern station, namely Ocracoke.

WIND

The average velocity of the wind is very near to 13.2 kilometers (8.2 miles) (Hatteras, 21.4 kilometers (13.3 miles)) and the total wind movement per annum, 118740.3 kilometers (73,619 miles) as compared with a wind movement of 191,935.5 kilometers (119,000 miles) at Hatteras.* The total wind force is therefore small. The prevailing direction of the wind is southeast. The total wind movements, however, from the south points of the compass exceed those from the north points by only a little, and are to each other in the ratio of 10 to 8. This fairly equal distribution of winds about the points of the compass accounts for the absence, for the most part, of those asymmetrical growth forms which are referred to the mechanical action of the wind. The direction of the wind in summer months is almost constantly southeast and the small amount of distorted growth is due to this fact as the direction which that growth takes indicates.

Summing up the above data the climate of the delta region may briefly be described as having: (1) A very long growing season, as shown by the sudden rise of the curve in the accompanying figure (Fig. 1), after the middle of January; (2) A large amount of precipitation well distributed throughout the year; (3) A high relative humidity with little annual variation; (4) A high degree of insolation, the effect of which is somewhat lessened by the high relative humidity, and (5) A relatively small wind force well dis-

* Based on six years' observations.

tributed as to direction. These factors are on the whole quite favorable to plant growth.

SOIL TEMPERATURES

A number of observations were made by means of a properly calibrated soil thermometer. Temperatures on the surface and at a depth of 10 cm. were taken on clear days and indicate the amount of heat to which the vegetation is exposed in ordinary summer weather. The results are as follows:

Surface of wet sand, 36° C.
Wet sand, 10 cm. deep, 32° C.
Surface of dry sand dune, 35.5° C.
Dry sand at 10 cm. 32° C.
(Air temp. at same time, 30° C.)

At a point near Port Eads, where some coal dust had been mixed with the alluvium, and where some euphorbias and a few other strictly radiate plants were growing, the surface temperature was 50° C. The surface temperature of sun-baked alluvium at 10–30 on the same day was 44° C. Here crotons, sidas and some other plants were found plentifully.

The temperature of the surface of a salt muck marsh was 38° C., and at a depth of 10 cm. 31° C.

These observations, though scanty, indicate a high soil temperature which probably often exceeds that observed.

GENERAL PHYSIOGRAPHIC FEATURES

The islands visited are of three distinct types: (1) The muck marsh islands; (2) The sand islands; (3) The mud lumps. They owe their origin to deposits of drift and alluvium from the Mississippi River. Of the first group Ile à Pitre, Sundown, and Sam Holmes Islands are types; Ship, Cat, and Breton Islands belong to the second type, while the third, the "mud lumps," consists of a large number of nameless islands just outside the several passes which form the main outlets of the river.

1. *The Muck Marsh Islands.*—These are near the outlet of Lake Borgne, Cubits Gap, Thompson's Pass, and the numerous bayous above the mouth of the river and are probably of the most recent formation. They are low, level and mostly small, many of

them being only a few acres in extent. They are composed of a very fine black alluvium which is so soft that a pole or an oar can be pushed into it one or two metres with very little exertion, and the soil seems to be held in place principally by interlacing roots of maritime plants. The water between these islands is usually shallow, seldom being over 1.6 meters in depth, and always more or less cloudy from the admixture of muddy water from the river.

Oysters are very abundant in the brackish waters, and the islands situated in the oyster region and exposed to violent wave-action often have a beach from two to several meters in width, formed of shells which are more or less broken. In all cases this beach is found only on the seaward side of the islands, and always resting on a foundation of black muck. In nearly all cases the muck foundation is bare and plantless from 0.5 to 2 meters from the water line; then comes a ridge of shells from two meters to sometimes as much as twenty meters in width and from 3 dm. to a meter high, the crest being near the river side, and the inner slope very abrupt. These shell beaches are found only on the shores of the muck marsh islands.

2. *The Sand Islands.*—These islands are from five to fifteen miles from the mainland, outside of Mississippi Sound, and probably owe their origin to the same causes which formed the muck marsh islands, though they are now covered for the greater part with sand. A close examination will usually show that a part of each one has the black, mucky foundation of the marsh islands, and if not found elsewhere some remains of this original soil can usually be found on the southeast side of the island where it is most exposed to erosion by winds and waves. All of these sand islands are moving to the northwest, in the direction of the prevailing winds. The southeastern shore is usually abrupt, with deep water within a few meters of the beach, while in nearly all cases the western end of the island is a long and almost barren sand spit, and often extending a mile or more farther in the form of a sand bar which is uncovered at low tide. The sand covering of these islands is only a few centimeters deep in some places and so low as to be constantly wet, forming sand marshes, while in other places the surface is raised from one to three meters, or even into dunes twenty-five meters in height, as on Cat Island. Of course

the amount of moisture in the sand varies with its elevation above tide and the greatest variety in flora is found on the largest islands having the greatest variety of soil and elevation.

3. *The Mud Lumps.*—The mud lumps vary in size from a few square rods to perhaps fifty acres. The general surface is somewhat undulating, and from one to three meters above tide. The soil is very compact, black or yellowish, with almost the texture of joint clay. None of these islands showed any of the usual signs of growth on any side, while all appear to be wearing slowly from wave action.

The contiguous waters are very shallow and the amount of salt held in suspension is considerable, decreasing as one passes seaward. The algal vegetation is small, even in the most favorable locality visited, Breton Island, and is to be found chiefly in the lee of the island. The collection has not yet been studied, and remains to be reported upon later.

Such extensive shallow waters, especially in the lee of an island, favor the extensive growth of *Ruppia*, with, however, scarcely any other plant save the few algae.

THE PLANT COVERING

Any attempt to present an analysis of the floral covering of the region just briefly described must of necessity be more or less unsatisfactory, for an analysis attempts to present the conditions as they are, while in point of effect we are dealing with a series of changes in those conditions. It must be admitted also that but few plants are habitually confined to one association, or even formation, and to delimit these is often no easy task, involving much more time in the field than the writers have had at their disposal. The following account may be claimed to be a fairly true picture of the conditions described, but would probably need revision as to details on subsequent investigation.

SAND STRAND VEGETATION

Beach formation.

Lower beach: no vegetation.

Middle beach.

Upper beach: *Panicum amarum* association.

Sand plain formation.

Sand spit plain: open, treeless, subject to inundation.

Basins: *Hydrocotyle* association.

Dunes.

Grass dunes: *Panicum repens.*

Pedestal dunes: *Iva, Serenoa.*

Flats: *Cyperus.*

Grass-covered sand plain, not subject to inundation.

Established sand plain, tree-covered, not subject to inundation.

Pinus-Sabal association.

Quercus geminata association.

Sand dune formation.

Established dunes of low stature; *Myrica-Ilex* association.

High, wandering dunes.

SHELL STRAND VEGETATION

Shell-dune formation.

Shell beach.

Lower.

Middle: *Euphorbia-Strophostyles* association.

Upper: *Iva frutescens-Lycium* association.

SALT MARSH VEGETATION

Muck marsh formation.

Batis-Salicornia association.

Grass associations.

Pure.

Mixed.

Shell-muck marsh formation.

Sand marsh formation.

Sand-muck marsh: *Juncus* association.

Sand (pure) marsh.

SAND STRAND VEGETATION

Beach Formation (Plate 8)

As one would expect, in a region where the water is very shallow the beaches are wide and have a very gentle slope. Such beaches are also subject to the action of the waves, and the plants which grow in this habitat are therefore exposed to the danger of wave action, as well as that of the wind. Their roots are of course in strictly saline conditions. There is little or no movement of the substratum due to the effect of the wind, at least in ordinary times, inasmuch as the sand is compacted by the water of capillarity.

Here as elsewhere according to the studies of Macmillan, Cowles, Kearney, and others in this country, the beach formation is readily divided into three main zones, namely the lower, middle and upper beaches. As the tides are here quite slight the lower beach is narrow as compared to that in most maritime regions. Vegetation is either entirely absent, or there may be at most a meagre and inconstant algal association. The middle beach (mid-strand) is relatively broad and the physiological conditions are extremely unfavorable on account of the above-mentioned saline soil conditions and on account also of the intense light and heat aggravated by the strongly reflecting surface of the sand. The plant covering is very sparse consisting of succulent annuals of the cespitose and radiant habit of growth. Two zones are distinguishable, an outer, seaward zone occupied chiefly by cespitose forms such as *Dondia linearis*, *Cakile fusiformis* and *Salsola Kali*, with the grass *Cenchrus megacephalus* which grows nowhere else. Towards the upper limit of this zone the radiant form *Sesuvium portulacastrum* is to be found, but no such massing of this plant such as was seen by Boergesen and Paulsen in the Danish Anti les has been observed. *Eragrostis secundaeflora*, is also a beach plant and responds to the high humidity of the region after the manner of some other grasses (*Poa alpina*, *e. g.*) to similar conditions, by becoming strongly proliferous. The inner, landward zone is characterized by a growth of *Ipomoea Pes-caprae*,* *I. acetosaefolia*, *Strophostyles helvola* and sometimes *Canavalia obtusaefolia*. These, with the exception of *Strophostyles*, are preëminently tropical strand plants whose ecological features have been described by Warming, Schimper, and others. All of these three forms reduced the layer of over-insolation by bringing the leaf's surface into a vertical position, *Ipomoea Pes-caprae* by folding the leaf at the midrib, *I. acetosaefolia* by folding

* Stems of immature plants 30 meters long, were found. Dr. H. J. Webber tells me (F. E. L.) that he has measured stems nearly four times this length on the Florida coast.

the lobes of the leaf on their chief veins, and *Canavalia* by bringing the leaflets separately into the vertical by means of the motile organs at their bases.

Strophostyles helvola, on the other hand, is a plant of wide northern distribution. It is of much smaller stature, but has very much the same ecological development as *Canavalia*. No one of these plants may be described as dominant in this region, except in one restricted locality on Breton Island where the two species of *Ipomoea* form a network covering the soil much as described by Schimper. (See Plate 8.) They do not, however, even here serve to attract other plants and the association is poor in species. Associated with the just mentioned prostrate forms are a few sedges and some grasses, notably *Spartina* and *Panicum amarum*, the latter in isolated clumps between which usually germinate the seeds of the prostrate vines already named and from which the plants extend their runners in various directions, but chiefly toward the lower beach.

The upper beach extends from the upper limit of high water and ordinary wave action, and shades off on the inner side into a sand plain formation to be considered beyond. The name upper beach is less appropriate than back strand, because the zone, properly speaking, is not a beach, as Cowles has pointed out. The term strand has, however, been given a much wider application, so we choose for our present purposes the word beach. The upper beach, then, is composed of very low dunes, caused by accumulations of sand about the grass, *Panicum amarum*, which here attains full development. Associated with *Panicum amarum*, a maritime plant found as far north as Long Island, is another large grass of more southern distribution, *Uniola paniculata*, which grows in scattered clumps, adding to the otherwise monotonous grass of the beach dune vegetation a very striking element of beauty in its gracefully curved large inflorescences. *Uniola paniculata* is, however, of much less importance as a sand-binding grass than it appears to be on the east coast of Florida or on Ocracoke, according to Webber (11) and Kearney (6), respectively. The quantitative relation, stated by Webber, namely, that in Florida it forms 75 per cent. of the vegetation is about reversed, *Panicum amarum* taking the lead to that extent.

Yucca gloriosa also appears occasionally as a striking feature of the beach dunes, as was observed on Breton Island.

Panicum amarum appears to correspond in its habitat and behavior to *Spinifex squarrosus* of New Zealand, as described by Schimper.*

The upper beach association may at times consist wholly of three plants, *Panicum amarum*, *Ipomoea Pes-caprae* and *I. acetosaefolia* (Plate 8). This occurs if the width of the island is not great enough to permit the growth of vegetation in the lee of the dunes. If, however, as occurs in the older, wider portions of an island, an accumulation of sand of some depth has taken place, or if the island has been extended into a sand spit of considerable area, other conditions are set up which we describe under the following head.

The Sand Plain Formation (Plates 9 and 10)

Floristically considered there are three leading types of the sand plain. These may be distinguished also by age, in the order of which they may very properly be described.

The youngest is the sand spit plain. This is usually a low-lying extent of sand, hot, brilliantly lighted and wind swept. It is also subject to inundation by the sea during heavy weather (Hilgard). Being continuous with the older part of the island, their beaches are continuous. The lower beach of the sand spit is less steep and strand pools are of frequent occurrence. The middle beach is in like manner less abrupt, and is coördinately much broader. The dunes of the upper beach may usually be followed for some distance from the older part of the island, but they sooner or later fail. The whole area of the plain is then open to the sea without the protection offered by the dunes, and produces a scattered vegetation of the beach annuals together with perennials of similar ecological character.

The occurrence of driftwood or of plants on the plain causes irregularities in the surface. These are of the form : (1) Of shallow depressions or basins of small extent usually below the general level and very generally wet ; (2) Of low dunes ; and (3) Of more or less level stretches of sand.

* Pflanzengeographie auf physiologische Grundlage.

In the basins one finds a scanty vegetation, a species of *Hydrocotyle* being the most constant element. The plant has prostrate buried stems and only the leaves and inflorescences appear above the surface. The petioles are vertically placed and the peltate leaf-blades are also strictly vertical, although no orientation was observed. *Mollugo verticillata* is to be found here also.

In the second place the surface may be raised locally into dunes of usually inconsiderable size. The dune formers are the grasses on the one hand (*Panicum repens* and *P. halophilum*) and chiefly two perennials, *Iva imbricata* and *Serenoa serrulata*, which here grow in symmetrical cespitose clumps and gradually collect about their bases a dune upon which they raise themselves above the general level, and so become raised upon a pedestal of sand. For this reason the name pedestal dune appears to be appropriate to this dune form. The absence of strong continuous winds may account for the ability of these plants to act in this manner.

Extending between the elevations and depressions are more or less level reaches where a number of plants grow whose form does not favor the accumulation of sand about them, plants namely which do not tend to produce a network of stems, such for example as some sedges (*Scirpus Americanus*, *Cyperus cylindricus*). There occur also a few small plants of the radiant type and some grasses (*Diodia teres*, *Sesuvium*, *Syntherisma fimbriatum*, *S. filiformis*, *Cenchrus incertus*, *C. tribuloides*, *Euphorbia cordifolia*). *Physalis angustifolia* is also frequently met with.

The second type of sand plain referred to above may be designated as the open, grass plain, characterized as it is by a plant covering of a large number of herbaceous species of low stature among which the grasses greatly predominate. Some of the grasses, however, are of large size, *Chaetochloa magna* and *Uniola paniculata* for example. The other prominent feature is effected by a heavy growth of slender vines (*Vigna glabra*, *Clitoria mariana*), sometimes so dense as to cover the other vegetation out of sight, and covering considerable area. On the whole the conditions in this type of sand plain are decidedly mesophytic as compared with the beaches and other formations here described, because of the dense covering of plants and because also of the much less salt content of the soil. Two species of *Commelina*, *Chamaecrista littoralis*, *Gerardia purpurea*, *Croton maritimum* and a goodly number of low mesophytes complete the association.

The third type of sand plain is the forest-covered area to be found only on the larger islands of the Mississippi Sound, where a large area has been for a long period of time removed from the immediate influence of the sea. Regarding Cat Island as a type, the plain may be described as established, inasmuch as the surface is subject to erosive agencies only to a very slight degree. There are no water courses, unless one would attach that name to sloughs in which the water is practically at a standstill. The wind can have but little effect upon the topography, as the soil is moist and moreover is protected by the tree covering, while the force of the wind is broken by the large dunes lying to the windward. The surface is level save for a few low sand mounds which are not improbably to be regarded as fossil dunes, whose topography is at present beyond the influence of erosive or moving agents. Elsewhere the surface is lowered a little and the soil becomes much wetter. Broadly speaking the whole area is covered by a forest of pines of two species, *Pinus australis* and *P. Taeda*, with *Sabal glabra* and *Serenoa serrulata* as prominent elements in the undergrowth. In the wetter places under the shade of the palmetto last named, a hepatic (*Pellia* sp.) was found in abundance in August, and there is reason to believe that in the winter season a number of species would be met with. In general, one may say that the pine-covered plain is ecologically a part of the coastal plain of the mainland, and that the flora differs from that of the pine barrens of the coastal plain in scarcely anything except in the number of species. So, too, with the mounds or fossil dunes above referred to upon which one finds invariably a growth of live oaks, generally *Quercus geminata*, or less frequently *Q. Virginiana*, under the shade of which, and in a soil of much greater organic content, grow a group of plants commonly found on the mainland in like situations. The tree trunks are clothed with incrusting lichens, while from the branches grow *Ramalina* and some foliaceous species. On the lower parts of the trunks, and on the ground, mosses (*Leucobryum* especially) and liverworts grow. The lichen *Cladonia rangiferina* in rich fruiting condition was also found growing in clumps on the ground. Beyond the shade of the trees, on the slope of the mound *Opuntia Pes-corvi* and *Baldwinia multiflora* are to be found together with a little convolvulus, *Breweria*, forming, however, a scanty plant covering only. Attention should be drawn to the fact that the epiphytic plants (*Polypodium polypodioides* and *Tillandsia usneoides*) which are so common on the live-oaks of the nearby mainland, are here entirely absent.

Sand Dune Formation

In addition to the dunes already described in connection with the sand beach and sand plain formations there are two other dune types which still remain to be mentioned. These are the established dunes of low stature and the high wandering dunes.

The former occur notably on Breton Island, and are usually less than one meter in height. They are clothed with a thicket of *Ilex vomitoria* and *Myrica Gale*, and with these is an undergrowth of herbaceous plants such as have been referred to in the description of the open grassy sand plain, of which in point of fact, this *Ilex-Myrica* dune formation is a part which has changed its aspect as a consequence of the growth of those evergreens. The cause of this change is obscure, but it seems probable that the shrubs have been better able to establish themselves on the lee of the grass plain. The formation corresponds very closely to the thicket formation of Ocracoke described by Kearney, but lacks the particular species mentioned by him. Owing to the rather heavy protective covering of shrubby vegetation these low dunes are not affected by the wind to an appreciable extent and may therefore be regarded as in a relatively static condition, or otherwise expressed, as established.

Only one of the islands visited affords conditions favorable for the formation of the high, wandering dunes, namely Cat Island, where they are to be found on the windward side. They are arranged in a linear system which lies parallel with the shore line, and range in height from ten to twenty meters. The most northerly dune of the system is the highest, and constitutes on this account a prominent landmark. It is quite naked save on the lee slope where a few annuals, *e. g.*, *Jatropa stimulosa*, *Cenchrus* sp. and some others, gain a temporary foothold in the shade of the trees which are doomed to partial or complete burial. The only relation which this dune in particular holds to the vegetation is that of a destructive agent, for the pines especially are not able to withstand the burial in sand. The live-oaks are, however, more resistant, and many examples of trees may be seen with only the ends of their branches protruding above the sand, and having the appearance of vigorous shrubbery. The branches of these oaks are covered with a growth of crustaceous lichens and a species of *Ramalina*, while an occasional annual grows in their shade upon the dune surface.

The other dunes of the series have on their windward slopes a vegetation of annuals and perennials composed chiefly of *Iva imbricata* and *Serenoa serrulata*, with occasional clumps of *Uniola paniculata*, *Siphonychia corymbosa* and species of *Euphorbia*, plants which are by no means confined to this habitat, as the reader has already seen. The lee slope, which in all cases observed is very steep, recalling the appearance of the dunes of Figs. 15 and 16 of Cowles' paper supports no plants excepting a meagre, but never too meagre, growth of *Cenchrus*. These dunes are in rapid motion, and have left behind them a "graveyard" of dead pines. Their motion is evidenced not only by the character of the lee slope but also by the distorted, protruding, but still living leaves of engulfed plants of *Serenoa*. Reference has been made to the low sand mounds encountered in the pine-clad plain as having originated as dunes, but which are now beyond the effect of the winds. Upon this explanation they may be called fossil dunes in a somewhat exact sense.

Shell Strand Vegetation (Plate 11)

In the general account of the physiographic features of the islands attention was drawn to the origin and presence of a dune of shells on the seaward margin of many of the low islands. There are two ways in which the dune may lie with reference to the margin of the alluvial plain upon which it is superposed. The figures here presented will show at a glance the difference. In the upper diagram (Fig. 2, *a*) the edge of the alluvium is bare, so that it is eroded by the waves, and *pari passu* the shell dune is advanced toward the lee edge of the island. Under some conditions the edge is eroded more rapidly than the shell dune is moved forward.

Or it may be also that the load of shells has not been lifted well upon the muck plain, so that in either case the seaward margin of the dune lies below the water level. In this way a shell beach is formed, such as is represented in the lower figure. A description

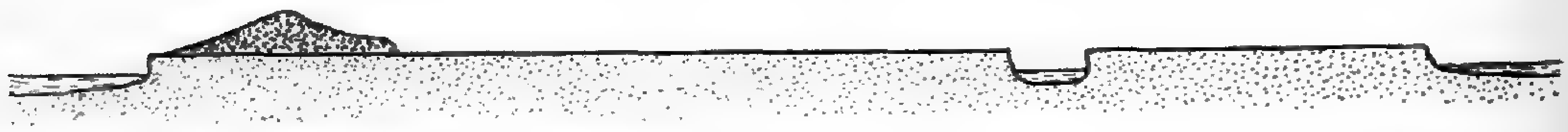

FIG. 2*a*. Diagram of a shell-marsh island at right angles to the shell dune.

of the latter condition will serve for the present purpose because, as will be shown, the flora of the two differs but little.

The conditions of growth on a shell dune are as follows: Organic materials, as well as alluvial detritus are almost entirely absent as they are carried through by the percolating water, which

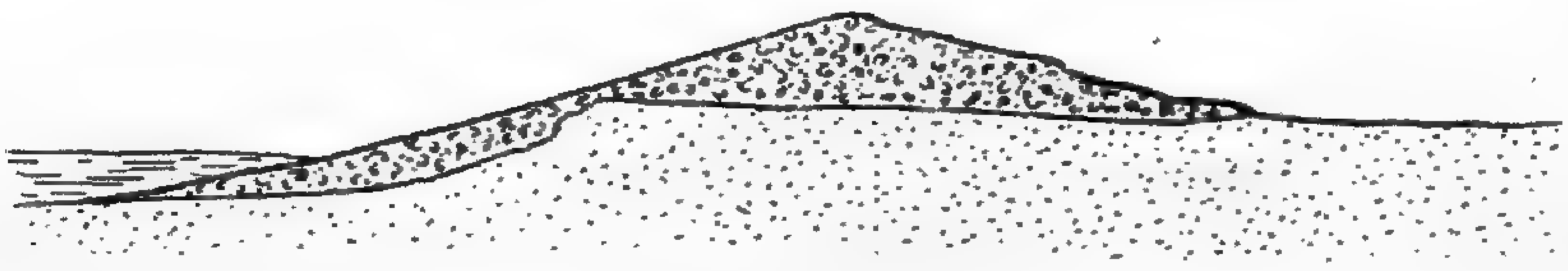

FIG. 2*b*.

at the same time reduces the salinity if the substratum. The degree of salinity may, however, be suddenly increased by the sea water in unusual weather. This absence of salinity is not true of the lower beach, which, however, is devoid of vegetation for other reasons. Water of capillarity is absent except rarely when the fragments are very small. A fair amount of moisture is, however, present because the shell fragments hold water better than might be suspected. These characters, taken together with the high temperature and intense insolation, produce a decidedly xerophytic condition. The percolating water contains probably an unusual amount of calcium carbonate, making the shell dune not unlike a coral beach.

In spite of such apparently unfavorable conditions, the small area of the shell dune produces a good number of plants.

Vegetation is not encountered in the lower beach or the lower zone of the middle beach. The plants of the upper zone of the middle beach are chiefly prostrate annuals, of which *Euphorbia polygonifolia* and *Strophostyles* are almost the only examples.

Chenopodium Berlandieri sometimes occurs. It is possible to point out the limit of the middle beach only in a loose way. For the present we regard the upper beach as occupying the ridge and the area behind it. Here the flora is very diversified. *Iva frutescens* is the first shrub to make its appearance, and this almost always heavily attacked by *Cuscuta Gronovii.* In lower places *Spartina polystachya* and *S. junciformis* and *Sporobolus Virginicus* are quite abundant. On the crests of the ridges *Dondia maritima* and *Atriplex cristata,* while here and further back *Lycium Carolinianum, Borrichia frutescens, Chrysoma pauciflosculosa,* and *Opuntia Opuntia* are the chief perennials. Among these *Ambrosia artemisaefolia, Leptilon Canadense, Lepidium Virginicum, Elymus Virginicus, Polygonum* and *Cakile fusiformis* form a weedy growth. Creeping over these plants are the vines *Seutera palustris, Vigna glabra* and *Ipomoea sagittata* and *I. commutata.*

SALT MARSH VEGETATION

Muck Marsh Formation (Plate 11)

The simplest salt marsh condition is to be found on those islands which are small and lie in a protected position so that the sea does not throw up the shell fragments which occur in the contiguous waters. An island of such character is a low-lying, alluvial flat with a surface which is nearly level. The flora is limited to a few species segregated usually in two easily recognizable associations. These are the grass association, either mixed or pure, and the *Batis-Salicornia* association. The former is to be found more often near the shore where the surface is a little higher than in the interior and is composed of *Spartina* (*S. patens* and *S. stricta*), which in many places are largely replaced by *Distichlis.* Other grasses are quite rare. The other association is composed of succulents of two genera, namely, *Batis maritima* of tropical and subtropical distribution, *Salicornia Bigelovii* and *S. ambigua.* The first-named is by far the most dominant plant, forming in some places a pure association covering acres of surface. A striking character of the plant is the strong development of cortical aërenchyma about the roots and the lower part of the stem. The anatomical characters of this and many others of the American tropical strand succulents have been described by Warming. The salicornias, which are plants of more northern distribution, are by no means so plentiful as *Batis*. They are, however, of the same ecological character, being stem succulents, while *Batis* is a leaf succulent. The only other plant occurring in the muck marshes is *Avicennia nitida*, with its well-known negatively geotropic roots (pneumathodes). This mangrove grows abundantly on some of the islands to the extent almost of the exclusion of other species (Breton Island), but in no case reaches a height greater than 60 cm. They produce, however, flowers and fruit. On some of the islands visited great numbers of dead plants were found which had doubtless been killed by the frost. The fact that all the dead ones were about of a size indicates that this plant is so killed and that it is here in its northern limit. The soil of the salt marsh is composed of a very finely-divided alluvium which packs very tightly, and this with the water which is saline results in a mass which effectually prevents the entrance of air. This accounts for the development of the pneumathodes of *Avicennia* and the abundant aërenchyma of *Batis*, paralleling the well-known structures of similar adaptive significance in many swamp plants.

The general appearance of the salt muck marsh vegetation is one of somber uniformity. The succulents are of the same height and color—a dark green, and the grass association is a bluish gray. The variety of color of the northern salt marsh plant covering is well-nigh absent.

From the above it will be seen that there are scarcely any plants common to the shell strand and muck marsh. Apparent exceptions (*e. g.*, *Spartina juncformis*) may usually be explained by the fact that the roots may penetrate into the mud through the shells. Marsh plants may thus be found in the shell strand, especially in the shell-muck marsh. The converse is scarcely ever true. The lee edge of the encroaching shell dune shows a sudden and complete change from the muck marsh, as is shown in Plate 4.

Shell Marsh Formation

In some instances the shell dune becomes broad and scattered on the inner limit and the shell fragments are mixed with the alluvium of the marsh so as to make a looser soil which is less homogeneous and better aërated. It happens also that the area may be better drained. In such conditions the plants are prostrate (*Lippia nodiflora, Lithophila vermiculata*) with the exception of *Salicornia*, one species of which has plagiotropous shoots. With these there was found on Bird Island a single plant of *Citrullus vulgaris*, a plant mentioned also by Kearney as occurring in a feral state on Ocracoke. *Limonium Nashii* grows usually in such a soil, and is to be found for the most part on the lee margin of the shell dune.

Sand Marsh Formation

On the larger islands the sand covering of the lee part of the island is sometimes so thin that the alluvial foundation is hidden by only a few centimeters. In limited areas, however, the depth of the sand may be greater. In these two ways the conditions for a sand marsh are set up in which the plants may be rooted in pure sand or partly in the underlying alluvium. The latter condition is especially favorable for the formation of a reed marsh in which species of *Juncus* are the chief factors. Marshes of this kind are sometimes of large area. When the sand covering is very thin, as is the case in parts of Breton Island, the sand marsh takes something of the character of the muck marsh, and *Batis* and *Salicornia* may occur. When the depth of sand is greater, which happens more frequently at a point more remote from the influence of the salt water an association of plants grows up in which *Xyris serotina, Utricularia subulata* and *Oldenlandia uniflora* are prominent members. The more shoreward stretches of wet sand are either naked or bear a sparse growth of small plants. Among the number are *Siphonychia corymbosa, Polypremum procumbens, Gratiola subulata* and *Diodia Virginiana*.

THE MUD LUMPS

The top soil of these islands is very thin, overlying a dense, sticky clay. The usual marsh and aquatic plants are almost wholly wanting, as are also pines and oaks. The more abundant grasses are *Spartina stricta* and *Capriola Dactylon*. The only large trees are melias which have doubtless been introduced. On one of these islands a dense growth of a trailing *Rubus* not observed elsewhere covered many acres. Tamariscinas and other Amaranthaceae are much more abundant here than on the sand islands. *Baccharis halimifolia* is abundant on all the mud lumps and is often the only woody plant.

THE DELTA

No attempt has been made in the preceding pages to include a treatment of the phytogeographical conditions of the land of the Delta, since it is a part of a region which justly requires a separate study. The general statements pertaining to the more recent part of that area are as follows.

The "passes" of the Mississippi River are broad channels of fresh water separated from the waters of the Gulf by an irregular and frequently very narrow strip of land of river deposit. The greatest elevation of the surface above sea level is on the bank of and near to the stream. On the other side the land slopes gradually away toward salt water, while toward the fresh water the slope is abrupt.

Two associations are to be recognized, both of which have grasses as the determining elements. These are the *Phragmites, Vigna* and the *Spartina* associations. The former occupies the higher levels and therefore the portion of the bank near the fresh water. The grass makes a dense growth, and spreads by means of the long decumbent stems and stolons. These and the roots bind the soil, which however is gradually eroded, leaving projecting clumps of the grass along the banks. From these clumps the decumbent or prostrate stems project out into the water and sway in the current, extending down stream 30 meters or more. On the highest part of the bank the "canes" form a mechanical support for a very profuse growth of *Vigna glabra* which is almost impenetrable. Occasional trees of *Salix nigra* and vines of *Ampelopsis arborea* are to be seen along the bank.

In the swampy ground of the lower levels which border on the salt water *Spartina* gives the character to the vegetation, and this is often the sole plant. The two associations fade into each other, but there is nevertheless a fairly distinct line of demarkation. As one advances northward and as the land broadens out, a sort of swamp meadow land is found, where occur many grasses and leguminous plants. Here, too, the willows become more numerous and the cypress comes in.

BALLAST

At the lower end of the south pass there occur a number of plants which are adventive from many parts of the world. These have been brought in ballast which has been dumped along the banks near Port Eads where these exotic forms are to be found in considerable profusion. A few have already become established and probably others will be established in the future. The ballast plants are chiefly tropical and subtropical in their origin.

PHYTOGEOGRAPHY

The general geographical relations of the Delta island flora may now be indicated briefly.

We notice with Kearney the infrequency of parasitic fungi, and it seems probable that his explanation is correct, namely that the adaptations which serve to inhibit transpiration enable plants to resist the attacks of parasites. Other fungi are also scarce. A very few boleti and polypori were collected.

The algal flora has already received mention. It may be added that a certain species of green alga occurs in quantity on the surface of the muck marshes, and attached to the lower parts of the stems of *Spartina* and other muck marsh plants. Otherwise the algal flora is very meagre.

Lichens are abundant on the limbs of trees (oaks and myricas) and sometimes on the ground on the larger islands.

Mosses are rare excepting in a few favored localities on the larger islands.

Liverworts are rather more abundant but are not striking in quantity or number of species. Some *Lejeunea* forms occur indicating a general tropical character of the hepatic flora.

Certain widely distributed ferns occur, and these will be mentioned in the list. They do not, however, form more than a weak element in the plant covering of the larger islands.

Regarding the spermatophyta we may make the following provisional statements :

1. Extended sand plains, removed from the direct influence of

salt water, make possible the growth of a large number of plants characteristic of the austro-riparian. These plains present the appearance of the typical pine barrens, with the absence of magnolias and deciduous oaks. The trees are *Pinus Taeda, P. palustris, Quercus geminata* and, less frequently, *Q. Virginiana.* As woody undergrowth *Sabal glabra, Serenoa serrulata* and a large congeries of herbaceous plants common to the austroriparian. In this regard the larger of the Delta islands stand in contrast with Ocracoke. A few of the genera may be mentioned as indicating the type of vegetation: *Aristida, Ascyrum, Andropogon, Drosera, Helianthemum, Gerardia, Hypericum, Lacinaria, Lechea, Opuntia, Panicum, Polygala, Rhexia, Sabbatia, Willughbaea.*

2. Certain plants are distributed far to the north and are found as strand plants.

**Baptisia leucantha.*
Cenchrus tribuloides.
**Eclipta alba.*
Euphorbia polygonifolia.
Monarda punctata.
Rhus copallina.
Ruppia maritima (in saline waters).
**Smilax Bona-nox.*
Strophostyles helvola.
Triglochin striata (Maryland).
Triplasis (Sieglingia) purpurea.
Vitis aestivalis.

Moseley has shown that the appearance of a certain number of plants of southern distribution in the region of Sandusky Bay, Lake Erie, is due to the higher temperature and longer growing season. A mean difference of nearly 5° F. as compared with the climate of Buffalo is noticed. Those plants marked thus * in the above list occur also at Sandusky Bay.

The following are found in North America only on the Atlantic coast as far north as indicated.

Baccharis halimifolia (Mass.).
Borrichia frutescens (Va.).
Croton maritimus (N. C.).
Distichlis spicata (Nova Scotia).
Gerardia maritima (Me.).
Ilex vomitoria (N. C.; Va.?).
Iva frutescens (Mass.).
Juncus scirpoides (N. Y.).
Kosteletskya Virginica (N. Y.).
Xanthoxylum Clava-Herculis (N. C.; Va.?).

Lippia nodiflora (Ocracoke Island, N. C.).
Opuntia Pes-corvi (N. C.).
Panicum amarum (changing to var. *minus* in its northern range).
Pluchea camphorata (Mass.; West Indies).
Salicornia ambigua (Mass.).
Salicornia Bigelovii (Nova Scotia).
Seutera (*Vincetoxicum*) *palustre.*
? *Solidago sempervirens* (New Brunswick).
Spatina patens (Newfoundland).
Spartina polystachya (Me.).
Yucca gloriosa (Ocracoke Island, N. C.).

4. Strand plants of tropical or subtropical distribution.

(*a*) Tropical plants of the New World:

Batis maritima.
Canavalia obtusaefolia.
Centella Asiatica.
Chrysoma pauciflosculosa.
Iva imbricata.
Lippia nodiflora.
Sabal glabra.
Serenoa serrulata.
Uniola paniculata (Virginia, West India, and South America).

(*b*) Tropical plants, circumterrestrial, or occurring at least in the Old and New World:

Avicennia nitida.
Ipomoea acetosaefolia.
Ipomoea Pes-caprae.
Lithophila (*Philoxerus*) *vermicularis.*
Sesuvium portulacastrum.

5. A few plants of very wide distribution occur as weeds, especially in the shell dune formation. The following are the principal ones:

Ambrosia artimisaefolia.
Lepidium Virginicum.
Leptilon Canadensis.

LIST OF SPECIES*

In the preparation of this list we have followed, as closely as possible, the nomenclature given in Britton and Brown's Flora of North America, the family sequence being that of Engler and Prantl, while the genera and species are arranged alphabetically. In addition to the species actually collected on this trip we have added several which have been collected previously by one of the

* Plants reported by Kearney (6) as occurring on Ocracoke Island marked *. Those occurring in the strand flora of New Jersey, reported by Harshberger (4) thus †.

authors (S. M. T.) on the same islands. The algae, some fungi and bryophytes collected have not yet been studied and therefore do not appear. We are indebted to Dr. N. L. Britton, Dr. J. K. Small, Mr. G. V. Nash, Dr. E. L. Greene, Dr. C. F. Millspaugh, Prof. F. Lamson-Scribner and Prof. F. S. Earle for the identification of numerous specimens.

Cercospora sp. On *Ipomoea acetosaefolia*, Breton Island.

Puccinia paspali T. & E. On *Paspalum Vaseyanum*, Port Eads.

Uromyces euphorbiae C. & P. On *Euphorbia prostrata*, Cat Island.

U. polygoni (Pers.) Fckl. On *Polygonum littorale*, Ile à Pitre.

OSMUNDACEAE

† *Osmunda regalis* L. Occasional on Cat and Breton Islands.

POLYPODIACEAE

Pteris aquilina caudata (L.) Hook. Cat and Breton Islands.

SALVINIACEAE

Azolla Caroliniana Willd. In quiet coves, mud lumps, near Passa Loutre, washed down by the currents. The plant was also collected floating in the stream, with *Lemna* sp.

PINACEAE

* † *Juniperus Virginiana* L. Two old trees on Cat Island, not observed elsewhere.

Pinus palustris Mill, *P. serotina* Michx., *P. Taeda* L. These three pines are abundant on Ship, Cat and other sandy islands, but are never found in black muck or very wet soils.

Taxodium distichum (L.) L. C. Rich. Occasional on Cat Island; the Delta.

TYPHACAE

* † *Typha latifolia* L.

Common in marshy places, even where the water is quite brackish, and one of the characteristic growths along the river banks. Almost the first species to take possession of the newly formed land about the jetties.

NAIADACEAE

† *Ruppia maritima* L. Common in brackish ponds.

SCHEUCHZERIACEAE

* *Triglochin striata* R. & P. Common in mouths of bayous on the larger islands.

ALISMACEAE

Sagittaria graminea cycloptera J. G. Smith. Ship Island, on margin of pond.

S. lancifolia L. On marshy ground, South Pass.

GRAMINEAE

Andropogon Elliottii Chapm. Occasional on dry knolls on the larger islands.

A. glomeratus Walt. Rather common on margins of ponds on sandy islands.

A. maritimus Chapm. Common on drifting sands only. Florida to Mississippi on the coast.

† *A. Virginicus* L. Occasional on Cat and Breton Islands.

Aristida dichotoma Michx. Ship and Cat Islands.

A. gracilis Ell. In one locality on Cat Island.

A. lanata Poir. Occasional in dry woods, Cat Island.

† *A. purpurascens* Poir. On dry sandy soil, somewhat remote from the beach on Cat Island.

A. spiciformis Ell. On sandy marsh, Ship Island.

* *Capriola Dactylon* (L.) Kuntze. Abundant everywhere except on the muck marshes and high dunes, very abundant on the mud lumps. Introduced.

Cenchrus incertus M. A. Curtis. Abundant on sandy soils, and the most common species of the genus. A pine barren grass. Southern Jersey southward.

C. megacephalus Doell. Abundant just above the tide line on all sandy beaches, but not found elsewhere.

† *C. tribuloides* L. Common on sandy islands.

* *Chloris petraea* Sw. Common in the interior of all sandy islands.

† *Diplachne fascicularis* (Lam.) Beauv. On low, wet sandy barrens, Ship and Cat Islands.

* †*Distichlis spicata* (L.) Greene. Abundant on damp soils, especially on the muck marsh islands.

Elymus Virginicus L. (?) Occasional on shell beaches, Ile à Pitre and Sam Holmes Islands.

Eragrostis hirsuta (Michx.) Nash. In a single locality, Breton Islands. Perennial.

**E. Elliottii* S. Wats. Occasional on dry sand.

E. pectinacea (Michx.) Steud. Common except on muck soils.

E. secundiflora Presl. Rather common on the drier soils of Ship, Cat and Breton Islands, many of the panicles of the plants on Breton Island being strongly viviparous, a peculiarity not found elsewhere. Confined to the gulf coast.

Erianthus saccharoides Michx. Cat and Breton Islands.

Chaetochloa corrugata parviflora (Poir.) Scribn. & Mer. Port Eads.

C. glauca (L.) Scribn. Port Eads.

C. gracilis (H.B.K.) Scribn. & Mer. Common on ballast ground, Port Eads.

* †*C. imberbis* (Poir.) Scribn. Ile à Pitre and Cat Island, on sandy beaches.

C. magna (Griseb.) Scribn. Abundant on low wet black soil on Breton Island, occasional on Bird and Battledore Islands.

* †*Panicum amarum* Ell. Very abundant on Battledore, Breton and other southern islands, but rare near the Mississippi and Louisiana coasts.

P. angustifolium Ell. Occasional on Cat and Breton Islands.

P. colonum L. Ship and Cat Islands.

†*P. Crus-galli* L. Occasional on margins of ponds on the larger islands and very abundant in the marshes along the river.

P. depauperatum Muhl. Occasional on Breton Island.

P. gibbum Ell. In one locality on Cat Island. Coastal plain from southeast Virginia to Florida, and westward to Texas and Cuba.

Panicum halophilum Nash

P. repens L. var. *confertum* Vasey, not *P. confertum* Desv. 1816.

A smooth and glabrous perennial with a long, stout rootstock from which arise rather stout erect stems which are densely clothed toward the base with overlapping leaves. Stems 1.5–4 dm. tall; leaves crowded below, scattered or wanting above; sheaths with the margin often ciliate; ligule a narrow scarious ring less than 0.5 mm. wide; blades firm, flat, lanceolate, usually 2–6 cm. long, sometimes longer, 3–8 mm. wide; panicle dense, 2–9 cm. long, its branches ascending; spikelets crowded, glabrous, about 2.5 mm. long and a little over 1 mm. wide, the first scale one half as long as the spikelet, or nearly so, the apex acute at a broad angle, apiculate.

In sand along the seashore acting as a sand-binder, Mississippi. Also in Mexico. Collected on Petit Bois Island, Mississippi, by S. M. Tracy, on May 8, 1898, no. 4566, and distributed as *P. repens confertum*. While resembling *P. repens* in general habit, its smaller dense panicle and the larger acute first scale of the spikelet will at once distinguish it. In *P. repens* the panicle is long and slender, and the first scale of the spikelet is only about a fourth as long as the spikelet and truncate at the apex.

Very common on beaches and damp, sandy places on all the islands, the horizontal creeping rootstocks often three metres in length and rarely producing tubers.

P. hians Ell. Common in wet, sandy places.

P. Nashianum Scribn. Dry, sandy banks, Cat Island. Common on dry sandy places, usually in the shade of palmettoes or other shrubs. Pine barrens.

†*P. proliferum* Lam. Observed only near an old house at South Pass. A straw grass.

P. repens L. Occasional on the dunes and dry sand ridges of Ship and Cat Islands, the abundant tubers on the perpendicular rootstocks often buried to a depth of eight decimetres.

P. sphaerocarpon Ell. Cat and Breton Islands.

P. Walteri Pursh. In wet, sandy places, Breton Island.

**Paspalum ciliatifolium* Michx. Common on the larger islands.

P. compressum Nees. Occasional on the larger islands, abundant on the mud lumps, and at Port Eads.

P. Curtissianum Steud. Cat Island.

**P. distichum* L. On wet, black, heavy soil on several islands; very abundant at South Pass and along the jetties.

P. Floridanum Michx. Cat Island.

P. membranaceum Walt. On margins of ponds, Ship and Cat Islands.

P. paspaloides (Michx.) Scribn. One locality on Ship Island.

P. plicatulum Michx. Abundant on rich, damp soil, Ship, Cat and Breton Islands.

P. setaceum Michx. Common on the larger islands.

P. Vaseyanum Scribn. Port Eads. Has been found by one of the writers (S. M. T.) at New Orleans and Mobile, but not elsewhere along the coast.

Phragmites Phragmites (L.) Karst. Occasional on wet soil on nearly all of the islands, and the most common species on the low mud flats, from Cubit's Gap to the mouth of the river, often growing in the edge of the water and producing floating, proliferous canes from five to eight metres in length. The predominant species on the low, newly-formed land near the jetties.

Spartina junciformis Engelm. & Gray. Entirely confined to the Gulf coast.

* † *S. patens* (Ait.) Muhl., † *S. polystachya* (Michx.) Ell., * † ? *S. stricta* (Ait.) Roth. All of these species were found very abundantly on nearly or quite every island and locality visited, *S. patens* and *stricta* being the more common species in the interior of the islands, while the others are confined principally to within a few meters of the beach.

* *Sporobolus Indicus* (L.) R. Br. Rare on the larger islands; abundant on made ground, from South Pass to Port Eads.

S. junceus (Michx.) Kunth. Not rare on dry knolls, Cat and Breton Islands.

S. Virginicus (L.) Kunth. On sandy beaches just above tide, often forming a dense sod-like growth.

Stenotaphrum secundatum (Walt.) Kuntze. Occasional on Breton Island and at South Pass.

S. filiforme (L.) Nash. Abundant on Cat Island, spikes often 3 dm. in length.

Syntherisma fimbriatum (Link) Nash. On dry beaches, Cat Island.

S. humifusum (Pers.) Rydb. Somewhat common on dry soil, Cat and Breton Islands.

S. sanguinale (L.) Nash. Common everywhere except on muck marshes.

Triplasis Americana Beauv. Occasional on dry, sandy soil in pine woods, Cat Island.

T. purpurea (Walt.) Chapm. On dry, sandy knolls, Cat, Hog, Battledore and Ship Islands.

Uniola longifolia Scribn. Occasional in moist woods, Cat Island.

**U. paniculata* L. Very abundant on Ship, Cat and Breton Islands, the larger lumps sometimes producing as many as sixty culms, and forming a striking feature of the dry and almost naked sand hills.

CYPERACEAE

**Cladium effusum* Torr. On borders of ponds, Ship, Cat and Breton Islands; common at South Pass and Port Eads.

Cyperus articulatus L. One locality on a dry, sandy beach, Cat Island.

*?†*C. cylindricus* (Ell.) Britton. Larger heads and broader leaves than those of the eastern type. Common on Ship and Cat Islands; occasional on Breton Island and at Port Eads.

C. erythrorhizos Muhl. Breton Island.

C. ferox Vahl. Cat and Breton Islands, not common.

C. flavus (L.) Boeckl. On ballast ground, Port Eads.

C. Haspan L. On wet, sandy soil, Ship and Cat Islands.

C. inflexus Muhl. South Pass.

C. Lecontei Torr. Common on damp, sandy soil on the larger islands; the rootstocks often two or three metres in length.

C. lutescens Torr. & Hook. Port Eads; Battledore Island.

C. microdontus Torr. Sand, Breton Island. Not common.

C. polystachyus Rottb. Widely distributed in tropical regions. On ballast ground, Port Eads. The Torrey Herbarium contains a specimen of this collected in New Orleans many years ago, probably about 1820, and one from St. Augustine, Fla., 1876, A. P. Garber.

C. prolixus H.B.K. In flower only; unknown hitherto in North America; ballast, Port Eads.

C. Surinamensis Rottb. On ballast ground, Port Eads. Doubtless adventive from the Caribbean region.

C. vegetus Willd. In wet meadow, South Pass.

C. virens Michx. In one locality at South Pass and on Breton Island.

**Dichromena colorata* (L.) A. S. Hitchcock. Rather common on the wet, sandy soils of the larger islands; not observed on the mainland, where it is replaced by *D. latifolia* Baldw.

* ?*Eleocharis albida* Torr. In a wet meadow, South Pass.

Fimbristylis autumnalis (L.) R. & S. Common.

†*F. castanea* (Michx.) Vahl. Common.

F. laxa Vahl. Ship Island and Port Eads.

**F. spadicea* (L.) Vahl. Breton and Cat Islands.

F. Vahlii (Lam.) Link. Common at South Pass.

Hemicarpa micrantha (Wahl.) Britton. Wet sand on Ship Island and river bank at South Pass.

Kyllingia brevifolia Rottb. In a wet meadow, South Pass.

Rynchospora dodecandra Baldw. On a sandy knoll in shade of oak trees, Cat Island.

R. fascicularis (Michx.) Vahl. Occasional on Cat Island.

* †*Scirpus Americanus* Pers. Breton Island and South Pass.

†*S. robustus* Pursh. On mud lumps.

Scleria triglomerata Michx. Cat Island.

Stenophyllus Stenophyllus (Ell.) Britton. On river bank at South Pass.

SABALACEAE

Sabal glabra (Mill.) Sarg. Occasional on Cat Island.

Serenoa serrulata Benth. & Hook. Abundant on the drier parts of the sandy islands.

LEMNACEAE

Lemna sp. In bays, brackish water, mud lumps.

XYRIDACEAE

Xyris serotina Chapm. On border of marsh, Cat Island.

COMMELINACEAE

Commelina nudiflora L. Cat and Breton Islands.

C. Virginica L. Breton Island.

PONTEDERIACEAE

Pontederia cordata L. Abundant along the river from Cubit's Gap to Port Eads.

JUNCACEAE

†*Juncus marginatus biflorus* Wood. Common on Ship and Cat Islands.

* †*J. scirpoides* Lam. Ship, Cat and Breton Islands.

LILIACEAE

**Yucca gloriosa* L. Abundant on sand hills, Breton Island.

SMILACEAE

Smilax auriculata Walt. Breton Island.

**S. Bona-nox* L. Common on dry, sandy beaches above tide line.

MYRICACEAE

* †*Myrica cerifera* L. Common on all islands producing shrubs, often forming dense thickets on the borders of marshes, Ile à Pitre, Cat and Breton Islands.

SALICACEA

Populus deltoides Marsh. Occasional on newly-made ground from South Pass to the jetties.

Salix nigra Marsh. Very abundant from South Pass to the jetties. The wood of this species is used almost exclusively in making the mattresses to form the jetties and the young trees are among the first to take possession of the newly-formed banks.

FAGACEAE

Quercus geminata Small. The common oak of Ship and Cat Islands.

**Q. Virginiana* Mill. Occasional on the islands, and the common form on the mainland.

MORACEAE

Toxylon pomiferum Raf. A single tree on ballast ground, Port Eads.

POLYGONACEAE

Polygonella gracilis Meisn. Occasional on sandy knolls, Ship and Cat Islands.

Polygonum littorale Link. On shell beaches, Ile à Pitre and Battledore Island.

P. Opelousanum Ridd. Ship and Cat Islands.

P. punctatum robustior Small. In wet meadows, South Pass.

* ? *Rumex verticillatus* L. On mud lumps.

CHENOPODIACEAE

Atriplex cristata H.B.K. On mud lumps and Breton Island.

**Chenopodium anthelminticum* L. On ballast grounds, Port Eads.

C. Berlandieri Moq. Common on sandy beaches.

†*Dondia linearis* (Ell.) Heller. Common on low, barren sand spits, Breton, Bird and Battledore Islands.

†*Salicornia ambigua* Michx.

†*S. Bigelovii* Torr.

Common on all saline marshes, and often forming the bulk of the vegetation over extensive areas. Both of the species are also found occasionally on wet and rather barren sand just above tide level.

* †*Salsola Kali* L. Sand beaches and plains, Breton and Bird Islands.

AMARANTHACEAE

Alternanthera philoxeroides Griseb. On ballast ground, Port Eads.

Amaranthus spinosus L. Occasional near an old house, Cat Island.

Froelichia Floridana Moq. On dry, sandy knolls, Ship, Cat and Breton Islands.

Lithophila vermicularis (*lata*) (L.) Uline. A few plants on shell marsh, Bird Island.

Tamariscina concatenata (Moq.) Uline & Bray. Breton Island and mud lumps.

T. tuberculata (Moq.) Uline & Bray. Battledore and Breton Islands.

BATIDACEAE

Batis maritima L. In all muck marshes or in those with a thin covering of sand.

AIZOACEAE

**Mollugo verticillata* L. Abundant on dry sand, Cat Island.

Sesuvium portulacastrum L. Rather common on damp sand or shell beaches.

CARYOPHYLLACEAE

Scleranthus annuus L. Occasional on sandy islands.

Siphonychia corymbosa Small. Occasional on Ship Island, which is the type locality, and abundant on Cat Island.

Stipulacida setacea Michx. Cat and Breton Islands.

NYMPHAEACEAE

Castalia tuberosa (Paine) Greene. In pond on Cat Island.

MENISPERMACEAE

Cebatha Carolina (L.) Britton. Occasional on Cat and Breton Islands.

LAURACEAE

Persea pubescens (Pursh) Sarg. Cat Island.

PAPAVERACEAE

Argemone Mexicana L. A few plants on ballast ground, Port Eads.

CRUCIFERAE

Cakile fusiformis Greene. On sand and shell beaches, Bird, Battledore and Breton Islands.

Lepidium Virginicum L. Battledore and Sam Holmes Islands.

DROSERACEAE

Drosera rotundifolia L. Wet sand, Cat Island.

ROSACEAE

**Rubus trivialis* Michx. Cat and Breton Islands.

Rubus sp. An unidentified species belonging to the *trivialis* group is very abundant on one of the larger mud lumps, where it makes a growth so rank and dense as to be almost impenetrable.

MIMOSACEAE

Acuan brachyloba (Benth.) Kuntze. In field at South Pass.

A. Illinoensis (Michx.) Kuntze. On shell beach, Ile à Pitre.

Mimosa strigillosa T. & G. Common at South Pass.

CAESALPINACEAE

Chamaecrista sp. Very abundant on low, damp, sandy soil on Breton Island.

Chamaecrista robusta Pollard. A few plants on dry situations on Cat Island.

PAPILIONACEAE

**Aeschynomene Virginica* (L.) B.S.P. Occasional on Cat Island, abundant at South Pass.

A. viscidula Michx. Ship and Cat Islands, on dry beaches.

Amorpha fruticosa L. South Pass and Port Eads.

Baptisia leucantha T. & G. A few plants on Cat Island.

Bradburya Virginiana (L.) Kuntze. Common on Breton and Cat Islands. A form with almost linear leaflets (var. *angustifolia*) at South Pass.

Canavalia obtusifolia DC. A few plants on Breton Island.

Clitoria Mariana L. Cat and Breton Islands.

Crotalaria ovalis Pursh. Cat Island.

C. rotundifolia (Walt.) Poir. Port Eads.

**Galactia volubilis* (L.) Britton. Abundant except on black, marshy soil.

Indigofera Caroliniana Walt. Occasional on Cat Island and at Port Eads.

Melilotus Indica (L.) All. On ballast ground, Port Eads.

Rhynchosia menispermoides DC. Dry, sandy woods, Cat Island.

Sesban macrocarpa Muhl. Occasional on Cat Island, abundant at Port Eads.

†*Strophostyles helvola* (L.) Britton. Very abundant on all dry, sandy soil excepting on the high dunes.

Stylosanthes biflora (L.) B.S.P. Common on Cat Island.

Trifolium repens L. Occasional along river bank at South Pass.

Vigna glabra Savi. Abundant in nearly every locality visited excepting the low salt marshes and high sand hills, often forming a dense growth covering several acres.

OXALIDACEAE

Oxalis corniculata L. Cat Island.

O. stricta L. Common.

LINACEAE

Linum Floridanum (Planch.) Trelease. Abundant on Breton Island.

RUTACEAE

**Xanthoxylum Clava-Herculis* L. Occasional on Cat Island.

MELIACEAE

Melia Azederach L. The only large trees on the mud lumps.

POLYGALACEAE

Polygala grandiflora L.

P. nana DC. Cat Island; rare.

EUPHORBIACEAE

**Acalpha gracilens* A. Gray. Common on Ship, Cat and Breton Islands.

Croton capitatus Michx. Abundant at Port Eads.

**C. maritimus* Walt. Occasional on Ship and Cat Islands.

C. sp. Cat Island. (L. & T., 205.)

Euphorbia Brasiliensis Lam. On ballast ground, Port Eads.

E. cordifolia Ell. Cat Island.

E. maculata L. Ile à Pitre and Port Eads.

*†*E. polygonifolia* Ell. Cat and Battledore Islands.

E. prostrata Ait. Ship Island.

E. serpens radicans Engelm. Port Eads.

Jatropha stimulosa Michx. Common on Cat Island, in sand, in the shade of trees, especially live-oaks, occasional on Breton.

ANACARDIACEAE

†*Rhus copallina* L. Occasional on Cat Island.

ILICACEAE

**Ilex vomitoria* Ait. Abundant on Ship, Cat and Breton Islands, occasional on Ile à Pitre and Battledore Island.

VITACEAE

Ampelopsis arborea (L.) Rusby. Cat Island and South Pass.

*†*Vitis aestivalis* Michx. Occasional on Cat Island.

MALVACEAE

Hibiscus lasiocarpus Cav. In wet meadows at South Pass.

* †*Kosteletzkya Virginica althaefolia* Shuttlw. Occasional on Breton Island.

Sida rhombifolia L. Common at Port Eads.

S. spinosa L. Cat and Breton Islands.

HYPERICACEAE

Ascyrum cuneifolium Chapm. Cat Island.

Hypericum Drummondii (Grev. & Hook.) T. & G. Cat Island.

Sarothra gentianoides L. Cat and Breton Islands.

CISTACEAE

Helianthemum corymbosum Michx. Abundant on Cat Island.

H. Georgianum Chapm. On a dry, sandy knoll, Cat Island.

Lechea minor L. Ship, Cat and Breton Islands.

**L. villosa* Ell. Common on Cat Island.

TURNERACEAE

Turnera ulmifolia L. On ballast ground, Port Eads.

CACTACEAE

Opuntia Opuntia (L.) Walt. Common on Cat and Breton Islands, and Isle à Pitre.

**O. Pes-corvi* LeConte. Occasional on dry, sandy soil, Cat Island.

ONAGRACEAE

Jussiaea Peruviana L.

J. suffruticosa L. On ballast ground, Port Eads.

**Ludwigia alata* Ell. Margin of pond, Ship Island.

Oenothera laciniata Hill. On ballast ground, Port Eads.

HALORAGIDACEAE

Proserpinaca palustris L. Common on margins of ponds.

UMBELLIFERAE

**Centella Asiatica* (L.) Urban. Abundant on Ship and Cat Islands.

Hydrocotyle Bonariensis Lam. Very abundant and vigorous at Port Eads.

H. sp. Wet sand, Cat Island.

VACCINIACEAE

Vaccinium arboreum Marsh. Occasional on Cat Island.

PRIMULACEAE

†*Anagallis arvensis* L. A single plant, on ballast ground at Port Eads.

* †*Samolus floribundus* H.B.K. Occasional on Cat Island and at South Pass.

PLUMBAGINACEAE

Limonium Nashii Small. Rather common in all saline marshes.

LOGANIACEAE

**Polypremum procumbens* L. Common on the islands in dry soil.

GENTIANACEAE

†*Sabbatia stellaris* Pursh. Abundant on all islands having a sandy soil.

ASCLEPIADACEAE

Asclepias amplexicaulis Michx. Abundant on dry, sandy knolls, Ship, Cat and Breton Islands.

**Seutera palustris* L. Abundant on saline marshes and on sandy beaches.

CONVOLVULACEAE

Breweria sp. Dry knolls, Cat Island.

†*Convolvulus sepium* L. On upper sand beach, Battledore Island.

†*Ipomoea acetosaefolia* R. & S. Common on Breton Island.

I. Carolina (L.) Pursh. Cat and Breton Islands.

I. Pes-caprae (L.) Sweet. Very abundant on dry sand.

**I. sagittata* Cav. Common on damp, sandy beaches.

CUSCUTACEAE

Cuscuta arvensis Beyr. Bird and Cat Islands.

C. Gronovii Willd. Quite common, and usually on *Iva frutescens.*

BORAGINACEAE

Heliotropium Curassavicum L. Occasional in nearly all localities.

H. Indicum L. Breton Island, the mud lumps and Port Eads.

H. inundatum Sw. On ballast ground, Port Eads.

VERBENACEAE

Avicennia nitida Jacq. Rather common from Mitchell Key southward.

Lantana Camara L. Abundant on ballast ground, Port Eads.

**Lippia nodiflora* (L.) Michx. Very common on damp soil.

Verbena littoralis H.B.K. On ballast ground, Port Eads.

V. officinalis L. Port Eads.

V. urticaefolia L. Occasional at South Pass.

LABIATAE

Clinopodium coccineum (Benth.) Kuntze. On dry, sandy knolls, Cat Island.

Lycopus Europaeus L. One locality on beach, Cat Island.

† *Mentha rotundifolia* (L.) Huds. Port Eads.

* †*Monarda punctata* L. A single clump on beach, Cat Island.

* ? *Teucrium* sp. Apparently an undescribed species, related to *T. Nashii.* Occasional on Cat Island.

SOLANACEAE

Lycium Carolinianum Walt. Common on shell beaches, Battledore, Sam Holmes and Sundown Islands.

Physalis angustifolia Walt. Abundant on dry sand, Cat and Breton Islands.

P. mollis cinerascens (Dunal.) A. Gray. On ballast ground, Port Eads.

**P. viscosa* L. On ballast ground, Port Eads. These specimens correspond closely with the true *P. viscosa* from South America, the common North American plant passing under that name probably being a distinct species.

Solanum gracile Link. Occasional on Breton Island.

S. nigrum L. Battledore Island and Port Eads.

S. rostratum Dunal. On ballast ground, Port Eads.

SCROPHULARIACEAE

**Gerardia maritima* Raf. Abundant on Cat and Breton Islands.

Gratiola hispida (Benth.) Pollard. Wet sand, Cat Island.

**Monniera Monniera* (L.) Britton. Cat Island and South Pass.

LENTIBULARIACEAE

Utricularia subulata L. Cat Island.

RUBIACEAE

**Diodia teres* Walt. Common.

* †*D. Virginiana* L. Common.

* ?*Galium hispidulum* Michx. Occasional among bushes on Cat Island.

Houstonia rotundifolia Michx. In rich, damp woods, Cat Island.

Mitchella repens L. Occasional on Cat Island.

**Oldenlandia uniflora* L. Cat Island.

CUCURBITACEAE

**Citrullus vulgaris* Schrad. One plant, Bird Island.

CAPRIFOLIACEAE

Sambucus Canadensis L. South Pass and Port Eads.

COMPOSITAE

Acanthospermum australe (L.) Kuntze. Port Eads.

Actinospermum uniflorum (Nutt.) Barnhart. Occasional on Ile à Pitre.

Aster exilis Ell. Bird Island and Port Eads.

†*Baccharis halimifolia* L. Mud lumps.

Bidens leucantha Willd. Abundant at South Pass and Port Eads.

Baldwinia multiflora Nutt. Dry sand hummocks, Cat Island.

Boltonia diffusa Ell. Cat Island.

**Borrichia frutescens* (L.) DC. Abundant on Breton Island and Ile à Pitre.

Chrysoma pauciflosculosa (Michx.) Greene. On dry sand hills, Cat and Ship Islands.

†*Chrysopsis Mariana* (L.) Nutt. Occasional on Cat Island.

Eclipta alba (L.) Hassk. Common on wet, sandy soil on the larger islands.

* †*Erechtites hieracifolia* (L.) Raf. A single locality on Hog Island.

Erigeron repens A. Gray. Damp, sandy soil, Breton Island; not before reported from east of Texas.

**Gnaphalium purpureum* L. Common on Cat and Breton Islands; a single plant observed at Port Eads.

Helenium tenuifolium Nutt. Abundant at Port Eads, but not observed elsewhere.

Heterotheca subaxillaris (Lam.) Britton & Rusby. Occasional on Cat Island.

* †*Iva frutescens* L. The most common shrub on all low, sandy islands.

I. imbricata Walt. Common on Breton Island; occasional on Sam Holmes, Hog and other sandy islands to the southward.

* †*Leptilon Canadense* (L.) Britton. Common on sand or shell beaches.

L. linifolium (Willd.). Occasional on Cat Island.

* †*Pluchea camphorata* (L.) DC. A few plants on Bird Island and at South Pass.

**P. foetida* (L.) B.S.P. Common on Cat Island.

* †*Solidago sempervirens* L. Not collected in flower, but presumed to be this plant. Breton Island.

Sonchus oleraceus L. Common on shell beaches, Sam Holmes, Sundown and other islands.

Trilisa odoratissima (Walt.) Cass. Abundant on Cat Island.

* †*Willughbaea scandens* (L.) Kuntze. Common on mud lumps, occasional on Cat and Breton Islands.

* ?*Xanthium strumarium* L. A single plant, on Breton Island.

LITERATURE

A very full list of references to the literature dealing with ecology will be found in Kearney's paper cited below.

1. **Boergesen, F. & Paulsen, Ove.** La vegetation des Antilles danois. Rev. Gen. de Bot. **12**: 434–446. 1900.

2. **Bray, W. L.** On the Relation of the Flora of the Lower Sonoran Zone in North America to the Flora of the arid Zones of Chili and Argentine. Bot. Gaz. **26**: 121–147. 1898.

3. **Cowles, H. C.** The ecological Relations of the Vegetation on the Sand Dunes of Lake Michigan. Bot. Gaz. **27**: 94–117; 167–202; 281–308; 361–391. 1899.

4. **Harshberger, John W.** An ecological Study of the New Jersey Strand Flora. Proc. Acad. Nat. Sci. Phil., 1900: 623–671. O., 1900.

5. **Hilgard, E. W.** Report on the Geology and Agriculture of the State of Mississippi. Jackson, Miss. 1860.

6. **Kearney, T. H., Jr.** The Plant Covering of Ocracoke Island: A Study in the Ecology of the North Carolina Strand Vegetation. Contrib. U. S. Nat. Herb. **5**: 261–319. 1 Au. 1900.

7. **Macmillan, C.** Observations on the Distribution of Plants along the Shore at Lake of the Woods. Minn. Bot. Stud. **1**: 949–1023. 1897.

8. **Moseley, E. L.** The climatic Influence of Lake Erie on Vegetation. Am. Naturalist, **31**: 60–63. Ja. 1897.

9. **Torrey, John.** Observations on the *Batis maritima*, of Linnaeus. Smithsonian Contributions. S. 1850.

10. **Warming, E.** Botaniske Exkursioner. Videnskabelige Middelelser fra den Naturhistoriske Forening. 1891.

11. **Webber, H. J.** Notes on the Strand Flora of Florida. Science, II. **8**: 658, 659. N. 1898.

12. **Porter, T. C.** Rare Plants of Southeastern Pennsylvania. March, 1900.

Explanations of Plates

PLATE 8. *Panicum amarum* dunes, with *Ipomoea acetosaefolia* on the extreme left foreground and *I. pes-caprae* on the extreme right.

PLATE 9. *Iva imbricata* dunes on the sand spit plain; a stem of *Ipomoea Pes-caprae* in the foreground.

PLATE 10. Sand spit plain. *Serenoa serrulata* dunes. In the middle foreground a *Panicum repens* dune. Left foreground *Cyperus cylindricus*. *Pinus Taeda* in the background; pine graveyard on the right.

PLATE 11. Shell dune showing lee margin encroaching on a pure *Batis* association. On the dune *Iva frutescens*.

The Nomenclature of the New England Agrimonies

By Eugene P. Bicknell

Under this title in Rhodora for December last, Dr. B. L. Robinson discusses the names of our New England agrimonies, somehow making his way to the conclusion that four of our five species should bear names other than those in current use. My own responsibility for these names is such that this paper might well be personal in some slight way. Its paragraphs, however, quite surpass the reasonable in their personal tone and, indeed, bristle with a sort of porcupine sharpness whereof I am intended to be the victim. It is, nevertheless, gratifying to find my treatment of the species themselves frankly endorsed by so accomplished a systematist as Dr. Robinson, and this, perhaps, is intended to weigh in ample balance against the tone of disagreement and criticism which pervades the remainder of his paper. All the more is this tone and criticism curious since a reconsideration of the whole matter shows that the conclusions so supported really stand for a "retrogressive search after priority," as is inadvertently admitted, instead of such a progressive search as can alone ever warrant any nomenclatural changes.

It may therefore be well to take up the species *seriatim*, following Dr. Robinson, and openly meeting the questions involved in the interest alike of logical principles and sound botany.

Agrimonia hirsuta (Muhl.)

Dr. Robinson's most serious objection to this name, as may fairly be inferred from his context, is on the score of its having been first used as a varietal designation. In other words, that its author's understanding of the plant which he named proves not to coincide exactly with our understanding of to-day—that some mysterious taxonomic value attaching to it was not fully apprehended by its discoverer when, recognizing its distinctness, he conferred on the plant its distinctive name.

Ostensibly the objection to the name rests on an alleged improper description. Now the question what is a proper and what an improper plant description must ever be something indeterminable by exact rule—a mere academic problem obviously ever open to the danger of receiving a solution far from the domain of practical ideas. As a matter of fact, a majority of accepted descriptions will not survive a certain kind of impossible test. Suffice it, therefore, that the *characterization* of a species, if not wholly by itself, then taken in connection with its context or other evidence, shall fix beyond peradventure the identity of the plant intended.

That this name *hirsuta* of Muhlenberg is unmistakable in its application admits of not the slightest doubt. In advancing a contrary view Dr. Robinson employs a kind of argument pitched somewhere between sarcasm and ridicule, which only betrays the weakness of his position, even apart from an unfairness of statement evidently more a matter of haste than of intent.

No one having given any close heed to our agrimonies can doubt the exact application of Muhlenberg's name. The agrimonies recognized by Muhlenberg were four in number. One other of our seven known North American species—a far southern plant (*A. incisa* Gray) was wholly unknown to him; so that the determination of what he meant by his *hirsuta* lies among three species only instead of among seven, as Dr. Robinson declares. The well-considered selection and often entire sufficiency for purposes of identification of Muhlenberg's descriptive adjectives is well evidenced in his "Catalogue," and it is not at all surprisprising to find that his characterization of "rough-haired" for one of his plants is entirely distinctive. The two eastern species not recognized by Muhlenberg are upon a moment's consideration promptly excluded from being in any way involved; one of them (*A. mollis* Britton) is soft-haired throughout; the other (*A. Brittoniana*) more or less so; while the fact that the latter is partly rough-haired has no bearing, since it is the most northern in range of all our species, not extending south to Carolina, which is expressly named by Muhlenberg, and properly so, as the southern limit of his *hirsuta*. The exact sufficiency and beautiful adequacy of Muhlenberg's characterization of rough-haired is thus apparent. Dr. Robinson's objection that the plant in question is one of the least "hairy" of the group is not at all to the point. Note that Muhlenberg says *rough-haired*, not *rough-hairy*, an acute and very true distinction. If Dr. Robinson objects to the plant being considered hairy it is nevertheless always obviously and characteristically rough-haired.

Nor is this all. In connection with his *Agrimonia Eupatoria hirsuta* Muhlenberg characterizes a variety *glabra*. This is clearly no other than the plant which, following Dr. Gray, I have taken up as the *A. striata* of Michaux. The fact that this plant was by Muhlenberg considered a variety of his *hirsuta* points with perfect directness to just what his *hirsuta* was. This *A. striata* in its leafy parts approaches so close to *A. hirsuta* that its varietal relationship might well be predicated until disproved by critical study. In first attempting the segregation of the two plants it needed the closest and most persistent observation in order to satisfy myself that they were actually distinct.

It may be added that if by his *hirsuta* Muhlenberg did not mean the plant here discussed then he had no knowledge of our commonest, most conspicuous and most wide-ranging species, doubtless also the species commonest and most conspicuous in the region where his observations were more especially carried on.

The "well-nigh necromantic power" which Dr. Robinson invokes to explain my interpretation of Muhlenberg's meaning may thus be identified after all with the most ordinary kind of common sense. It follows that the name *hirsuta* for our common species is scientifically because logically secure.

As for Wallroth's name *A. gryposepala*, which Dr. Robinson would adopt for the species, I am charged with the motive of "displacing" it. As a matter of fact the name had never appeared in American botany until resurrected by me and assigned a place —a clearly rightful place—as a synonym.

AGRIMONIA BRITTONIANA Bicknell

Dr. Robinson's indictment of this name rests upon two counts: first, that the plant is the same as *A. pilosa* Ledeb. of central Europe; second, that both plants are to be referred to the *A. striata* of Michaux.

If the European and American plants are really the same it is a matter of great interest, but I think it can scarcely be held that sufficient study has yet been given to the question to warrant any final pronouncement on this point. It must be kept in mind that we are here dealing with a group of very critical species, and that those of our own country, absolutely distinct as they are, were, within a few years, although common and well-represented in herbaria, hopelessly confused and mostly thrown together under one name. Although I have given much attention to our species, I should hesitate to announce any capital conclusions as to identities founded on anything less than a most careful comparative study of complete material. The specimens of *A. pilosa* Ledeb. that I have myself examined, though few in number, were all from European herbaria and presumably authentic. These examples, apparently, indeed, representing more than a single species, were of plants certainly closely allied to *A. Brittoniana*, but which I could not regard as identical. Nor can the figure of *A. pilosa* Ledeb. in Reichb. Icon. 3 : *pl. 252*, which is cited by Wallroth, be correlated with our American plant.

A most interesting tendency of the more critical study of our plants has been to effect a gradual elimination of European forms once admitted to our flora, and it is certainly still in need of demonstration that a common American agrimony, not of alpine distribution, ranging from Quebec and New England somewhat southward along the Alleghanies and west to the Rocky Mountains, thence south into Arizona and New Mexico, is identical with a central European species.

The brief allusion to *A. pilosa* in my paper has been quite misunderstood by Dr. Robinson. Nothing was attempted in the way of "disposal" of the species, only a mere reference to the confusion regarding it in the treatments of different European botanists. Wallroth placed it as a variety under *A. Dahurica*, an earlier name.

As to the application of the name *A. striata* Michx., here is a case where doctors disagree. Dr. Gray many years ago having seen material of Michaux, as is expressly attested by him, referred it unhesitatingly to the *A. parviflora* DC., also by him examined, this latter being precisely the plant described by me under Michaux's name. Now, Dr. Robinson, having examined a specimen of Michaux in the Jardin des Plantes, declares it to be the same as my *A. Brittoniana*. It is hard to solve this puzzle unless there be in existence, or was in Dr. Gray's time, more than one specimen of Michaux's *A. striata* which thus would represent a composite species. That it was at least a mixed species can scarcely be doubted, since otherwise it would appear that our commonest species was to Michaux quite unknown.

It has been shown that Dr. Gray long ago established the identity of *A. striata* Michx. with *A. parviflora* DC. It remains to be proved that in so doing he was under no misconception in regard to the exact application of De Candolle's name. This is easily done. Both names were placed by Dr. Gray as equivalent synonyms under his own *A. Eupatoria* var. *δ*. An excellent specimen of this variety, so labeled in Dr. Gray's handwriting, is preserved in the Columbia Herbarium. It is precisely the plant which I have taken up under Michaux's name!

Dr. Gray's note on the specimen of Michaux in the herbarium of the Jardin des Plantes "est *A. Eupatoria* var. *minor*" would seem to exclude *A. Brittoniana* from Michaux's species, inasmuch as the latter becomes the largest plant of the group. The difficulties that have been encountered in the past in causing Dr. Robinson to see that critical species in other genera are really different may well be looked on as adequate reason for hesitating to accept his identification of *Brittoniana* with *striata*, in view of the earlier conclusion of Dr. Gray. At this point arises the question whether there is not, or was not in Dr. Gray's time other material representing Michaux's *A. striata*, perhaps in the Richard herbarium.

Michaux's brief description referred to by Dr. Robinson as "rather characteristic" is in reality no more characteristic of one of our species than of several others, and his assertion that his plant had white petals is characteristic of no species. No adequate reason yet appears why the name *A. Brittoniana* should not continue to stand.

AGRIMONIA STRIATA Michx. *fide* A. Gray

Agrimonia glabra (Muhl.).

Michaux's name *A. striata* has now been used in such varying senses that it becomes necessary to use another name in connection with it in order to indicate clearly the plant intended. In my use of the name, as explained in my paper reviving the species and now again in the above discussion of *A. Brittoniana*, I followed Dr. Gray who was at pains to certify to its rightful application. Next in order of priority comes Muhlenberg's name *A. Eupatoria glabra* which, as we have now learned, should be rendered *Agrimonia glabra*, a most fitting designation, being wholly inappropriate to any other one of our species.

Dr. Robinson's assumption that, had I taken due note of the type-station of Michaux's plant, I could scarcely have failed to surmise its identity with my *A. Brittoniana* is quite wide of the mark. As well might I have predicated the identity of Michaux's plant with *A. hirsuta* Muhl., also an inhabitant of the same region. Any surmise of the kind would, in fact, have been presumptuous in the face of Dr. Gray's explicit announcement of the exact identity of Michaux's plant. Moreover the ranges given in my paper were expressly stated to be incomplete —"based alone on specimens actually examined and doubtless subject to considerable extension in some cases." As a matter of fact the species *A. glabra* (Muhl.) does occur in the Dominion as attested by specimens since examined from lower Canada.

The name *A. microcarpa* Wallr., which Dr. Robinson would adopt for this species, was unfortunately not given with an interrogation in my synonymy as it should have been. A better insight into the matter has since shown that the name has no application to the plant in question, but almost certainly refers to some form of the species taken up by me as *A. pumila* Muhl. Wallroth's name *A. rostellata* is, however, clearly applied to the plant, but is antedated twenty-nine years by Muhlenberg's *A. glabra*.

AGRIMONIA MOLLIS (T. & G.) Britton

That the name *A. platycarpa* Wallr. "will be preferred by conservative botanists" for this species is open to grave doubt. The conservative botanist who proceeds by preference rather than by rule is lost from the start. The first distinctive appellation for the species was *mollis*—*mollis*, therefore, instantly became its inalienable name, personal preference now to the contrary notwithstanding.

But even were it necessary to adopt a name of Wallroth's for the plant Dr. Robinson's choice of *A. platycarpa* would still be erroneous. I am here myself at fault through having omitted the mark of interrogation in taking up this name in the synonymy of *A. mollis*. It is not at all clear that the name does not refer to one of the apparently several forms or species included under *A. pumila* Muhl. At any rate, the name quite certainly does not pertain to the type of *A. mollis.*

I am well satisfied that *A. mollis* is an aggregate actually embracing a group of species. But in order to elucidate this a greater amount of material than is now available and the closest study will be indispensable. It may then be possible to give to Wallroth's name a definite meaning. There seems, however, little reason to doubt that Wallroth's name, *A. pubescens* is rightfully assigned to the synonymy of *A. mollis.*

All things considered it can only be regretted that a wholly unnecessary confession has been introduced into the nomenclature of our agrimonies. Changes in botanical names, necessary evils at best, are especially to be deplored when proposed in disregard alike of easily ascertained certainties on the one hand and of palpable uncertainties on the other.

In what has been written in support of such changes in the names of the New England agrimonies nothing is brought forward which at all justifies the displacement of any of the names previously adopted.

The Home of Botrychium pumicola

By Frederick V. Coville

(With Plate 7)

In the summer of 1897 the writer, with Mr. E. I. Applegate, acting as assistant, and a camp hand, was engaged in an investigation of the flora of the Cascade Mountains of Oregon. On August fifth in a brief trip to the summit of Llao Rock, 8148 feet altitude, one of the highest elevations in the rim of Crater Lake, a *Botrychium* was discovered, growing in considerable abundance at a single point in the dry pumice gravel with which the broad summit is covered. The spot was on the rounded crest of the rock about fifty yards west of its highest point. As the species was believed to be undescribed an ample supply of specimens was collected, and from this the following description was drawn.*

Botrychium pumicola Coville †

Rootstock vertical, reaching a length of 8 cm. and a diameter of 3 mm., with an abundance of roots a millimeter or less in diameter; stem, together with the segments of the frond, reaching a height of 10 cm., the former about twice the height of the latter and in ordinary specimens 2 to 3 or even 3.5 mm. in diameter, the lower half or two-thirds thickly sheathed with the dark brown remnants of the stems of previous years; frond glaucous, the sterile segment nearly sessile, reaching a length of 3 cm., ternate, the divisions nearly sessile, the lateral ones about half or two-thirds the length of the middle one, each pinnately parted into fan-shaped somewhat one-sided lobes, these with crenulate margins and usually two or three lobules, the lowermost lobes of the middle division sometimes distinctly pinnatifid into several lobules; fertile segment in most specimens a little longer than the sterile, bipinnate, or one or both the lowest branches sometimes so developed as to indicate a tendency to ternate division; bud with sterile segment erect, the axes of the lobes horizontal.

This *Botrychium*, although not very closely related to any species heretofore described, may best be compared with *lunaria* and

* Published in Underwood, Our Native Ferns, ed. 6, 69. 1900.

† On the ground of euphony the combination of letters *icic*, which in strict etymological practice would occur in this word, was reduced to *ic*.

boreale. In general makeup and particularly in the form of the lobes of the frond it resembles *lunaria,* indeed it bears a striking resemblance to such an aberrant ternately divided specimen of *lunaria* as is figured by Milde in his Gefäss-Cryptogamen.* In the series of thirty-one specimens of our plant preserved in the National Herbarium, however, the ternate character of the sterile segment is constant, except in a few depauperate plants in which the segment is only a few millimeters in length. In *pumicola* the three divisions of the sterile segment are ovate-triangular in outline and the lobes uniformly imbricated, the lower and larger lobes are frequently lobulate, or sometimes even pinnatifid and the entire sterile segment is congested to a maximum length of 3 cm. In *lunaria* the sterile segment has a single division, triangular-lanceolate in outline, its lobes little or not at all imbricated and seldom distinctly lobulate, the whole sterile segment often reaching a length of 5 or even 10 cm. In general configuration *pumicola* closely resembles *boreale,* a resemblance chiefly due to the deltoid-ovate outline of the sterile segment of *boreale,* but the latter has rhomboidal instead of lunate lobes, and although these show a tendency to lobulation, they have not developed to such a conspicuously greater extent than those immediately above to give the frond a really ternate character. From both *boreale* and *lunaria* the present species differs in its very pale green glaucous color, the much more persistent stem-sheaths, and the fact that the stems are buried in the soil up to the point of separation of the two segments. All of these are xerophilous characters correlated with the remarkable habitat of the plant.

The soil of Llao Rock, a fine pumice gravel, apparently without any admixture of humus, is covered in winter by probably ten feet of snow. After this melts away in spring, the soil becomes very dry, and as July and August are almost rainless the plants of this and similar areas are subjected to an annual drouth of several weeks' duration. While the elevation of this spot is very near timber line, where the flora would normally be made up of circumpolar plants, not a single such plant is found there. The species found on the area are follows:

Sitanion elymoides Raf.

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* Milde, Nov. Act. Acad. Leop. Car. 26^2: *pl. 47. f. 125.* 1858.

Trisetum subspicatum (L.) Beauv.*
Carex Breweri Boott.
Eriogonum ovalifolium Nutt.
Eriogonum pyrolaefolium Hook.
Eriogonum umbellatum Torr. and another undetermined species.
Polygonum Newberryi Small.
Lupinus minimus Dougl.
Phlox diffusa Benth.
Phacelia Magellanica (Lam.) Coville.†
Orthocarpus pilosus Wats.
Pentstemon Davidsonii Greene.
Aster Shastensis Gray.
Hulsea nana Gray.
Raillardella argentea Gray.
Hieracium gracile Hook.

In all these plants there are conspicuous protective modifications which enable the species to endure the summer drouth to which they are subjected. To ordinary circumpolar plants, accustomed to the more humid conditions of moisture-holding soils, such a drouth would be fatal. The absence of such plants on the deeply cinder-covered summit of Llao Rock may therefore be easily understood. In general the plants of the area are either, like the *Botrychium*, forms which have been derived from circumpolar generic types and which have developed drouth-resistant characters adequate to their survival, or like the species of *Eriogonum*, they belong to genera confined to the American continent and growing characteristically at moderate elevations in the arid region, but differ in such a way from these low-elevation species as to be able to withstand the severe cold of a subalpine situation.

Explanation of Plate 7

Fig. *a*, entire plant; fig. *b*, lateral view of frond; fig. *c*, base of stem, the sheath dissected away so as to show the enclosed bud. Figures *a* and *b* are natural size, fig. *c* twice the natural diameter.

* Typical *Trisetum subspicatum* is a circumpolar grass but our plant does not belong to the typical form of the species. It is likely to prove an undescribed species or subspecies.

† *Phacelia Magellanica* is a composite species and a critical study of it will doubtless show that the form to which the Llao Rock plant belongs is not identical with the typical form.

North American Plantaginaceae.—II *

By E. L. Morris

(With Plate 12)

One correspondent has written me asking on what grounds, in the preceding paper, I published the various species as annual and whether I found the determinative characters in the stems or in the leaves. He then said he had a perennial *Plantago* of the group under question, a specimen of which he would send me. Without doubt, the full study of the histology of specimens would assist to no small degree in the classification of the species of any genus or family. It is a matter for regret that there has been published no such study in *Plantago* (American species) for it would throw additional light on the old and recent species. The specimen sent me was a very proliferous form of *P. aristata*. Whether it was a true perennial or a persistent individual freak I was unable to decide. To a written request for a statement from him of how many seasons this plant or its surrounding plants had been observed to persist, I have recently received the following answer: "The plantain I sent you has flourished this year, and I have seen many specimens larger than the one I sent you. The small [ones] with one or two inflorescences are, no doubt, seedlings that bloom already in the first season. I measured one individual covering 1 ½ square feet, all from one root, evidently four years old!" My own observations in the field of *P. aristata* and *Purshii* force me to the belief that they are true annuals. Unfortunately I have not seen my correspondent's plants. Their wide range and great frequency have given good opportunity to many observers, some of whom assure me that they have seen no indications of these species being other than annuals, after devoting attention to this question the past two seasons in the South where the perennial duration would be most marked for these dry-ground species. The

* The equivalent of North American Plantaginaceae, I, was published as "A Revision of the Species of *Plantago* commonly referred to *Plantago Patagonica* Jacquin," Bull. Torr. Club, 27 : 105–119. 1900.

proliferous specimen of *P. aristata* referred to above has the following unusual characters: Just below the middle of the central peduncle is a group of three bracts developed into leaves, the longest 96 mm. in length, in the axils of which instead of flowers are three peduncles bearing two many-flowered and one several-flowered spikes. These spikes are like the others on the plant except in the shorter bracts. Above this group, below the base of the terminal spike, are several scattered foliaceous bracts, the longest 65 mm. by 3 mm., each bearing in its axil a normal flower. A similar specimen, though less markedly proliferous, is in the herbarium of the New York Botanical Garden. It was collected at Brookings, South Dakota. Another nearly like the first is Pollard & Maxon's no. 60, from Alabama, 1900, in the U. S. National Herbarium.

Plantago aristata Nuttallii (Rapin) Morris is regarded by Dr. N. L. Britton to be a clear case of nanism. My own observations of this subspecies in New Jersey, in July, 1900, suggest the possibility of such being the correct position of these plants.

In the preceding paper, for the sake of uniformity, I described with others the species *P. spinulosa* Dcne., *Purshii* R. & S., and *erecta* Morris. Though, as then understood, these species were plainly aggregate, judged by the material used from the various herbaria, it did not seem wise to segregate them till further study was made and a more accurate knowledge of the types was gotten. The greatest diversity occurs in the forms referred to *P. spinulosa* Dcne., because of the least differentiation of characters in the older descriptions and having no plates at hand for reference. Specimens sent me for study from several collections, possibly referable to *P. spinulosa* Dcne., so far as American records of the type could suggest, were so distinct from each other that knowledge of the type became necessary. This was gained, on inquiry, from the kind answer of Mr. C. DeCandolle of the DeCandollean Prodromus Herbarium at Geneva, and the accompanying photograph (represented in Plate 12) of Decaisne's type, together with a bract and flower from the type. This photograph and the bract and flower evidently are not fully representative of the plants American authorities have called *spinulosa*, because they are too young to have ripened the pyxes and thereby swell the calyx to mature size, and too young to have the mature internodes developed. However, the bracts and the flowers are suggestive of the mature characters of this species. Specimens have been examined from the plateau and prairie regions west of the Mississippi River. To distinguish this species from the others of the spinulose group, it has seemed wise to revise the former description of *P. spinulosa.* The others I have referred to the new species *P. verticillata, picta, oblonga* and *ignota.*

To definitely understand the differences between typical *Plantago Purshii* R. & S. (= *P. Lagopus* Pursh, not L.; *P. gnaphaloides* (*sic*) Nutt.; etc.) and its forms, I have tried to ascertain the characters of the types. I have not been able to study Roemer and Schultes's type, if they had one, but they refer their name to *P. Lagopus* Pursh (Fl. 1: 99. 1814), as collected in dry situations along the Missouri River. Nuttall refers his name *gnaphaloides* to his own plants, noting "(*Lagopus* Pursh, a name already applied to a very distinct species)," collected on "high and gravelly hills; commencing to appear near the confluence of the river Jauke, and the Missouri." His type has not been available to me, but one of his collections in Arkansas contained specimens of typical *Purshii,* and the specimens are in his own handwriting named *gnaphaloides.* Concerning the station of his type from the river "Jauke," there has been some discussion.

Coulter and Rose, in their Monograph of North American Umbelliferae, have referred to this locality the type of an umbellifer and suggest with question the possible equivalence of this name to Jaune, the old French name for the Yellowstone, although Dr. Rose has said to me that this explanation is not very satisfactory. It is known that Nuttall did not go much west of the Mandan villages, which never have extended west of the present town of Mandan. Previous to Nuttall's visit to these villages they gradually had been moving from the east along the Missouri River. The only other river, whose old name is known, at whose confluence with the Missouri Nuttall did collect many species, which by small error could be called "Jauke," is the present Dakota or James River, in those days known as the Jacque River. Its union with the Missouri is in the midst of the country which Nuttall traversed. The transfer from Jacque to "Jauke" probably was due to mispronounciation of the name, not to clerical error. With three hundred and fifty miles to account for between the Mandan villages and the Yellowstone River, and with only one other river in the Dakotas having a somewhat similar name, it is reasonable to conclude that the river "Jauke" was the Jacque River. Pursh refers his *Lagopus* to specimens seen in Nuttall's herbarium, collected by Nuttall. In the herbarium of the Philadelphia Academy of Sciences is Pursh's specimen of his *Lagopus* from Bradbury's collection. The far northwestern range of two forms of *P. Purshii* readily suggests that further study may determine them as distinct species, though at present they strongly intergrade in western Wyoming and Montana and in Oregon and Idaho. One of these was annotated by Dr. Gray as *P. Patagonica* var. *spinulosa* Syn. Fl. N. Amer. It very markedly differs, however, from any forms hitherto referred to *spinulosa*. With only these facts and the strong intergradations, it is impossible to separate the very unlike extremes of this species. It varies from short, compact, heavily-villous, dense-spiked forms of sun-baked plateaus and prairies to the tall, grass-like, glabrate, interrupted-spiked, quite long bracted ones of the cloud-covered mountains. There are no varying anatomical characters to distinguish these forms other than those due to moisture and temperature.

Mr. G. B. Grant, of Lexington, Massachusetts, has sent me specimens of a *Plantago* collected at Avalon, Santa Catalina Island. At first it seemed to be a form of a mainland species, but it differs in many important characters. It is closely related to *P. dura* Morris, but differs in the following points: The plant is conspicuous by its brilliant white pubescence over as brilliant a green of the plant itself, the spikes are coarser and more showy, the bracts are without callous apices and little if at all exceed the lobes of the calyx, and the callous teeth of the leaves. For this handsomest of the western narrow-leaved Plantagos, I propose the name *P. speciosa*.

Size, habit and leaf characters, together with dimorphism of the stamens in *P. erecta* Morris form the basis of separation from *erecta* of the new species *P. obversa* which could be included in the other on bracteal and floral characters only.

Reference to the former paper and to the records in this will convince at once that the geographical distribution and the climatic conditions characteristic of such ranges are in importance secondary only to the anatomical characters and habits, if not the direct cause of them. These apparently had no consideration in the older writings on this family inside of continental distribution. I am fully convinced that sufficient study of the habitats and range of these and other species of the Plantaginaceae will be of the utmost value in further verification and recognition of the true relationships within the family. It is a matter of personal regret that I have not been able to study these important points in the field.

Several correspondents have suggested that the collectors' numbers and dates would have made the first paper more useful. I believe worse confusion was avoided by the omission of such numbers and dates, for as many as a dozen collectors have distributed from two to four species of *Plantago* under a single number and date, sometimes even broad- and narrow-bracted species together. To illustrate: The only specimens of R. A. Plaskett's no. 55, from the Santa Lucia Mountains, available to me were undoubtedly separable from the other California material at hand. Miss Alice Eastwood wrote that her material distributed as Plaskett's no. 55 could not be *P. tetrantha* by any freedom of interpretation. To prove her statement she sent on her specimens. These were undoubtedly *P. erecta*, there not being a single plant of *P. tetrantha*.

I am greatly indebted to all who have so kindly loaned me their specimens or allowed me the facilities at their hands, and for the specimens presented to me. Definite acknowledgement is made in the record of the place of deposit of these specimens. And more especially am I under obligation to Mr. C. DeCandolle for his courtesy in presenting me with the photograph mentioned above.

PLANTAGO SPINULOSA Dcne.; DC. Prod. **13**: 713. 1852

P. Patagonica var. *spinulosa* Gray, Man. ed. 2: 269. 1856.

A *light or bright green annual*, with a short simple stem, with white to fuscous pubescence: *leaves* crowded, somewhat lax, ascending to erect, few to numerous, *linear to spatulate-linear*, commonly induplicate, acuminate at the apex, callous-tipped, entire, narrowed to the margined semi-clasping petiole, *3-ribbed, even* *through the petiole*, with fainter interposed nerves, 50–125 mm. by 3–6 mm., *glabrate above and pubescent below to heavily villous throughout*: *peduncles* ascending to erect, solitary to several, 50–100 mm. high, *pubescent to very villous*: *spikes* rather stout, *dense or with the internodes equalling the flowers*, erect, *long-cylindrical*, 30–65 mm. long, villous: *bracts rather rigid-herbaceous*, ascending to spreading, *two to five times as long as the flowers*, *linear-subulate to aristate*, acute, 7–17 mm. by 0.5–1 mm., pubescent to villous: flowers perfect: *calyx* villous, its *divisions scarious, with broad green midribs* spatulate-oblong, rounded, 2.5 mm. long: *corolla* surpassing the calyx, its *lobes* reflexed, twice as long as the constricted throat, *ovate, obtuse, sub-auriculate at the base*, 1.5 mm. by 1 mm., *white to tawny*: stamens four, and, with the style, just exserted from the tube: *pyxis equalling the calyx*, oval, rounded, 2.5 mm. by 1.5 mm., *circumscissile at the middle*: seeds two, dark brown, oblong, finely pitted.

Twenty-two specimens or sheets have been examined from Assiniboia, Montana, South Dakota, Wyoming, Nebraska, Kansas, Oklahoma, and Texas, as follows: 5 in the U. S. National Herbarium, 2 in the Gray Herbarium, 3 in the Herbarium of the Missouri Botanical Garden, 2 in the Herbarium of the New York Botanical Garden, 2 in Columbia University Herbarium, 1 in the Herbarium of the California Academy of Sciences, 2 in the Herbarium of the Philadelphia Academy of Sciences, 3 in the Herbarium of the Canadian Geological and Natural History Survey, 1 in the University of Texas Herbarium, one in the Herbarium of Dr. E. L. Greene, and 1 in my own herbarium, the last being the photograph and bract and flower of Decaisne's type, which sheet is loaned to the U. S. National Herbarium for public reference.

Plantago verticillata sp. nov.

A *lax light green annual*, with a short stem: *leaves* ascending, several, *linear*, acuminate at the apex, entire, *widest* and semi-clasping *at the base of the petiole*, 3(–5)-ribbed, 80–100 mm. by 3–5 mm., pubescent: *peduncles* ascending, several, *equalling or surpassing the leaves*, 100–160 mm. high, pubescent: *spikes slender, with the internodes 4–10 mm.* long, erect, *long-cylindrical*, 50–70 mm. long, merely pubescent: *bracts slender, herbaceous, spreading, three to five times as long as the flowers, linear subulate*, acute, 6–14 mm. by 0.5 mm.: *flowers* perfect, *conspicuously verticillate in threes; calyx divisions scarious, with broad green midribs* spatulate-oblong, rounded, 2 mm. long:

corolla one third surpassing the calyx, its *lobes* reflexed, two times as long as the constricted throat, *narrowly ovate, obtuse, slightly sub-auriculate at the base*, 1.5 mm. by 1 mm., *white*: stamens four, equal to the throat: *pyxis* oblong, rounded, about 1.5 mm. by 1 mm., *circumscissile at the lower third*: seeds two, dark brown, oblong, finely pitted.

Four sheets or specimens have been examined from Texas as follows: 1 in the U. S. National Herbarium, 1 in the Gray Herbarium, 1 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium. Type specimen is A. A. Heller's no. 1769 from Kerrville, Texas, May 14–21, 1894, in the U. S. National Herbarium.

Plantago picta sp. nov.

A green annual except the light-green spikes, sub-caulescent or slightly caespitose, low and, if much exposed, spreading, or erect: *leaves* crowded, several, *linear*, acute at the apex, callous-tipped, entire or with very small callous teeth, *the petioles scarcely margined, except toward the semi-clasping base*, 30–200 mm. by 2–4 mm., glabrate to villous: peduncles solitary to several, 10–200 mm. high, pubescent: *spikes with the internodes nearly equalling to slightly surpassing the flowers, long cylindro-conic* by the long lower to short upper bracts, 10–65 mm. long, pubescent to villous: *bracts herbaceous*, sometimes foliaceous, ascending, *three times as long as the basal to equalling the apical flowers, linear, attenuate*, acute, 2–15 mm. by 0.5–1.5 mm. at the scarious-margined base, pubescent to villous: *calyx* villous, its *divisions white-scarious, with light green midribs, hence appearing somewhat striped*, oblong, rounded, 2 mm. long: *corolla much surpassing the calyx, its lobes* reflexed, about *two times as long as the constricted throat, ovate, acute or obtuse*, sub-auriculate at the base, 1.5 mm. by 1 mm., white: stamens four, just exserted from the tube: *pyxis* equalling the calyx, *round-ovate*, 2 mm. by 1.5 mm., *circumscissile just below the middle*: seeds two, dark brown, oblong, finely pitted.

Nine sheets or specimens have been examined from Utah, Arizona and southern California as follows: 4 in the U. S. National Herbarium, 3 in the Herbarium of S. B. Parish, 2 in my own herbarium from Mr. S. B. Parish. Type specimen is S. B. Parish's no. 2643, from the Mouth of Santa Ana Cañon, California, April 18, 1893, in the Herbarium of S. B. Parish.

Plantago oblonga sp. nov.

A light *cinereous-green acaulescent annual: leaves* crowded, ascending to erect, several, *linear or slightly wider above the middle*, involute at the apex, callous-tipped, entire, *the petioles not distinguishable*, semi-clasping at the base, 30–50 mm. by 2–3 mm., *glabrous except a mass of wool upon and about the base: scapes* basal, ascending to erect, solitary to several, *equalling or surpassing the leaves*, 40–75 mm. high, pubescent: *spikes with the flowers imbricated*, erect, oblong, 15–20 mm. by 8 mm., pubescent: *bracts rigid-herbaceous, sometimes sub-foliaceous, surpassing the basal to equalling the apical flowers, linear, blunt*, 5–10 mm. by 0.5–0.75 mm., slightly pubescent at the base: *calyx* slightly pubescent, its *divisions scarious, with light green sub-coriacious midribs, broadly oblong except the outermost*, rounded, 3 mm. long: *corolla* surpassing the calyx by the length of the *lobes*, which are strongly reflexed, two times as long as the constricted throat, *triangular-ovate, acute or obtuse*, sub-auriculate at the base, 2 mm. by 1 mm, *white:* stamens four, just exserted from the tube: *pyxis* equalling the calyx, *broadly oblong*, rounded, 3 mm. by 1.5 mm., *circumscissile just below the middle:* seeds two, dark brown, oblong, finely pitted.

Three sheets or specimens have been examined from the Colorado Desert in California, as follows: 1 in the U. S. National Herbarium, 2 in the Herbarium of the Missouri Botanical Garden. Type specimen is from C. R. Orcutt's collection from the Colorado Desert, San Diego County, California, April, 1870, in the U. S. National Herbarium.

Plantago ignota sp. nov.

A fuscous-green sub-caulescent coarse annual, generally villous: *leaves* crowded, spreading to ascending, several, *linear to lanceolate-linear*, acute at the apex, callous-tipped, entire, *narrowed to the margined semi-clasping petiole*, 60–100 mm. by 2–4 mm., *3-ribbed*, villous below to scarcely pubescent above: *peduncles* axillary, several, *stout, shorter than the leaves*, 30–100 mm. long, pubescent: *spikes very coarse with the internodes at length just surpassing the flowers* ascending to erect, *long-cylindrical*, 50–60 mm. long, villous: *bracts thick-herbaceous, one and one half to two times as long as the flowers, linear to slightly attenuate, abruptly callous-tipped*, 5–10 mm. by 1–1.25 mm., very silky-villous: *calyx* very villous, its *divisions scarious, with green midribs*, oblong, rounded, 4 mm. long: *corolla* little surpassing the calyx, its *lobes* reflexed, much longer than the very short throat, *round-ovate, obtuse, sub-auriculate at the base*, 1.5–2 mm. by 1.75 mm., *tawny to white: pyxis* equalling the calyx, *narrowly obovate*, 3 mm. by 1.5 mm., *circumscissile at the middle*: seeds two, very dark brown, narrowly oblong.

Five specimens have been examined from Arizona and northern Lower California, as follows: 1 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium, 2 in the Herbarium of the Philadelphia Academy of Sciences, 1 in the Herbarium of S. B. Parish. Type specimen is E. A. Mearns' no. 199, from Fort Verde, Arizona, April 3, 1888, in the Columbia University Herbarium.

Plantago speciosa sp. nov.

A green acaulescent annual with a rather coarse root: *leaves* crowded, erect, numerous, *linear, long-tapering to the acute apex*, callous-tipped, *with scattered slender callous teeth, the petioles not distinguishable*, 70–120 mm. by 2–3 mm., *3-nerved, glabrate on the upper surface to woolly-lanate throughout: scapes* ascending to erect, *rather stout*, several to numerous, *equalling to surpassing the leaves*, 70–120 mm. high, appressed pubescent: *spikes many-flowered, coarse, hoary, conspicuous, erect, cylindrical*, 20–40 mm. by 8 mm.: *bracts* rigid, *herbaceous, scarious-sided below the middle about the length of the calyx, triangular-lanceolate, widest at the base, blunt at the apex*, 3–4 mm. long, *silky-villous: calyx divisions scarious, with brown or purple midribs, obovate-oblong*, rounded, 3–3.5 mm. long: *corolla conspicuous* its *lobes* strongly reflexed *orbicular-ovate, obtuse*, 2 mm. by 2 mm., *very white, summit of the throat very dark brown*: stamens four, just exserted from the tube: style equalling the lobes: *pyxis curpassing the calyx, broadly oval*, obtuse, 3 mm. by 2 mm., *circumscissile at or just below the middle*: seeds two, very dark brown, oblong, rough.

Two sheets or specimens have been examined from California, as follows: 1 in the Herbarium of Mr. G. B. Grant, of Lexington, Massachusetts, 1 in my own herbarium from Mr. Grant. Type specimen is G. B. Grant's no. 2412, from Avalon, Santa Catalina Island, California, in the Herbarium of E. L. Morris, the specimen loaned for reference to the U. S. National Herbarium.

PLANTAGO ERECTA Morris, Bull. Torr. Club, **27**: 118. 1900

P. Patagonia var. *Californica* Greene, Man. Bay Reg. 236. 1894; not *P. Californica* Greene, Bull. Calif. Acad. Sci. **1**: 123. 1885.

A green acaulescent *annual, generally pubescent or sparingly villous, noticeably erect in habit: leaves* basal, *strict*, several to numerous, *narrowly linear, obtuse at the apex, almost truncately and brown callus-tipped, entire, usually involute towards the apex,* slightly clasping at the base, 40–140 mm. by 1–4 mm., *3-ribbed, the outer very near the margins and frequently forming a part of the involution: scapes strictly erect* or rarely ascending, *stout*, 35–240 mm. high: *spikes thick*, four- to many-flowered, *oval-capitate to oblong-cylindrical*, 10–40 mm. by 6–8 mm.: *bracts small, rigid, herbaceous, scarious-sided, about one half as long as the sepals, deltoid-lanceolate to ovate,* obtuse or acute: *calyx divisions thick, herbaceous, scarious-sided,* green to brownish, oblong, obtuse, 3 mm. long: *corolla* with the tube just surpassing the calyx, its *lobes* strongly reflexed, two to three times as long as the constricted dark brown throat, *orbicular, obtuse or abruptly apiculate*, 2.25 mm. by 2 mm., *white*: stamens shorter than the petals or (dimorphic) very long exserted from the tube: *pyxis one third surpassing the calyx, ovate,* truncate or retuse, 4–5 mm. by 2 mm., *circumscissile at the lower third*, purple: seeds two, dark brown, oblong, finely pitted.

Fifty-eight sheets or specimens have been examined from California and Oregon, as follows: 11 in the U. S. National Herbarium, 2 in the Gray Herbarium, 4 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium, 3 in the Herbarium of the New York Botanical Garden, 18 in the Herbarium of the California Academy of Sciences, 5 in Dr. E. L. Greene's Herbarium, 1 in the Herbarium of the University of Wisconsin, 7 in the Herbarium of S. P. Parish, 1 in the Herbarium of W. N. Suksdorf, 1 in the Herbarium of G. B. Grant, 4 in my own herbarium.

Plantago obversa sp. nov.

P. erecta Morris, in part, Bull. Torr. Club, **27**: 118. 1900.

A *coarse* sub-caulescent *annual: leaves* crowded, ascending to erect, rather slender, numerous, *linear, long-tapering to the apex,* herbaceous or callous-tipped, *with scattered long callous-subulate teeth, the petioles not distinguishable,* 70–200 mm. by 2–3 mm., *3-ribbed, glabrate to villous: scapes* spreading to erect, *rather stout*, solitary to several, *surpassing the leaves* 70–300 mm. high, appressed pubescent: *spikes very coarse,* erect, *oblong to cylindrical,* 15–40 mm. by 8 mm., *pubescent: bracts small,* rigid, *herbaceous, scarious-sided, about one half as long as the sepals, ovate or sometimes deltoid-lanceolate and then slightly more than* *one half as long as the sepals,* obtuse or acute, pubescent : *calyx* pubescent, its *divisions scarious, with thick brown herbaceous midribs,* spatulate-oblong, rounded, 3 mm. long : *corolla conspicuous,* surpassing the calyx, its *lobes* strongly reflexed, two to three times as long as the constricted throat, *orbicular, obtuse or abruptly short-apiculate,* 2 mm. by 2 mm., white : stamens four, just exserted from the tube : *pyxis one-third surpassing the calyx, ovate,* rounded, 3.5 mm. by 2 mm., *circumscissile just below the middle :* seeds two, very dark brown, oblong, finely-pitted.

Eleven specimens have been examined from California, as follows : 1 in the U. S. National Herbarium, 1 in the Gray Herbarium, 3 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium, 4 in the Herbarium of the California Academy of Sciences, 1 in the Herbarium of Dr. E. L. Greene. Type specimen is Belle Sumner Angier's no. 21, from Del Mar, California, May, 1894, in the Herbarium of the Missouri Botanical Garden.

DEPT. OF BIOLOGY, WASHINGTON, D. C., HIGH SCHOOLS.

Revision of the North American Species of Heterocladium*

By G. N. Best

(With Plates 13 and 14)

HETEROCLADIUM Bryol. Eur. fasc. 49–51. 1852

Somewhat large to rather small plants growing on stones, rocks, rotten wood and the ground. Stems rigid, stoloniform, sparingly radiculose and paraphyllose, complanately branched; leaves more or less papillose, margins plane and papillose-dentate, costa short, thin, not rarely obsolete; stem leaves triangular-ovate, narrowly acuminate, cordate, subclasping; branch leaves ovate to ovate-lanceolate, acute, obtuse or acuminate; pedicels smooth, capsules inclined to horizontal, short-necked, annulate; exostome well developed; endostomial band one third to one half the length of the teeth with well-developed segments and cilia; operculum conic to rostrate; calyptra cucullate, fugacious.

The short, thin, usually broad costa and the elongated, circumscribed leaf-cells of the basal-central area separate the members of this genus from the closely related *Thuidia*. The *Pseudoleskeae*, while more distinctly plants of high altitudes, in their distribution closely approximate the range of the *Heterocladia*, differing however from these in having their stem leaves plicate with margins recurved and costae well developed.

Key to Species

Leaves smooth.
  Operculum conic.
    Ultimate branch leaves spreading. — *H. procurrens.*
Leaves more or less papillose.
    Ultimate branch leaves imbricate. — *H. squarrosulum*
  Operculum rostrate.
      Cells of branch leaves with 2 to 5 papillae.
    Ultimate branch leaves acute or short acuminate. — *H. heteropterioides.*
      Cells of branch leaves with 1 to 3 papillae.
    Ultimate branch leaves long to acuminate, secund. — *H. Macounii.*

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* The material on which this revision is based was furnished chiefly by the New York Botanical Garden, the Geological Survey of Canada and the Agricultural Department at Washington. My thanks are due those having these collections in charge and also Mrs. Britton for invaluable assistance, Miss Alexandrina Taylor for the care with which she has executed the drawings and M. Jules Cardot for notes and specimens

1. HETEROCLADIUM PROCURRENS (Mitt.) Rau & Hervey, Cat. 38, 1880

Pterogonium procurrens Mitten, Journ. Linn. Soc. **8**: 37. *pl.* 7. 1865.

Heterocladium procumbens Jaeg. and Sauerb. Adumb. 246.

Hypnum (*Heterocladium*) *procurrens* L. & J. Mosses of N. A. 321. 1884.

Heterocladium aberrans Ren. & Card. Bot. Gaz. **15**: 59. 1890.

Plants rather stout, in spreading tufts, pale green to yellowish green. Stems, with central strand, 4 to 8 cm. long, stoloniform, pinnately branched; smaller branches simple, attenuate; larger branches (secondary stems) closely pinnate; paraphyllia few, linear-lanceolate, serrate: stem leaves scariose, distant, 1.4 to 1.8 mm. long, .6 to .9 mm. wide; from an erect, auriculo-cordate, subclasping base broadly triangular-ovate, abruptly subfiliform acuminate, spreading-recurved, margins crenate-serrate, costa thin, divided, one branch longer, disappearing below the middle; larger branch leaves similar, not auriculate, subdistichous, spreading, gradually acute to narrowly acuminate; smaller branch leaves ovate-lanceolate, lower acute, upper obtuse; cells of stem leaves smooth, clear, multiform, those of central-basal area linear, obtusely pointed, .006 mm. wide, 4 to 6 times as long, the others broader and shorter, varying from oblong-fusiform to oval-rhombic; apical cells linear. Dioicous; perichetial bracts radiculose at base, whitish, outer broadly ovate, inner subvaginant, from an oblong base, long narrowly acuminate, serrate, flexuose-spreading, scarcely costate; pedicels smooth, flexuose, curved above, about 2 cm. long; capsules reddish brown, oval-oblong, asymmetric, horizontal, pachydermous, curved and constricted when deoperculate; urn 1.5 to 2 mm. long, 1 mm. wide; exothecial cells thick-walled, oval-oblong; annulus broad, deciduous; exostomial teeth yellowish, margined, closely articulated, confluent at the reddish base; endostomial band scarcely one half the length of the teeth; segments split; cilia 1 to 3, nodose; operculum conic, apiculate; spores smooth, .013 to .016; matures in June; on rocks, more rarely on roots of trees or the ground.

Type locality, North America; type in Hb. Mitten. British North America, Drummond.

Montana (Holzinger & Blake, Williams); Idaho (Leiberg, Sandberg); Washington (Allen, Röll); British Columbia (Macoun).

EXSICCATI: Ren. & Card. Musc. Am. Sept. 94 as *H. aberrans.*

Macoun Can. Musc. 484 and 692 as *H. homoeopterum.*

Macoun Can. Musc. 498 and 690 as *H. procurrens.*

U. S. Nat. Hb. 138 as *H. aberrans.*

U. S. Nat. Hb. Plants of N. Idaho 1122 as *H. aberrans.*

Holzinger & Blake, Plants of N. W. Montana 47.

The characters of *H. procurrens* are fairly constant and well marked. The leaves, sub-shining and spreading, wet or dry, make its recognition easy. In a few specimens the leaves when dry were erect-spreading but when moistened became spreading. I am indebted to Dr. Mitten for a portion of the type.

2. HETEROCLADIUM SQUARROSULUM (Voit) Lindb. Musc. Scand. 37. 1879

Hypnum squarrosulum in Sturm D. Fl. **2**, fasc. 11. 1810.

Hypnum dimorphum Brid. Spec. Musc. **2**: 149. 1812. Lesq. & James, Manual Mosses N. Am. 321. 1884.

Heterocladium dimorphum Bry. Eur. fasc. 49–51. *t. 479.* 1852.

Plants rather small, in thin spreading tufts, pale yellowish green, rarely deep green. Stems, with rudimentary central strand, 3–6 cm. long, stoloniform, radiculose, irregularly branched; smaller branches simple, larger (secondary stems) pinnate, rarely bipinnate; paraphyllia multiform, roundish ovate to narrowly lanceolate, serrate; leaves of primary stems variable, the lower often rudimentary, the upper obscurely two-ranked, *papillose, subscariose*, .5–.7 mm. wide, .7–.9 mm. long, costa short, thin, divided or bicostate, not rarely obsolete; from a decurrent, cordate, subclasping base broadly round-ovate, abruptly subfiliform acuminate, spreading recurved, margins plane, crenulate-serrulate; leaves of the secondary stems loosely appressed-imbricated when dry, erect-spreading when moist, broadly ovate, serrulate, obtuse to short acuminate; ultimate branch leaves roundish ovate, rounded-obtuse, rarely subacute; leaf cells of the basal-central area of primary stems nearly smooth, clear, linear, about .006 mm. wide, 3–6 times as long, in some passing through the middle into the acumen, in others surrounded by a broad border of shorter cells, varying from roundish quadrate to oblong-oval, with a subcentral papilla on both surfaces; leaf cells of the branch leaves similar, those of the basal-central area shorter, the border cells sometimes hexagonal-quadrate. Dioicous; perichetial bracts radiculose at base, scariose, flexuose-spreading, long acuminate, serrate, inner obscurely costate; pedicels smooth, flexuose, about 1.5 cm. long; capsule curved, horizontal, short-necked, pachydermous, constricted below mouth when deoperculate; urn 1.5 mm. long,

.7 mm. wide; exothecial cells roundish quadrate to oblong, thick-walled; teeth of exostome well developed, yellowish, strongly lamellate, confluent at base; endostomial band nearly one half the length of the teeth; segments as long as teeth, more or less open; cilia 1–3, nodose, scarcely appendiculate; annulus of two rows of large cells, deciduous in pieces; operculum short, conic, obtuse; spores smooth, .009–.012 mm.; matures in late winter or early spring; grows on rocks, roots of trees and on the ground.

From Mt. Washington, New Hampshire (Allen, James), north through Newfoundland (Waghorne), New Brunswick (Moser), Labrador (Waghorne) to Greenland (Fl. Gr.); and from Montana (Williams) northwestward. Idaho (Leiberg, Röll); Hector, Rocky Mts. (Macoun). Found in fruit by R. S. Williams and John Moser. Of wide range but rare and local.*

EXSICCATI: Macoun Can. Musc., 660 and 687 as *H. dimorphum.*

Macoun, N. F. Mosses 6 as *H. dimorphum.*

ILLUSTRATIONS: Dixon & Jameson Hand-Book Brit. Mosses *pl. 50.*

Husnot Musc. Gal., *pl. 87.*

Limpricht Die Laubmoose **2**: 817. *fig. 350.*

H. squarrosulum varies considerably from differences in habitat. When appearing on rocks at high altitudes the tufts are usually more compact, the secondary stems and branches subjulaceous and the leaves more obtuse. Growing on roots of trees or on the ground it is more diffuse, the secondary stems not so closely branched and the leaves looser and more acuminate. The subcentral papillae are good diagnostic characters. European bryologists include under *H. squarrosulum* a moss, probably a distinct species, which resembles *H. procurrens.* The leaves of the secondary stems and branches are loosely spreading, deeply concave from an erect base, roundish obtuse, the spores larger and the operculum acuminate. As found in Hb. Jaeger (N. Y. Bot. Gard.) it is 993 of Bryoth. Eur.

3. HETEROCLADIUM SQUARROSULUM COMPACTUM Mol. in Sched. Pfeffer, Bryogr. Stud. *pl. 71.* 1869

In dense, grayish green tufts. Primary stems stoloniform with rudimentary leaves, not rarely defoliate; secondary stems ascend-

* Renauld & Cardot in Musc. Amer., Sept. 49, 1892, extends the range to Washington.

ing-erect, closely branched, branches short, obtuse, terete ; leaves when dry appressed-imbricated, round-obtuse, nearly entire, resembling those of *Myurella julacea* but having a different areolation.

In Europe on exposed rocks at high altitudes. Collected by J. B. Leiberg, near Lake Pend D'Oreille, Idaho, September, 1889, on slate ledges and distributed as 175, "Mosses from Kootenai County, Idaho."

4. **Heterocladium Macounii** sp. nov.

Plants small, in dense, spreading tufts, yellowish green to golden brown. Stems, without central strand, stoloniform, 3 to 5 cm. long, irregularly branched; stems and branches curved at tips ; larger branches (secondary stems) pinnate or bipinnate, often subfasciculate, ascending-erect ; paraphyllia few, ovate to linear-lanceolate, serrate ; stem leaves close, appressed when dry, erect-spreading when moist, subsecund, narrowly costate to the middle, .3 to .4 mm. wide, .5 to .7 mm long ; from a cordate, subclasping base ovate, gradually to abruptly acuminate, spreading, tips recurved, margins plane, papillate-serrulate ; larger branch leaves ovate-lanceolate, long acuminate, serrate, more or less secund ; cells of the basal-central area of stem leaves sublinear, .005 to .007 mm. wide, 3 to 5 times as long, gradually passing into the quadrate cells of the basal angles and margins and becoming roundish quadrate to rhombic-oblong above, each cell with usually two small papillae on both surfaces near the ends of its long diameter ; apical cells of smaller branch leaves quadrate, crowned with two papillae. Dioicous ; perichetial bracts whitish, inner long acuminate, flexuose-spreading, serrate ; pedicels smooth, shining, flexuose, about 1.5 cm. long ; capsules oblong, gradually tapering to a short neck, horizontal, pachydermous, reddish brown, lightly constricted under mouth and subpendant when deoperculate ; urn .8 mm. wide, 1.5 to 2 mm. long ; exothecial cells elliptical-oblong ; exostomial teeth yellowish brown, strongly lamellate, confluent into a reddish basal band ; endostomial band nearly one half the length of the teeth; segments somewhat open, as long as the teeth ; cilia 1 to 2, nodose-appendiculate ; annulus broad, of two rows of cells, deciduous ; operculum conic, obliquely rostellate ; spores .009 to .012 ; matures in spring. Grows on rocks.

Type locality, Vancouver Island ; type in Herbarium of New York Botanical Garden ; collected by John Macoun, June 2, 1893, and distributed as *Heterocladium Vancouveriense* Kindb., Can. Musc. 638.

Although collected at several points on Vancouver Island it does not appear to have been found elsewhere. In its general appearance it resembles *H. squarrosulum*. It is, however, smaller and the branch leaves alone suffice to distinguish one from the other.

Forms analogous to *H. Macounii* are found on the mountains of England, Scotland, Belgium, Germany and probably in the adjoining countries, and are usually referred to *H. heteropterum* (Bruch), from which they differ in being stouter, yellowish green to golden-brown, branch leaves lanceolate, often secund, and leaf-cells longer and narrower. As no capsules were found on the specimens examined their differentiation from both *H. Macounii* and *H. heteropterum* must be based solely on the vegetative characters.

5. **Heterocladium heteropterioides** sp. nov.

Plants quite small, in intricate spreading tufts, dark green. Stems, without central strand, 3–6 cm. long, variously divided and irregularly branched; larger branches (secondary stems) ascending-erect, pinnate to bipinnate; branchlets fasciculate, often tufted; leaves of primary stems erect-spreading, lower sometimes recurved at tips, papillose, .25–.35 mm. wide, .4–.5 mm. long; from a cordate, subdecurrent base, triangular to ovate-lanceolate, finely pointed, margins plane, papillose-denticulate, costa thin, usually short, rarely narrow and longer, reaching the middle; leaves of secondary stems appressed when dry, erect-spreading when moist, cordate-triangular, acute to acuminate, margins papillose-serrulate; ultimate branch leaves ovate, acute to narrowly acuminate; cells of the basal-central area of stem leaves, not so clearly differentiated as in the preceding species, oblong to sublinear, about .006 mm. wide, 2–4 times as long, those of the basal margins quadrate, passing into oval-oblong above, each cell with 2–5 small, bead-like, irregularly distributed papillae on both surfaces; apical cells of ultimate branch leaves quadrate to oblong, crowned with 2–4 papillae. Dioicous; perichetial bracts whitish, flexuose-spreading, inner long and narrowly acuminate, margins denticulate; pedicels smooth, flexuose-curved, about 1.5 cm. long; capsule oval, horizontal, short-necked, pachydermous, contracted under mouth when deoperculate; urn 1.5 mm. long, .7 mm. wide; exothecial cells thick-walled, oval to oblong; annulus broad, of 2–3 rows of large cells, deciduous; exostomial teeth yellowish, strongly lamellate, confluent at base; endostomial band about one half the length of the teeth; segments slightly open; cilia

1–2, nodose; operculum conic-rostrate, straight or oblique, nearly as long as capsule: spores smooth, .010–.012 mm.; matures in summer; grows on rocks and stones in damp places.

Type locality, Washington; type collected by J. A. Allen in Upper Nesqually Valley, Oct. 4, 1898; type with mature capsules.

Idaho (Leiberg); Oregon (Howell); British Columbia (Macoun); Vancouver Island (Macoun).

EXSICCATI: Macoun Can. Musc. 267 and 108 as *H. heteropterum.*

Macoun Can. Musc. 108 as *H. Vancouveriense.*

H. heteropterioides is apparently confined to the Northwest, rare in fruit and often associated with *Hypnum occidentale.* The apical cells of the ultimate branch leaves of the closely related *H. heteropterum* are hyaline, long oval, with a single papilla at their distal ends. The leaf-cells moreover on both surfaces have one or two, usually two, small, rounded papillae near the ends of their long diameters. As this species can be confidently looked for along the Atlantic coast, from Newfoundland northward, these characters will serve to distinguish it from *H. heteropterioides.*

6. **Heterocladium heteropterioides filescens** var. nov.

In widely spreading tufts, dark green passing yellowish green. Stems prostrate, 8–10 cm. long, or longer, sparingly branched; stems and branches filiform; leaves smaller; papillae as in type; sterile.

Type of variety collected by W. B. Wittemeyer in canyon of the Stillaquamish River, Washington, June, 1892. Same range as the type and about as common.

EXSICCATI: Macoun Can. Musc. 688 as *H. heteropterum.*

Resembling the European *H. heteropterum* var. *flaccidum* (Br. & Sch.), var. *fallax* Milde, but differing in being stouter, tufts not so compact, stems longer and leaf cells with more papillae.

DOUBTFUL OR EXCLUDED SPECIES

1. *Heterocladium Vancouveriense* Kindb. Cat. of Canadian Plants **6**: 183. 1892, is *Hypnum occidentale** S. & L., Icon. Musc. Supp. 105. *pl. 81.* 1874.

* See also The Bryologist, **4**: 13. 1901.

2. *Heterocladium homoeopterum* C. M. & K., distributed as Can. Musc. 484, is *H. procurrens.*

3. *Heterocladium frullaniopsis* C. M. & K. Cat. Canadian Plants **6**: 183. 1892. Mr. John Moser, who is credited with the collecting of this species at Canaan Forks, N. B., writes me that Professor Macoun is unable to find it in his collection and that he has not succeeded in getting a specimen from Dr. Kindberg but kindly sends what he supposes to be a duplicate of the type. This is a rather stout form of *Pterigynandrum filiforme*, approaching the var. *decipiens.*

Explanation of Plates

These plates were drawn from a magnification twice as great as expressed in the numbers which represent the magnification of the figures as they stand in the reproduction.

Plate 13. Heterocladium procurrens

1. Plant, natural size.
2. Portion of stem showing arrangement of leaves. × 11½.
3, 4, 5. Outlines of stem leaves. × 11½.
6. Basal portion of stem leaf. × 87½.
7. Cells from middle portion of stem leaf. × 87½.
8. Cells from center of stem leaf; showing the two veins the walls of which are shaded. × 120.
9. Apex of stem leaf. × 87½.
10. Paraphyllium. × 57½.
11. Paraphyllium showing width of walls. × 87½.
12. Ultimate branch showing arrangement of leaves. × 11½.
13. Leaf from ultimate branch. × 15.
14. Basal portion of branch leaf. × 87½.
15. Apex of same. × 87½.
16. Capsule (drawn dry). × 8.
17. Operculum. × 8.

Heterocladium squarrosulum

18. Plant, natural size.
19. Portion of primary stem showing arrangement of leaves. × 18½.
20, 21. Outlines of primary stem leaves. × 18½.
22. Basal portion of primary stem leaf. × 120.
23. Apex of same. × 120.
24. Central cells from primary stem leaf. × 207½.
25. Marginal cells from the same. × 207½.
26. Paraphyllium showing cells. × 87½.
27, 28. Paraphyllia. × 45.
29, 30. Outlines of secondary stem leaves. × 18½.
31. Apex of secondary stem leaf. × 120.
32. Cross section of secondary stem leaf showing papillae. × 270.

33. Portion of ultimate branch showing arrangement of leaves when moist. × 18½.
34. Portion of ultimate branch showing arrangement of leaves when dry. × 18½.
35, 36, 37. Outlines of ultimate branch leaves. × 25.
38. Oblique view of ultimate branch leaf showing papillae. × 87½.
39. Apex of ultimate branch leaf. × 120.
40. Operculum. × 15.

PLATE 14. HETEROCLADIUM MACOUNII

1. Plant, natural size.
2. Portion of secondary stem showing arrangement of leaves. × 18½.
3, 4. Outlines of secondary stem leaves. × 25.
5. Basal portion of secondary stem leaf. × 120.
6. Apex of same. × 120.
7. Apex of some of the secondary stem leaves. × 120.
8. Central cells from secondary stem leaf. × 210.
9. Marginal cells from same. × 210.
10. Marginal cells showing papillæ. × 500.
11. Cross section of secondary stem leaf showing papillæ. × 270.
12, 13, 14. Paraphyllia. × 57½.
15. Outline of ultimate branch leaf. × 35.
16. Apex of ultimate branch leaf. × 120.
17. Cross section of stem. × 57½.
18. Capsule. × 8.
19. Operculum. × 15.

HETEROCLADIUM HETEROPTERIOIDES

20. Plant, natural size.
21. Portion of stem showing arrangement of leaves. × 18½.
22, 23. Outlines of stem leaves. × 25.
24, 25. Paraphyllia. × 162½.
26. Basal portion of stem leaf. × 210.
27. Apex of same. × 210.
28. Central cells from stem leaf. × 210.
29. Marginal cells showing papillæ. × 500.
30. Cross section of stem leaf showing papillæ. × 270.
31, 32. Outlines of ultimate branch leaf. × 45.
33. Apex of ultimate branch leaf. × 210.
34. Cross section of stem. × 57½.
35. Capsule. × 8.
36. Operculum. × 11½.
37. Portion of annulus and capsule. × 120.

Proceedings of the Club

WEDNESDAY EVENING, NOVEMBER 28, 1900

President Brown in the chair. Eleven persons present.

The following active members were elected: Mr. Howard J. Banker, Williamsport, Pa.; Dr. Wm. Lamson, 50 East 31st Street, New York City; Mr. Roland K. Brown, 320 Broadway, New York City; Mr. R. S. Williams, New York Botanical Garden, New York City.

The scientific program consisted of a paper, by Mr. Frederick H. Blodgett, on "The Seed and Seedling of *Lilium tenuifolium* Fisch." in which the seed characters were presented in detail and with comparison with those of *Erythronium*. Interesting differences were found in the size of the *Lilium* seeds, about 93% of which germinated, the small seeds as quickly as the larger though with less vigorous subsequent growth.

TUESDAY EVENING, DECEMBER 11, 1900

This meeting was held at 4 P. M. at the Botanical Garden, Bronx Park, and was preceded by a visit to the conservatories and grounds under the guidance of Dr. Britton. Dr. Rusby was in the chair and 39 persons were present; Prof. F. E. Lloyd acted as Secretary *pro tem.*

The committee on program was authorized to announce one meeting of the Club monthly, to be held at the New York Botanical Garden each month at 4 P. M.

The committee appointed November 28th to consider a proposed change in the Constitution relative to distribution of memoirs recommended the proposed change.

The program included a brief address by Prof. Charles E. Bessey, explanations by Dr. Britton of the plan of the Garden Conservatories, and the exhibition by Miss Anna M. Vail of valuable books recently added to the Garden Library.

Mr. J. E. Kirkwood presented a paper on "The Embryology of the Cucurbitaceae." Mr. R. M. Harper exhibited a very interesting series of specimens and photographs of plants from Georgia, and gave notes on their habitat and distribution. Dr. J. K. Small described a series of tree and shrub species from the South, with critical notes. Dr. D. T. MacDougal presented notes on the bulbils of *Lysimachia terrestris.* They are formed during the latter part of the season, in the axils of many leaves, and are morphologically branches. On completing their growth they pass into rhizomes. They are killed by freezing and desiccation.

Another paper was by Dr. M. A. Howe, "Remarks on rare North American Hepaticae." The first hepatic discussed was a rare species of *Riccia*, discovered by Mr. R. M. Harper, during the past summer, at Athens, Georgia.

Dr. Howe also furnished a brief account of a collection of hepaticae, made in the Yukon Region, by Mr. R. S. Williams—a collection of much interest, inasmuch as it contained one species which appears to be entirely new, one which has not heretofore been reported from this continent, five others new to the Alaskan region, and besides these, two or three which have been rarely collected in America. The report upon Mr. Williams' hepaticae is soon to be published.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Beal, W. J. A few Observations of Root-hairs. Plant World, **3**: 182–184. *pl. 8.* D. 1900.

Best, G. N. *Hypnum occidentale* S. & L. Bryologist, **4**: 13. Ja. 1901.

Best, G. N. Vegetative Reproduction of Mosses. Bryologist, **4**: 1–3. Ja. 1901.

Cardot, J. Recherches anatomique sur les Leucobryacées. Mém. Soc. Sci. nat. et math. Cherbourg, **32**: 1–84. *pl. 1–19.* 1900.

Carruthers, W. & Smith, A. L. A Disease in Turnips caused by Bacteria. Jour. Bot. **39**: 33–36. Ja. 1901. [Illust.]

Christ, H. Fougères collectées par M. le Dr. J. Huber au Bas-Ucayali et au Bas-Huallaga (Alto Amazonas) en octobre–décembre 1898. Bull. Herb. Boissier, II. **1**: 65–76. 29 D. 1900.

New species in *Polybotrya* and *Selaginella* (4).

Coville, F. V. & Rose, J. N. Two Editions of Sitgreave's Report. Jour. Bot. **38**: 443, 444. N. 1900.

Dittrich, G. Zur Entwickelungsgeschichte der Helvellineen. [Inaug. Dissert.] Pp. 1–36. Breslau, 1898.

Fischer, G. Beitrag zur vergleichenden Anatomie der Blätter der Compositen. [Inaug. Dissert.] Pp. 1–110. Erlangen, 1898. [Illust.]

Gallardo, A. Algunos casos de teratologia vegetal: Fasciación, proliferación y Sinantia. An. Mus. Nac. Buenos Aires, **6**: 37–45. *pl. 1–3.* 23 Ap. 1898.

Gallardo, A. Notas fitoteratológicas. Com. Mus. Nac. Buenos Aires, **1**: 116–124. *pl. 4.* 29 S. 1899.

Graebner, P. Sparganiaceae. Das Pflanzenreich, **4**[10]: 1–24. *f. 1–5.* 30 O. 1900.

Description of all species.

Graebner, P. Typhaceae. Das Pflanzenreich, **4**[8]: 1–18. *f. 1–4.* 1900.

Description of all species.

Grosse, F. E. Beiträge sur vergleichenden Anatomie der Onagraceen. [Inaug. Dissert.] Pp. 1–67. Dresden. [Illust.]

Harris, C. W. Lichens—The Usneas. Bryologist, **4**: 13–15. *pl. 1, 2.* Ja. 1901.

Hennings, P. Einige neue Uredineen aus verschiedenen Gebieten. Hedwigia (Beiblatt), **39**: (153)-(155). 30 O. 1900.

New species in *Puccinia* from Venezuela and Argentina.

Hirn, K. E. Monographie und Iconographie der Oedogoniaceen. Acta Soc. Sci. Fennicae, **27**: i.–iv, 1–394. *pl. 1–64.* 1900.

Several new American species described.

Hollick, A. An Example of deductive Reasoning. Plant World, **3**: 184, 185. D. 1900.

A note on the Quaternary flora of Staten Island.

Holm, T. *Erigenia bulbosa* Nutt. A morphological and anatomical Study. Am. Jour. Sci. IV. **11**: 63–72. *f. 1–6.* Ja. 1901.

Holzinger, J. M. A new *Hypnum* from Montana. Bryologist, **4**: 12. Ja. 1901.

Holzinger, J. M. *Grimmia Manniae* and *Grimmia Holzingeri.* Bryologist, **4**: 10–12. Ja. 1901.

Holzinger, J. M. *Webera proligera* (Lindb.) Kindb. in North America. Bryologist, **4**: 12. Ja. 1901.

H[ooker], J. D. *Adesmia boronioides.* Curt. Bot. Mag. III. **56**: *pl. 7748.* 1 D. 1900.

Native of southern Patagonia.

H[ooker], J. D. *Dasylirion quadrangulatum.* Curt. Bot. Mag. III. **56**: *pl. 7749.* 1 D. 1900.

Native of Mexico.

H[ooker], J. D. *Passiflora capsularis.* Curt. Bot. Mag. III. **56**: *pl. 7751.* 1 D. 1900.

Native of Brazil.

Huber, J. Sur la végétation du Cap Magoary et de la côte atlantique de l'Ile de Marajo (Amazone). Bull. Herb. Boissier, II. **1**: 86–107. *pl. 1–6.* 29 D. 1900.

An ecological paper, accompanied by six half-tone engravings of typical plant-communities.

Huntington, J. W. Notes on *Buxbaumia.* Bryologist, **4**: 8, 9. Ja. 1901.

Krüger, F. Der anatomische Bau des Stengels bei den Compositae Cichoriaceae. [Inaug. Dissert.] Pp. 1–80. Göttingen, 1898. [Illust.]

Lindman, C. A. M. Einige neue brasilianische Cyclanthaceen. Bihang k. Svenska Vet.-Akad. Handl. **26**[8]: 1–11. *pl. 1–4.* 1900.

Carludovica rivularis, C. Mattogrossensis, and *Evodianthus Freyreissii* sp. nov.

Lindroth, J. I. Mykologische Notizen. Bot. Notiser 1900: 241–255. 1900.

Includes description of *Aecidium sanguinolentum* sp. nov. on various species of *Geranium*, among which is *G. maculatum* from North America.

Lister, A. On the Cultivation of Mycetozoa from Spores. Jour. Bot. **39**: 5–8. Ja. 1901.

Macoun, J. M. A List of the Plants of the Pribilof Islands. The Fur Seals and Fur Seal Islands of the North Pacific Ocean, 559–587. *pl. 87–94.* Washington, 1899.

Includes new species in *Polygonum*, *Elymus*, *Russula* and *Flammula*; also diagnoses and illustrations of others originally described elsewhere.

Magnus, P. Einige Bemerkungen zu Ernst Jacky's Arbeit über die Compositenbewohnenden Puccinien vom Typus der *Puccinia hieracii.* Hedwigia (Beiblatt), **39**: (147)–(150). 30 O. 1900.

Miyaké, K. On the Starch of evergreen Leaves and its Relation to Carbon Assimilation during the Winter. Bot. Mag. Tokyo, **14**: 44–49. 20 Ap. 1900.

Rabenhorst, W. Die Wanderung des Kalkoxalats in der Pflanze. [Inaug. Dissert.] Pp. 1–56. Siegen, 1898. [Illust.]

Radlkofer, L. Sapindaceae. Flora Brasiliensis, **13**^{3}: 225–344. 1 Jl. 1892; 345–464. 1 S. 1897; 465–658. *pl. 58–123.* 1 Ap. 1900.

Includes many new species in various genera.

Rehm, H. Beiträge zur Pilzflora von Südamerika. VIII. Discomycetes (Nachtrag). IX. Hypocreaceae. X. Microthyriaceae. XI. Dothideaceae. Hedwigia, **39**: 209–224. *pl. 11. f. 1–13.* 10 Au. 1900; 225–234. 30 O. 1900.

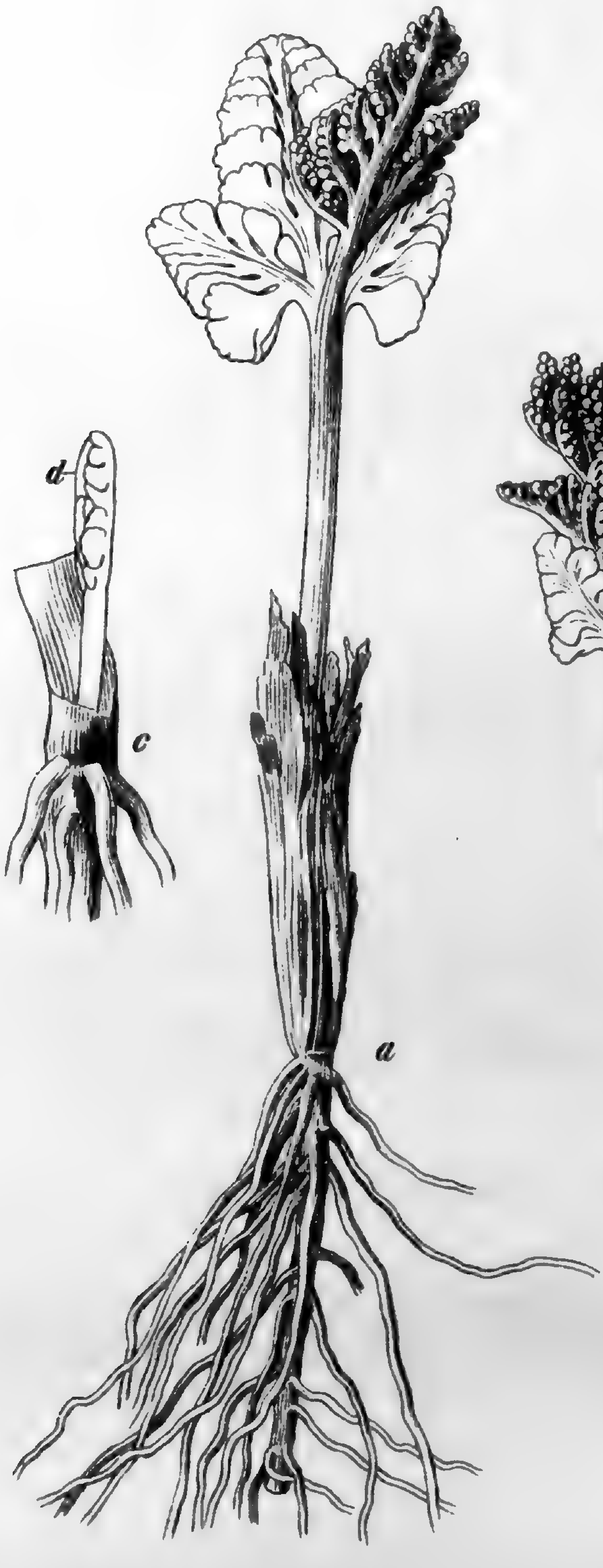
New species in *Aulographum*, *Lembosia*, *Morenoella*, *Hysterostomella*, *Lophodermium*, *Lindauella*, *Phragmonaevia*, *Patellaria*, *Leciographa*, *Chlorospleniella*, *Agyrium*, *Sorokina*, *Agyriopsis*, *Physmatomyces* (gen. nov.), *Tapesia*, *Psorotheciopsis* (gen. nov.), *Trichobelonium*, *Pezizella*, *Dasyscypha*, *Sphaeroderma*, *Nectria*, *Hypomyces*, *Clintoniella*, *Calonectria*, *Oomyces*, *Myiocopron*, *Microthyrium*, *Vizella*, *Seynesia*, *Micropeltis*, *Saccardinula*, *Bagnisiel a*, *Phyllachora*, and *Do'hidella*.

Rendle, A. B. Supplementary Notes on the Genus *Najas.* Trans. Linn. Soc. I. **5**: 437–444. O. 1900.

Richter, C. G. Beiträge zur Biologie von *Arachis hypogaea.* [Inaug. Dissert.] Pp. 1–38. Breslau, 1899.

Russow, A. Beiträge zur Morphologie des pflanzlichen Zellkerns. [Inaug. Dissert.] Pp. 1–41. *pl. 1, 2.* Rostock, 1899.

Smith, A. M. Hylocomiums of the northeastern United States. Bryologist, **4**: 3–7. Ja. 1901. [Illust.]



BOTRYCHIUM PUMICOLA

Panicum amarum dunes, with *Ipomoea acetosaefolia* on the extreme left foreground and *I. Pes-caprae* on the extreme right.

Iva imbricata dunes on the sand spit plain; a stem of *Ipomoea Pes-caprae* in the foreground.

Sand spit plain. *Serenoa serrulata* dunes. In the middle foreground a *Panicum repens* dune. Left foreground *Cyperus cylindricus.* *Pinus Taeda* in the background ; pine graveyard on the right.

Shell dune showing lee margin encroaching on a pure *Batis* association. On the dune *Iva frutescens.*

“ *Plantago spinulosa* Dcne. (herbier du Prodromus) Ch. Wright.—Collection du Texas oriental faite en 1848–49 Dcne. en 1850.
C. d-Candolle, Mai 1900.”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VOL. 28 MARCH, 1901 No. 3

BULLETIN

OF THE

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Memoirs. (See last page of cover.)

VOL. 28 No. 3

BULLETIN

OF THE

TORREY BOTANICAL CLUB

MARCH 1901

Some small-flowered Species of Nemophila from the Pacific Coast

BY ALICE EASTWOOD

(WITH PLATES 15–20)

Nemophila parviflora Dougl. (Trans. Linn. Soc. **17**: 275) has been an appropriate name under which all the small-flowered *Nemophilae* of the Pacific Coast have been placed. In this heteromorphous collection, as described in Gray's Synoptical Flora of North America (**2**: 156), two synonyms are recognized. These are *N. heterophylla* Fisch. & Mey. (Sert. Petrop. 1846. *pl. 8*), and *N. pdunculata* Dougl. (Trans. Linn. Soc. **17**: 275). Since the publication of the second edition of the Synoptical Flora, (Jan. 1, 1886), two small-flowered species have been published, *N. spatulata* Coville (Contr. Nat. Herb. **4**: 156), and *N. sepulta* Parish (Erythea, **7**: 93).

Small-flowered *Nemophilae* have been for years accumulating in the Herbarium of the California Academy of Sciences and have either been put with the undetermined species or labelled *N. parviflora*.

Considerable observation in the field added to a knowledge of these herbarium specimens has convinced the writer that, instead of one species with small flowers, there are many. This is undoubtedly one of the genera so common in California and so puzzling, where the evolutionary impulse is very strong and where new species are now being evolved.

If these *Nemophilae* had been large-flowered, numerous species would have been recognized long ago, as the differences in the

[Issued 27 March.]

corollas alone would have been sufficient to attract attention. In all, there is great variability in the leaves, some species having scarcely two leaves alike on the same plant. The calyx generally changes with age, becoming larger and thinner in fruit with the venation more evident. The auricles also change and are often wanting or abortive. The style grows after the flower expands and the style branches become more divaricate. When the corolla falls, they usually surpass the calyx. In all the species examined, the flowers proved to be hermaphrodite.* All are

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*NEMOPHILA PARVIFLORA (Dougl. MSS.), foliis pinnatifidis, lobis paucis latis subdentatis, calycis sinubus breviter appendiculatis, corollis calycem vix superantibus, placentis 2 ovulatis.

Flores parvi. Calycis appendiculi saepius brevissimi interdum evanidi, rarius post anthesin elongati. Squamae corollinae parvae, angustae.

Received both from Mr. Douglas and Dr. Scouler from the Columbia.

N. PEDUNCULATA (Dougl. MSS.), foliis pinnatifidis, calycis sinubus breviter appendiculatis, corollis calycem vix superantibus, placentis 6-ovulatis.

Habitus, calyx, corolla omnino *N. parviflorae*. Folia angustiora, longius petiolata, lobis magis integris distinctisque.

Gathered by Mr. Douglas on the Columbia.

Copied from the original place of publication, Trans. of Linn. Soc. 17: 275.

NEMOPHILA HETEROPHYLLA Fisch. & Meyer

N. pilis setulisque rectis adspersa: foliis superioribus sparsis dentato-lobatis, inferioribus oppositis subpinnati-sectis: segmentis petiolulatis rotundatis sinuato-lobatis, superioribus basi confluentibus: corolla subpelviformi: lineis inter stamina membranaceo-alatis glabris: seminibus corrugato-verrucosis, arillo calyptraeformi. Annua, gracilis, subdichotomo-ramosa, ramis elongatis. Caulis, rami atque pedunculi setis rectis reversis adspersi, subglabri. Folia inferiora opposita, petiolo longo gracili basi modice dilatato ibique pilis longis ciliato fulta, setulis pilisque longioribus adspersa, subpinnatisecta: segmentis ovato-subrotundis, 3 lin. circ. in diametro vel paulo majoribus, saepius sinuato-lobatis (lobulis rotundatis), interdum integerimis, inferioribus petiolulatis, summis tribus basi confluentibus: folia superiora sessilia, rarius opposita, plerumque sparsa, oblonga, dentato-lobata, basi cuneata ibique pilis longis barbata. Pedunculi solitarii, uniflori, gracillimi, in fructu declinati. Flores quad formam *N. atomariae* similes, sed paulo minores. Calyx hispidissimus: laciniis sub ovatis 2½ v 2 lin. longis: appendicibus multo minoribus, subovatis. Corolla calyce duplo longior, coerulea, impunctata, subpelviformis, fundo glaberrima: alis inter stamina membranaceis per totam longitudinem adnatis utrinque attenuatis subciliolatis notata. Stylus basi hispidus, bifidus, stigmatibus subcapitatis. Capsula generis, disperma (semper?). Semina flavescentia, ovata, corrugato-verrucosa, verrucis rotundatis: arillus calyptraeformis.

Hab. in Nova-California ad sinum Bodega.

Fisch. & Meyer. Sert. Petrop. 1846. Descr. with plate 8.

NEMOPHILA SPATULATA Coville

Annual, branching from the base, more or less appressed-hirsute throughout: branches procumbent, usually less than 10 cm. long, cotyledons oblong to spatulate, entire, petiolate; leaves opposite, spatulate. tapering into a margined petiole, coarsely 3–5-toothed, never pinnatifid at the apex, the teeth broad, acute or obtuse, entire: pemore or less hispid with fine or stiff bristles or hairs which on the stems and peduncles are spreading or appressed downwards, on the leaves and floral organs are upwardly appressed. The appendages at the base of the corolla differ in plants from different localities and have been taken as the chief distinguishing specific characteristic. These appendages are often difficult to discover, being so thin and small. It was learned by experience that, after the dried flower had been softened and spread out so as to show the form of the parts; if then, the corolla were allowed to become almost dry, there was a stage when the form and character of the appendages could be delineated. The color of the flowers is not known except in a few instances. This is owing to the changes incident to drying, poisoning, and age. The anthers in all the dried flowers are black or dark brown, either ovate or oblong-ovate with pointed apex and the base either cordate or sagittate.

In the figures which have been made of the flowers and leaves, the parts of the flowers have been enlarged five times, the leaves are the natural size. Where the leaves vary greatly so that no one leaf could be considered typical the outlines of more than one are drawn.

Whether all the species here described and named are finally recognized as species makes very little difference, the main object of the paper being to call attention to these plants so as to interest others in the numerous forms and provoke study and observation in the field. Except in a few instances, a series of specimens has not been available for examination. It would be well for the student to examine many flowers on the same plant and on many plants of similar appearance in any one locality to learn whether the form of the scales of the corolla is an individual or specific characteristic. In all cases where a series has come under the

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duncles shorter than the leaves, reflexed, at least in fruit: calyx 1–2 mm. long, its lobes ovate-lanceolate, acute, the appendages lanceolate, acute, about one half as long as the lobes: corolla broadly campanulate, slightly exceeding the calyx or sometimes shorter: internal scales none: filaments about as long as the corolla tubes: anthers ovate: ovary globular-ovate, hispid: stigmas sessile: capsule depressed, and just before dehiscence slightly compressed: seeds 4, globular, 1.5 to 2 mm. in diameter, pale brown, with few or no pits, sparingly scaly and with a conspicuous but deciduous caruncle.

Type specimen in the United States National Herbarium, no. 1671. Death Valley Expedition; collected August 21, 1891, in Whitney Meadows, Sierra Nevada, Tulare County, California, by Frederick V. Coville.

observation of the author the differences in the shape and insertion of these scales appear to be specific.

None of the old names, *parviflora*, *heterophylla*, *pedunculata*, have been assigned to any of these species. If, in ignorance of the types, the writer has made any synonyms, no great harm is done and the result will be less confusing than if old names were applied to new plants. The chances of making synonyms are less in the former than in the latter case, since *N. parviflora* and *N. pedunculata* were both originally collected on the Columbia River and are probably not natives of California; while *N. heterophylla* was collected at Bodega Port, a place with many plants peculiar to itself.

The species seem to naturally arrange themselves into the following sections.

Section I. Corolla tubular, minute. 1. *N. humifusa* Kellogg. 2. *N. sepulta* Parish. 3. *N. quercifolia* Eastwood. 4. *N. Austinae* Eastwood. 5. *N. macrophylla* Eastwood.

Section II. Corolla tubular-campanulate. 6. *N. inconspicua* Eastwood. 7. *N. pustulata* Eastwood. 8. *N. Kelloggii* Eastwood. 9. *N. micrantha* Eastwood. 10. *N. Plaskettii* Eastwood.

Section III. Corolla salverform. 11. *N. exilis* Eastwood.

Section IV. Corolla open campanulate. Depressed plants with a tendency to bury the fruits in the ground. Flowers rather large, leaves small, not deeply lobed. 12. *N. humilis* Eastwood. 13. *N. nana* Eastwood. 14. *N. Congdoni* Eastwood.

Section V. Corolla open-campanulate, approaching tubular-campanulate. Stems long and weak, with long internodes. Leaves lobed, generally unequal on the two sides. 15. *N. flaccida* Eastwood. 16. *N. inaequalis* Eastwood.

Section VI. Corolla rotate-campanulate or pelviform. Stems widely branching, usually weak and with long internodes. Leaves with some of the divisions petiolulate. 17. *N. hispida* Eastwood. 18. *N. divaricata* Eastwood. 19. *N. tenera* Eastwood. 20. *N. gracilis* Eastwood. 21. *N. nemorensis* Eastwood. 22. *N. glauca* Eastwood. 23. *N. fallax* Eastwood. 24. *N. exigua* Eastwood. 25. *N. pulchella* Eastwood.

Section VII. Corolla almost rotate with short tube and campanulate limb. Stems branching, winged. Leaves regularly cleft. 26. *N. alata* Eastwood.

Section VIII. Corolla rotate, without tube. 27. *N. rotata* Eastwood.

1. **Nemophila humifusa** Kellogg in herb. sp. nov.

Stems depressed, spreading in close mats and very prolific, appressed hirsute-canescent with hairs strongly deflexed: leaves opposite pinnatifid with lobes subdivided, somewhat setaceously mucronate: flowers from all the axils even the lowest on deflexed peduncles which bury themselves in the sand when in fruit: divisions of the calyx about ¾ shorter than the corolla with conspicuous auricles half as long as the sepals, spreading or deflexed: corolla white or whitish, about 2 mm. long, tubular with lobes about as long as the tube, entire or slightly toothed at apex, sparingly hispid on the back, bearded in double lines at the base within: filaments inserted a little above the base, equal or longer than the tube: anthers oblong, mucronate: capsule globose, purplish or pinkish with dark base and striated with dark purple lines vanishing towards the style, hirsute with ascending, appressed white hairs, 6–8-seeded: seeds oblong, corrugated, spotted with white scales (these soon deciduous), the calyptra stipe-like with a bract on the one side like a handle to a dipper.

This abounds in the sand hills of San Francisco and blooms very early in spring, flowering as soon as it reaches the surface of the ground and marvelously laden with fruit on the under side.

This is Dr. Kellogg's description with a few additions by the writer. It was read before the California Academy of Sciences April 3, 1878, according to the heading at the head of the description.

Besides the specimens collected by Dr. Kellogg and mounted on the same sheet with the description in his handwriting, there is a specimen collected by Mrs. Brandegee in May (year not given), another by the same collector from Point Lobos, San Francisco, April 17; another from Lake Merced, San Francisco, collected by the writer, February 25, 1895; another, by the same collector, from Warthen, Fresno County, May 11, 1893; one without flowers, from Epperson's, collected by Mr. T. S. Brandegee in 1888.

There is a variation from the typical form which has been collected by the writer at Cuyama, on the boundary between Santa Barbara and San Luis Obispo Counties and also on Stony Creek on the San Miguelito Ranch, near Jolon in the Santa Lucia Mountains, Monterey County. This is characterized by smaller, less dissected leaves, narrower and longer calyx divisions with the auricles much longer, much more slender peduncles and more slender stems and more open habit of growth. The general shape of all the parts is about the same.

2. NEMOPHILA SEPULTA Parish, Erythea, 7: 93

Hirsute; stems 5–8 (rarely 15) cm. long, procumbent; leaves usually approximate, opposite, oblong in outline, 12 mm. (rarely 5 cm.) long, the lower half narrowed into a margined petiole, above pinnately parted nearly to the midrib into 5 or 7 equal, oblong, entire, mucronulate lobes: flowers on slender peduncles, soon deflexed, and burying the capsule more or less in the soil: lobes of the calyx triangular-acuminate, ciliate, the appendages nearly as long as the lobes: corolla very small (4–6 mm. in diameter), little exceeding the calyx lobes, white, its appendages minute, consisting of narrow, vertical folds, ciliate with 1–3 short hairs: ovules 4: mature capsule 4–6 mm. in diameter, much exceeding the calyx lobes: seeds 4, irregularly triangular, rounded on the back, obscurely pitted, and with a conspicuous caruncle.

In rich soil, in meadows at Bear Valley, 6,500 ft. alt., in the San Bernardino Mountains, June, 1895, 3782 Parish, and other distributions. In some respects approaching *N. Menziesii* H. & A., from which it differs in its condensed and prostrate habit, much smaller flowers, less deeply parted style, and notably in the number and shape of the much larger seed.

3. **Nemophila quercifolia** sp. nov.

Stems decumbent or ascending, branching chiefly from the base, 10–15 cm. long, angled, cinereous with dense, fine, white, spreading bristles: internodes longer than the leaves or peduncles, 5 mm.–3 cm.: leaves opposite, ovate to ovate-oblong and suborbicular, crenately five-lobed, with the lobes again crenate or entire, 10–15 mm. long, 10–12 mm. wide, densely appressed hairy with stiff and fine hairs intermixed, somewhat pustulate at base; upper leaves almost sessile, lower on petioles somewhat longer than the blades: peduncles becoming spreading-recurved in fruit, the upper longer than the leaves, the lower ones shorter: calyx with oblong acute divisions, 2–3 m. long, 1 mm. wide, hairy on both surfaces, veins apparent: auricles short, narrow, linear, deflexed-spreading: corolla tubular, 3 mm. long, with the rounded divisions sometimes equal, shorter than the tube; appendages 2 narrow plates close to the base of the filaments, glabrous: filaments inserted above the base, longer than the tube of the corolla:

anthers small, cordate: ovary densely hispid: style shorter than the calyx with divisions half the entire length, hairy at base: pod globular, hispid: seeds 2, globular, scrobiculate: calyptra stipe-like, deciduous.

This grows in the neighborhood of *Sequoia gigantea* in the woods of Fresno County. It was first collected by Mr. T. S. Brandegee at Comstocks, near Sequoia Mills, July 24, 1892, in fruit, and by the writer in flower at Sequoia Mills, May, 1894.

It belongs to the group with corollas tubular and comes nearest to *N. sepulta* Parish. A comparison of the figures illustrating the two species will show some of the differences. The two are quite unlike also in habit, *N. quercifolia* being much more sparsely flowered and with much longer internodes. Apparently *N. quercifolia* does not bury its capsules in the ground as is the case with *N. sepulta*.

4. **Nemophila Austinae** sp. nov.

Branching from the base and dichotomously above with the stems slender, weak, decumbent or ascending, clothed with a few, scattered, deflexed bristles: internodes 2–3 times as long as the leaves, 1–6 cm.: cotyledons oval, 1 cm. long on petioles of the same length or slightly longer: leaves ovate in outline, 1–2.5 cm. long, 5–18 mm. wide, 5–7-lobed with rounded entire or lobed divisions and broad rachis, mucronate; base cuneate, tapering to margined petioles (texture thin and veiny, the surface clothed with fine, closely appressed hairs): petioles connate-clasping at the dilated base, as long as or shorter than the blades, almost wanting on the upper leaves: peduncles slender or rarely stout, recurved, somewhat tortuous, surpassed by the leaves: calyx with triangular-subulate divisions, 3 mm. long, 1 mm. wide, hairy on the outer surface and on the inner near the apex: auricles linear, more than half as long as the sepals, deflexed: corolla tubular, slightly spreading, 3.5 mm. long, with retuse divisions not so long as the tube, each with 2 short rows of hairs at base between the stamens: stamens inserted above the base, about as long as the tube: anthers heart-shaped: ovary globular, not hispid on the lower part, nor densely so on the upper: style divided half way, very short: seeds two, corrugated, with the caruncle covered with a shallow, cap-like calpytra which is neither bracted nor stipe-like.

This was collected by Mrs. R. M. Austin on Davis Creek, under trees, June, 1885. It is named in honor of Mrs. Austin whose collections have been so valuable in furthering the knowledge of the flora of California.

It comes nearest to *N. humifusa* Kellogg but is of different habit, foliage, capsule, seed, and with a corolla of a different shape.

5. **Nemophila macrophylla** sp. nov.

Stems weak, procumbent or supported by other plants, retrorsely hispid with scattered bristles, branching, ribbed: internodes generally longer than the leaves becoming 8 cm. or more: leaves opposite or alternate near the ends of the branches, thin, ovate-orbicular in outline, variously lobed and divided, often with the three upper lobes confluent, cuneate in outline, the lower more spreading, often lobed or toothed, obtuse at the rounded apex; blades 1–4 cm. long, almost as wide as long; petioles slender compared with the leaf, dilated and connate clasping at base, about as long as the blades; the appressed bristles on the surface scattered but dense on the petioles: peduncles long, slender, spreading or recurved in fruit, longer than the petioles: calyx enlarging noticeably in fruit, the divisions in flower oblong, acute, 3 mm. long, hispid on both sides, more densely so on the outer: auricles blunt, 1 mm. long: corolla slightly surpassing the calyx, tubular, the tube longer than the oblong divisions, hispid externally and ciliate at apex; appendages at base of 2 narrow scales which are ciliate on the free edge, about 1 mm. long: stamens as long as the tube of the corolla, inserted near the base: anthers ovate: ovary hispid at summit: style divided below the middle: pod purplish: seeds 4, coarsely pitted, the calyptra stipe-like.

This strange looking *Nemophila* was collected by the writer near the Sur River in Monterey County, June 16, 1893. It grew in a shady place.

It comes near *N. micrantha* but differs in habit, foliage, shape of calyx, size of corolla and shape of appendages.

6. **Nemophila inconspicua** sp. nov.

Branching widely from the base, decumbent, with branches 3–15 cm. long, slender, clothed with a few retrorse bristles: internodes shorter or longer than the leaves, from .5 to 5 cm.: leaves spatulate in outline, 3–5-lobed, generally with one lobe on one side, two on the other, tapering to a broad margined petiole which is connate-clasping at base when there is an opposite leaf; lobes similar to broad teeth, mucronate; surface with the hairs soft, loosely appressed, denser on the lower surface: peduncles equalling or exceeding the leaves, spreading or nodding in fruit: calyx with the divisions triangular-subulte, not quite 3 mm. long, a little more than 3 mm. wide, hairy on both surfaces, more densely so on the outer: auricles linear-subulate, 1 mm. long, deflexed, corolla blue, tubular-campanulate, 4 mm. long, the obovate divisions as long as the tube, hairy on the outside and with a double row of hairs between the filaments on the inside: stamens inserted at the base, filaments equalling the tube, anthers ovate-oblong: ovary hispid on the upper part: style short, 1 mm. long, divided less than half way, hairy below the forks: seeds 3 or 4, verrucose-corrugated: caruncle covered with a shallow deciduous calyptra.

This was collected by the writer at Bearskin Meadows on the trail from Millwood to Kings River Cañon, July 1, 1899.

It appears to be near *N. spatulata* Coville of which no specimen is available for comparison. It is apparently not the same, since *N. spatulata* is described as without appendages on the tube of the corolla and with sessile stigmas.

7. **Nemophila pustulata** sp. nov.

Stem branching from the base, apparently somewhat fleshy, ascending or erect, angled, hispid with retrose bristles which are minutely pustulate at base: internodes 2–3 times as long as the leaves, 1–3 cm.: leaves opposite, broadly oval or ovate in outline, with 5 divisions, the 3 upper confluent, the 2 lower cut almost to the base: petioles of lower leaves longer than the blades; upper shorter, both connate-clasping at the dilated base; divisions oval, sometimes dentate, usually entire, mucronulate: peduncles shorter than the leaves, but elongating after anthesis and deflexed: calyx very hispid on the outer side, less so on the inner near the apex: divisions triangular-subulate, 2 mm. long, 5 mm. wide at base: auricles small, strongly spreading deflexed: corolla tubular-campanulate, 4 mm. long, with retuse divisions a little shorter than the tube, hairy on the outside and slightly ciliate at the apex; appendages at base attached by the short side near the filaments, the free part subulate with some hairs at apex: stamens with filaments as long as the tube inserted above the base: anthers small, heart-shaped: ovary densely hispid: style divided about half way: seeds and fruits not seen.

This is very near *N. micrantha* and may prove to be only a form of that species. The plants from which the description is drawn are young and the differences in habit may be due only to the immaturity. The leaves are more regular and the appendages on the corolla tube dissimilar. The pubescence of the entire plant is characterized by a roughness caused by the pustules at the bases of the hairs.

The specimens from which the description is made were collected by John Macoun in the vicinity of Vancouver, May 6, 1893 (no. 667).

8. **Nemophila micrantha** sp. nov.

Stems becoming long and lax, decumbent or supported by other plants, some of the stems 3 dm. long, winged, more or less retrorsely hispid: internodes 2 or 3 times as long as the leaves, 1–14 cm.: leaves opposite, various, regularly or irregularly 3–5-lobed, with the lobes dentate or entire, broadly ovate in outline or one-sided, cuneate at base; lowest leaves with the two lowest divisions petiolulate, surface hispid with regularly appressed hairs which are more abundant on the lower surface: petioles equalling or shorter than the blades, dilated and connate-clasping at base: flowers from the lowest axils with peduncles that elongate and are recurved in fruit, generally shorter than the subtending leaves: calyx with triangular-subulate divisions about 2 mm, long, veiny, very hispid externally, slightly so on the inner surface: auricles very short, spreading: corolla tubular-campanulate, 3 mm. long, divisions shorter than the tube, retuse at apex; appendages consisting of a pair of narrow scales which are ciliate along the free edge: stamens inserted a little above the base of the corolla, about as long as the tube: anthers small, heart-shaped: ovary and lower part of style very hispid, the latter divided about to the middle: capsule containing 2–4 orbicular seeds with deciduous, stipe-like calyptra; the surface of the seeds obscurely corrugated and minutely pitted.

This grows in shady places under brush and trees in the region of *Sequoia sempervirens*. Specimens examined from Mount Tamalpais, Lagunitas, Mill Valley, Fairfax, all in Marin County, and collected by the writer, from March to August; Big Tree Grove, Santa Cruz Mountains, collected by Mrs. Brandegee, May, 1887. No. 742 of the collection of H. E. Brown, from near Mendocino, is probably the same species but differs somewhat from the form common in Marin County.

There seems to be some variation in the size of the leaves and the flowers, but in the main the distinguishing characteristics are constant. The appendages on the corolla tube are difficult to find, being very small and thin. They are attached by the shortest side, the free part of each pair being linear-subulate and inclined towards the other.

9. **Nemophila Kelloggii** sp. nov.

Stems long, slender, lax, weak, decumbent or supported by other plants, somewhat retrorsely hispid, ribbed, becoming more than 2 dm. in length: internodes becoming 10 cm. long: leaves opposite, ovate to orbicular in outline, 1–3 cm. long and of about the same breadth, generally 5-lobed with lobes subequal, the upper 3 more or less confluent and cuneate at base, the lower two oblong or elliptical, entire or lobed, veins evident, thin in texture, hispid with appressed hairs which are denser on the lower surface and less regular on the upper surface, inclined to be postulate at base; petioles equalling or shorter than the blades, dilated and clasping at base, hispid and bristly ciliate: peduncles shorter than the leaves, spreading in flower, nodding after anthesis: calyx with linear oblong divisions, 2–2.5 mm. long, extending almost to the base, hispid externally, sparingly so near the apex on the inner surface, veiny: auricles small, deflexed, sometimes wanting, corolla tubular-campanulate, 3 mm. long with the divisions as long as the tube, hispid on the outside: divisions a little more than 3 mm. broad, emarginate or obtuse at apex: appendages consisting of two linear scales, the free sides folding towards each other, ciliate on the margin: stamens about as long as the tube of the corolla, attached a little above the base: anthers small, cordate: ovary densely hispid: style divided about the middle: capsule globular: seeds 2–4, with a stipe-like calyptra about as long as long as the seed.

This was collected by Dr. A. Kellogg and Mr. McLean in the Santa Cruz Mountains in 1876.

While it is near *N. micrantha* it seems best at present in view of the differences in foliage, flower and seed, to consider it distinct.

10. **Nemophila Plaskettii** sp. nov.

Stems erect, branching from the base and dichotomously above, 4-angled, rather stout, cinereous, the stem bristles rather few, downwardly appressed: internodes twice as long as the leaves, 1–7 cm.: leaves broad, oval to ovate in outline, 1–2.5 cm. long, 1–2 cm. wide, 5-lobed, the three upper lobes somewhat confluent, the two lower petiolulate, entire or lobed, appressed hairy; petioles about as long as the blade except on the uppermost leaves, dilated at base and connate-clasping; first leaves orbicular or oval, on petioles two or three times the length of the blades: peduncles erect in flower, deflexed and inclined to be tortuous in fruit, about as long as the petioles on the lower leaves: calyx with triangular subulate divisions, 2 mm. long, densely hispid on the outer surface, less so on the inner: auricles very short, deflexed, greener than the calyx divisions: corolla tubular-campanulate, 5 mm. long, with rounded, retuse lobes extending almost half way; appendages at base very small and thin, scarcely evident: filaments equalling the corolla tube, inserted above the base: anthers cordate: style divided almost to the base with large, capitate stigmas: ovary densely hispid: capsule 2–3-seeded with the seeds corrugated-verrucose and having a stipe-like calyptra.

This is close to *N. micrantha* but differs in the flowers as can be seen by comparing the figures and also in a stouter habit and more divided leaves.

It was collected by Mr. R. A. Plaskett on Willow Creek, Santa Lucia Mountains, Monterey County, February 27, 1898. It is no. 32 of his distribution and is named in his honor.

11. **Nemophila exilis** sp. nov.

Stems slender, branching widely from the base, the upper branches horizontal or declined, hispid throughout and cinereous with numerous spreading bristles, varying in length and on the old parts, pustulate at base: internodes generally longer than the leaves, 1–6 cm: leaves opposite, alternate at the upper part, entire or 2–5-lobed, often unequal on the two sides, varying extremely on the same plant; lobes broadly dentate or suborbicular, mucronate, base cuneate, tapering to a broad margined petiole, generally shorter than the blade, the upper leaves sessile; pubescence as on the stems and peduncles except the general direction of the bristles: peduncles surpassing the leaves, slender, spreading horizontally with the fruiting calyx nodding at the end: calyx deeply divided with linear-acuminate divisions, 4 mm. long, 1–2 mm. wide, veiny, hairy on the outer surfacc only: auricles 1 mm. long, spreading, deflexed, linear, acute: corolla salverform with campanulate tube 4 mm. long and a spreading border of suborbicular divisions, which are obtuse, emarginate or retuse at apex, between 3 and 4 mm. long and 2–3 mm. wide, slightly hairy externally, and generally sparingly ciliate at apex: basal scales glabrous, 3-sided, attached by the longest side on each side of a filament, the free part with the upper side longer than the lower: stamens with filaments as long as the tube of the corolla, attached at the base: anthers oblong-ovate: style slender, divided to the middle: ovary densely hispid: capsule globular, hispid, mottled: seeds wanting.

This was collected on the Hog Ranch Road, Tuolumne County, California, by J. W. Congdon, June 9, 1897.

While the corolla approaches those that are tubular-campanulate, it is distinctly salverform, though the tube is short and broader at the top than at the base.

12. **Nemophila flaccida** sp. nov.

Bright green: stems weak, decumbent, much branched, almost glabrous on the older parts, sparingly retrorsely hispid on the younger, becoming 3 dm. or more in length: internodes 2–3 times as long as the leaves, the lowest ones 6–9 cm.: leaves alternate, thin, with the veins scarcely evident, variously dentate or lobed, scarcely two leaves alike on the same plant; lower leaves 3–5-lobed with the 3 upper lobes confluent, the 2 lower often petiolulate and with the 2 sides unequal; upper leaves variously dentate, lobed or almost entire, sessile with the general outline ovate: petioles winged, dilated at base: peduncles long, capillary, spreading, with the flowers nodding after anthesis, surpassing the leaves, 1–3.5 cm. long: divisions of the calyx triangular-subulate, extending almost to the base, 4 mm. long, 1 mm. wide, veiny, glabrous on the inner surface except near the base of the ovary, hispid on the outer and on the margin: auricles small, acute, deflexed: corolla rotate-campanulate with the tube shorter than the obovate, obtuse or emarginate divisions, externally hairy: appendages attached near the stamens, the free side rounding, ciliate or fringed: filaments longer than the tube of the corolla, inserted at the base: anthers oblong: ovary densely hispid above the disk at base: style slender, divided to the middle, equalling or shorter than the calyx: pod globular, 2–4-seeded: seeds with calyptra stipe-like, corrugated, verrucose.

This was collected by H. E. Brown near Pitt River, Shasta County, May 15–18, 1897 (no. 261). A specimen collected by the writer between Ukiah and Orr's Hot Springs is for the present placed under this species. The material is too poor for certainty but the appearance of the plants is the same. This last specimen was collected by the author June 22, 1894.

13. **Nemophila inaequalis** sp. nov.

Stems slender, weak, apparently decumbent, 3 dm. or more long, retrorsely hispid with weak bristles: internodes 1–6 cm. long: leaves alternate, occasionally opposite, unequal on the two sides, 2–4 cm. long, 1.5 cm. wide, generally 5-lobed on one side, 2–3-lobed on the other, tapering from the lowest lobe to the broad petiole which is clasping at base, generally shorter than the petiole, margined and ciliate; lobes orbicular-oblong, obtuse or mucronulate, sparingly hispid with appressed hairs, the lower surface paler than the upper; upper leaves almost sessile: peduncles almost as long as the subtending leaves, slender, erect in flower, somewhat spreading after anthesis: flowering calyx 4 mm. long with 5 linear-lanceolate divisions which extend almost to the base, veiny, very hispid externally, slightly so on the inner side near the apex: auricles short, subulate, deflexed: fruiting calyx becoming 6–7 mm. long, the auricles lengthening in the same proportion: corolla tubular-campanulate, the 5 oblong-obtuse divisions as long as the tube, together 5 mm. long: appendages at base attached near the base, sword-shaped, 1 mm. or more in length ascending on each side of a filament, apparently crossing: stamens about as long as the tube, inserted a little above the base: anthers dark brown, ovate: ovary hispid with dense, white hairs: style divided to the middle: capsule containing 2–4 orbicular seeds with convoluted surface and the calyptra scarcely protuberant.

This was collected on the Russian River, June, 1886, by T. S. Brandegee.

14. **Nemophila humilis** sp. nov.

Low, 5 mm.–6 cm. high, with a few branches from the base, cinereous throughout. First leaves oblong-spatulate entire, 5–10 mm. long with petioles shorter than or slightly longer than the blades: leaves opposite, spatulate in outline, 3–5-lobed, often irregular or unequal with a cuneate base which merges into a broad petiole about equalling the blade; lobes of the leaves tooth-like or obtuse and mucronulate: flowers from the lowest axils, pale blue, on peduncles which are at first erect but later are reflexed, becoming 5–8 mm. long: calyx with oblong, acute lobes, 3 mm. long, 2 mm. wide near the base, veins scarcely visible, hairy on both surfaces, the margin fringed with long uneven hairs: auricles linear, ⅓ as long as the sepals: corolla open campanulate with spreading limb and tube ⅓ as long: divisions obovate, 3 mm. long, 2 mm. wide, with emarginate apex and throat hairy but without distinct appendages: filaments inserted at the base of the corolla, about as long as the tube: anthers small, pointed: ovary densely hispid from below the middle: style divided about half way, very short: capsule with 5 seeds: these immature almost orbicular, 2 mm. in diameter with the calyptra prominent, cap-like, apparently soon deciduous.

This species was collected by the writer on the trail between Summit and Summit Soda Springs, in Placer County, June 9, 1898. It grew on a bank where the ground was still wet from the recently melted snow.

It approaches the large-flowered group more than any of the species described in this article.

15. **Nemophila nana** sp. nov.

Low, branched from the root and with short procumbent stems 2–5 cm. long, hispid throughout with appressed hairs which are minutely pustulate at the base, wing-angled: leaves opposite, crowded, elliptical in outline, 1–1.5 cm. long, 5–7-lobed with the lobes opposite or alternate; divisions ovate-elliptical, mucronate: petioles as wide as the rachis and about as long as the blade, dilated and connate-clasping at base, somewhat decurrent, forming the winged angles of the stem, ciliate especially near the base: flowers blooming from the earliest leaf axils: peduncles at first erect, later recurving as if to bury the seeds, 5–15 mm. long, almost as broad as the petioles: calyx divisions triangular-subulate, 2 mm. long, often 1–2 mm. wide, hispid on both surfaces, with long hairs on the margin: auricles linear, more than half as long as sepals, though sometimes mach shorter and almost obsolete. Corolla open-campanulate, pale blue with darker dots in lines, 5 mm. long, with obovate, emarginate divisions almost twice as long as the tube; appendages attached near the base of the filaments, curved towards the stamens, minutely hairy on the free edge: stamens with filaments a little longer than the tube, inserted at the base: anthers cordate: style divided half way, hairy at base, the pointed apex of the style broadening to it: ovary hispid especially on the upper part: capsule 5-seeded: seeds 2–5 mm. long, obtusely angled, brown, covered with scattered white scales: calyptra cap-like.

This was collected by the writer February 12, 1900, on the old road to Bartlett Springs from Upper Lake in Lake County. It grew on a moist bank alongside the road on the side of the mountain towards Upper Lake and was seen in several localities. The flowers are pale blue and so buried among the leaves as to be scarcely visible.

16. **Nemophila Congdoni** sp. nov.

Low with assurgent stems, branching from the base, sparingly hispid with downwardly spreading hairs, ribbed; internodes shorter than the leaves, about 1 cm.: leaves opposite, oblanceolate to spatulate, entire, lobed or toothed, tapering to a short broad margined petiole or the uppermost sessile: pubescence white-hairy, appressed: peduncles from the lowest axils, rather stout, declined, somewhat tortuous, apparently burying the fruits in the ground: calyx with linear lanceolate divisions, hairy on both surfaces, 5 mm. long, 1–2 mm. wide: auricles subulate, strongly declined, 2 mm. long: corolla open-campanulate with the divisions longer than the tube, 8 mm. long: divisions obovate, emarginate or obtuse at apex, 4 mm. wide: appendages consisting of 2 laciniate scales attached close to the filaments by one side, the apex with a few long hairs: there are a few hairs also in the tube of the corolla: stamens with filaments as long as the tube and inserted a little above the base: anthers oblong, cordate at base: ovary densely hispid: style divided to the middle, in flower shorter than the calyx: seeds 4, with cap-like calyptra The calyx enlarges considerably in fruit.

This was collected by J. W. Congdon on the Tioga Road, July 6, 1896. There is a specimen collected by the same botanist on the Road to Hetch-Hetchy, June 7, 1897. This is without flowers and so is uncertain. The species is named in honor of the well-known botanist, its discoverer.

17. **Nemophila hispida** sp. nov.

Stems slender, erect, dichotomously branching above the base and becoming decumbent, rough and hispid with fine, white, stiff bristles, ribbed: internodes generally longer than the leaves, becoming 6 cm. or more: first leaves orbicular, 5 mm. wide, on long petioles; lower leaves opposite; upper alternate, 1–4 cm. long, elliptical in outline, with 7–9 divisions; lower divisions petiolulate, upper somewhat confluent, all lobed and the lobes mucronulate; upper surface with bristles appressed, lower with bristles more spreading: petioles as long as or shorter than the blade, densely hispid-ciliate, dilated and connate-clasping: peduncles as long as or shorter than the leaves, retrorsely hispid, spreading but with flowers nodding after anthesis: calyx with lanceolate, acute divisions, 3 mm. long, hispid on the outside, glabrous within, somewhat veiny: the auricles linear, 1/4 as long as the divisions: corolla rotate-campanulate about twice as long as the calyx, with obcordate or obovate divisions, 4 mm. broad, white veined with blue, as long as the tube: appendages at base short, triangular, obtuse, adherent by one side with the free side pointing towards the filaments and overlapping: stamens with filaments inserted at the base of the corolla, about as long as the tube: anthers dark brown, ovate, pointed: ovary and lower part of style densely hispid, the latter branched above the middle: fruit immature.

This was collected by the writer near the foot of the new road from Clear Lake to Bartlett Springs, February 15, 1900.

The plants were young and grew to a height of 15 cm. with erect, branching stems, inclined to be decumbent. Undoubtedly when it grows older the stems elongate and trail over the ground or are supported by the stems of other plants.

18. **Nemophila divaricata** sp. nov.

Stems slender, divaricately forking, weak, retrorsely hispid with white hairs, ribbed, erect or decumbent, becoming 2 dm. or more in height: internodes longer than the leaves, 1–10 cm.: leaves opposite, oblong to ovate in outline, 1–3 cm. long, 5 mm.–1.5 cm. wide, divisions 5–7, the 3 upper generally confluent, the lower petiolulate, ovate-orbicular, entire or lobed: petiole about as long as the blade, hispid-ciliate, broadening towards the connate-clasping base: pubescence hispid with appressed hairs on both surfaces, veining not evident on upper surface, faint on lower: divisions of the calyx triangular-ovate or subulate, about 1 mm. long, glabrous on the inner surface, hispid on the outer and on the margin: the appendages very small, 1–3 mm., strongly deflexed: corolla rotate-campanulate, 7.5 mm. long with tube as long as the divisions, white, tinged with blue, hairy on the outside: divisions retuse or emarginate at apex, 4 mm. wide: appendages attached by the side next the stamens, folding towards each other, the free side ciliate or fringed, 2 mm. long: stamens with filaments a little longer than the tube inserted at its base: anthers oblong: ovary hispid to the base with white hairs: style divided half way, in fruit much surpassing the calyx: fruit not seen.

This was collected on Mount St. Helena by the writer, April 21, 1900, also by Mr. Brandegee in 1889. The figures show some variation between the plants of the two collections: but in all essential points they are alike. This is nearest to *N. hispida* from which it differs in having larger flowers and the appendages on the corolla differently attached. These two may be geographical varieties of the same species: but it seems better for the present to leave them as distinct species.

19. **Nemophila tenera** sp. nov.

Stems divaricately branching from the base and dichotomously above, 1–2 dm. high: branches slender, hispid with fine retrorse bristles which are minutely pustulate at base, ribbed: internodes more than twice as long as the leaves, 1–5 cm: leaves except near the top of the stem opposite, oblong-ovate in outline, .5–2 cm. long, 5–10 mm. broad, 5–7-lobed with the divisions confluent at apex, orbicular mucronulate, elliptical, entire, lobed or toothed below, almost petiolulate: petiole broad, equalling or shorter than the blade, ciliate-hispid especially at the dilated base: peduncles slender, spreading, with the flower and fruiting calyx nodding, generally surpassing the leaves, hispid with retrorsely spreading bristles: calyx with the divisions linear-oblong, appressed hairy on the inner surface, hispid on the outer: auricles small, scarcely evident: corolla rotate-campanulate, 5 mm. long, with the broad obcordate or retuse divisions longer than the tube: appendages at base triangular, attached by one side, the upper free side toothed, the other towards the stamens entire: stamens inserted a little above the base of the corolla with filaments a little longer than the tube: ovary densely hispid: style apparently divided only near the top, shorter than the calyx divisions: capsule and seeds not known.

This appears to be found along the western base of the Sierra Nevada in Placer and Amador Counties. Specimens were examined from Applegate, Placer County, collected by Mrs. Helen Smith, May, 1899; from Folsom collected by Mr. T. S. Brandegee, April, 1883; and from Drytown, Amador County, collected by George Hansen, April 8, 1896 (no. 2064).

20. **Nemophila gracilis** sp. nov.

Stems very slender, branching from near the base and dichotomously and tritomously above, ribbed, sparingly hispid with retrorse hairs: internodes, except near the ends of the branchlets, 4–6 cm. long: leaves opposite, generally unequally lobed with 1–2 divisions on one side, 2–3 on the other, rarely 1 or 2 on each side, all broadly petiolulate, oblong-elliptical: margin sinuate, apex obtuse or mucronulate: upper surface bright green with sparingly appressed, stiff hairs which have black pustules at base, the lower paler and soft hairy, veining evident, texture thin: petioles somewhat shorter than the blades, narrower that the rachis, dilated and connate-clasping at base: flowers very small on capillary, hispid peduncles, 10–15 mm. long: calyx with linear-oblong divisions, thin and somewhat veiny, 1–2 mm. long, sparingly hispid on both surfaces, bristles on the margin long and unequal: auricles less than ¼ as long as the sepals: corolla rotate-campanulate, 3 mm. long: divisions as long as the tube, obovate-oblong, glabrous on inner surface, hairy on the outer: appendages narrow, glabrous, triangular, attached next the filaments by the longest side, the opposite angle free: stamens with slender filaments a little longer than the tube of the corolla attached at the base: anthers oblong, small: ovary and lower part of style densely hispid, divisions of the style not extending to the middle: seeds large, more than 1 mm. in diameter, obscurely pitted and covered with scattered scales that are soon deciduous: calyptra not seen: on the specimens examined there was only one capsule, so that this description of the seed is not comprehensive enough to have much value.

This species was collected near Fresno by P. H. Buckminster in 1888.

21. **Nemophila nemorensis** sp. nov.

Stems branching from the base and dichotomously above, becoming more than 3 dm. long, decumbent or ascending, supported by other plants, weak, sparingly hispid with retrorse bristles, strongly ribbed; lower internodes about 8 cm., upper becoming much shorter: leaves opposite or alternate, at the ends of the branches, upper ones frequently oblong, entire, on short petioles; lower compound, with the top division 3-lobed, cuneate, the 4 or 6 lower ones orbicular on petiolules equalling or twice their length, often the lower leaflets are lobed: petioles hispid-ciliate at the dilated bases; pubescence of stiff hairs upwardly appressed: peduncles slender, spreading, with the fruit generally nodding, 2–4 cm, long: divisions of the calyx linear-lanceolate, 2.5 mm. long, hispid externally, glabrous within: appendages very short, deflexed, darker green than the divisions: corolla rotate-campanulate, white, 6 mm. long, the divisions a little longer than the tube, obovate, retuse, hairy externally; appendages triangular, attached by the long side, the opposite angle free and glabrous: stamens as long as the tube of the corolla, inserted a little above the base: anthers oblong, cordate: ovary very hispid: style divided half way: pod globular, hispid, papillose, surpassing the calyx: seeds 2–3, scrobiculate with cap-like calyptra, easily detached.

This pretty *Nemophila*, distinguished by the delicacy of its foliage, grows in shady places under brush and trees, and is found around San Francisco Bay. It varies extremely in foliage and slightly in the floral organs. The following specimens have been examined: two specimens from South San Francisco collected by Mrs. Brandegee, April, 1890 and 1892; four from Sutro's Hill, San Francisco, collected by the writer, April, 1894; four from Fairfax, Marin County, collected by the writer on several occasions, in the months of April and May; one from Angel Island collected by E. L. Greene, April, 1886; one from Lagunitas Lake, one from Lagunitas Creek, and one from Mount Tamalpais collected by the writer in March and April, 1896, 1898; one from San Rafael, collector unknown, collected April 18; three from Fruitvale, Alameda County, from Mrs. R. L. Toplitz, March, 1895.

22. **Nemophila glauca** sp. nov.

Stems branching from the base and above with spreading branches, rather stout, 2 mm. in diameter, pale glaucous, hispid with appressed hairs, somewhat angled: internodes on the lower stems longer than the leaves, on the upper shorter, 1–5 cm. long: leaves opposite: lower leaves with the apical division 2–3-lobed or entire, the 4 lower suborbicular, petiolulate, oval in outline, 1–2 cm. long, 1–1.5 cm. wide; upper leaves less divided and with divisions more approximate, almost sessile: petioles on the lower leaves as long as the blade, connate-clasping at the base: the upper leaves and flowers form clusters at the ends of the branches, the internodes probably elongating later: flowers from the lowest axils of the branches, on long, slender, erect or horizontally spreading peduncles which are as long as or shorter than the leaves: calyx with triangular-subulate divisions, hairy on both surfaces, with linear auricles half as long as the sepals: corolla white, rotate-campanulate, 5 mm. long, with broad obovate divisions nearly 4 mm. wide and hairy on the outside: appendages attached by one side, the freed edge somewhat laciniate: stamens with the filaments inserted on the base of the corolla, longer than the tube: ovary hairy above the middle, ovoid: style divided half way with spreading lobes: capsule not ripe.

This was collected by Mrs. C. C. Bruce on Big Chico, Butte County, May, 1897 (no. 2037).

23. **Nemophila fallax** sp. nov.

Widely spreading from the base and dichotomously branching above with erect or spreading branches, glaucous, hispid with fine, retrorsely spreading bristles, ribbed; lower internodes about twice as long as the leaves, about 6 cm: lower leaves ovate in outline, with 5–7 divisions: these petiolulate, orbicular, entire or 2–3-lobed; upper leaves much smaller, 2–3-lobed, aggregated with the flowers at the ends of the branches: petioles equal or shorter than the blades, hispid ciliate, dilated and clasping at base: flowers white, on slender axillary peduncles from almost the lowest axils: peduncles shorter than the leaves, at first erect, later spreading with the flowers nodding: sepals thin, veiny, hispid on both surfaces, lanceolate, 3 mm. long: auricles ovate, 1 mm. long, deflexed spreading: corolla rotate-campanulate, with the divisions twice as long as the tube, together about 5 mm. long, hairy on the outside, of thin texture, no hairs or appendages at base; divisions retuse or emarginate at apex, 3 mm. wide: stamens with filaments longer than the tube of the corolla inserted at the base: ovary globular with the style branches surpassing the calyx forked half way down: fruit not seen.

This is similar in general appearance to *N. glauca* with which it was included by the collector. The pubescence is more spreading, the branching is more open, the leaves thinner and more openly divided while as can be seen in the figures the flowers are quite different in the shape and size of calyx and corolla which are also much thinner in texture; and lastly the corolla is without any hairs or appendages in the throat or at the base.

It was collected by Mrs. C. C. Bruce on Big Chico Creek, May, 1897. It is part of her no. 2037.

24. **Nemophila exigua** sp. nov.

Stems simple or branching from the base, slender, erect, almost glabrous; internodes 2–3 times as long as the leaves, about 3 cm.: leaves opposite, about 1 cm. long, broadly oblong to orbicular in outline, simply 5–7-lobed with the lobes generally opposite regular, entire and mucronulate, hispid with appressed hairs, petiole from almost none to slightly longer than the blade, broad, dilated and clasping at base: peduncles rather stout, spreading with the fruiting calyx nodding: calyx with triangular-subulate divisions, 2 mm. long, glabrous except near the bristly-ciliate margin: auricles linear, more than half as long as the divisions: corolla white, dotted with violet, rotate-campanulate, 3 mm. long, with divisions as long as the tube, somewhat hairy on the outside; appendages at base of 2 narrowly linear scales which are hairy on the free side: stamens a little longer than the tube of the corolla, inserted at its base; anthers cordate: ovary hispid, ovate: style divided above the middle, shorter than the calyx: pod purple, orbicular, 1–2-seeded: seeds orbicular, covered with scattered scales, irregularly pitted with the calyptra, stipe-like.

This was collected by George Hansen, at Stony Creek, Amador County, March 26, 1896 (no. 1522).

25. **Nemophila pulchella** sp. nov.

Stems widely branching from the base and above, slender, weak, decumbent or supported by other plants, becoming 3 dm. long, cinereous with retrorsely spreading, stiff, white hairs, ribbed with the ribs on the lower part becoming winged; longest internodes 10 cm.; lower leaves opposite, upper alternate, ovate in outline, 1–4 cm. long, divisions usually 5, the upper 3-lobed with orbicular mucronate divisions, the lower distant, petiolulate, 3-lobed; upper leaves with the lobes more approximate, and with shorter petioles: peduncles long, capillary, spreading or reflexed, half as long as the long internodes, longer than the upper, shorter ones: calyx with linear divisions extending almost to the base, veiny, hispid externally, sparingly hairy within, 2 mm. long, less than 1 mm. wide: auricles button-like or even wanting: corolla rotate-campanulate, blue or rarely white, 6–8 mm. across; divisions obovate-oblong, hairy on the outside in lines, glabrous within; appendages of two narrow, linear scales inserted between the stamens by one side, the free side ciliate on the margin: stamens with filaments longer than the tube of the corolla, inserted at the base: anthers oblong: ovary and lower part of style densely hispid: style forked almost half way: seeds 2–4, corrugated, with cap-like calyptra.

This beautiful little *Nemophila* is distributed through the lower mountains of the southern Sierra Nevada. Specimens have been examined from Sequoia Mills, Fresno County, from Kaweah in several distinct localities and with several specimens showing variation in foliage, habit and size of flowers. These were all collected by the writer. They grew in the shade of brush. Besides there are three specimens collected by Dr. G. Eisen in the foothills of the Sierra, probably from the same region, and three from C. A. Purpus collected in the Chaparrau belt, in the brush, Bear Creek, Tulare County, altitude 3000–5000 ft. (no. 1720). It flowers in April and May.

26. **Nemophila alata** sp. nov.

Stems several from the base, simple or branching above, erect but weak, apparently succulent, glabrous, sometimes spotted with purple, flat with wings broader than the axis, together 2 mm. wide: internodes about as long as the leaves, generally shorter than the peduncles, varying from 2–5 cm.: leaves almost regularly 5–7 pinnately parted, veiny, sparingly pubescent with hairs scattered or chiefly on the veins: divisions oblong, mucronate, the upper three somewhat confluent, the lower almost falcately spreading: petioles equalling or shorter than the blades, 2–4 mm. wide, dilated at the connate-clasping base which is sparingly ciliate: flowers from all the axils, on glabrous, winged, horizontally spreading peduncles which are about 4 cm. long: divisions of the calyx linear-subulate, 3 mm. long in flower, veiny, hispid on the outer surface, glabrous on the inner, ciliate: auricles becoming almost as long as the divisions, strongly declined and hispid: corolla rotate-campanulate, 5.5 mm. long: divisions longer than the tube, obovate, emarginate, 3 mm. broad, with two rows of hairs between the filaments at base: stamens with filaments as long as the corolla tube and cordate-acuminate anthers: ovary hispid at summit and at the base of the style: style divided half way to the base, stigmas capitate: capsule orbicular, or ovate, margined, apparently flattened, glabrate, veiny under the lens, 5–6 mm. in diameter: seeds about 4, oblong, obscurely pitted: calyptra prominent and scrobiculate.

This well-marked species was collected by H. E. Brown, near Clear Creek, Butte County, California, March 3–22, 1897, being no. 173 of his collection.

27. **Nemophila rotata** sp. nov.

Stems one or several from the root, decumbent or ascending, about 12 cm. long, rather slender, angled, hispid with stiff, fine, spreading bristles, internodes longer or shorter than the leaves, from .5–3 cm.: leaves opposite, oblong in outline, 3–7-lobed, 5 mm. to 2 cm. long, 2 mm.–12 mm. wide, tapering at base to a broad margined petiole as long as the blade and dilated, connate-clasping at base, forming prominent nodes when the stems grow old, bristly-ciliate, especially near the base: divisions suborbicular, entire or more rarely lobed or toothed, mucronate: rachis as wide or slightly wider than the petiole; surface with the veins distinct, paler on the lower than the upper surface, the appressed hairs spreading: flowers from the lowest axils, soon deflexed on elongating, somewhat tortuous peduncles, which are densely hispid with horizontally spreading bristles and in length generally exceed the internodes: calyx with the divisions almost to the base, triangular subulate, 2 mm. long, hispid on both surfaces, near the apex on the inner: auricles linear, spreading, somewhat elongating in fruit: corolla bright blue, rotate, 9 mm. in diameter: divisions ovate-oblong, obtuse or acute at apex, extending almost to the base: basal scales, linear, hairy, attached by the base on each side of a filament: filaments and anthers violet, the former more than half as long as the petals, the latter heart-shaped: style divided almost to the base, ovary densely hispid: seeds 4–8, minutely scrobiculate and obscurely corrugated, the caruncle covered with a deciduous, stipe-like, curved calyptra.

This *Nemophila* was first collected by C. R. Orcutt in the Cantillas Mountains, Lower California (no. 1128), July 5, 1889. On

February 28, 1891, it was collected by the writer near San Diego.

It is easily distinguished from all the other species by the distinctly rotate corolla. It has apparently the same habit of burying its seeds in the ground that is shared by *N. sepulta* Parish and *N. humifusa* Kellogg.

Explanation of Plates 15-20

In these plates the figures of the dissected flowers are enlarged five times; the leaves are the natural size.

PLATE 15

FIG. 1. *Nemophila humifusa* Kellogg. Lake Merced, a, b, c; Mount Diablo, d, e, f; Cuyama, g, h, i.

FIG. 2. *Nemophila sepulta* Parish. a, b, c.

FIG. 3. *Nemophila quercifolia* Eastwood. a, b, c.

FIG. 4. *Nemophila Austinae* Eastwood. a, b, c.

FIG. 5. *Nemophila macrophylla* Eastwood. a b, c, d.

FIG. 6. *Nemophila inconspicua* Eastwood. a, b, c, d.

PLATE 16

FIG. 7. *Nemophila pustulata* Eastwood. a, b, c.

FIG. 8. *Nemophila micrantha* Eastwood. Lagunitas Lake, a, b, c, d; Mill Valley, e, f, g; near Mendocino City, h, i, j.

FIG. 9. *Nemophila Kelloggii* Eastwood. a, b, c, d, e.

FIG. 10. *Nemophila Plaskettii* Eastwood. a, b, c.

PLATE 17

FIG. 11. *Nemophila exilis* Eastwood. a, b, c, d, e.

FIG. 12. *Nemophila humilis* Eastwood. a, b, c, d.

FIG. 13. *Nemophila nana* Eastwood. a, b, c.

FIG. 14. *Nemophila Congdoni* Eastwood. a, b, c, d.

PLATE 18

FIG. 17. *Nemophila hispida* Eastwood. a, b, c.

FIG. 18. *Nemophila divaricata* Eastwood. Author's collection a, b, c, d; collection of T. S. Brandegee, e. f, g.

FIG. 19. *Nemophila tenera* Eastwood. a, b, c, d, e.

FIG. 20. *Nemophila gracilis* Eastwood. a, b, c.

PLATE 19

FIG. 21. *Nemophila nemorensis* Eastwood. a, b, c, d.

FIG. 22. *Nemophila glauca* Eastwood. a, b, c.

FIG. 23. *Nemophila fallax* Eastwood. a, b, c.

FIG. 24. *Nemophila exigua* Eastwood. a, b, c, d.

FIG. 25. *Nemophila pulchella* Eastwood. a, b, c, d, e.

PLATE 20

FIG. 15. *Nemophila flaccida* Eastwood. a, b, c, d, e, f.

FIG. 16. *Nemophila inaequalis* Eastwood. a, b, c, d, e.

FIG. 26. *Nemophila alata* Eastwood. a, b, c.

FIG. 27. *Nemophila rotata* Eastwood. a, b, c, d.

Riccia Beyrichiana and Riccia dictyospora

By Marshall A. Howe

In the course of some remarks at the meeting of the Torrey Botanical Club held on December 11, 1900, the writer made allusion to the probable rediscovery at Athens, Georgia, by Mr. R. M. Harper, of *Riccia Beyrichiana*—a species which is alleged to have been discovered in this country about seventy years ago by Herr Beyrich and has of late been a subject of considerable doubt inasmuch as nothing apparently like it had been met with since. It was our intention, as expressed to some at the time, to secure, if possible, a portion of Beyrich's original plant before publishing any notes on Mr. Harper's specimens, in order that the determination might not rest upon description alone. In the original description nothing at all is said of the spores, from which, in this genus, important specific characters are now drawn. Three years ago, Herr Franz Stephani gave a new diagnosis of the species, including an account of the spores, but this description was in a few respects somewhat out of harmony with Mr. Harper's plants and increased the desire on our part to see the specimens of Beyrich's own collecting. A loan of the desired original from the Lindenberg herbarium, now preserved in the Naturhistorisches Hofmuseum at Vienna, has recently been obtained through the courtesy of Dr. A. Zahlbruckner. And a careful comparison of Beyrich's plant with that of Mr. Harper has led to the unexpected conviction that the two plants are absolutely distinct from each other.

Some further reference to the brief history of *Riccia Beyrichiana* may be of interest at this point. The species was originally described in Lehmann's "Novarum et minus cognitarum Stirpium Pugillus Septimus," published in Hamburg in 1838. Like several other parts of this work, the seventh Pugillus contains the diagnoses of numerous new Hepaticae, diagnoses which are commonly ascribed to the joint authorship of Lehmann and Lindenberg though it is occasionally suspected that Lindenberg was chiefly responsible for them. The fact that Lindenberg had already, only two years before, published his classical "Monographie der Riccien" makes it very probable that this *Riccia*, at least, would have received his special attention. *Riccia Beyrichiana* was, however, a MS. name of Hampe's under which, as it would seem, Hampe had communicated the plant to one or the other of the authors of the work. It is stated in connection with the first description that the plant was collected by C. Beyrich in North America, between Jefferson and Gainesville, there being no intimation as to what part of North America these two towns might be found in. But from what is known of Beyrich's travels and of American geography, it is evident that the Jefferson and Gainesville in question are in northern Georgia, where these two towns are county-seats, lying fifteen or twenty miles apart. Jefferson, by the way, is, according to Mr. Harper, less than twenty miles from Athens, where the plant recently suspected to be *R. Beyrichiana* was collected. To return to our bibliographical sketch, an abridged description of the species, a few years after its publication, was included in the Synopsis Hepaticarum of Gottsche, Lindenberg, and Nees, and then, in 1856, an English abstract of this was given a place by Sullivant in the second edition of Gray's Manual. In some unaccountable way, Sullivant ascribed the plant to Tennessee. In Professor Underwood's "Descriptive Catalog of the North American Hepaticae," published in 1884, the species was treated much as by Sullivant, though with more reference to the original description. But in some critical notes on the American species of *Riccia* published by Professor Underwood in the Botanical Gazette in 1884, *Riccia Beyrichiana* was omitted on the ground that there was no recent evidence that it was a member of our flora.

In 1898, however, Herr Stephani, in his Species Hepaticarum, states that he has seen Beyrich's plant, that it was collected in Jefferson, North America, and that it is doubtless a good species. And he gives a new and somewhat detailed description of it. After an examination of the Lindenbergian material, we concur with Herr Stephani in the opinion that *Riccia Beyrichiana* is a valid species. The pocket in the Lindenberg herbarium is marked clearly "Int. Jefferson & Gainsville, 13/8 33. Beyrich. Mis.

Hampe 1837," and in view of the little attention which the collection of the *Ricciae* has as yet received in this country it seems to us that it is too early to suspect that everything in this connection is not just as it purports to be. Herr Stephani's description* leaves little to be desired outside of a more detailed account of the spores, which we have supplied below in course of comparison with Mr. Harper's plant. The specimens collected by Mr. Harper represent, we believe, a hitherto unrecognized species which we would characterize as follows:

Riccia dictyospora sp. nov.

Thallus simple or once dichotomous, forming irregularly gregarious patches, finally oblong or elongate-obovate, rarely sublinear, 4–10 mm. × 1–2 mm., reticulate above, light green (when dry) with at length a narrow dark-purple border; median sulcus acute and somewhat pronounced toward the apex; ventral scales entire, purple at maturity, slightly exceeding the thin submembranous ascending thallus-margins; width of transverse sections of the thallus 1.5–3 times their height, the ventral outline rounded-convex or somewhat flattened, air-canals narrow and vertical, special cells densely filled with a yellowish granular substance ("oil-body" cells) usually abundant: primary epidermal cells oval-papilliform, soon collapsing, leaving more or less persistent cup-like vestiges: monoicous: antheridial ostioles not elevated: spores brown, rather translucent, soon exposed by the rupture of the overlying parts, 95–116 μ in maximum diameter, scarcely angled, somewhat flattened, wholly destitute of wing-margins, almost uniformly areolate over entire surface, in optical section appearing densely beset on all sides with short truncate spines or papillae; areolae of the outer face 8–12 μ in width, often less perfect in the middle of the face; areolae of the inner faces so similar to those of the outer as not to be readily distinguished at first sight, yet slightly larger and less regular, with somewhat less elevated boundaries.

On moist granite rock near Oconee River, Athens, Georgia (alt. 183 m.), Roland M. Harper, June 26, 1900, no. 68a.

In *Riccia dictyospora* the markings of the spore-wall are developed over its entire surface with a rare uniformity, the areolae being carried over the rounded scarcely perceptible wingless angles with little interruption. That there is, however, a difference in the

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*Bull. Herb. Boiss **6**: 318. 1898.

development of the inner and outer faces becomes especially apparent when these faces are compared in profile. The spines or papillae of the outer face are then seen to be considerably longer, projecting 6–9 μ, while those of the inner faces project only 4 or 5 μ.

Riccia Beyrichiana, with which, on account of its dark purple lower surface and the geographical association, *Riccia dictyospora* is perhaps most likely to be confused, is a considerably smaller plant* with thick rounded-obtuse, or, at the thallus-apex, merely acute, margins, which occasionally bear short cilia. In *R. dictyospora*, on the other hand, the thallus-margins are thin and submembranous and no cilia have been seen. But more striking distinctive characters are to be found in the spores. In *Riccia Beyrichiana* the mature spores are so extremely opaque that very little can be made of their surface-markings until they have been well saturated with glycerine after having been soaked out in water. It is nevertheless seen at once that they are distinctly angular, though often flattened or irregular in form, and that they are very large, measuring 116–140 μ in maximum diameter. In glycerine it can be determined that the inner faces are almost absolutely smooth, being roughened only by very fine granulations or sometimes by a faint suggestion of areolae. The outer face bears areolae which are 15–20 μ in diameter—much larger than in *R. dictyospora*. The boundaries of these areolae are less elevated than in many species of *Riccia* and the outer face as a rule appears rather obscurely papillate, yet in profile view it sometimes exhibits papillae 4 or 5 μ in length. The seams or wings at the angles of the spore are often narrow and obscure, but they sometimes broaden here and there into expansions 6–8 μ in width. It is possible that the opacity of the spores of Beyrich's plant has slightly increased during the many years of preservation, but age can be in no way responsible for the

* None of the specimens that we have seen from the Lindenberg herbarium is more than 5 mm. long and when soaked out they measure only .6–.8 mm. in width, though it is probable that after nearly seventy years of drying they do not quite regain their former dimensions. In regard to length, however, it is to be noted that Lehmann and Lindenberg in the original diagnosis (Lehm. Pugill. 7: 1. 1838) describe the "fronds" as "2–4 lineares," while Stephani (*l. c.*) has recently described them as "usque 10 mm." The antheridia of *Riccia Beyrichiana* we have not seen, paucity of material standing in the way of extended search, so we are unable either to confirm or deny Stephani's statement that the species is monoicous.

other important characters which distinguish the spores of *Riccia Beyrichiana* from those of *R. dictyospora.* Age has not made the mature spores of *Riccia Beyrichiana* the more angular, it has not increased their size, it has not left more or less of a wing at their angles, it has not smoothed off their inner faces, and it has not doubled the diameter of the meshes of the outer face.

We do not know of any *Riccia* hitherto published which seems very closely allied to *R. dictyospora.* Among American species, *Riccia Americana* and *R. Austini* resemble it in the entire absence of wing-margins to the spores but in other respects have little in common with our plant.

Riccia Beyrichiana apparently remains a species unknown except from the original collection of August 13, 1833. It is to be hoped that botanists resident in the Southern States and those traveling in that region will consider its rediscovery a problem worthy of their attention.

COLUMBIA UNIVERSITY, 11 February, 1901.

The Genus Teucrium in the Eastern United States

By Eugene P. Bicknell

Here and there along the shores of the Hudson near New York, grows a germander with palest pink flowers. The plant has long been familiar to me and, in accordance with established usage, I have always known it as the *Teucrium Canadense* of Linnaeus—the single species of the genus credited generally to the eastern states.

In Maine, some years ago, the same plant was found growing in abundance on stony shores back of the beaches both along the ocean and about the mouth of the York River. Here, however, there occurred with it at several places a somewhat stouter plant having rose-purple flowers which, although greatly resembling the other was obviously not the same.

An added interest came into the matter when, upon the occasion of a joint field meeting of the Philadelphia and New York botanical societies in Bucks County, Pennsylvania, on July 4, 1899, a germander just in flower along the shores of the Delaware River was readily seen to be different from the two which had been previously met with ; and even more interesting was the receipt of specimens collected on the shores of Lake Champlain by Mr. W. W. Eggleston which again it was impossible to correlate satisfactorily with anything before seen.

An examination of the herbaria of the New York Botanical Garden and Columbia University showed that the mass of eastern specimens could be readily sorted into two series, one representing a coastwise plant, that of the Hudson River—the other being the plant of the Delaware and showing it to be our commonest and most generally distributed species. In these considerable collections the brighter-flowered Maine plant was quite unrepresented and the Champlain plant only by a few examples mostly from the same localities from which I had already received it. In addition two specimens from Michigan possessing characters not shared by any of the others were especially noteworthy, as well as a typical example of *T. occidentale* Gray from as far east as Lake Ontario. A detailed study of the whole subject gave the very unexpected result that six species instead of two are to be credited to our eastern flora.

In these circumstances it becomes necessary before pursuing the subject further to inquire into the exact significance of the Linnaean names *T. Canadense* and *T. Virginicum*, both applied to plants of the Eastern United States. In Species Plantarum we find that the former species was based primarily on the *Chamaedrys Canadensis* of Tournefort and that under it a specimen of Gronovius' is also cited, but with a mark of doubt. The *T. Virginicum* was based alone on a Gronovian species.

When in London three years ago, Professor Underwood kindly undertook to look into the matter of the Linnaean types. The specimen underlying *T. Virginicum* was searched for with the assistance of Mr. Britten both in the British Museum and at the Linnaean Society rooms; it was not to be found and is probably not now in existence.

The specimen doubtfully cited by Linnaeus under his *T. Canadense* was, however, brought to light at the British Museum. It proved to be "wholly unsatisfactory" and was regarded both by Mr. Britten and Professor Underwood as a pathological plant. However, from the careful notes and sketches of the leaves made by Professor Underwood I have little doubt that the specimen is actually our common coastwise plant. On the other hand Tournefort's description of his *Chamaedrys Canadensis*, the actual type of the Linnaean species, although unsatisfactory, points with reasonable certainty to our common inland species; his words "*urtice folio subtus incano*" apply with ready appropriateness to this plant while scarcely to be suggested by the narrow-leaved coast form. The name *T. Canadense*, therefore, while not wholly free from uncertainty now that six species present themselves, may fairly be retained for our more inland plant, and fortunately so since this species being the most widely distributed and commonest of all may be accepted as the one for which the name has been more especially used.

As to *T. Virginicum* of Linnaeus the evidence deducible from the words of Gronovius, all that remains to us, allows scarcely a doubt that it was nothing else than the *Chamaedrys Canadense* of Tournefort and that therefore the name *T. Virginicum* L. has quite properly been considered a synonym of *T. Canadense* L. At the same time it is fairly clear that Gronovius recognized both of our most common species, a discrimination of nearly two hundred years ago which has remained unverified to the present day.

But a further interest attaches to Linnaeus' treatment of his *T. Canadense.* In his remarks touching it he refers descriptively to a plant from "Canada" and also to one which he had in cultivation. The latter, again, can scarcely be other than his *T. Virginicum*, but the former by the clearest indications of probability was the Lake Champlain species of which I have spoken and which is perfectly distinct from the species with which Linnaeus associated it. Therefore of the six species now to be recognized it appears that two only have ever received distinctive names.

TEUCRIUM CANADENSE L. Common Germander

Erect, from .5 to over 1 dm. high, simple or above with several flowering spikes: stem and inflorescence closely canescent-pubescent: leaves rather thin, ovate to ovate-oblong or narrower, rounded or rarely subcordate at base, acute or acuminate at apex, 6–14 cm. long, 2.5–5 cm. wide, closely and often irregularly dentate-serrate, above green and thinly appressed-hirsutulous to glabrate, hoary-pubescent beneath, the canescent petioles 5–12 mm. long or shorter on the upper leaves: calyx often purplish, canescent, 5–7 mm. long, turbinate, the upper teeth acute or obtuse, the lower pair slightly longer, triangular-subulate: bracts mostly not surpassing the mature calyx: spikes dense: corolla pink, 15–20 mm. long, the outer surface minutely glandular-puberulent.

Western New England to Georgia and southern Texas, west to Arkansas. Low grounds and river shores, June–July.

NEW YORK: ex Herb. Torrey; Head of Seneca Lake, Gray.

PENNSYLVANIA: Point Pleasant, E. P. B.; Nockamixon Rocks, H. H. Rusby; Sayre, W. C. Barbour; Easton, A. A. Tyler.

OHIO: Columbus, N. L. Britton.

WEST VIRGINIA: Ripley, C. F. Millspaugh; Bayard, C. F. M.

NORTH CAROLINA: Biltmore.

SOUTH CAROLINA: Pickens County.

GEORGIA: Macon, J. K. Small.

TENNESSEE: Henderson, S. M. Bain; Knoxville, A. Ruth.

KENTUCKY: C. W. Short, M.D.; Lexington, R. Peter.

MISSOURI: Watson, B. F. Bush.

ARKANSAS: Dr. Pitcher.

KANSAS: Ft. Riley, E. E. Gayle, J. B. Norton.

INDIAN TERRITORY: Dr. Edward Palmer.

TEXAS: Kerryville, A. A. Heller.

MEXICO: Sonora, Geo. Thurber, no. 698, probably var. *angustifolium* Gray.

ARIZONA: Tucson, C. G. Pringle, probably var. *angustifolium* Gray.

NEBRASKA: Mead, P. A. Rydberg.

IOWA: Debora, E. W. D. Holway.

WISCONSIN: Milwaukee, Dr. H. E. Hasse.

Teucrium littorale sp. nov. Coast Germander

Pale and canescent, 30–50 cm. high, erect or assurgent, often with ascending branches: leaves thickish and rugose-veiny, narrowly oblong or sometimes broader, narrowed into the petiole, acute or obtusely pointed, closely fine-serrate or becoming unequally somewhat dentate-serrate, 6–11 cm. long, 1.5–4 cm. wide, when dry the upper surface minutely papillose-roughened beneath the soft appressed pubescence; petioles 5–10 mm. long: spikes narrow, often interrupted; bracts about the length of the calyx: calyx small, 4–5 mm. high, becoming somewhat gibbous-urceolate, the teeth short, the upper ones obtuse: corolla pale pink, about 15 mm. long, loosely pilose without.

On or near the coast, Maine to Florida, July–August.

MAINE: York Harbor, Aug. 26, 1896, E. P. B. Type, in Herb. N. Y. Bot. Gard.

MASSACHUSETTS: Nantucket, E. P. B.

NEW YORK: Ft. Washington, E. P. B; Long Island, ex Herb. Torrey, Sag Harbor, N. L. Britton.

MARYLAND: Stocton, H. H. Rusby.

VIRGINIA: Norfolk, N. L. Britton, A. A. Heller.

SOUTH CAROLINA: Charleston, L. R. Gibbes.

FLORIDA: Chapman; Duval Co., L. H. Lighthipe; Jacksonville, A. H. Curtiss.

Teucrium roseum sp. nov. Maine Germander

Rather stout and deep green, 30–70 cm. high, the stem soft pubescent or downwardly villous, often with ascending branches above: leaves short-oblong or oblong-ovate, cuneate at base, acute or acuminate at apex, irregularly dentate-serrate or somewhat cut-serrate with numerous subspreading teeth, more or less densely hoary-tomentose beneath, softly pilose-pubescent above, 6–9 cm. long, 2.5–4.5 cm. wide, the slender petioles hoary-pubescent, 10–15 mm. long: inflorescence hoary-villose: calyx often purplish, 5–7 mm. long, the upper tooth acute, the lateral ones obtuse, the lower pair but little longer, triangular-subulate; pedicels very short: bracts usually longer than the calyx, ciliate-fringed: corolla rose-purple, somewhat smaller than in *T. littorale* and less exserted, more or less pilose-bearded.

Coast of Maine, August–September, York Harbor, Aug. 18, 1896, E. P. B. Type in Herb. N. Y. Bot. Gard. Mt. Desert, Aug. 19, 1897. E. P. B.

TEUCRIUM OCCIDENTALE Gray. Western Germander

From 30–80 cm. high, becoming erectly branched above, the dense narrow spikes either short or flexuously elongated: stem and petioles villous-hirsute with spreading or recurved hairs, the inflorescence densely hirsute and viscid-glandular; leaves ovate-oblong, narrower or broader, 4–9 cm. long, 1.5–3 cm. wide, mostly rounded at base, acute and sharp-serrate, papillose-hirsute above, tomentulose or hirsute-pubescent beneath with spreading hairs on the larger veins, petioles 10–20 mm. long: bracts mostly shorter than the calyx: calyx often purple, 5 mm. long to the acute upper teeth, the elongated lower teeth more or less stiffly lanceolate-subulate: corolla pinkish-purple, 8–12 mm. long, tomentulose and glandular without.

Ontario and Missouri to California and British Columbia, August.

ONTARIO: Kingston, J. Fowler.

NEW YORK: Manitou Beach, Lake Ontario, N. L. Britton.

OHIO: Riddell, 1834.

MISSOURI: Jackson Co., B. F. Bush.

NEBRASKA: P. A. Rydberg.

IOWA: Armstrong, R. I. Cratty; Ames, L. H. Pammel and C. R. Ball.

COLORADO: Canyon City, Miss Alice Eastwood.

ARIZONA: Fort Apachee, Mrs. R. W. Hoyt.

CALIFORNIA: Valley of the Sacramento, Wilkes Expedition, no. 1331.

BRITISH COLUMBIA: John Macoun.

Teucrium boreale sp. nov. Northern Germander

Erect or ascending, rather slender, often widely branched from the base, from 30 to 80 cm. or more tall: stem loosely pubescent with recurved hairs, especially on the angles, to glabrate, the inflorescence somewhat villous-pubescent, scarcely if at all glandular: spikes rather short or the terminal one elongated, often interrupted and somewhat flexuous: leaves thin or membranous, ovate-oblong to oblong-lanceolate, sometimes narrowly so, 5–10 cm. long, 2–3.5 cm. wide, acute at the apex, rounded or narrowed at the base, more or less regularly sharp-serrate to dentate-serrate, above minutely hispidulous puberulent, beneath thinly tomentulose, or sometimes glabrate throughout: petioles of the main leaves becoming 10–20 mm. long: bracts mostly shorter than the calyx, ciliate: calyx thin, campanulate, 4–5 mm. long, the subequal teeth short and broad, the lateral pair very obtuse: corolla purplish-pink, 12–15 mm. long, about three times the length of the calyx, loosely short-pubescent and dotted with minute glands, the terminal lobe broad.

New Hampshire to northern New York, August.

NEW HAMPSHIRE: Lyme, W. W. Eggleston.

VERMONT: Alburg Springs and Rutland, W. W. Eggleston; Burlington, Grant.

NEW YORK: West Point, ex-Herb. Torrey; Westminster Park, Miss E. Babcock. Type from Vermont, in Herb. N. Y Bot. Garden.

Teucrium menthifolium sp. nov. Mint-leaved Germander

Sparsely hirsute-pubescent with recurved hairs to nearly glabrous except the inflorescence, smaller and less branched than *T. occidentale*, the denser spikes shorter, with the bracts often conspicuously elongated and foliaceous, the pubescence not viscid nor glandular: leaves firm and thickish, pale green, minutely pubescent to glabrate above, white-veiny and thinly tomentulose beneath, with longer hairs on the veins or glabrate, lanceolate or narrowly oblong, narrowed or contracted at the base, 5–9 cm. long, 2–3 cm. wide, acute or acuminate at the apex, somewhat regularly sharp-serrate: calyx 5–6 mm. long, narrowly campanulate, the teeth shorter and less rigid than in *T. occidentale*, the lateral obtuse, the lower pair only slightly longer: corolla pink, short, sometimes not twice the length of the calyx, thinly pubescent and glandular, the terminal lobe small, often not broader than the lateral ones.

CENTRAL MICHIGAN: Alma, July 17, 1890, August, 1892. Charles A. Davis. Type in Herb. Columbia.

Synopsis of the Species

Pubescence of stem more or less closely hoary.

Canescently short-pubescent : leaves ovate-oblong, rounded at base, the upper surface thinly hispidulous to glabrate : corolla pink, minutely glandular-puberulent. 1. *T. Canadense.*

Downy-canescent : leaves narrowly oblong or broader, the base narrowed, the upper surface soft-pubescent : corolla pale pink, loosely pilose. 2. *T. littorale.*

Soft-pubescent or downwardly villose : leaves oblong-ovate, cuneate at base, pubescent above : corolla rose-purple, pilose-bearded. 3. *T. roseum.*

Pubescence looser, of longer spreading or recurved-spreading hairs.

Pubescence usually dense and spreading, the inflorescence hirsute and glandular-viscid. 4. *T. occidentale.*

Pubescence shorter and sparser, the inflorescence not glandular-viscid or scarcely so.

Leaves thin, bracts short : corolla about three times the length of the calyx. 5. *T. boreale.*

Leaves firm, bracts often elongated : corolla about twice the length of the calyx. 6. *T. menthifolium.*

Further Studies on the Potentilleae

By P. A. Rydberg

I. WEST AMERICAN SPECIES

Potentilla horrida sp. nov.

A stout perennial with very thick woody root and a short caudex covered with the thick coriacious brown remains of old leaves: stems ascending, 1.5–4 dm. high, stout, few-leaved, hirsute-villous: petioles of the basal leaves 5–10 cm. long, stout, densely hirsute-villous, broadened at the base and surrounding the stem: leaves digitate; leaflets usually 5, linear-oblong or oblong-lanceolate, obtuse, crenulate, 3–5 cm. long, 7–12 mm. wide, densely pubescent on both sides, almost velvety: pubescence at first white, later on brown, consisting of tomentum and longer silky hairs: stem-leaves similar or trifoliolate, much smaller; the upper subsessile; the stipulates lanceolate to linear-subulate, 1–3 cm. long, adnate to the petioles: cyme rather congested: hypanthium and calyx densely pilose: bractlets lanceolate, acute, about half as long as the ovate-lanceolate sepals which are about 5 mm. long: petals yellow, broadly obovate, about 7 mm. long.

A species of the *gracilis* group, but resembling most *P. Haematochrus* in habit and pubescence. It differs, however in the coarser pubescence, the 5-foliolate, instead of 7-foliolate leaves and the yellow petals. The type specimens were found at an altitude of 2250 m.

Mexico, State of Chihuahua: Sierra Madre, near Colonia Garcia, 1899, *Townsend & Barber, 16.*

Potentilla brunnescens sp. nov.

A tall strict perennial with short scaly rootstock: stem 4–5 dm. high, pubescence, especially above, tinged with brown or purplish: basal leaves digitately 5–7-foliolate; petioles often 2 dm. long, villous with spreading hairs; leaflets 4–7 cm. long, broadly oblanceolate in outline, brownish strigose on both sides, paler beneath, pectinately divided to near the midrib; segments linear, obtuse: stem-leaves similar but short-petioled or subsessile, smaller: cyme many-flowered, corymbiform: hypanthium and calyx villous-strigose: bractlets linear, obtuse, about half as long as the ovate-lanceolate, acute sepals: petals yellow, 5–6 mm. long, obovate, about one fourth longer than the sepals.

The species is a member of the *gracilis* group and nearest related to *P. flabelliformis*, from which it differs in the light brown or yellowish pubescence and the lack of tomentum on the lower surface of the leaves. The type was collected at an altitude of nearly 2000 m.

WYOMING: Spread Creek, in the Teton Forest Reserve, 1897, *F. Tweedy, 212.*

Potentilla Townsendii sp. nov.

A slender perennial with a deep root and a short caudex, covered by the brown remains of old leaves: stem ascending, 3–5 mm. high, sparingly silky: petioles of the digitate basal leaves 7–10 mm. long, slightly hairy; stipules adnate to the petioles; the free portion linear-subulate; leaflets 5–7, oblanceolate to almost linear, serrate, acute, glabrous above, sparingly hairy beneath, principally on the veins: stem-leaves 2–3, similar, but with shorter petioles: stipule large, 3–4 cm. long, lanceolate or ovate-lanceolate: cyme rather open: hypanthium and calyx silky-strigose: bractlets linear-lanceolate, equalling the lanceolate sepals: petals yellow, broadly obcordate, about 1 cm. long and almost twice as long as the sepals.

This species is perhaps nearest related to *P. heptaphylla*, but easily distinguished by the narrow leaflets and the larger flowers. It was collected at an altitude of about 2250 m.

MEXICO, STATE OF CHIHUAHUA: Sierra Madre, near Colonia Garcia, July 17, 1899, *Townsend & Barber, 105.*

Potentilla filipes sp. nov.

A tall perennial with several stems from the short caudex. Stem 3–5 dm. high, slender, silky-hirsute, simple up to the inflorescence: few-leaved: basal leaves mostly 7-foliolate, digitate, with hirsute petioles, 5–15 cm. long; leaflets obovate to oblanceolate, obtuse, coarsely crenate, 2–6 cm. long, green and sparingly strigose above, white-tomentose beneath; stem-leaves similar, but smaller, usually 5-foliolate, short-petioled: stipules ovate-lanceolate, entire: cyme open: pedicels very slender, as well as the hypanthium and calyx silky hirsute and more or less viscid: bractlets linear-lanceolate, a little shorter than the lanceolate, acute sepals: petals yellow or somewhat orange, broadly obcordate or obovate and emarginate, 6–8 mm. long, exceeding the sepals: stamens about 20.

This species is nearest related to *P. pulcherrima* Lehm., and I had referred all the specimens cited below, except the type, to that species. It differs from *P. pulcherrima* in the very slender pedicels, the total lack of tomentum on the hypanthium and the calyx and the evident viscidity of these organs and the pedicels. It grows in mountain meadows and on hillsides at an altitude of 2400–3200 m.

COLORADO: Wahatoya Cañon, Spanish Peaks, 1900, *Rydberg & Vreeland, 6039* (type); West Mancos Cañon, 1898, *Baker, Earle & Tracy, 306;* La Plata Mountains, *182.*

MONTANA: Bridger Mountains, 1896, *J. H. Flodman, 561.*

Potentilla permollis sp. nov.

A stout hoary perennial. Stems simple, about 6 dm. high, densely and softly pubescent with long whitish hairs: basal and lower stem-leaves usually 7-foliolate, digitate; petioles about 1 dm. long, pubescent: leaflets obovate to oblanceolate, obtuse, coarsely cleft nearly half way to the midrib, with lanceolate lobes, densely soft-pubescent on both sides, greenish above, white and somewhat tomentose beneath: upper stem-leaves 3–5-foliolate, similar, smaller, short-petioled: stipules of the stem-leaves large, adnate to the petiole, ovate, often over 3 cm. long: cyme rather open: hypanthium and calyx densely white-pubescent: bractlets linear-lanceolate, about equalling the lanceolate sepals: petals yellow, 6–7 mm. long, obcordate, exceeding the sepals by about one fourth: stamens about 20.

This species is nearest related to *P. Blaschkeana*; but differs principally in the denser and white pubescence and the smaller flowers. It grows in meadows.

WASHINGTON: Endicot, Whitman Co., 1898, *A. D. E. Elmer, 1830.*

Potentilla obovatifolia sp. nov.

A low perennial with a thick tap-root: stems ascending or depressed, 2–3-leaved, 1.5–2 dm. high, sparingly villous: basal leaves mostly digitately 7-foliolate with petioles 3–10 cm. long: leaflets broadly obovate, obtuse, coarsely crenate-serrate, green and sparingly hairy above, white tomentose beneath, .5–3 cm. long: stem leaves mostly 3-foliolate, small, short-petioled with broadly lanceolate stipules: cymes open but few-flowered: hypanthium and calyx densely silky: bractlets and sepals lanceolate, subequal: petals obcordate, yellow, about 8 mm. long, nearly twice as long as the sepals.

This species is a member of the *concinna* group and nearest related to *P. concinniformis*; but is larger; the leaflets are greener and more glabrous above and the bractlets are longer. By the size it approaches the *gracilis* group.

MEXICO: *Pringle, 6890.*

Potentilla Hallii sp. nov.

A more or less villous-hirsute ascending or decumbent perennial with a short rootstock or caudex: stem about 3 dm. long, sparingly villous-hirsute, terete and light green: leaves mostly digitately 5-foliolate or the upper 3-foliolate or simple: basal ones with petioles 3–5 cm. long: leaflets obovate, 1–3 cm. long, coarsely serrate-crenate, green and slightly hairy above: paler, hirsute and sparingly tomentulose beneath: upper stipules ovate, entire, 12–15 mm. long: cyme rather open: hypanthium and calyx hirsute, more or less tinged with purple: bractlets ovate-lanceolate about one third shorter than the ovate acute sepals: petals yellow, about 5 mm. long, scarcely exceeding the sepals: stamens 20.

This species is nearest related to *P. fastigiata*, but is greener and with a more open cyme. As to the pubescence of the leaves, it resembles *P. viridescens*; but is in every respect smaller and the stem is not erect. On account of its small size, it could just as well be referred to the *maculata* group as to the graciles. The type grew at an altitude of about 1600 m.

CALIFORNIA: Pine Ridge, Fresno County, 1900, *Hall & Chandler, 182.*

Potentilla propinqua

Potentilla diffusa A. Gray, Mem. Am. Acad. 1849: 41. 1849. Not Willd.

P. Hippiana, var. *diffusa* Lehm. Ind. Sem. Hort. Bot. Hamb. 1849: 8.

P. Hippiana, var. *propinqua* Rydb. Bull. Torr. Club, **24**: 3. 1897.

The original specimens were rather depauperate and the most prominent characters which separate it from *P. Hippiana* were not noticed by me when I prepared my Monograph of the North American Potentilleae. The plant is much greener than *P. Hippiana*; the upper surface of the leaves, as well as the pedicels, hypanthium and the calyx, is only slightly silky, not at all tomentose; the cyme in well-developed specimens is more open and flat-topped; and the upper segments of the leaves are decurrent and sometimes confluent, which is never the case in *P. Hippiana.* By the latter characters it approaches *P. ambigens* Greene. From this it differs in the appressed pubescence, the smaller flowers and the less coarsely toothed segments. Baker's no. 390, as represented in the herbarium of the New York Botanical Garden, was named *P. ambigens* by Professor Greene, but belongs unquestionably to this species.

Horkelia Chandleri sp. nov.

A low silky perennial with very thick and woody root and short cespitose caudex with erect branches densely covered by the remains of old leaves. Stems scapiform, slender, silky villous, 7–16 cm. high: basal leaves numerous, 4–5 cm. long, densely silky, terete, worm-like from the numerous small crowded segments: flowers about 4 mm. in diameter, rather many in subcapitate dense clusters, hypanthium cup-shaped, as well as the calyx densely villous: bractlets linear, about two thirds as long as the triangular-ovate sepals: petals yellow, linear, 1.5 mm. long, shorter than the sepals: stamens mostly 5: filaments subulate-filiform.

This species closely resembles *H. Muirii* in the leaves and the thick root and caudex: but differs in the taller scape, the more numerous flowers, the longer bractlets, and the narrower linear petals. The type grew at an altitude of about 3450 m.

CALIFORNIA: Mt. Goddard, 1900, *Hall & Chandler*, 700.

Drymocallis gracilis sp. nov.

A tall and slender, glandular pubescent perennial with a more or less cespitose caudex. Stem about 6 dm. high, glandular-pilose throughout, branched above: basal and lower stem-leaves pinnately 7–9-foliolate, 1–3 dm. long: leaflets obovate to flabelliform, 1–5 cm. long, coarsely incised, except at the bases, sparingly pubescent on both surfaces: upper stem-leaves 3–5-foliolate, subsessile: pedicels slender, .5–4 cm. long, very glandular: hypanthium and calyx glandular: bractlets linear, about half as long as the lanceolate acuminate sepals; these in fruit often 8 mm. long: petals white, small, broadly obovate, scarcely exceeding the sepals: stamens, 20–25: style slightly fusiform.

This species resembles most *D. glandulosa incisa* in habit and leaf-form; but differs in the white petals, more acuminate sepals and the denser glandular pubescence. The type was collected at an altitude of about 1600 m.

CALIFORNIA: Pine Ridge, Fresno County, 1900, *Hall & Chandler, 138.*

II. SOME SPECIES FROM GREENLAND

Some time ago Mr. Morten Pedersen, Assistant at the Botanical Garden of Copenhagen, requested me to determine a collection of *Potentillae* collected by him in Greenland. He also kindly sent me several other specimens from the herbarium of the Botanical Museum of such forms that I had not seen at all or of which I had had only imperfect material. With the help of this material I have been able to settle several important points and considerably modify the disposition in my monograph.

POTENTILLA MACULATA Pourr. Act. Toloss. 3: 316. 1788

The following specimens additional to those given in my monograph,* belong to this species:

GREENLAND: Kingua Tasiusok (61°45′), 1889; Scoresby Sund, 1891; Danmarks, Oe. 1892; Jameson's Land, 1891, *N. Hartz;* Godthaabs Fjord, 1883, *J. A. D. Jensen;* Alangua, 1885, *S. Hansen;* Umanaks Fjord, 1885, *P. Eberlin;* (locality not given), *Raben, 1;* Scoresby Sund, 1891, *H. Hartz;* † Kvan Valley, behind Ujaragsugsuk, 1898, *Morten Pedersen, 705;* Ekalunguit Itivnerit *429;* both on Disco.

POTENTILLA MACULATA var. FIRMA Lange, Consp. Fl. Groenl. 235 is scarcely that of Lehmann,‡ although it agrees perfectly with Lehmann's description. The latter was in reality based upon *P. alpestris α firma* Koch. I have no means to find what this really is; but Lehmann cites *P. alpestris c rubens* Hegetschw. and *P. rubens* Vill. as synonyms. These names represent a coarser plant from Austria, Switzerland and Italy with longer and more acute teeth to the leaves. I think it is a good species distinct from

* Mem. Dep. Bot. Columbia Univ. 2: 59.

† This sheet is labeled *Potentilla maculata* Pourr. var. *gelida* C. A. Mey., as it appears on the label from the fact that a few of the basal leaves are ternate, a condition not uncommon in *P. maculata*. It has nothing to do with *P. gelida* C. A. Meyer.

‡ Rev. Pot. 120.

P. maculata. The Greenland plant cited by Lange agrees fully with the typical *P. maculata* except that the leaflets are broader, more round and overlapping each other by the margins. I scarcely think that it deserves a varietal name. If it does it must bear some other name than *firma*, as this is preoccupied. The specimens cited by Lange and the only one seen is the following:

GREENLAND: Holsteinsborg, 1884, *Eug. Warming & Th. Holm.*

Potentilla Langeana sp. nov.

P. maculata β hirta Lange, Consp. Fl. Groenl. 6. 1880. Not *P. hirta* L.

A cespitose perennial. Stems erect or ascending, 2–3 dm. high, sparingly hirsute with erect branches: basal leaves digitately 5-foliolate: stipules large, adnate, lanceolate, 1–2 cm. long: petioles 3–8 cm. long, sparingly hirsute: leaflets cuneate-obovate, more or less densely silky-hirsute on both sides, 1–3 cm. long, coarsely toothed above the middle with oblong ovate teeth, the cuneate base entire: lower stem leaves similar but smaller and short-petioled: upper stem-leaves ternate or simple and subsessile: stipules ovate, acutish, about 1 cm. long: cyme 3–7-flowered; hypanthium silky hirsute: bractlets oblong to lanceolate, acute or obtuse, about one fourth shorter than the lanceolate sepals: petals broadly obcordate, 7–8 mm. long: stamens about 20.

The species differs from *P. maculata* not only in the characters given by Lange, the several-flowered cymes and the long pubescence of the leaves; but also in the more acute teeth, the longer and more acutish bractlets and narrower sepals. In *P. maculata* both the teeth of the leaves and the bractlets are rounded at the apex and the latter are only one half or two thirds as long as the sepals. *P. Langeana* is in reality nearer related to *P. verna* than to *P. maculata* but distinguished from that by the pubescence. In Conspectus Florae Groenlandicae several more specimens are cited belonging to *P. maculata β hirta* Lange. The following are the only ones seen by me:

GREENLAND: Amaralik Fjord, 1831, *J. Vahl* (type); Kangerdluarsuk Fjord, 1884, *Warming & Hohn;* Natsilik, *S. Hanson;* Ekalunguit Itivnerit on Disco, 1898, *Morten Pedersen, 419;* Ekigtok in Disco Fjord, *1684* (a taller and more glabrate form*);

* This was labeled *P. maculata* var. *pyrenaica* (Ramond) Lehm., which is quite a different plant, having thick leaves with short teeth directed forward.

Kuanersuit on Disco, *2710*; Engelskmandens Havn, Disco, *1879* (a slender depauperate form*).

POTENTILLA EMARGINATA Pursh, Fl. Am. Sept. 353. 1814

Undeveloped or depauperate specimens of this species resemble often very closely *P. nana* and I am now inclined to regard the two species as forms of one. In Alaska and other arctic regions of the American Continent they seem distinct enough but the plants from Greenland, Spitzbergen and Novaja Semlja are often so confusing that it is hard to tell to which to refer them.

The specimens collected by Mr. Pedersen are as follows, those approaching *P. nana* are marked by (?).

GREENLAND: Skarvefjord, 1898, *Pedersen*, *279*; Ingigsok, *218a* and *218b*; Mudderbugten, *966* (?); Ekalunguit Itivnerit, *1414*; Plateau behind Ujaragsugsak, *3099*; all on Disco.

POTENTILLA NANA Willd.; Schlecht. Mag. Ges. Naturf. Fr. Berlin. **7**: 296. 1813

Among the many species of *P. emarginata* sent from Copenhagen, there are two sheets, however, that represent the typical *P. nana* with its round teeth and rounded obtuse sepals and bractlets, viz.:

GREENLAND: Manatsook, 1883, *Dr. Berlin*; Upernaviarsur, 1887, *Ryder*, *7*.†

POTENTILLA NIVEA L. Sp. Pl. 499. 1753

Of the typical *P. nivea* the collection sent contains many sheets, the following was the only one collected by Mr. Pedersen:

GREENLAND: Rocks behind Kuanersuit on Disco, 1898, *M. Pedersen*, *2706*.

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*On the label is written "*Potentilla maculata* Pourr. var. *debilis* Lehm. in var. *hirtum* Lge. transiens." Lehmann cites under the var. *debilis*, *P. incisa* Desf. as a synonym. The latter is figured in Nestler's Monograph as a large plant with narrowly cuneate leaflets deeply incised at the apex, and quite unlike the specimens cited above. The latter I cannot distinguish from the typical *P. Langeana* except in size.

† The last was determined by Lange as *P. nivea prostrata*, which must be a mistake as it is unlike the other specimen collected by Vahl and does not agree with the description.

POTENTILLA NIVEA ALTAICA (Bunge) Rydb. Mem. Dep. Bot. Columbia Uni. **2**: 86. 1898

Potentilla nivea var. *arenosa* Lange Consp. Fl. Gr. 236. Not Turcz.

The specimens collected by Warming and Holm were determined by Lange as *P. nivea arenosa* Turcz. but that variety is described as having glomerate flowers, which is not the case in Warming and Holm's specimens. These do not differ from the common form of *P. nivea Altaica* except that the flowers are somewhat smaller. In fact they are as like the figure in Ledeb. Icon. Fl. Ross. **4**: 329 as I have seen. If Lange's determination in this case were correct the varieties *Altaica* and *arenosa* must be united. I think, however, that the latter is quite different and restricted to Asia. The following specimens belong here and are not recorded in Conspectus Florae Groenlandicae:

GREENLAND: Amaralik Fjord, 1831, *J. Vahl*; Scoresby Sound, 1892, *N. Hartz*; Kakatsiak, 1885, *S. Hanson*; Christianshaab, 1884, *Warming & Holm*; rocks behind Kuanersuit on Disco, 1898, *M. Pedersen 2702–5, 2707–9* (?);* Christianshaab, 1833, *J. Vahl* (?).†

POTENTILLA NIVEA PALLIDIOR Sw. Sum. Veg. Scand. 19. 1874

Potentilla nivea subviridis Ledeb. Fl. Ross. **2**: 57. 1844.

The following specimens belong here:

GREENLAND: Scoresby Sound, 1892, *N. Hartz*; Godhavn, 1871, *Th. Fries.*

Potentilla subquinata (Lange)

Potentilla nivea pentaphylla Lehm. Nov. Stirp. Pug. **9**: 69. 1851. Not *P. pentaphylla* Richt. 1815; *P. nivea subquinata* Lange, Consp. Fl. Groenl. 9. 1880; *P. nivea quinquefolia* Rydb.

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* All of Mr. Pedersen's specimens are sterile and without fully developed leaves. They are remarkable for their long branching caudices and may belong to the variety of the next species described below or perhaps to an undescribed species. They cannot be determined satisfactorily.

† This was determined by Lange as var. *prostrata* but it does not agree with Rottboell's description especially as to the glomerate heads, sinuate-dentate leaves, revolute margins and purple veins. I refer this doubtfully here as it differs from all other specimens seen in the narrow leaflets.

Bull. Torr. Club, **23**: 302. 1896; *P. quinquefolia* Rydb. Mem. Dep. Bot. Columbia Univ. **2**: 76. 1898.

When I changed *P. nivea pentaphylla* Lehm. to *P. nivea quinquefolia*, I did not know that it was identical with Lange's var. *subquinata*. From his description, especially from the words "eleganter pinnatifidis" I was lead to the supposition that it represented the quinate form of var. *Altaica*. Consequently I referred Lange's var. *subquinata* to that variety. As Lange's name is older than my own, it should be adopted. I am well satisfied with the change, as my own as a specific name is a misnomer. The following specimens belong here.

GREENLAND: Disco Fjord, 1894, *P. Soerensen*, *301*; Akingdlek, 1890, *N. Hartz*, *1*; Kingua Orpiksuit, *2*; Atanekerdluk and Kuanersuit on Disco, 1871, *Th. Fries*; Kingigtok, 1890; *N. Hartz*; rocks behind Kuanersuit on Disco, 1898, *M. Pedersen*, *2718*, *2717*, *2713*, *2715a*, *2712*; Disco Fjord, *3906*; Skansen, Disco, *927*; Kuganguak Valley, *2313* and *496*; Vajat-shore, Unartuarsuk, *113*.

SPITZBERGEN: Kap Thorsen, 1896, *E. Joergensen*.

Potentilla subquinata Pedersenii var. nov.

Caudex with elongated branches covered by the remains of old leaves; stems low, less than 1 dm. high, 1–3-flowered, as well as the petioles covered with long white hairs: leaflets small, 1–1.5 cm. long, broadly obovate: white silky on both sides and tomentose beneath, in age more glabrate above, bractlets very narrow, linear or linear-lanceolate.

GREENLAND: Vaigat Assuk, Disco, 1898, *M. Pedersen*, *470* (type) and *1061a*. Rocks behind Kuanersuit, *2711*, *2714*, *2716*, and *2710*; Ingigsak, *233*; Rocks by Mudderbugten, *967*; Mungarut, *924*; all on Disco.

POTENTILLA VAHLIANA Lehm. Mon. Pot. 29 and 172. 1820

Fine specimens of this species were also in Pedersen's collection.

GREENLAND: Vajgat, Assuk on Disco, *M. Pedersen 1061b*. Lyngmarken by Godhaven, *80*; Rocks behind Kuanersuit on Disco, *2715b*; Roede Elv, Disco, *3441b*.

POTENTILLA PULCHELLA R. Br. in Ross' Voy. 142

GREENLAND: Kugsinarsuk, Disco, 1898, *M. Pedersen, 494;* Vaigat-shore, Assuk, *457* and *941;* Kutdlisat, *396a;* Jameson's Land, 1891, *N. Hartz.*

POTENTILLA PULCHELLA ELATIOR Lange Consp. Fl. Groenl. 4. 1880

GREENLAND: Kardlunguak, 1890, *N. Hartz;* Atanekerdluk, 1871, *Th. M. Fries;* Vaigat Shore by Assuk, 1898, *M. Pedersen, 462.*

ARGENTINA EGEDII (Wormskj) Rydb. Mem. Dep. Bot. Columbia Uni. **2**: 158. 1898

GREENLAND: Disco Fjord by Kuanersuit, 1898, *M. Pedersen, 1448;* Ungorsivik by Maligiak, *438.*

Some new Fungi

By S. M. Tracy and F. S. Earle

Meliola anomala sp. nov.

Epiphyllous, forming black, velvety, usually orbicular patches, 2–5 mm. in diameter, often with a grayish border; perithecial mycelium rather scanty, of thick, brown, opake, frequently septate threads about 8 μ in diameter; conidial (?) mycelium abundant, of nearly hyaline, slender, branching threads about 4 μ in diameter; conidia not seen; capitate hyphopodia very numerous, often densely crowded, usually the upper cell oval to ovate, smoothly rounded, about $16 \times 12\,\mu$, occasionally angled or sublobate and very rarely elongate and once septate, basal cell small and short, about $6 \times 6\,\mu$; mucronate hyphopodia none; setae very numerous, dark brown, frequently septate, tip entire, blunt, the upper third usually conspicuously flexed and irregular, 200–300 μ long, base about 7 μ thick, tip 4 μ thick; perithecia scattered, abundant, about 200 μ in diameter, of soft, small-celled parenchyma, cells about 8 μ; asci clavate to obovate, pedicellate and conspicuously fascicled, 8-spored, about 100×20–$40\,\mu$; ascospores inordinate, strongly clavate, broad above, narrowed to a blunt point below, light fuliginous, 4-septate, 40–45 μ long, 12 μ broad above, 4 μ broad below.

On living leaves of *Persea* sp., Palma Sola, Fla., May 14, 1900, S. M. Tracy, no. 6600.

This interesting species is evidently closely related to *Meliola clavatispora* Speg. but it differs from published descriptions of that species in the much longer and curiously flexed and irregular setae, and in the stalked not sessile hyphopodia.

If this is to be considered a true *Meliola* and there seems no reason to doubt it, it would seem to effectively dispose of the scheme of classification proposed by some recent authors by which *Meliola* has been taken from its natural allies among the Perisporiaceae and thrust in among the exceedingly different Aspergillales. In this species the asci are as conspicuously fascicled as in any of the Sphaeriales.

Hysterostomella Floridana sp. nov.

Epiphyllous, scattered, spots none; stromata black, superficial, crust-like, 1–4 mm. in diameter, the margin sterile and smooth, the central portion rugose with irregular elongated ridges formed by the connivent lips of the poorly defined subconfluent ascomata, the margin bordered by a narrow indistinct, *Lembosia*-like subiculum of anastomosing fuscus threads: asci broadly oval, aparaphysate, rather thick-walled, 30–35 × 20–25 μ; ascospores eight, inordinate, narrowly ovate, about equally uniseptate, constricted, ends obtuse or the narrower one subacute, hyaline to light olivaceous (probably darker with age), 16–18 × 6–7 μ.

On leaves ot *Ardesia Pickeringii*, Manatee, Fla., May 11, 1900, S. M. Tracy, no. 6612.

The five previously described species of this little-known tropical genus are all from South America. It is evidently closely related to *Lembosia* from which it can only be separated by the compound stroma-like ascoma.

This peculiar group of black, superficial, mostly tropical fungi has always been classed in the Hysteriales on account of their elongated ascomata that open by a slit. This seems to be only a superficial resemblance, their real affinity as indicated by mode of growth, structure of the ascoma and characters of spores and asci being much closer to the Microthyriaceae.

Hysterostomella sabalicola sp. nov.

Hypophyllous, scattered on small, irregular, yellow spots; stromata black, scutellate, small, irregularly oval, .75–1 mm. in diameter, sterile margin narrow, 50 μ, of compacted parallel radiating threads, subiculum none, central portion elevated and rugose from the long, irregular connivent lips of the poorly defined ascomata: asci oval, about 40–50 × 20 μ; ascospores eight, inordinate, equally uniseptate, nearly hyaline (perhaps young), about 20 × 6 μ.

On leaves of *Sabal Palmetto*, Longboat Key, Fla., April 26, 1900, S. M. Tracy, no. 6597.

Lembosia brevis sp. nov.

Epiphyllous on irregular brownish spots 2–4 mm. in diameter; ascomata thickly scattered black, crust-like, usually simple and distinct, but occasionally forking or sparingly confluent, very short, ends obtuse, 100–175 × 70–80 μ, subiculum reduced to a fringe of numerous parallel, simple, fuscous threads about 10–20 × 2–3 μ; asci oval, about 20 × 16 μ; ascospores eight, inordinate, oblong, ends obtuse, nearly equally uniseptate, subhyaline (young) about 8–10 × 4 μ.

On living leaves of *Ilex* sp., Longboat Key, Fla., April 27, 1900, S. M. Tracy, no. 6570.

This differs from any of the described species on *Ilex* in the numerous very short ascomata and especially in the character of the subiculum.

Lembosia cactorum sp. nov.

Scattered without definite spots; ascomata black, shining, straight, distinct not anastamosing or forking, rather thick or sub-elevated, with the aspect of a small *Hysterium*, 200–500 × 100–150 μ, ends obtuse, lips connivent or slightly parted, subiculum of agglutinated and anastomosing threads 2–4 μ in diameter, and usually extending to 20–40 u or more, epithecium well developed; asci oval, 25–30 × 16–20 μ: ascospores eight, narrowly ovate, inordinate, unequally uniseptate, ends obtuse, hyaline (?) about 12 × 4 μ.

On *Opuntia vulgaris*, Palma Sola, Fla., May 2, 1900, S. M. Tracy, no. 6592.

This species departs somewhat widely from the usual *Lembosia* type. The ascoma is better developed and firmer. This with the presence of an epithecium points to a relationship with the true Hysteriaceae.

The color of the spores is not a reliable character in this group. They are usually long hyaline or faintly tinted, only becoming dark (usually brownish) with age.

Acanthostigma conocarpi sp. nov.

Amphigenous but mostly hypophyllous, scattered, without spots; perithecia minute, subconic, brown, of thin, delicate, obscurely cellular parenchyma, 75–90 μ, clothed with scattered, erect, rigid, entire, dark fuscous, opake bristles 40–50 μ long, base about 4 μ wide, tapering upward to an acute point; asci oblong or slightly obovate, short-pedicillate, about 40 × 10 μ; paraphyses thread-like, slightly exceeding the asci; ascospores distichous, cylindric-clavate, anterior end obtuse, posterior subacute, twice septate, not constricted, hyaline, about 12 × 3 μ.

On leaves of *Conocarpus sericea* (DC.) Frank, Longboat Key, Fla., April 27, 1900, S. M. Tracy, no. 6573.

This is related to *A. Berenice* (B. & C.) Sacc. on *Magnolia* leaves but it is smaller in all of its parts and the spores are only 2-septate.

Plowrightia circumscissa sp. nov.

Thickly scattered over large deadened areas; stromata black, buried in the leaf substance, at length exposed by the circumscissile breaking away of the epidermis, irregularly oval or suborbicular, occasionally confluent, ⅓–1 mm., ostioles punctate, three or four to eight or more in each stroma; asci stipitate, aparaphysate, thick-walled, about 60–80 × 16 μ; ascospores subdistichous, ovate, at length about equally uniseptate, hyaline, about 20 × 5 μ.

On languishing leaves of some aloe (*Agave* sp. ?), Longboat Key, Fla., April 26, 1900, S. M. Tracy, no. 6596.

This is a striking species from the peculiar way in which the innate fungus frees itself from the epidermis of the host. The dead areas often involve the tips of the leaves but in other cases they are lateral.

Cercospora convolvuli sp. nov.

Amphigenous, widely effused, forming large olivaceous areas, without definite spots and only slightly discoloring the leaf; conidiophores cespitose in divergent clusters of 10 to 20 or more, not tuberculate, brown, at first continuous, the lower half becoming conspicuously septate at intervals of 4–8 μ, upper half continuous, variously contorted and marked by conidial scars, about 40–50 × 5 μ; conidia hyaline, clavate or subcylindric, usually curved, continuous or at length obscurely and sparingly septate, 60–100 × 3–4 μ.

On leaves of *Convolvulus acetosæfolia*, Breton Island, La., Aug. 18, 1900, Tracy & Lloyd, no. 593.

Cercospora torta sp. nov.

Hypophyllous, widely effused, discoloring the leaf above but not forming definite spots; conidiophores scattered, not fascicled, long and slender, nearly straight, frequently septate, when dry flattened and seeming twisted at the septa, 60 μ or more long, about 4 μ wide; conidia long, slender, subcylindric, at length multiseptate, about 80 × 3 μ.

On *Cynoctonum petiolata* (*Mitreola*), Ocean Springs, Miss., Sept. 15; 1900, Tracy & Lloyd, no. 590.

Passalora (?) melioloides sp. nov.

Epiphyllous, forming black, velvety, orbicular patches 2–3 mm. in diameter, or confluent over larger areas; mycelium abundant, superficial, of straight, rigid, creeping, fucous threads about 4 μ in diameter, and septate at intervals of 20–30 μ; conidiophores erect, rigid, simple, dark fuscous, opake, about 150–200 × 6 μ, septate at intervals of 12–20 μ; conidia solitary, acrogenous, light fuscous, narrowly oval, uniseptate, scarcely constricted, about 25 × 6 μ.

On living leaves of *Quercus Virginiana*, Clearwater, Fla., April 20, 1900, S. M. Tracy, no. 6608.

The generic position of this fungus is doubtful. It is much larger and more conspicuous than those usually referred to *Passalora* and in that genus no mention is made of a superficial mycelium. At first glance it resembles a *Meliola* but no hyphopodia are present and there are no perithecia. The same thing was taken several years ago on this host at Ocean Springs, Miss., but at this writing the specimens are not accessible.

Proceedings of the Club

Annual Meeting, January 8, 1901

Professor Rusby in the chair; seventeen persons present.

Annual reports were presented, as follows:

The Secretary, Professor E. S. Burgess, reported fifteen meetings held during the year, with an average attendance of thirty-eight; nineteen active members were elected. The active membership is now 238, the total membership 383; twenty papers have been presented besides twenty-six brief notes of collections or of botanical progress.

The Editor, Professor L. M. Underwood, reported a continued increase in the number of pages and of plates in the Club's publications, including in Volume 27 of the Bulletin, 666 pages and 33 plates, and including Volume 9 of the Memoirs with 292 pages and 9 plates.

Reports were also received from the Corresponding Secretary, Curator and Librarian.

No report was received from the Treasurer, Mr. M. L. Delafield, Jr., owing to his protracted illness.

Dr. P. A. Rydberg, as Chairman of the Library and Herbarium Committee, reported on the present unsatisfactory condition of the Club's Herbarium, as to care, accessibility and determination. The suggestion was made, therefore, that the Club donate its herbarium to the New York Botanical Garden under such conditions as these:

(*a*) That the Torrey Botanical Club herbarium should constitute the nucleus of the separate local collections of the Garden, to be known as the Torrey Botanical Club Local Herbarium or by some similar name agreed upon.

(*b*) That the Garden take proper care of the same, supplement it from its own collections and from future gifts from members of the Club and other persons, so that it may contain representatives of all of the species growing within the 100-mile limit.

(*c*) That the members of the Garden staff keep the specimens properly named and labeled, so that the collection may be of the greatest possible service.

(*d*) That all members of the Club shall have full and free access to this collection.

The annual election of officers followed, with the following result: *President*, Hon. Addison Brown. *Vice-Presidents*, Dr. T. F. Allen, Dr. H. H. Rusby. *Treasurer*, Dr. H. B. Ferguson. *Recording Secretary*, Prof. E. S. Burgess. *Corresponding Secretary*, Dr. J. K. Small. *Editor*, Prof. L. M. Underwood. *Associate Editors*, Dr. C. C. Curtis, Dr. M. A. Howe, Prof. F. E. Lloyd, Dr. D. T. MacDougal, Dr. H. M. Richards, Miss Anna Murray Vail. *Curator*, Dr. P. A. Rydberg. *Librarian*, Miss Anna Murray Vail.

Other business transacted included the following :

Three resignations were accepted, of Miss F. K. Sturgis, Miss Helen M. Ingersoll, Miss M. A. Johnston.

Two active members were elected, Mrs. Josephine D. Lowe, Lowecroft, Noroton, Fairfield Co., Conn. ; Mr. E. G. Buttrick, Winchendon, Mass.

Two nominations for active membership were made.

An amendment to the Constitution was adopted, pursuant to the report of a Special Committee at the preceding meeting. By this amendment, Section XIV. of the Constitution will read as follows :

" Each active member upon his election and annually thereafter shall pay to the Treasurer the sum of four dollars, which shall entitle him to a copy of the Bulletin for the year, and if he desires it, to a copy of such Memoirs as are published during the year, for one dollar additional."

Discussion followed upon the need of the establishment by the Club of a monthly for the publication of notes and botanical matter of a popular nature, especially with view to stimulate local botany, to be sold only by subscription ; the space of the Bulletin being now wholly needed for technical matter.

The following resolutions offered by Dr. Britton were then adopted :

" RESOLVED : That the publication by the Club of a monthly periodical is desirable, to contain short articles and notes with special reference to the study of the local flora, thus covering the ground occupied by the Bulletin at its establishment in 1870.

"RESOLVED: That the editors be authorized and requested to proceed at once with the publication of such a periodical and to designate an editor for it from their number.

"RESOLVED: That until further advised by the Club, the editors be instructed to print not more than twelve pages per month in an edition not to exceed five hundred copies, and to accept subscriptions for said periodical at one dollar per annum.

"RESOLVED: That this periodical bear the name 'Torreya' in honor of Dr. John Torrey, the founder of the Club."

WEDNESDAY, JANUARY 30, 1901

This meeting was held at the Museum of the Botanical Garden at 4 p. m. Dr. T. F. Allen presided; 26 persons were present. Two new members were elected: Miss Elsie Kupfer, 44 W. 97 St.; Mr. George Wirsing, 104 Bowers St., Jersey City.

Dr. Allen made to the Club a suggestion that he donate his collection of Characeae to the Botanical Garden to ensure its preservation. It contains numerous specimens from all over the world, and very many type specimens.

Dr. Britton remarked that this collection is one of the most complete and authoritative in existence, and would be a valuable accession to the Garden.

Dr. Underwood reported an interview with the Librarian of Columbia University, who accepts the proposition of January 8th, regarding future exchanges.

It was thereupon moved and adopted that the future exchanges of the Club become the property of the Botanical Garden (except in case of sets which are already in part the property of Columbia University) with the proviso that the Garden reciprocate by allowing to all members of the Club, full and free access to the Garden Library.

On motion of Dr. Underwood, elections were made and resolutions were adopted as follows:

1. Dr. N. L. Britton was made one of the Board of Editors.

2. Dr. M. A. Howe was made Editor of the Club's new journal Torreya.

3. The matter of subscriptions to Torreya was turned over to the Treasurer.

4. The Board of Editors was allowed one hundred dollars toward defraying the expenses of the new journal Torreya.

5. To all members of the Club, Torreya is to be sent free.

The scientific program was as follows: E. S. Burgess, "Remarks on the History of *Aster Claytoni*"; E. G. Britton, "Some Mosses collected in Washington State by F. L. Gardner." The second paper was deferred on account of the lateness of the hour.

The paper by E. S. Burgess on the history of *Aster Claytoni*, which will soon appear in print, was illustrated by a series of specimens showing type and variations, and a range from the Hudson River to Virginia. The first specimen known was collected in the mountains of Virginia by John Clayton, apparently in or before 1754, during his botanical expedition along the James or that to the sources of the Rappahannock. It is no. 767 of the Gronovian herbarium preserved by the British Museum. Comparisons kindly made by Mr. Edmund G. Baker, of the British Museum, show its identity with plants observed first on Manhattan Island at Inwood, by E. S. Burgess, in 1896, and kept under observation since for study of development. The description of no. 767 written by Clayton and Gronovius, and published in the Flora Virginica, Part III., in 1762, without a specific name, long remained without reference to any of our known native species, Forster's reference in 1771 to *Aster macrophyllus* proving untenable. In reestablishing the species in the Illustrated Flora in 1898 under the name *Aster Claytoni*, it was intended to pay this tardy tribute to the memory of its discoverer, John Clayton, rightly styled by Collinson as at that period, 1764, "the greatest botanist of America." The species seems particularly frequent in the lower Hudson region, where it had however been hitherto confused with its smoother and more forking ally, *Aster divaricatus*.

EDWARD S. BURGESS,

Secretary.

Index to recent Literature relating to American Botany

Arcangeli, G. Altre osservazioni sull' *Araucaria imbricata* Pav. e sull' *A. Brasiliensis* A. Rich. Bull. Soc. Bot. Ital. 1900: 314–317. D. 1900.

Bailey, W. W. Notes on the Flora of Rhode Island. Rhodora, **3**: 33, 34. F. 1901.

Barton, E. S. On certain Galls in *Furcellaria* and *Chondrus*. Jour. Bot. **39**: 49–51. *pl. 418*. F. 1901.

Beal, W. J. Tumble-Weeds. Rhodora, **3**: 18. 2 Ja. 1901.

Contains list of nine tumble-weeds of Michigan.

Bennetts, W. J. Additions to the Flora of Milwaukee County. Bull. Wis. Nat. Hist. Soc. II. **1**: 161–166. Jl. 1900.

Bennetts, W. J. November Wild Flowers. Bull. Wis. Soc. Nat. Hist. II. **1**: 186, 187. Jl. 1900.

A list of 36 species observed in the vicinity of Milwaukee Nov. 1–5, 1900.

Bessey, C. E. *Baptisia tinctoria* as a Tumble-weed. Rhodora, **3**: 34, 35. F. 1901.

Brainerd, E. *Scirpus atratus* a synonym of *Scirpus Peckii*. Rhodora, **3**: 31–33. F. 1901.

Brandegee, K. Some Sources of Error in Genera and Species. Zoe, **5**: 91–98. 6 F. 1901.

Brandegee, T. S. New Species of Plants, mainly from Baja California. Zoe, **5**: 104–106. 6 F. 1901.

New species in *Ranunculus*, *Malpighia*, *Brongniartia*, *Houstonia*, *Perezia* and *Bumelia* (2).

Britten, J. Some proposed Changes in Nomenclature. Jour. Bot. **39**: 67–69. F. 1901.

Bruncken, E. Distribution of some Trees and Shrubs in the Vicinity of Milwaukee. Bull. Wis. Nat. Hist. Soc. II. **1**: 31–42. Ja. 1900.

Bruncken, E. On the Forest Conditions in the Vicinity of Milwaukee. Bull. Wis. Nat. Hist. Soc. II. **1**: 179–184. Jl. 1900.

Bruncken, E. Some remarkable Trees in the Vicinity of Milwaukee. Bull. Wis. Nat. Hist. Soc. II. **1**: 43–45. Ja. 1900.

Christ, H. Filices, Equisetaceae, Lycopodiaceae, Selaginellaceae, Rhizocarpaceae. Primitiae Florae Costaricensis, **3**: 1–66. 1901.

New species and varieties in *Trichomanes*, *Elaphoglossum*, *Pleurogramme*, *Polypodium*, *Adiantum*, *Pellaea*, *Pteris*, *Asplenium*, *Diplazium*, *Aspidium*, *Phegopteris*, *Dennstaedtia*, *Cyathea*, *Alsophila*, *Hemitelia*, *Botrychium* and *Lycopodium*.

Dangeard, P. A. La reproduction sexuelle des champignons. Le Botaniste, **7**: 89–130. My. 1900.

Dangeard, P. A. Les zoochorelles du *Paramoecium bursaria*. Le Botaniste, **7**: 161–191. My. 1900.

Dangeard, P. A. Observations sur le developpement du *Pandorina morum*. Le Botaniste, **7**: 192–208. *pl. 1.* My. 1900.

Dangeard, P. A. Programme d'un essai sur la reproduction sexuelle. Le Botaniste, **7**: 257–268. Au. 1900.

Dangeard, P. A. Recherches sur la structure du *Polyphagus euglenae* Nowak, et sa reproduction sexuelle. Le Botaniste, **7**: 213–257. *f. 3.* Au. 1900.

Davenport, G. E. A plumose Variety of the ebony Spleenwort. Rhodora, **3**: 1, 2. *pl. 22.* 2 Ja. 1901.

Asplenium ebeneum Hortonae var. nov.

Driggs, A. W. *Botrychium matricariaefolium* in Connecticut. Rhodora, **3**: 36. F. 1901.

D[ruery], C. T. Cacti in their natural Habitats. Garden, **59**: 25, 26. 12 Ja. 1901.

Notes on cacti and other plants in northern Mexico.

Duggar, B. M., & Stewart, F. C. The sterile Fungus Rhizoctonia as a Cause of Plant Diseases in America. Bull. Cornell Univ. Agric. Exp. Sta. 186: 51–76. *f. 15–23.* Ja. 1901.

Eastwood, A. *Asclepias Kotolo.* Zoe, **5**: 98, 99. 6 F. 1901.

Eastwood, A. A Study of *Erysimum grandiflorum* Nutt. and the Species aggregated under it. Zoe, **5**: 100–103. 6 F. 1901.

Erysimum concinnum sp. nov.

Evans, A. W. *Fossombronia salina* in Connecticut. Rhodora, **3**: 7–10. 2 Ja. 1901. [Illust.]

Fernald, M. L. *Monarda fistulosa* and its Allies. Rhodora, **3**: 13–16. 2 Ja. 1901.

M. mollis menthaefolia (Graham) Fernald, new name.

Geheeb, A. Révision des mousses récoltées en Bresil dans la province de San Paulo par M. Juan J. Puiggari pendant les années 1877–1882. Rev. Bryol. **28**: 9–11. 1901.

Greene, E. L. New or noteworthy Species—XXVIII. Pittonia, **4**: 233–241. 5 Ja. 1901.

New species in *Thalictrum*, *Rumex* (2), *Lappula*, *Allocarya* (2), *Solidago*, *Coleosanthus* (5), *Coreopsis*, *Parthenium*, *Picradenia* and *Zygadenus* (2).

Greene, E. L. Studies in the Compositae—VIII. Pittonia, **4**: 242–284. 26 Ja. 1901.

New species in *Bidens* (20), *Megalodonta* (gen. nov.) (2), *Conoclinium* (3), *Eupatorium* (8) and *Antennaria*.

Greene, E. L. *Taraxacum* in North America. Pittonia, **4**: 227–233. 5 Ja. 1901.

Eight new species described.

Graenicher, S. The Fertilization of *Symphoricarpos* and *Lonicera*. Bull. Wis. Nat. Hist. Soc. II. **1**: 141–156. *f. 1–6*. Jl. 1900.

Greenman, J. M. The Genus *Senecio* in New England. Rhodora, **3**: 3–7. 2 Ja. 1901.

Eight species enumerated. *S. Balsamitae pauperculus* (Mx.) Fernald, and *S. Balsamitae praelongus*, new varieties.

Heller, A. A. Catalogue of North American Plants north of Mexico, exclusive of the lower Cryptogams. Second edition. 1–252. [Lancaster, Pa.] 10 N. 1900.

16,673 species and varieties enumerated, besides the additions and corrections. Pp. 3–8 contain new combinations in nomenclature.

Heller, A. A. Some Changes in Nomenclature. Muhlenbergia, **1**: 1–8. 10 N. 1900.

A continuation of pp. 3–8 of the second edition of his catalogue of North American Plants.

Hennings, P. Fungi mattogrossenses a Dr. R. Pilger collecti 1899. Hedwigia (Beiblatt), **39**: (134)–(139). 10 Au. 1900.

New species in *Marasmius*, *Pluteus*, *Pleurotus*, *Lycoperdon*, *Dimerosporium*, *Pilgeriella* (gen. nov.), *Hypoxylon*, and *Aschersonia*.

Heydrich, F. Die Lithothamnien des Museum d'histoire naturelle in Paris. Engler's Bot. Jahrb. **28**: 529–545. *pl. 11*. 11 Ja. 1901.

New species and new names in *Melobesia*, *Lithophyllum* (5), *Lithothamnion* (5), from California, Bermuda, Labrador and South America.

Hieronymus, G. Plantae Lehmannianae praesertim in Columbia et Ecuador collectae, Compositae II. Engler's Bot. Jahrb. **28**: 559–659. 11 Ja. 1901.

New species in *Vernonia*, *Stevia*, *Eupatorium*, *Mikania*, *Bigelovia*, *Egletes*, *Baccharis*, *Achyrocline*, *Greenmania* gen. nov., *Clibadium*, *Polymnia*, *Stemmatella*, *Wedelia*, *Aspilia*, *Viguiera*, *Spilanthes*, *Verbesina*, *Calea*, *Galinsoga*, *Pectis*, *Liabum*, *Gynoxys*, *Senecio*, *Werneria*, *Chuquiragua*, *Mutisia*, *Trixis*, and *Jungia*.

Kellerman, W. A. Twelve Additions to the Ohio Plant List. Ohio Naturalist, **1**: 59, 60. F. 1901.

Marshall, N. L. The Mushroom Book. 8vo. i–xxvi, 1–167. *pl. 1–48.* New York, 1901. [Illust.]

A popular guide to the study of fleshy fungi, with reproductions in color of photographs by J. A. and H. C. Anderson.

Meehan, T. *Aster concolor.* Meehan's Monthly, **10**: 161, 162. *pl. 11.* N. 1900.

Meehan, T. *Aster tanacetifolius.* Meehan's Monthly, **11**: 1, 2. *pl. 1.* Ja. 1901.

Meehan, T. *Helianthus lenticularis.* Meehan's Monthly, **11**: 17, 18. *pl. 2.* F. 1901.

Murdoch, J., Jr. *Cycloloma* on Cape Cod. Rhodora, **3**: 18. 2 Ja. 1901.

Parish, S. B. The Vegetation of Plymouth three hundred Years ago. Rhodora, **3**: 17. 2 Ja. 1901.

Penhallow, D. P. A Decade of North American Palaeobotany. 1890–1900. Science, II. **13**: 161–176. 1 F. 1901.

Quaintance, A. L. The Brown Rot of Peaches, Plums and other Fruits (*Monilia fructigena* Persoon). Bull. Ga. Exp. Sta. **50**: 237–269. *f. 1–9.* O. 1900.

Ravn, F. K. Nogle *Helminthosporium-Aster* og de af dem fremkaldte Sygdomme hos Byg og Havre. Bot. Tidsskrift, **23**: 101–322. *pl. 1–2.* 1 Ja. 1901.

Rehder, A. Ein Ausflug nach Nord-Carolina. Mitteil. Deutsch. Dendrol. Gesellsch. **9**: 89–94. 1900.

Renauld, F. Notice sur un *Limnobium* de l'Amérique du Nord et une forme analogue des Pyrénées. Rev. Bryol. **28**: 8. 1901.

Hypnum (*Lymnobium*) *Bestii* Ren. & Bryhn.

Robinson, B. L. The correct Disposition of *Sisymbrium Niagarense.* Rhodora, **3**: 16, 17. 2 Ja. 1901.

This species is found identical with *Brassica nigra* Koch.

Robinson, B. L. The Identity of the Linnaean *Gnaphalium plantaginifolium.* Rhodora, **3**: 11–13. 2 Ja. 1901.

Rothrock, J. T. Cottonwood, Carolina Poplar, Necklace Poplar (*Populus monilifera* Ait.). Forest Leaves, **7**: 184, 185. D. 1900. [Illust.]

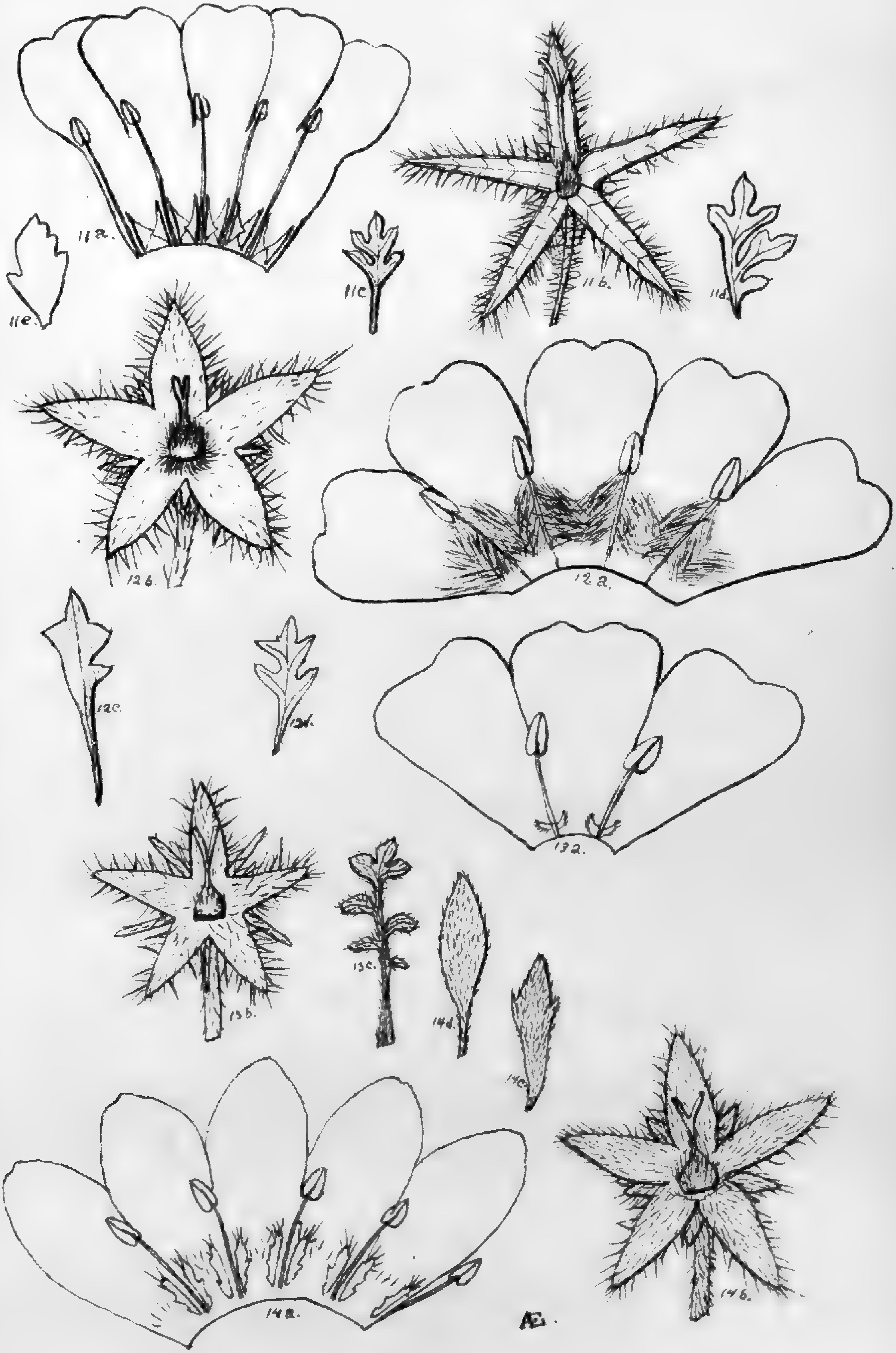
Rothrock, J. T. June Berry, or Shad Bush, *Amelanchier Canadensis* T. & G. Forest Leaves, **8**: 8. F. 1901.

Paper accompanied by two full-page half-tones of unusually large specimens.

Sargent, C. S. Notes on *Crataegus* in the Champlain Valley. Rhodora, **3**: 19–31. F. 1901.

1. Nemophila humifusa. 2. N. sepulta. 3. N. quercifolia. 4. N. Austinae. 5. N. macrophylla. 6. N. inconspicua.

7. Nemophila pustulata 8. N. micrantha. 9. N. Kelloggii. 10. N. Plaskettii.



11. Nemophila exilis. 12. N. humilis. 13. N. nana. 14. N. Congdoni.

17. Nemophila hispida. 18. N. divaricata. 19. N. tenera. 20. N. gracilis.

21. Nemophila nemorensis. 22. N. glauca. 23. N. fallax. 24. N. exigua.
25. N. pulchella.

15. Nemophila flaccida. 16. N. inaequalis. 26. N. alata. 27. N. rotata.

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BULLETIN

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TORREY BOTANICAL CLUB

APRIL 1901

A preliminary Contribution to a Knowledge of the Hydnaceae

By H. J. Banker

It is the purpose of the present paper to review our knowledge of the American mesopus forms of the genus *Hydnum*, with a view to call attention to these plants and prepare the way for an ultimate thorough revision of the group. In the present chaotic state of our knowledge of these plants, accuracy in the discrimination of species or in the formulation of a synopsis is often impossible; it is hoped, however, that the paper may be found of some service to the field botanist. The writer has found himself greatly hampered in his work by the difficulty of obtaining sufficient material for his purpose. It has seemed best, therefore, to prepare this contribution, imperfect though it must be, to encourage the coöperation of collectors in the accumulation of material and notes for a more thorough study of the group. Thus far the work has been based to a great extent on herbarium material, which, particularly in the fleshy forms, has proven very unsatisfactory. It is important that the plants should be studied in the living condition and ample notes made of their characteristics. Unquestionably there are many species at present confounded under a single name. This seems especially the case with *H. imbricatum*, *H. ferrugineum*, and *H. zonatum*. It is probable that this is due partly to the scattered and inaccessible character of the literature on this group but chiefly, doubtless, to the fact that the forms have not received a careful comparative study, which can only be accomplished with the aid of an abundance of material supplemented by excellent field notes. It will therefore, be pertinent to present a few suggestions concerning the field work.

I. Collection

The Hydnaceae are to be found almost everywhere, but more especially in woodlands. The mesopus forms are nearly all terrestrial, while the other forms are as universally lignatile. The plants are readily recognized by the characteristic feature of the hymenial surface being in the form of awl-shaped spines projecting downward. In other respects the mesopus forms, that is, those having a central stem, resemble the ordinary toadstools. In collecting, plenty of material should be gathered that every variation of the plant may be shown. No collector should be satisfied with a half dozen plants if more can be obtained; scrappy collections have been the bane of mycologists. The entire plant should be removed, including if possible a portion of the substratum. Plants of different collecting should be kept separate, even if believed to be of the same species. A good way to protect them is to lay down a piece of tissue paper and, piling the plants in the middle, fold the paper carefully around them and deposit in a basket or collecting case. The author generally uses paper bags into which the plants can be easily slipped and, if liable to injury, can be removed by tearing the bag. In putting up material in this way it is a good plan to select one of the best plants and, taking a piece of colored paper, tear a hole in it through which the stem may be passed and then slip the paper up close to the pileus; the plant may then be wrapped up with its fellows. When the time comes to care for the specimens this paper will usually be found to furnish a very good spore print. The paper in which the plants are wrapped should be marked to correspond to the field notes.

II. Preservation

The fleshy forms are especially subject to decay and should be cared for the same day as collected if possible, while none should be left more than twenty-four hours. The tough or woody species and resupinate forms may be very well preserved by rapid drying in a current of hot air. An excellent method is to suspend them in a wire basket over a stove where they may be heated as much as possible without danger of scorching. This will insure the destruction of insects, eggs and larvae. If then placed in small paper boxes, or, if not intended immediately for the herbarium, in tight paper bags with a few moth balls, they will be practically safe from these ravagers.

The fleshy species will undergo a greater change in this process of drying, sometimes so great as to be wholly unrecognizable; it is, therefore, necessary in addition to make special preparations of one or two specimens. This may be done by (1) Cutting a vertical slice through center of pileus and stem; (2) Half the remaining pileus is placed right side up, the other half with the under side up; (3) The remainder of the stem is placed with its outer surface uppermost, and the plant thus spread out is pressed and dried between dryers as in the case of a flowering plant, but with less pressure.

A spore print should be obtained in every case where it is possible. This should be taken on a square of plain paper, light or dark colored, in contrast with the color of the spores. The print may be obtained in two ways: (1) As indicated above under "Collection"; this will give excellent results as to color of spores and does not injure the plant; but (2) If a typical spore print is desired, the stem should be cut from the plant close to the under surface of the pileus, and the latter placed with the hymenial surface downward, on a sheet of paper of the proper color and then protected from draughts by inverting a bell glass or tumbler over it. The spore print may be permanently fixed by spraying with a solution of white shellac in alcohol by means of an atomizer.

III. Notes

As there is no convenient method of preserving these plants in a fresh condition, good field notes become of the utmost importance. In fact, specimens without accompanying notes are oftentimes practically worthless.

On finding a plant or group of plants, there should be noted first, the environment and character of substratum, the growth habit, whether solitary, scattered, grouped, or cespitose. Then the plant itself should be examined and all its features carefully noted: the color whether varied or uniform; size of plant, giving actual dimensions; form of pileus and character of surface; in the scaly species the character and size of scales should be carefully determined; form and character of stem; texture of plant and structure of the interior should be fully described; color and character of teeth, whether coarse, fine, long, short, giving actual dimensions as far as possible; the color of the spores is important, as is also their size, form, and markings, but this will require the use of a compound microscope; the odor, when fresh and also in process of drying, and the taste are quite important; change of color in the fresh specimen when bruised or cut should be looked for; color and character of the juice of the plant should be observed; while even the character of the insect and other animal life for which it may furnish pabulum is not unworthy of the botanist's attention. Special care must be taken to keep the specimens and notes numbered to correspond correctly.*

In the following synopsis several species included in the notes will be found to be omitted. This is for the reason that an attempt to arrange them in synoptical form at present would be only guess work. Most of these, however, are included in the *species dubiae* and it is doubtful if they are really American species. On the other hand, there are a number of plants met with in the herbaria and, therefore, very likely to be found again in nature, which have heretofore been referred erroneously to known species; no attempt has been made to provide for these in the synopsis as their characters are too little known and it is quite probable that they will prove to be undescribed species.

There has been no attempt to adjust the taxonomic relations of the group, nor has its nomenclature been disturbed even where it is known that changes must be made: but the iconography and exsiccati have been given quite fully as these may be of value to those who have access to large collections and libraries.

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* Very helpful and more complete instructions in the collection and preservation of all kinds of fungi have been published in the following works: **Burt**, On Collecting and Preparing fleshy Fungi for the Herbarium. Bot. Gaz. **25**: 172–186. *pl. 14.* 1898. **Underwood**, Moulds, Mildews, and Mushrooms, 201–206. 1899. **Atkinson**, Mushrooms, edible, poisonous, etc. 222–229. 1900.

Synopsis of Species

Lignatile ; small, 2 cm. wide ; dark green throughout. 1. *H. atro-viride.*
Terrestrial.
  Substance of pileus fleshy, brittle.
    Bright colored, white, yellow, or orange.
      White ; spores small, less than 6 μ wide.
        Plant small, less than 3 cm. wide. 3. *H. albidum.*
        Plant larger, more than 5 cm. wide. 4. *H. albo-magnum.*
      Buff or yellow ; spores more than 5 μ wide.
        Teeth decurrent.
          Plant solitary. 5. *H. Washingtonianum.*
          Plants cespitose, flesh turning yellow when cut.
          6. *H. caespitosum.*
        Teeth not decurrent or but slightly so. 2. *H. repandum.*
        Pileus cracked and split. 7. *H. diffractum.*
    Dull colored, fuscous, ferruginous, or gray.
      Pileus smooth.
        Pinkish gray, stem scabrous. 13. *H. scabripes.*
        Brownish.
          Teeth not decurrent or but slightly so; pileus expanded, plane, smooth.
          9. *H. laevigatum.*
          Teeth decurrent.
            Pileus infundibuliform, stem slender.
            10. *H. infundibulum.*
            Pileus plane or convex. 29. *H. fusipes.*
      Pileus scaly or tomentose.
        Plants solitary.
          Scales thick, regularly imbricate. 12. *H. imbricatum.*
          Scales thin, irregular, superficial. 11. *H. subsquamosum.*
        Plants cespitose.
          Plants confluent, stem somewhat branched.
          30. *H. versipelle.*
          Plants distinct, stem slender, flexuose.
          37. *H. Fennicum.*
  Substance of pileus tough, corky, woody, or coriaceous.
    Surface of pileus zonate.
      Teeth in age light colored, white to yellow. 26. *H. cyathiforme.*
      Teeth in age dull colored, gray or brown.
        Pileus regular, stem subcentral, substance uniform.
          Pileus more or less infundibuliform, strigose, with a sterile margin.* 22. *H. zonatum.*
          Pileus expanded, umbilicate.
            Zonations elevated; pileus less than 4 cm. wide.
            25. *H. fasciatum.*
            Zonations not elevated; pileus more than 4 cm. wide.
            23. *H. confluens.*

---

* If obscurely zonate with the funnel more or less filled with a mass of coarse spongy substance *cf. H. scrobiculatum.*

Pileus irregular, lobed; stem eccentric; substance in two layers, the outer spongy, tomentose, the inner compact, darker.
16. *H. putidum*.

Plant zonate internally only,* not on the surface of the pileus.

Hard, woody texture throughout, at least when dried

Light colored, yellow, buff, or orange. 20. *H. aurantiacum*.

Gray to smoky; substance variegated with blue (?).
32. *H. compactum*.

Pileus composed of two layers, the lower hard, compact, continuous with stem, the upper consisting of a mass of dense felty tomentum.

Plant ferruginous, concolorous; stem covered with a felty tomentum.
19. *H. spongiosipes*.

Pileus variegated, light to dark brown, without tomentum on stem.
18. *H. ferrugineum*.

Pileus coriaceous, more or less infundibuliform, the surface rugose or broken up into a coarse spongy mass.

Color brown. 21. *H. scrobiculatum*.

Color ash-gray. 28. *H. canum*.

Plant azonate.

Inner substance of pileus and stem blue-black.

Surface of pileus gray, convex to plane; plant tomentose and bibulous when fresh. 15. *H. albonigrum*.

Surface of pileus buff or cream colored, concave to infundibuliform.
17. *H. suaveolens* (?).

Inner substance of pileus and stem brown to fuscous.

Spores white.

Pileus tough, corky; plant confluent, spreading, forming a crust-like mass. 14. *H. vellereum*.

Pileus coriaceous, stem slender. 40. *H. graveolens*.

Spores ferruginous or fuscous. 34. *H. mirabile* (?).

1. HYDNUM ATRO-VIRIDE Morgan, Jour. Cin. Soc. Nat. Hist. **18**: 38. *pl. 1. f. 5*. 1895

ICON.: Morgan, *loc. cit.*

TYPE LOC.: Auburn, Ala. (Atkinson).

This species has not been reported since Atkinson discovered it in Alabama. It is a small plant, "1–2 cm. wide" and is clearly distinguished by its peculiar dark green color throughout, which is characteristic even of the spores. It is further unique in being, apparently, the only central stemmed form that grows on wood.

2. HYDNUM REPANDUM L. Sp. Pl. **2**: 1178. 1753

ICON.:† Bulliard, Herbier de la France. *pl. 172!*; Sowerby,

* This zonation can be observed by making a vertical section through pileus and stem.

† In this extensive list an attempt has been made to roughly indicate degree of excellence. Those followed by one ! are fair to good, those followed by two !! are unusually excellent and faithful representations, while all others are indifferent or worthless.

Eng. Fung. *pl. 176!*; Barla, Champ. de Prov. de Nice *pl. 39. f. 1–9!*; Sicard, Hist. nat. Champ. *pl. 58. f. 293*; Britzelmayer, Hym. Sudb.* *Hydnei f. 4*; Bolton, Geschichte *pl. 89*; Krombholz, *pl. 50. f. 1–9!*; Badham, Escul. Fung., ed. 1847, *pl. 12. f. 3*; Badham, *op. cit.*, ed. 1863, *pl. 8. f. 3 & 4*; Bel. Champ. Tarn. *pl. 7*; Fries, Sverig. ätl. svamp. *pl. 15. !!*; Paul, Icon. des Champ. *pl. 35. f. 1–2*; Harzer, Naturg. Abb. Pilze. *pl. 23. pl. 46* (*var.*); Hussey, Ill. Brit. Myc. **1**: *pl. 16 !!*; Vittadini, Desc. Fung. Mang. *pl. 25. f. 2*; Peck, Reg. Rep. **48**: *pl. 38. !*; Rep. Conn. Board Agric. **29**: *pl. 6. f. 2 !*; Cordier, Les Champ. *pl. 43 !*; Gillet, Les Champ. *pl. 322*; † Gibson, Edible Toadstools and Mushrooms, *pl. 27 !!*; Dietrich, Forstflora, ed. 1840; **2**: *f. 187*. *Idem.*, ed. 1860; *pl. 291. f. 1*. Atkinson, Mushrooms, *pl. 68*.

EXSICC.: Sydow, Myc. Marchica, 2819; Rabenhorst, Fungi Eur. 803; Desmazieres, Pl. Crypt. de France, 312; Herpell, Samml. präp. Hutp. 18.

TYPE LOC.: European (Giss).

Orono, Me. (Harvey); Mt. Everett, Mass., West Goshen, Conn., New York City (Underwood); Flatbush, L. I. (Zabriskie); Sandlake, Rensselaer Co., N. Y. (Peck); Ft. Edward, N. Y. (E. C. Howe) New Jersey (Ellis); Pennsylvania (Schweinitz); Fayette, Co., W. Va. (Nuttall). It has also been reported, but specimens have not been examined, from Rhode Island (Olney, Bennett); Ohio, Kentucky (Morgan); Maryland (Banning); North Carolina (Schweinitz); South Carolina (Curtis).

This is one of our most common and widely distributed species. A fleshy, terrestrial, subcentrally stemmed plant; it is readily distinguished by its light color, pale-buff to yellow, sometimes reddish, never white. Its only slightly decurrent teeth separate it at once from *H. Washingtonianum* Ell., its color and large spores, 7–9 μ wide, separate it distinctly from *H. albidum* Pk. and from the large white southern form.

* This is a wretched piece of work whether regarded from a scientific or from an artistic standpoint. It is often impossible to decide from the figures what they are intended to represent. It is especially unfortunate that Britzelmayer has in this work published many new species, whose characters, without an accurate description, are most effectually obscured.

† The plates of this work originally unnumbered are here numbered in accordance with the Lists of the author.

2b. HYDNUM RUFESCENS Persoon: Obs. Myc. **2**: 95. 1799

ICON.: Bolton, Geschichte *pl. 89;* Barla, Champ. de Prov. de Nice *pl. 39. f. 10–12;* Britzelmayer, Hym. Südb. *Hydnei f. 5;* Patouillard, Tab. analyt. Fung. *f. 147;* Peck, Reg. Rep. **48**: *pl. 38. f. 7–10.*

TYPE LOC.: European.

This has been reported from New England (Oakes); Maryland (Banning); Pennsylvania and North Carolina (Schweinitz).

The status of the species is doubtful and it seems best to regard it as a variety of *H. repandum* from which it appears to differ only in its more slender stem and in the reddish color of the pileus. If it can show no more marked characteristics than these it should hardly be given the dignity of a distinct species. Barla's figures, *op. cit.*, show a marked scaly imbricate pileus! Persoon in Syn. Meth. Fung. 556, says: "Pileus obsolete et subtiliter zonatus est." There seems to be no indication of either of these features in our American plant. The name itself is preoccupied by *H. rufescens* Schaeffer, Fung. Bav. et Pal. Icon. **4**: 95. *pl. 141.* 1763, which seems to be even more clearly true *H. repandum.*

3. HYDNUM ALBIDUM Peck, Bull. N. Y. State Mus. Nat. Hist. **1**: 10. 1887

ICON.: Peck, Rep. Reg. **51**: *pl. 56. f. 1–7.*

TYPE LOC.: Sandlake, Rensselaer Co., N. Y. (Peck).

The species has been reported, I believe, only from Middlebury, Vt. (Burt), since Peck first described it. It is probable that it is usually referred to *H. repandum* from which it is not readily distinguished. While characteristically a smaller plant than *H. repandum* (2–3 cm. broad), specimens of the latter are often found equally as small. When fresh, its white color should distinguish it, but in the dried state the color resembles that of *H. repandum* too closely to be distinguished. The most certain distinction seems to be in the spores which are about half the size of those of *H. repandum*, being from 3.5 μ to 5.5 μ wide, but in form they are very similar. Careful field observation of this plant is very desirable.

4. **Hydnum albo-magnum** sp. nov.

A low broad fleshy plant "white throughout, then turning yellowish." Pileus even, glabrous, repand, 5–8 cm. wide; substance fleshy, brittle, white; stem short, thick, central, or excentric, 2–4 cm. high, 1–2.5 cm. thick, expanding into a thick base; teeth slender, 2–4 mm. long, slightly decurrent: spores somewhat irregular but distinctly oval, apiculate, small, 3.5–4 μ by 5.5–7 μ.

TYPE LOC.: Auburn, Ala. (Earle).

The plant, while closely related to *H. repandum* and *H. albidum*, seems to be readily distinguished from the former by its white color, glabrous pileus, and small oval spores; from the latter it is separated by its much larger size, stouter stem, and oval form of spores. The above description is based entirely on dried specimens and needs to be confirmed by comparison with the living plant.

5. HYDNUM WASHINGTONIANUM Ell. & Everh. Proc. Phila. Acad. 1894: 323. 1894

TYPE LOC.: Tracyton, Wash. (Parker).

This plant has not been reported since it was found by Miss Parker. It resembles *H. repandum* but the teeth are decurrent half way down the stem and the "substance tougher."

6. HYDNUM CAESPITOSUM Banning; Peck, Reg. Rep. **44**: 74. 1891

ICON.: Banning, Fungi of Maryland, *pl. 137*.*

TYPE LOC.: Carroll Co., Md. (Banning).

The plant has not been reported by any one but Miss Banning. Her description as quoted by Peck, *loc. cit.*, is too brief to be very satisfactory but is materially supplemented by her plate. The plant, which appears to be closely related to *H. repandum*, seems to differ from that species, especially in the round, thick, convex, nearly hemispherical pileus, the proportionately thickened stem, equal to a third or a half the diameter of the pileus, and in the flesh turning yellow when cut.

7. HYDNUM DIFFRACTUM Berk. Lond. Jour. Bot. **6**: 323. 1847

TYPE LOC.: Waynesville, O. (Lea).

Since its original discovery by T. G. Lea, this plant has been

* This is a work in manuscript deposited in the N. Y. State Herbarium at Albany.

reported only by A. P. Morgan from Kentucky and Ohio. I have not seen an unquestionable specimen of it and am in doubt as to its true character. As this is a strictly American plant and seems to be well characterized, it is desirable that it should be better known and better represented in our herbaria, especially considering that it is now over fifty years since it was first described by Berkeley, and yet in that time only two specimens of it have ever been reported. As the original description will not be readily accessible to many, I add it in part for the purpose of assisting in the identification of the plant.

"Pileus 3 inches broad, convex smooth, of a tough, fleshy substance, at length much cracked and split, margin involute. Stem 1½–2 inches high, ¾ of an inch or more thick, buff, and split like the pileus, tender when fresh. Spines even, subulate, entire, soft, of a pale buff. Smell vinous. A remarkable rigid species when dry."

"Allied to *H. candidum* and *H. repandum*." Lond. Jour. Bot. **6**: 323. 1847.

It is to be hoped that collectors, especially in Ohio, will watch closely for this interesting plant.

8. HYDNUM CURTISII Berk. Grevillea, **1**: 71. 1872

TYPE LOC.: South Carolina (Curtis).

The plant does not seem to be readily distinguished from *H. levigatum* especially in view of the uncertainties connected with the latter. The chief distinctions seem to be the smaller size, less than 5 cm. wide, with the stem attenuate upward from a bulbous base.

It has never been reported since its discovery, but a plant found by Earle in Alabama and now in the Underwood Herbarium has been referred here. It appears to conform fairly well to the description but the latter is too meager to be entirely satisfactory.

9. HYDNUM LEVIGATUM Swartz, Kongl. vet. Acad. nya handl. 1810: 243. 1810

ICON: Fries, Sverig. ätl. Svamp. *pl. 81!*. Barla, Champ. Prov. de Nice *pl. 38. f. 5, 6* (?); Bresadola, Fung. Trid. *pl. 138* (?).

TYPE LOC.: European.

New Jersey (Gentry). Reported also from Pennsylvania (Schweinitz) and North Carolina (Curtis). The Schweinitzian specimen now in the Philadelphia Academy of Science is nearly destroyed so that its characters can not be determined. Curtis' specimen I have not seen. It seems doubtful if the plant is common with us. Most of the specimens referred here in the collections are evidently something quite different. I have seen but one specimen (Gentry's) that appeared to have just claim to being regarded as this species.

There seems to be no little uncertainty among authors concerning this plant. Descriptions vary greatly; Barla's figure seems to depict a very different plant from Swartz' and Bresadola's figure is doubtful. The chief distinctive characteristic of the plant is the thick, fleshy, *regular*, *glabrous* pileus, 5–15 cm. wide, by no means repand. Saccardo says, "spores 10–15 μ long."

In view of the uncertainty that seems to prevail concerning this plant and as Swartz's original description is often inaccessible, it is quoted in full.

"*H. laevigatum*, pileo carnoso convexo castaneo laevi, aculeis mollibus albido-cinereis; stipite inaequali elongato. Erinaceus obscure ferrugineus, subtus denticulis, longioribus cinereis. *Stipes* 2–3 pollicatis, teretiusculus inaequalis saepe tortuosus sulcatus, solidus, carnosus, pallidus, crassitie digiti minoris. *Pileus* diam. sub 2 pollic. et ultra, modice convexus, centro disci rarius depresso, margine deflexus, carnosus laevis nec squamosus, medio subinde rimosus, fragilis, pallide castaneus l. ferrugineus. *Caro* albescens. *Aculei* numerosissimi, longiusculi subulati, albido-cinerei, fragilissimi, molles."*

10. HYDNUM INFUNDIBULUM Swartz. Kongl. vet. Acad. nya handl. 1810: 244. 1810

ICON.: Svensk. Bot. *pl. 492.*†

TYPE LOC.: European.

Reported from Pennsylvania (Schweinitz); Ohio (Lea, Morgan); Kentucky (Morgan). Schweinitz's specimen in the Philadelphia Academy of sciences is nearly destroyed; what remains

* Kongl. Vetenskaps Acad. nya Handlingar 1810: 243.

† This work has not been seen but as it is the only place where this plant is supposed to be figured it is quoted as above.

rather suggests *H. scrobiculatum.* The Ohio specimens have not been seen. Morgan's Kentucky specimens answer well to the descriptions of *H. infundibulum* except as to size. The European plant is described as 20 cm. wide and with stem 5–8 cm. long and 3 cm. thick. Morgan's specimens are 4–7 cm. wide with stem 4–5 cm. long, a much smaller plant. The plant is distinguished by its infundibuliform pileus, with erect flexuose, plicate margin.

11. HYDNUM SUBSQUAMOSUM Batsch, Elench. Fung. 111. 1783

ICON.: Batsch, Elench Fung. *f. 43!.* Paulet, Icon. Dec. Champ. *pl. 33. f. 1;* the latter simply a copy of Batsch.

TYPE LOC.: European.

Reported from Rhode Island (Bennett); Pennsylvania (Schweinitz); South Carolina (Schweinitz, Curtis, Ravenel). Bennett's Rhode Island specimen is unquestionably *H. scrobiculatum* and therefore must be excluded. Schweinitz's specimen is doubtful, the others have not been seen. Schweinitz's Pennsylvania specimen is identical with a specimen in the Underwood herbarium referred to *H. imbricatum* and characterized by coarse aculei, a slender stem and a remarkably light porous substance to the pileus when dried. This species so far as our American forms are concerned is doubtless involved in confusion with *H. imbricatum.* A thorough investigation is greatly needed of these related species including *H. levigatum.*

12. HYDNUM IMBRICATUM L. Sp. Pl. **2**: 1178. 1753

ICON.: Schaeffer, Fung. Bav. et Pal. Icon. *pl. 140;* Sowerby, Eng. Fung. *pl. 73;* Bolton, Geschichte *pl. 88;* Barla, Champ. de Prov. de Nice *pl. 38. f. 1–4;* Fl. Dan. *pl. 176*; Harzer, Naturg. Abb. Pilze *pl. 3. f. 6–9;* Fries Sverig. ätl. Svamp. *pl. 33;* Gautier, Champ. *pl. 1. f. 3;* Pat. Tab. analyt. Fung. *pl. 245;* Richon and Rose, Atlas Champ. *pl. 65. f. 8–11;* Greville, Scot. Crypt. Flor. *pl. 71;* Atkinson, Mushrooms, *f. 189.*

EXSICC.: Krieger Fung. Sax. 419; Linhart, Fung. Hung. 347; Roumeguere, Fung. Select. 5328; Roumeguere, Fung. Gall. 2310; Sydow, Myc. March. 105; Ellis, N. Am. Fung. 926;* Herpell; Samml. präp. Hutp. 75.

* In one set of N. A. F. under this number there was found a most typical specimen of what I regard as *H. imbricatum*, in another set under the same number the specimen appears to be a very distinct thing and entitled to be treated as a different species.

TYPE LOC.: European.

Reported from Massachusetts (Seymour); New Jersey (Ellis); Montana (Tweedy); New York (Peck); Rhode Island (Bennett); Pennsylvania (Schweinitz); Maryland (Banning); West Virginia (Nuttall); South Carolina (Schweinitz); Ohio (Lloyd); Kentucky (Morgan). This distribution can be regarded only as provisional as the specimens are found, so far as examined, to vary too greatly among themselves. For example, Tweedy's Montana specimen is a gray-brown plant with the pileus broken up into large, thick, imbricate plates, while Morgan's Kentucky plant is yellowish-brown with the pileus covered with numerous fine thin scales. There seems to have been a disposition among collectors to refer everything with a scaly pileus to this species. It seems probable, however, that we have several distinct species masquerading under this name. It is especially desirable that careful observations should be made of fresh specimens of this plant, with reference to the character of the scales, size, arrangement, and structure; also as to the teeth, length, size, color, and whether closely set or not; in addition to the usual points to be observed in the fleshy fungi.

13. HYDNUM SCABRIPES Peck, Reg. Rep. **48**: 13. 1896

TYPE LOC.: Elizabethtown, N. Y. (Peck).

The plant has not been reported since its first discovery by Peck. It is a very peculiar and well-marked species, large and conspicuous, with pileus 9–12 cm. broad, pinkish gray in color; teeth decurrent; stem 9–12 cm. long, scabrous-dotted.

14. HYDNUM VELLEREUM Peck, Reg. Rep. **50**: 110. 1897

TYPE LOC.: Port Jefferson, N. Y. (Peck).

This plant has been found also in Rensselaer Co., N. Y. by the writer. It forms shapeless crusts spread over the substratum of fallen leaves and often assumes nearly a resupinate character. It somewhat resembles *H. albonigrum* but is dryer in substance in the fresh condition and the color of the interior is much lighter, ashy-gray or brownish. It appears to grow in dryer situations than the former plant. Both species emit a strong heavy odor in drying which lasts for months. In *H. vellereum* this odor is quite suggestive of slippery elm.

15. HYDNUM ALBONIGRUM Peck, Reg. Rep. **50**: 110. 1897

TYPE LOC.: Gansevoort, N. Y. (Peck).

Massachusetts (Vail); Moravia, N. Y. (Banker). The plant is readily distinguished by its hard, nearly black central portion surrounded by a spongy-tomentose structure similar to *H. spongiosipes* but color gray-black and teeth white. When fresh this tomentose portion is tumid with water which can be readily squeezed out in drops. The plant grows among fallen leaves in wet springy situations. In drying it emits a heavy odor suggestive of certain fertilizing phosphates. It seems to be closely related to *H. vellereum*, with which it should be compared.

16. HYDNUM PUTIDUM Atkinson, Mushrooms, Edible, Poisonous, etc. 199. *pl. 69. f. 188.* 1900

TYPE LOC.: Blowing Rock, N. C. (Atkinson).

No specimens of this species have been examined but from Atkinson's plate and description it appears to be closely related to the above *H. albonigrum* Pk. from which it is evidently clearly separated by its larger size, "8–12 cm. broad," and by its "prominent concentric zones." The plant is further described as "remarkable for its peculiar odor, resembling, when fresh, that of an Ethiopian; for its tough, zonate pileus with a prominent white edge, and the stout irregular stem, resembling the stem of *Hydnum velutinum*,* with a thick, spongy, outer layer and a central hard core."

It is worthy of note that we evidently have here a group of closely related species that are especially characterized by the possession of a "peculiar odor." It is unfortunate that odors are so difficult to describe. It may be further noted that we also have in this genus a group of species marked by a peculiar double character in the internal structure, consisting of a thick, spongy or tomentose outer layer and a central hard compact portion.

17. HYDNUM SUAVEOLENS Scop. Fl. Carn. **2**: 472. 1772

TYPE LOC.: European.

Ft. Edward, N. Y. (E. C. Howe); Sandlake, N. Y. (Peck); Kentucky (Morgan); Connecticut (Underwood); New Jersey (Ellis).

* This probably refers to the species recognized in this paper as *H. spongiosipes* Pk.

Although this plant has been quite largely reported it seems doubtful if the true *H. suaveolens* of Scopoli has ever been found in this country. This notice of it would, therefore, have been placed with the *Species dubiae*, but that in the collections a plant with uniform characteristics is quite generally found referred to this species. Unless this plant undergoes considerable change in drying it does not appear to possess the characteristic blue color so strongly emphasized in the descriptions of *H. suaveolens* Scop. In many ways the American plant seems closely related to *H albonigrum* Pk. and *H. vellereum* Pk., differing from the former chiefly in the lighter color of the interior (not black) and in the cream colored or buff surface of the pileus. It differs from the latter in the darker color of the interior, and in its buff pileus; it is also more regularly mesopus in form. In fact it appears in many of its features to be intermediate between *H. albonigrum* and *H. vellereum* and is specifically distinguished by its cream colored pileus.

It is very desirable that accurate observations should be made on this plant in its fresh state, and its true position definitely determined.

18. HYDNUM FERRUGINEUM Fries,* Obs. Myc. **1**: 133. 1815

ICON.: Fries Icon. Select. Hym. *pl. 4;* Krombholz. *pl. 50. f. 10, 11.*

Bresadola Fung. Trid. *pl. 143;* Bulliard, Herbier de la France *pl. 409* are cited under this name, but they do not represent *H. ferrugineum* Fr. Bresadola's figure may be possibly *H. scrobiculatum.*

EXSICC.: Roumeguere, Fung. Gall. 2308; Desmazieres, Pl. Crypt. de France 2159 (?); Ravenel, Fung. Amer. 433;† Ravenel, Fung. Car. **3**: 17.‡ Exsiccati appear to furnish no satisfactory information on this species.

TYPE LOC.: European.

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* Fries's name for this plant is excluded by *H. ferrugineum* Pers. Tent. Disp. Meth. Fung. 30. 1797, which was given to a resupinate species. It should be known as *H. carbunculus* Secretan, Myc. Suisse, **2**: 515. 1833.

† In the set examined the specimens are uncertain and of little value.

‡ The specimen under this number in the set examined is not *H. ferrugineum* Fr. but is a peculiar brick red plant that has been quite generally referred here. It seems probable that it is an undescribed species.

This plant has also been reported from Alabama (Earle); New Jersey (Ellis); South Carolina (Ravenel); Pennsylvania (Schweinitz); North Carolina (Curtis); Florida (Lloyd); Ohio (Lloyd). I have not seen the last three and as to the others, several are evidently the brick red species of Ravenel, while Schweinitz's plant appears to be the same as *H. spongiosipes* Pk. Earle's Alabama plant appears to correspond closely to Fries's description and figure. *H. ferrugineum* Fr. would seem to be positively distinguished by the unique blood-red drops that gather on the pileus and which in drying leave a dark varnished coating on the plant.

19. HYDNUM SPONGIOSIPES Peck, Reg. Rep. **50**: 111. 1897

TYPE LOC.: Round Lake, N. Y. (Peck); New Jersey (Ellis); Ohio (Morgan); Iowa (McBride); Alabama (Atkinson). This plant has been uniformly reported as *H. velutinum* Fr. but Peck is undoubtedly correct in describing it as a distinct species. The hard central portion distinct from the spongy-tomentose exterior both of stem and pileus gives a marked character to the plant. Uniform cinnamon brown throughout, the pileus 3–10 cm. broad.

20. HYDNUM AURANTIACUM (Batsch) A. & S. Conspectus Fung. Nisk. 265. 1805

ICON.: Batsch, Elench. Fung. **2**: *pl. 40. f. 222!;* Bresadola Fung. Trid. *pl. 142.*

EXSICC.: Roumeguere, Fung. Select. 5329 and 6635; Sydow, Myc. March. 811. The latter is somewhat doubtful.

TYPE LOC.: European.

New York (Underwood); New Jersey (Ellis); Alabama (Earle); Pennsylvania (Schweinitz). Also reported, but the specimens not seen from: New England (Sprague); South Carolina (Curtis); Rhode Island (Bennett). This species is well marked by its woody texture and bright orange color, which is quite permanent in the interior, but varies considerably on the exterior. There is little doubt that the plant should be known as *H. floriforme* Schaeffer, Fung. Bav. et Pal. Icon. **4**: 97. *pl. 146. f. 1–6.* 1774. Both figures and description correspond well to this plant. Persoon in Commentarius 57. 1800, identified Schaeffer's figures with *H. suberosum* var. *β aurantiacum* Batsch, and named the plant *H. hybridum.* Fries, likewise, regarded these figures of Schaeffer as representing *H. aurantiacum* Sys. Myc. **1** : 403. 1821.

I have seen specimens of the plant with the same turbinate pileus as shown in part of Schaeffer's figures though the more common form appears to be the concave or infundibuliform pileus shown in others of his figures. That the two forms should be treated as distinct species, as was done by Persoon, seems very doubtful.

21. HYDNUM SCROBICULATUM Fries, Obs. Myc. **1** : 143. 1815

ICON. : Fries, Icon. Select. Hym. *pl. 5. f. 1!!*; Britzelmayer, Hym. Südb. *Hydnei f. 8.*

EXSICC. : Romell, Fung. Scand. 19; Roumeguere, Fung. Gall. 3007, 3626.

New York (Cushier); New Jersey (Ellis); Rhode Island (Bennett). The last reported as *H. subsquamosum.*

The plant is closely related to *H. zonatum* Batsch, from which it is difficult to separate it absolutely. The more typical forms have the surface of the pileus roughened and broken up into a coarse, spongy or scaly mass. But in other forms this feature becomes a mere roughening of the surface which also appears obscurely zonate, thus forming an easy transition to *H. zonatum.*

22. HYDNUM ZONATUM Batsch, Elench. Fung. 111. 1783

ICON. : Batsch, Elench. Fung. **2** : *pl. 40. f. 224 a, b, c!*; Nees, Sys. Pilz. *pl. 32. f. 242.**

EXSICC. : Ravenel, Fung. Car. **1** : 25.

TYPE LOC. : European.

Connecticut (Underwood); Rhode Island (Bennett); New Jersey (Ellis); South Carolina (Ravenel); Ohio and Kentucky (Morgan); Alabama (Underwood). Specimens also reported but not examined from Florida (Calkins).

The typical form of this species is clearly marked and readily recognized by its infundibuliform, coriaceus pileus, with several sharply defined zones, by its soft cinnamon brown color, and by its

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* This is of no value. α and β are mere copies of Schaeffer's figure of *cyathiforme*, while B is a copy of Batsch.

sterile margin, which does not curl in drying. But from this it varies in numerous ways forming intermediate series that connect it so closely with other species, particularly *H. scrobiculatum*, that it is very difficult to say where the line should be drawn between them. The plant should receive careful field study, and its variations noted, especially in single gatherings, where there is reason to believe the plants have all sprung from a common mycelium.

23. HYDNUM CONFLUENS Peck, Reg. Rep. **26**: 71. 1874

TYPE LOC.: New Scotland, N. Y. (Peck).

The plant has not been reported by any but its discoverer. "Pileus thin, tough, expanded, sometimes confluent, hygrophanous; stem surrounded below by a dense myceloid tomentum." Pileus 5–8 cm. wide. This is not the same as *H. concrescens* var. *confluens* Pers. Myc. Eur. **2**: 165. 1825 so that the present name cannot hold.

24. HYDNUM CORIACEO-MEMBRANACEUM Schweinitz, Syn. N. A. Fung. 162. 1834

TYPE LOC.: Bethlehem, Pa. (Schweinitz).

This plant has never been reported since Schweinitz described it. The type specimen in the Schweinitz collection in the Philadelphia Academy of Science is unfortunately totally destroyed Berkeley and Curtis, who saw the specimen in 1855, reported that it was "a very singular and distinct species" in their commmentary on the Syn. Fung. Amer. Bor.* Schweinitz himself remarks "distinctissima species." It would be especially interesting if this apparently clearly marked species could be rediscovered. The original description is added, therefore, as it is not generally accessible.

"Pileis concrescentibus, lato-repandis, subinfundibuliformibus, coriaceo-membranaceis, exacte *Polypori versicoloris* substantia in varietati ejusdem membranacei ceterum glabris, strigoso-zonatis margine strigoso fimbriatis, saepe laceratis, 1–2 uncialibus diametro, pallide cervinis. Subulis sparsis, subulatis, longis saepe tortis, lutescentibus. Stipitibus tenuibus, centralibus, brevibus, concrescentibus." Syn. N. A. Fung. 162. 1834.

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* Jour. Acad. Sci. Phila. II. **3**: 215. 1855.

25. HYDNUM FASCIATUM Peck, Reg. Rep. **41** : 78. 1888

TYPE LOC.: Catskill Mts., N. Y. (Peck).

The species has been reported only by its discoverer. It is a very distinct and beautiful species. "Pileus thin, coriaceous, nearly plane, umbilicate, blackish-brown, adorned with three to seven narrow elevated scabrous tawny-gray concentric zones," 1.5–2.5 cm. wide.

26. HYDNUM CYATHIFORME Schaeff. Fung. Bav. et Pal. **4**: 93. 1763

ICON.: Schaeffer, Fung. Bav. et Pal. Icon. *pl. 139!!*

Bulliard, Herbier de la France *pl. 156?* Flor. Dan. *pl. 1020. f. 2?* Harzer, Naturg. Abb. Pilze *pl. 3. f. 1–5?* Sicard, Hist. Nat. Champ. *pl. 58. f. 294?* Britzelmayer, Hym. Südb. *Hydnei f. 9?* Schaeffer's figures are clearly marked and readily identify the plant, the others are all doubtful and most of them appear to represent a totally different plant.

EXSICC.: Krieger, Fung. Sax. 906; Sydow, Myc. March. 206 and 1011; De Thümen, Myc. Univ. 207;* Rabenhorst, Fung. Eur. 611* and 2304;* Herpell, Samml. präp. Hutp. 115; Roumeguere, Fung. Gall. 2306.†

TYPE LOC.: European.

New Hampshire (Minns); Connecticut (Underwood). It has also been reported but specimens not seen from Rhode Island (Bennett) and California (Harkness). The Schweinitzian specimens reported from South Carolina and Pennsylvania are not *H. cyathiforme* Schaef. but appear intermediate between *scrobiculatum* and *zonatum*, having the fertile curling margin of the former but the distinct zonations of the latter. The specimens are marked "(H. scrobiculatum) Epic. 21. Hydnum cyathiforme Bull."

H. cyathiforme Schaeff. is often regarded as a synonym of *H. tomentosum* L. (see De Thümen and Rabenhorst above). But for the present it seems best to follow Fries in keeping them distinct, although, I admit, the reason for doing this is chiefly the fact that Linnaeus's two-line description is not sufficient to identify any-

* These specimens are marked *H. tomentosum* L. but are typical plants of *H. cyathiforme* Schaeff.

† Roumeguere's specimens are practically worthless for critical purposes.

thing, while Schaeffer's plant is readily recognized from his figure and is clearly characterized by the white or cream colored teeth, the darker zonate pileus, somewhat tomentose at the center, and with margin the color of the teeth. The pilei are frequently confluent, forming a thin expanded crust supported by the slender distinct stems.

27. HYDNUM DELICATUM Schweinitz, Syn. N. A. Fung. 161. 1832. Not *H. delicatum* Klotsch.

TYPE LOC.: Bethlehem, Pa. (Schweinitz).

This species has not been reported except by its discoverer. The type specimen in the Schweinitz collection at Philadelphia is partly destroyed, but sufficient remains to show the chief characters of the plant. It is a very dainty little species, 1.5–2 cm. high, ash-gray in color; pileus thin, flat to infundibuliform; stem attenuate to the base. A plant in the Ellis collection at the N. Y. Botanical Garden marked *H. suffocatum* is to all appearances this species and so gives another station, Newfield, N. J.

28. HYDNUM CANUM Schweinitz, Syn. Fung. Car. 77. 1818

TYPE LOC.: North Carolina (Schweinitz).

Also reported from Bethlehem, Pa. (Schweinitz).

The species has never been reported by any other than Schweinitz himself. His description is too brief to convey any definite idea of the species. Fries regarded the plant the same as *H. gracile* with a confidence that would indicate he had seen something more than Schweinitz's three-line description. The specimen in the Schweinitz collection at Philadelphia, while not very satisfactory, appears to be a plant closely resembling *H. scrobiculatum* in all important features except that the color is ash-gray.

SPECIES DUBIAE

29. HYDNUM FUSIPES Pers. Myc. Eur. **2**: 162. 1825

ICON.: Pers. *op. cit. pl. 20. f. 4–6.*

TYPE LOC.: European.

Bethlehem, Pennsylvania (Schweinitz). Has never been reported except by Schweinitz. His specimen as preserved in the Philadelphia Acad. of Sci. does not in the least resemble Persoon's figure and appears to be an immature plant of some sort. The decidedly decurrent teeth would seem to distinguish the species well and it is doubtful if it has ever been found in this country.

30. HYDNUM VERSIPELLE Fries, Ofvers. af Kongl. Vet. Ak. Förhand. 1861: 73. 1862

ICON.: Fries, Icon. Select. Hym. *pl. 1!*.

TYPE LOC.: European.

This species has been reported but once. New York (Fairman). I have seen only a single specimen of this collection but doubt if it is *H. versipelle*. The plant seen does not show in the least the confluent cespitose character emphasized by Fries both in his description and in his figure.

31. HYDNUM TOMENTOSUM L. Sp. Pl. **2**: 1178. 1753

ICON.: Smith, Seeman's Jour. Bot. **6**: *pl. 76*.

TYPE LOC.: European.

This has been reported only by Schweinitz. His specimen in the Philadelphia Academy is now only a scrap but is clearly not *cyathiforme* Schaef. nor does it resemble *H. tomentosum* L. as figured by Smith, *loc. cit.* It seems safe to assume that *H. tomentosum* L., if we are to regard it as distinct from *H. cyathiforme* Schaeff., has not been found in this country.

32. HYDNUM COMPACTUM Persoon, Comm. Schaeff. 57. *pl. 146. f. 1, 2, 3, 5, 6.* 1800

TYPE LOC.: European.

Reported from South Carolina (Curtis) and North Carolina (Schweinitz). No species of the genus seems to be more uncertain than this. An examination of specimens from collectors in this country, as well as a study of European exciccati, reveals a very great difference of conception as to the characters of the species; even published descriptions are difficult to harmonize. An appeal to Persoon's original description does not give much help in the matter. He established the species on part of Schaeffer's figures of *H. floriforme*, the turbinate forms of *pl. 146. f. 1, 2, 3, 5, 6*, and gave a very meager description, but one that differs essentially from Schaeffer's account of *floriforme.* As there is no good reason to suppose Schaeffer's figures did not correctly represent the plant he described, we are left not only in doubt, but in some confusion as to what plant Persoon may have had in mind. A plant from Alabama, in the Underwood collection, conforms quite closely to Persoon's description and resembles in form Schaeffer's figures, but does not correspond to any known European plant. It is doubtful, therefore, whether it should be regarded as *H. compactum* Pers. Moreover, it does not show the blue variegations mentioned by Fries, a characteristic which is quite evident in some of the European specimens. I have not seen Curtis's specimens, while Schweinitz's plant as preserved at Philadelphia is very curious and distinct from anything I have seen. I believe we have several unique species in this country passing under the name of *H. compactum.*

33. HYDNUM CINEREUM Bull. Herbier de la France, 309. 1791

ICON.: Bulliard Herbier de la France, *pl. 419!;* Sicard, Hist. nat. Champ. *pl. 58. f. 297.*

TYPE LOC.: European.

Bethlehem, Pa. (Schweinitz). Has been reported only by Schweinitz and his specimen is too uncertain to draw any conclusions. In the absence of actual specimens it is impossible to satisfactorily locate this plant. It is doubtful if this species has really been found here.

34. HYDNUM MIRABILE Fries, Monog. **2**: 349. 1863

ICON.: Fries, Icon. Select. Hym. *pl. 3. f. 2!.*

TYPE LOC.: European.

Port Jefferson, N. Y. (Peck). This species has been reported only by Peck and he expresses doubt as to whether his specimen is rightly referred here. The plant is characterized by a peculiar woolly tomentum covering the entire plant.

35. HYDNUM VELUTINUM Fries, Sys. Myc. **1**: 404. 1821

ICON.: Bulliard, Herbier de la France *pl. 453. f. 2.*

TYPE LOC.: European.

All specimens reported as *H. velutinum* that have been examined have proven to be *H. spongiosipes* and it is probable that the latter species has been generally referred to *velutinum.* Curtis's North Carolina specimen has not been seen.

36. HYDNUM CONCRESCENS Persoon, Obs. Myc. **1**: 74. 1796

TYPE LOC.: European.

North Carolina (Schweinitz).

Schweinitz is the only one who has reported a species under this name. Later in his Syn. N. A. Fung. 161 he referred the same plant to *H. cyathiforme* Fr. As *H. concrescens* Pers. is a doubtful species, and Fries himself afterward repudiated his own *H. cyathiforme* it is difficult to say what Schweinitz's plant may have been. There is no specimen in his collection at Philadelphia.

37. HYDNUM FENNICUM Karst. Rev. Myc. **9**: 10. 1887

TYPE LOC.: European.

Port Jefferson, N. Y. (Peck); Kentucky (Morgan).

The American plants referred to this species are somewhat doubtful but correspond closely to a specimen from Karsten himself which is preserved in the New York Botanical Garden. The plant appears to be especially marked by a dark blue color at the base of the stem.

38. HYDNUM SPADICEUM Persoon, Icon. et Disc. 34. 1798

ICON.: Persoon, *op. cit. pl. 9. f. 1.*

TYPE LOC.: European.

Reported from Rhode Island (Bennett) and North Carolina (Schweinitz). Schweinitz afterward regarded his specimen as *H. connatum* and Bennett's plant appears to have been destroyed.

39. HYDNUM CONNATUM Schultz, Prodr. Flor. Starg. 491. 1806

TYPE LOC.: European.

Reported from North Carolina (Schweinitz). The specimen in the Acad. Nat. Sci. Phila. does not seem to differ from *H. scrobiculatum.*

40. HYDNUM GRAVEOLENS Delast.; Fries Epic. 509. 1836–38

ICON.: Fries, Icon. Select. Hym. *pl. 6. f. 1!.*

EXSICC.: Ravenel, Fung. Car. **3**: 16; Sydow, Myc. March. 908: Roumeguere, Fung. Select. 6241; Roumeguere, Fung. Gall. 2007; Rabenhorst, Fung. Eur. 1104.

TYPE LOC.: European.

Reported also from Ft. Edward, N. Y. (E. C. Howe) and North Carolina (Curtis). I have not seen these specimens. The exsiccati quoted above furnish little information regarding this species; the American collections are of uncertain relations and it seems doubtful if the species has ever really been found in this country. Such specimens as I have been able to examine do not satisfy me as corresponding either to Fries' figure or description.

DICKINSON SEMINARY, WILLIAMSPORT, PA. March, 1901.

New Plants from Wyoming. XIII.

By Aven Nelson

Potentilla Plattensis pedicellata

Erect, slender, several-stemmed from the crown of a semi-fleshy root, bright green but under a lens silky-strigose, taller than the species (often 3 dm. high): stipules entire or cleft-toothed, ovate-lanceolate, acute: leaflets divided nearly to the midrib, the segments linear-oblong, acute or subacute: inflorescence open, many-flowered, the long slender pedicels widely divaricate: bractlets and sepals subequal: petals scarcely exceeding the sepals.

The aspect of the plants now proposed as a variety of *P. Plattensis* is so different from that of the species that I did not at first associate them with it. Closer examination shows, however, that they must be thus allied and probably best as a variety only.

Collected on the grassy banks of a mountain stream, Centennial, Albany Co., July 27, 1900, no. 7730.

Ligusticum affine

Moderately stout, .5–1 m. high, glabrous: root leaves large, including the petiole from one third to one half the length of the stems; petiole from nearly as long to much exceeding the blade; blade usually biternate, then once or twice pinnate; segments mostly ovate-oblong, deeply cleft into linear-oblong or linear-lanceolate lobes, these sometimes few-toothed: stem leaves few (1–3), much reduced, usually ternate, then pinnate, the segments more deeply cleft or even divided and with narrower lobes: umbel long-peduncled, sometimes 1–3 long-peduncled accessory umbels (inflorescence subcorymbose), many-rayed, crowded (*i. e.*, the rays suberect), with involucels of few linear-subulate bractlets which are usually early deciduous: rays (fruiting) 3–6 cm. long: pedicels 5–10 mm. long: flowers white: fruit elliptic, 5 mm. long, the ribs distinctly winged: oil tubes usually 5 in the intervals and 10 on the commissural side: stylopodium flattened-hemispherical.

This species now proposed was included in *L. simulans* C. & R., Monog. N. A. Umbel. 135, but it is no part of the type numbers there cited. The species are distinct not only by good field charters but fruit characters are not wanting. It is only the ampler and well fruited specimens of the collections of 1900 (which have not yet been distributed) that makes this segregation possible.

That Dr. Rose himself was inclined to think that the material represented two species is shown by the fact that some of the numbers of the collections of 1896 and 1897 were at that time named *L. Porteri* while the specimens that he has made his type numbers were not referred to any species.

L. affine is the larger plant, with pale-green foliage in contrast to the dark-green of the others; the leaves are more decompound and the segments more deeply cleft with much narrower lobes; the naked peduncles (often subcorymbose) conspicuously surpass the foliage; the umbels are more compact; the fruits larger, broader and more evidently winged; the number of oil tubes greater (mostly 3 in the intervals and 6–8 on the commissural side in *L. simulans*). The two species grow in similar situations and at the same stations but not, so far as my observations go, commingled. My collections of them have always been kept distinct in the field. I cite 7695, Centennial, Albany Co., July 26, 1900, as type. Of the numbers named under *L. simulans* I would here refer 1784, 4175 and possibly others.

Pseudocymopterus sylvaticus

Root fleshy, cylindrical or conical, 3–10 cm. long; stems glabrous as are also the leaves, 1–2 from the narrowed crown, sheathed below by the dead, brown leaf bases, slender, erect, 3–8 dm. high (including the long naked peduncle), usually simple but sometimes with one or two slender erect branches: leaves few, oblong to ovate in outline, pinnate; the segments 5–9, mostly petiolulate, ovate in outline, 3–6 cm. long, pinnately or bipinnately cleft or parted into linear acute segments; root-leaves 10–25 cm. long, including the slender petiole which usually exceeds the balde; stem-leaves only 2–5, on successively shorter petioles: umbel 5–10-rayed, with involucels of long linear bractlets: rays 15–25 mm. long; pedicels very short: fruit broadly elliptic, 5 mm. long; lateral wings thin and as broad as the body; the dorsal and intermediate ribs thickened at base and narrowly winged, with narrow intervals; oil tubes mostly 1 (more rarely 2–3) in the intervals, 2–4 on the commissural side.

Allied to *P. montanus* (Gray) C. & R. In fact the descriptions as drawn do not readily separate them. A considerable series of *P. montanum*, however, show the two species to be wholly distinct. The Wyoming plants when fully mature are seen to be tall slender plants, with the leaf-segments parted into long linear lobes. The peduncles are long and naked, the fruits are broader with thinner, conspicuous wings and the oil tubes are on the whole fewer. Their habitats seem to be as wholly different as their aspect. The typical New Mexican *P. montanus* occurs on "Sunny declivities at the foot of mountains," while *P. sylvaticus* is found in dense, wet or even boggy woods along streams. The young plants of *P. sylvaticus* have rather the hue and aspect of *Harbouria* than of *P. montanus*.

The type number is 7667, Tie City, Albany Co., July 20, 1900. Collected also on Saw Mill Creek, May 25, 1895, no. 1238. It seems probable that no. 217 of the Hall and Harbour collection and Professor Crandall's specimens from the mountains of Larimer Co., Colorado, July 14, 1898, may have to be included.

Musineon pedunculatum

Acaulescent or nearly so, glabrous throughout: root deep-set, 1–2 dm. long, 10–25 mm. in diameter, cylindrical or fusiform, semi-woody and covered with a thick, rough or warty bark: crown clothed with brown, scarious, nerved, lanceolate bracts: stems few (2–5), borne on a short naked foot 2–4 cm. long, the foot more or less concealed by the scarious bracts of the crown: each stem with 1 or 2 short (1–3 cm.) internodes, simple or branching at the nodes, terminated by a long naked widely divaricate or prostrate peduncle: leaves thick, somewhat glaucous, 4–8 cm. long, longer than the dilated petiole, of broad outline (oblong to ovate), usually ternate, the segments pinnate or even bipinnate, ovate in outline, the ultimate segments broad and short, variously cut or toothed: peduncles rather stout, slightly flexuous, 12–20 cm. long, much exceeding the leaves, sometimes twice or thrice as long: umbel 10–20-rayed; rays 15–25 mm. long; pedicels very short (1–4 mm.): fruits apparently smooth (not yet mature), 4 or 5 mm. long: oil tubes about 3 in the intervals, and 4 on the commissural side: seed slightly flattened dorsally, with plane face.

An undoubted *Musineon* yet more clearly distinct from *M. divaricatum* and *M. Hookeri* than they are from each other. It may be necessary sometime to slightly modify the fruit characters as given, since no fully mature fruits are at hand.

Secured on the stiff, Wasatch tertiary clays (almost devoid of other vegetation) at the Bush Ranch, near Steamboat Mt. in Sweetwater Co., June 10, 1900, no. 7093.

Musineon trachyspermum. I doubt if the reduction of this Nuttallian species to a synonym of *M. Hookeri* is justifiable. Among the specimens at hand from the interior desert region of Wyoming is one from the clay hills in the vicinity of the Platte River that answers well to the description in T. & G. Fl. **1**: 642. It has been distributed under no. 4853.

Lomatium purpureum

Root thick, semi-woody, vertical, 1 dm. or more long, 1 cm. (more or less) in diameter: leaves all basal, wholly glabrous, ternate and each division pinnate or bipinnate; the ultimate segments small, from oblong to linear, 5–8 mm. long, obtuse or subacute; the primary petiole 5–9 cm. long, about as long as the rest of the leaf, purple as are also the peduncles: scapes (peduncles) glabrous, 10–20 cm. long, exceeding the leaves: umbel unequally 7–10-rayed, the younger and shorter ones often aborting: involucre wanting; involucels of oblong, acute, green bractlets: rays 5–30 mm. long: flowers yellow, pedicels very short, in fruit only 1–3 mm. long; fruit glabrous, elliptic, 5–7 mm. long, the wings half as wide as the body, the dorsal and intermediate ribs evident, acute or even narrowly winged: oil tubes 1–3 in the intervals, 4–6 on the commissural side.

The specimens upon which this species is based were collected in the Yellowstone Park in 1899 and distributed under a herbarium name in the sets of plants from that region.

At that time I thought it a *Peucedanum* and I still see no reason for changing that opinion except, of course, to adopt the name *Lomatium* which Drs. Coulter and Rose have shown to be the proper and tenable name of a large part of our west-American plants that have so long been known as *Peucedanum*.* In the monograph cited, one of the numbers (5496) distributed is referred to *Pseudocymopterus montanus* (Gray) C. & R. but on what ground is not clear. Habital and fruit characters are certainly those of *Lomatium*. The thin coherent lateral wings, the strengthening cells beneath each rib and the obsolete calyx teeth point to this rather than any other genus. In habit is much like *L. orientale*

* Monog. N. A. Umbel. 204.

C. & R., L. *Nevadense* (Wats.) C. & R. or *L. Cous* (Wats.) C. & R. but it has nearly the fruit of *L. circumdatum* (Wats.) C. & R. Like that species it shows a tendency in the dorsal and intermediate ribs to become narrowly winged and the seed is somewhat concave on the face with a central ridge.

The collections of it are all from Yellowstone Park as follows: 5496, Madison Cañon, June 25; 5611, Glen Creek, July 1; 6720 (type), Dunraven Peak, Aug. 27. It occupies open, stony or gravelly ridges at 6000 to 9000 ft. altitude.

Dodecatheon philoscia

Glabrous throughout: scape 1.5–3 dm. high, very slender, mostly 1–3-flowered though sometimes with more, from a short cormose-rootstock with fibrous roots: leaves few (4–8), elliptic to oblong, mostly obtuse, variable in size (2–7 cm. long), tapering into a short slender petiole: bracts minute, oblong: calyx-lobes lanceolate, 2–3 mm. long, twice as long as the tube: united part of the corolla with a purple wavy line; lobes deep sky-blue, narrowly oblong, 15 mm. long, about 3 mm. broad, obtuse: united filaments about 1 mm. long, yellow: anthers broadly subulate, acute, deep-blue on the back, about 5 mm. long; connective linear-acuminate: capsules on slender erect pedicels (which are 2–4 cm. long), subcylindric, about 4 mm. in diameter and 1 cm. long, twice as long as the calyx, splitting only at the summit into five (at length) divergent teeth.

I am at a loss to know to what species this is most nearly allied. On account of the few, broad, thin (almost membranous when dry), entire, widely spreading leaves it cannot be compared with *D. pauciflorum* (Durand) Greene from which its short filaments also separate it.

It perhaps may be best compared with the *D. Maedia* of the eastern states from which its smaller size, slender scape and pedicels, slender petioles, few flowers and different capsule separate it.

It was secured on gravelly and stony, shaded bars in the river bed at Jelm (Laramie River), Aug. 11, 1900, no. 8063.

Swertia palustris

Stems simple, erect, glabrous, 2–3 dm. high: leaves glabrous, thin, almost membranous when dry, entire or rarely denticulate: root-leaves oblong to elliptic, usually very obtuse, 5–10 cm. long, on margined petioles somewhat shorter; stem-leaves several, generally in pairs but not rarely alternate, spatulately oblanceolate or broader, tapering gradually into the broad margined petiole which becomes gradually shorter upward and absent in the uppermost: inflorescence very strict: peduncles erect, axillary to the bracts and uppermost leaves, 1–3-flowered: flowers 5-merous: sepals subulate-lanceolate, delicately nerved, about half as long as the petals: corolla lobes dark blue shading to purple, oblong, obtuse, about 10 mm. long, 3–4 mm. broad: glands orbicular, the appendages few (10 or less), short subulate: seeds seemingly lenticular (those at hand immature), wing-margined.

It often happens, once attention is called to it, that some species that has remained a long time generally accepted and undisturbed is found to be a very nicely separable aggregate. Dr. Greene and others have repeatedly made this clear. As soon as segregation has begun other workers must of necessity investigate their own material and at the same time it stimulates the field work in that particular group. This nearly always leads to the definition of yet other species. Evidently this experience is to be repeated in the case of *Swertia.* The old world *S. perennis* is wholly unknown to me but, with the characters which Dr. Greene assigns to it * it is no longer possible to refer any of our forms to that. In fact to do so would be to reject the work already done. But if we accept the characters, upon which Dr. Greene's species † are founded, as specific, it is equally impossible to include some other Rocky Mountain forms in them. *S. palustris* is nearest to *S. scopulina* but differs from it in its leafy stems, more numerous 5-merous flowers, shorter sepals and apparently very different seeds.

The species now proposed is abundant in shaded subalpine bogs of southern Wyoming. I cite no. 7774, Nash's Fork, July 30, 1900, as type.

Swertia congesta

Commonly less than 2 dm. high: leaves alternate, rarely more than 3 or 4, usually on the basal half of the stem (the upper half somewhat scapiform), from elliptic to oblanceolate, obtuse or subacute, 3–6 cm. long, sessile or on short margined clasping petioles: inflorescence congested, usually subtended by a pair of foliar bracts: flowers 5-merous, 3–7, dark bluish-purple: sepals as in

* Pittonia 4: 184.

† Pittonia *l. c.*

the preceding: corolla lobes elliptic, obtuse, usually emarginate, 8–10 mm. long, nearly half as broad; glands cup-shaped, the setaceous appendages as long as the cup: filaments flat and thin, their bases involved in a ring of very short, sparse, subulate setae in the base of the corolla: seeds small, very numerous, irregular (?), narrowly wing-margined on the angles.

Readily distinguished from the preceding by its smaller size, alternate leaves, congested inflorescence and the ring of setae in the base of the corolla.

It occurs at higher elevations than the preceding, being alpine or nearly so, and in open wet grassy swales. The type no. is 7852, Medicine Bow Mts., Aug. 1, 1900.

✓Phacelia Knighti

A diminutive annual, 2–5 cm. high, minutely puberulent, scarcely viscid, simple or branched: leaves few (5–10?), semi-fleshy, orbicular to ovate, entire or nearly so, 5–10 mm. long: flowers few, subspicate and nearly sessile in the uppermost axils: corolla narrowly campanulate, about 5 mm. long, ⅓ longer than the linear-spatulate calyx lobes, the limb purple, the tube yellowish, the appendages of the tube narrowly linear: seeds about 14, oblong, large for the plant, conspicuously alveolate-hexagonal-reticulate, slightly wing-margined by the cellular coat.

While this species is probably nearest to *P. cephalotes* Gray yet it can hardly be compared with it and may be best looked upon as a strictly coördinate member of that section of *Phacelia* containing those 4 or 5 species which are peculiar to the arid interior West. It is a vernal species following closely upon the melting of the spring snows. The specimens at hand were secured upon the absolutely naked (to all appearances) slopes of the Wasatch clays in Sweetwater Co., June 10, 1900 (no. 7118). The tiny plants occurred only in the cracks in the loose soil and were detected by Professor W. C. Knight to whom the species is dedicated.

Asclepias curvipes

Root thick and woody: stems usually several, from ascending to nearly erect, 4–8 dm. high, simple, obscurely puberulent, becoming glabrous: leaves opposite or sometimes the lowest alternate, ovate-lanceolate, obtuse or acute, minutely and softly pubescent on the lower face, glabrate on the upper, 7–15 cm. long, short-peduncled, exceeding the short internodes: umbels mostly simple, few: peduncles 3–7 cm. long, axillary from the only slightly reduced uppermost leaves: pedicels slender, 15–20 mm. long: sepals lanceolate, 3–4 mm. long: corolla purple; its lobes ovate-elliptic, obtuse and usually emarginate, twice as long as the sepals: hoods yellowish with purple center, ovate, obtuse, the base slightly narrowed, as long as the corolla lobes, exceeding the strongly incurved, sickle-shaped horn: anther wings broad and unappendaged: follicles lanceolate-acuminate in outline, 7–10 cm. long, erect on the sharply deflexed fruiting pedicels, mostly densely white tomentose and with a lighter tomentum on the pedicels and peduncles.

In 1895 I collected this species in flower at Wood's Landing (no. 1556) and determined it as *A. Hallii* Gray. In 1900, I secured the same plant in fruit from the same locality (no. 8191). I am now convinced that, while it is related to *A. Hallii*, the relatively long peduncles, the somewhat differently colored flowers, the broader corolla lobes and hoods, the absence of the double gibbosity in the hoods, the sharply deflexed pedicels and the decided tomentum on the erect follicles easily separate it.

Pentstemon exilifolius

Stems several to numerous, from a tufted, usually much branched caudex from which spring numerous thickened-fibrous roots, glabrous, as are also the leaves and inflorescence, 1 (rarely 2) dm. high: leaves very numerous, crowded on the crowns, narrowly linear, channelled or involute, subulate-pointed, 15–25 mm. long; stem-leaves opposite, similar, passing into the smaller bracts: thyrsus narrow (approaching a raceme), crowded, few- to many-flowered; pedicels slender: sepals ovate-acuminate, the acuminations green, the body scarious-margined: corolla white, tubular-funnelform, 12–15 mm. long, obscurely pubescent in the throat, scarcely bilabiate, the nearly obicular lobes widely spreading, 6–7 mm. long: anthers glabrous, the sterile filament scarcely dilated, very stiffly and densely short pubescent.

This species has been considered as *P. laricifolius* Hook. & Arn., a species published in Bot. Beechy's Voyage from Snake Fort. Certain plants from the interior of Wyoming, closely allied, were included by Dr. Gray in the description as drawn for the Syn. Fl. The Wyoming specimens that I have seen are clearly distinct. *P. laricifolius*, the original description shows, has obtusish shining leaves; the corolla is ventricose; both the lip and throat are pilose as is also the sterile filament. In *P. exilifolius* the corolla is almost glabrous and the sterile filament reminds one of a diminutive tooth brush. In fact *P. exilifolius* is more nearly allied to *P. aridus* Rydb. of Montana though specimens and descriptions show these also clearly distinct.

This species is common on dry stony plateaus in southern Wyoming and has been distributed by me as *P. laricifolius* under the following numbers: 419, 1442, 5015 and 7460. The latter is taken as the type and is from Halleck Cañon, July 6, 1900.

Pentstemon exilifolius desertus

Quite similar; the leaves broader; calyx purplish; corolla purple; pubescence in the throat yellow, stiffer than in the species.

This variety occurs sparingly on dry sandstone ridges in the Red Desert. Point of Rocks, June 12, 1900, no. 7160.

Castilleja collina

Many stemmed from a short caudex with an enlarged crown, 15–25 cm. high (the plant often as broad): the roots usually numerous, yellowish, thickened, semi-fleshy: pubescence a fine puberulence with some soft white woolly hairs at the base of the leaves, on their margins and in the inflorescence: stems simple, the exterior ones in the cluster decumbent: leaves 2–4 cm. long, dark green, variously cleft; the lower mostly pinnately, with the body narrowly lanceolate and cuneate at the base, the divaricate lobes linear or broader, sometimes again cleft, 1–3 on either side; the upper similar but with the undivided center becoming broader (oblong or broader): bracts bright red, more freely cleft than the leaves, as large or larger: calyx sparsely soft pubescent, cleft nearly to the middle before, less deeply behind, the lobes again cleft half their length into lanceolate segments: corolla yellowish, about 3 cm. long; galea distinctly exceeding the tube, slender, truncate or with a short tooth at apex, obscurely pubescent on the exserted tip; lip very short, 3-toothed, the central one short, the lateral longer, acute, divaricate.

This species is common in southeastern Wyoming on gravelly, granite slopes. It has often been collected, the earlier specimens having been disturbed as *C. parviflora*. Later it has been disposed of (under protest) as *C. angustifolia* (Nutt.) Don. From this it differs in its broader, always cleft leaves, its shorter inflorescence (short even in fruit), in its unequally cleft calyx, in its galea which exceeds the tube and in its characteristic lip. The color, too, is not the scarlet varying to yellow that occurs in *C. angustifolia*.

The type no. is 6995, Sand Creek, May 31, 1900.

✓Valeriana furfurescens

Root fleshy, smooth, vertical, cylindro-conical, 1–2 dm. long, usually only 6–12 mm. in diameter, but slightly enlarged at the crown: stems singly (rarely more) from the crown, strict, slender, striate, glabrous, 5–10 dm. high including the long inflorescence: leaves largely basal, all narrow, glabrous except for a minute puberulence on the margins and sometimes on the veins: root-leaves linear-oblanceolate, entire (seemingly always so), acute at apex, tapering gradually into a slender, scarcely margined petiole, 10–20 cm. long including the variable petiole (petiole usually much shorter than the blade); stem-leaves few, entire or with a few approximate lobes, with broader, shorter, often connate petioles: bracts linear: bractlets minute, ovate, acuminate, scarious margined: inflorescence a greatly elongated open-paniculate cyme, often more than half of the height of the plant: flowers exceedingly minute, light yellowish-green, very numerous; corolla 1–1.5 mm. long, the ovate-orbicular lobes about equalling the campanulate tube: stamens 3, included, nearly sessile: fruit about 3 mm. long, ovate, compressed, glabrous but minutely scurfy-rugulose, or in age merely splotched with brown.

This excellent species finds its nearest ally in *V. edulis* Nutt. but the specific distinctions are so evident that it is almost unnecessary to direct attention to them. The enormous root, the pubescent, semi-fleshy, pinnate leaves, the less open inflorescence, the relatively large white flowers and pubescent fruits of *V. edulis* will at once separate them.

V. furfurescens was secured in a small grassy mountain valley where it occurred in the greatest abundance and seemed to be unusually uniform in aspect and size of all the organs characterized. Chug Creek, near Iron Mountain Station, July 2, 1900, no. 7381.

✓Chrysopsis resinolens

Perennial, green and resin scented: root woody, conical, the expanded crown bearing few to many ascending or suberect stems: stems 2–4 dm. high, very leafy especially upward, sparsely hispid-ciliate and minutely glandular or resinous: leaves numerous, erect or but slightly spreading, with minute, gland-tipped hairs or dotted with resinous particles, hispid-ciliate especially on the margins; the lower dead and falling away at anthesis; narrowly oblanceolate, on short, hispid-ciliate petioles; the upper sessile, narrowly oblong or subspatulate, 3–5 cm. long, obtuse or subacute, apiculate: inflorescence terminal, crowded, very leafy, densely but finely glandular, the leafy bracts hispid-ciliate on the margins; heads few (3–10), rather large, paniculately-corymbose: involucre broadly campanulate, 1 cm. high, green, granular-resinous, ciliate-pubescent; bracts linear-acute, in 3–4 rows, the inner equalling the disk: rays 20 (more or less), deep yellow or orange colored, 8–12 mm. long: pappus dingy, the outer series distinct, of short, narrow scabrous-margined paleae.

The nearest ally of this species seems to be *C. viscida* (Gray) Greene, which has a more southwesterly range. That differs from the species now proposed in its strongly decumbent, rigid stems, its smaller size, smaller and fewer leaves, and open, branched inflorescence. In many respects *C. resinolens* is nearer *C. fulcrata* Greene from which, however, a comparison of specimens shows it to be amply distinct.

Collected on open slopes in the foothills of Laramie Peak, Albany Co., July 13, 1900. The type number is 7583.

Chrysopsis resinolens ciliata

Smaller than the species, the stems more numerous and crowded on the crown; leaves nearly glabrous on the faces but conspicuously ciliate margined, closely and minutely glandular-dotted; heads fewer, closely crowded and subtended by leafy bracts: rays broader and fewer: the outer pappus shorter and of fewer paleae.

Collected on sandy river banks, Dunn's Ranch, Albany Co., July 16, 1900, no. 7560.

Machaeranthera ramosa

Perennial from rather deep-set woody roots: stems several to numerous, prostrate-spreading or somewhat assurgent, each freely branched (often intricately so) throughout, 3–4 dm. long, the whole plant forming a conspicuous mat from .5 m. to nearly 1 m. across, stems and slender branchlets green with a fine puberulence: leaves green, nearly glabrous; the radical and cauline entire or irregularly denticulate, broadly linear or linear-spatulate, 3–5 cm. long, often wanting at anthesis; the rameal numerous, small, linear, entire or nearly so, often somewhat fascicled: heads numerous, terminating the branchlets; involucres broad, subhemispherical, the lanceolate bracts in 5 or 6 series and rather loosely imbricated, the green, acuminate tips at length reflexed, distinctly glandular-viscid (the peduncular branchlets only slightly so): rays 20 (more or less), purple: akenes compressed, greenish, thinly and finely pubescent.

Some years since a large number of specimens of this species were distributed (partly through the Minnesota Exchange Bureau) as *Aster canescens viridis* Gray, under nos. 1150 and 2788. More recently it has been distributed as *Machaeranthera canescens* (Pursh) Gray, which it is a long ways from being. It is, possibly, nearer to *M. viscosa* (Nutt.) Greene, but from that also it is at once separated by its habit. From the former by the pubescence; the number and the position of the involucral bracts, and the color of the rays. From the latter by the shape of the involucre and akenes. The species may be somewhat local. It is abundant in certain localities on the Laramie Plains but I have never collected it outside of this range. I cite as type number 8152, Laramie, Aug. 27, 1900.

✓ Rudbeckia ampla

Perennial, from horizontal rootstocks with large fleshy crowns from which spring numerous semi-fleshy roots: stems clustered, *i. e.*, several from the same tuft, 1–2 m. high, glabrous, strongly striate, moderately branched above: leaves numerous and ample, light green and glabrous below, a shade or two darker above with minute scattering hispid hairs from pustulate bases (the hairs sometimes deciduous), with conspicuous, light-colored veins: basal leaves large, 2–3 dm. broad, trifoliate, on petioles 2–4 dm. long: the leaflets petiolulate, broadly oval or ovate in outline, three-cleft, the segments coarsely and irregularly serrate, the middle segment often again lobed or cleft: lower stem-leaves similar but smaller, the petioles becoming slenderer and shorter upward, the leaves merely 3-parted: upper stem-leaves sessile, 3-parted or merely cleft, 1–2 dm. long; the segments becoming entire as to margin, the lateral oblong-lanceolate, the middle variously toothed and cleft: rameal leaves reduced, becoming entire and bract-like, from broadly oval-acute to lanceolate: heads terminating the branches, large: involucral bracts oblong to ovate, obtuse or subacute, 8–12 mm. long: rays 6–12, conspicuous, 3–5 cm. long, 8–15 mm. wide: disk in full anthesis and in fruit cylindrical-ovate, 2–4 cm. high.

That this is in part the *R. laciniata* of Gray's Syn. Fl. 262 is possible but it is far from the typical eastern *R. laciniata* L. The pinnately arranged narrow segments with wide sinuses of the smaller leaves of that, need but to be compared with the trifoliate-palmate broad segments and narrow sinuses of this to see that they are distinct. The larger rougher disk, the fewer and stouter peduncles and the different involucral bracts are equally characteristic of *R. ampla.*

Whether all the Rocky Mountain forms belong here I am unable to say, but I would include Baker's no. 699, Pagosa Springs, Colo.; 224, Jennie M. Archibald, Berwind, Colo.; and all my numbers as follows: Eagle Rock Cañon, Aug., 1891; no. 1575, Cotton Wood Cañon, Aug. 5, 1895; no. 7709, Centennial, July 26, 1900.

Contributions to a better Knowledge of the Pyrenomycetes.—II.

A NEW SPECIES OF ERGOT

By David Griffiths

After being led to believe that the fungus flora of the arid regions of southern Arizona was next to nil, the writer, while on a short trip in the San Pedro and Sulphur Spring Valleys, was more than pleased by finding several very interesting parasitic things as common and, in places as abundant, as in the moister and cooler regions of the North and the East. The principal object of the trip was the acquisition of seeds of native forage plants for experimentation. The greater number of the fungi secured were therefore, naturally associated with forage plants. No less than a dozen smuts and a much larger number of rusts were found in a short two-week trip. As far as the material has been studied, the most interesting parasitic fungus secured is a species of *Claviceps*, the description of which is the occasion for the present paper. A few general remarks on some of the characteristics of the parasitic fungus flora of the portions of the two valleys visited, together with that of the Santa Cruz in the vicinity of Tucson will be of some interest, and, possibly, pave the way for future publications.

It should be stated that the Sulphur Spring Valley is a basin rather than a valley and is of about 2000 feet greater altitude than the Santa Cruz, while the San Pedro is approximately an average between them. On account of the excessive drouths of the summer of 1900, the Santa Cruz was, during the month of October, almost devoid of the more valuable nutritious grasses. The Sulphur Spring, on the contrary, had a luxuriant growth of *Bouteloua*, *Aristida*, *Hilaria*, *Pappophorum*, *Chloris*, *Triodea*, and *Andropogon*. The San Pedro was about an average between the two. It is needless to state that the condition of the vegetation was a good index to the amount and the character of the precipitation which had occurred since the middle of July. The grasses which grew in such abundance in the higher valley occurred commonly in each of the others but in diminishing quantities westward. The smuts with which the grasses were as badly affected in the higher altitudes were next to absent in the lower drier areas about Tucson in the Santa Cruz. Only one species of the smuts mentioned, and this in very small quantity on a single host, was found in the latter locality. This species was found in two stations near Tucson, one a poorly cultivated, irrigated field and the other a broad shallow wash on the mesa, which received the drainage of a considerable area. The hosts were common, however, in places within a radius of ten miles of Tucson. I think I have never met with a more striking example of the effect of drouth on the development of the smuts of native grasses.

It must also be borne in mind that the period of development of the parasitic fungi of this region is much shorter than it is in the regions favored with a more equable distribution of rainfall. Some of the hosts grow up and mature their seed in the short period of two months after the advent of the summer rains. The life of the fungus must likewise be subjected to the same shortening process. Indeed the parasitic fungi like their hosts necessarily spring into activity when the summer rains come and follow the advent of this agency as much as they do the seasonal variations of temperature.

These remarks are equally applicable to the species of ergot in question. There was plenty of the host (*Hilaria mutica*) of this interesting species found in the vicinity of Vale in the Santa Cruz valley, but careful search was required in order to ascertain the presence of sclerotia upon it, while they were exceedingly abundant wherever the host was found in the Sulphur Spring Valley. The space traveled over in the *Hilaria* region of the upper valley is estimated to have extended in the aggregate a distance of at least 15 miles, where there were patches of the grass every few rods. Scarcely any of it was free from the ergot. There was one locality on the railroad right-of-way near Cochise where the fungus was exceedingly abundant. The occurrence of an acre of grass making an excellent stand of hay with scarcely a head free from ergot would represent rather the extreme for the *Agropyron* and *Elymus condensatus* regions of the Northwest. Yet this represents exactly the condition on the so-called deserts of Arizona. The vicinity of an abandoned roadbed, while covered with a rather shorter growth of grass than the remainder of the patch, was as badly infested as any the writer has ever seen. Here there was scarcely a perfect seed produced, each being replaced by the scle-

FIG. 1.

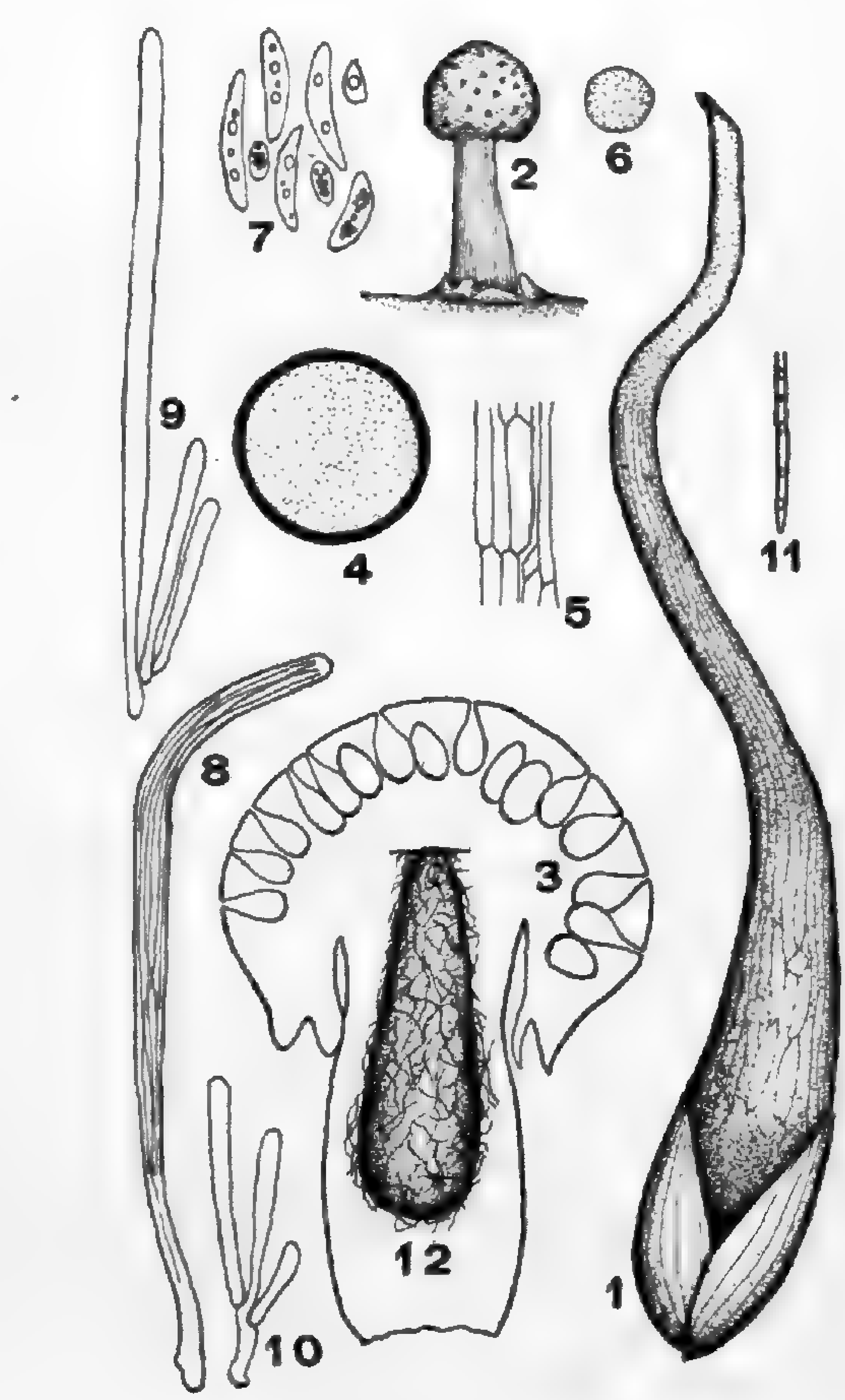

FIG. 2.

FIG. 1. Spike showing sclerotia.

FIG. 2. 1. Sclerotium, × 3. 2. Stroma, × 8. 3. Section of stroma, × 25, from microtome section. 4. Section of base of sclerotium, × 5. 5. Surface of sclerotium showing reticulations, × 8. 6. Section of sclerotium near the apex, × 10. 7. Conidia, × 285. 8. Ascus, × 285. 9 and 10. Groups of young asci, × 285. 11. Portion of a spore, × 600. 12. Perithecium, × 45.

rotium of an ergot. Several heads were found with as many as twenty sclerotia produced in each.

The development of the ascosporic stage from the sclerotium is of considerable interest and importance inasmuch as the sclerotia grow readily, whereas, every botanist who has attempted to cultivate the sclerotia of the various forms of *Claviceps purpurea*, knows how difficult and uncertain is their development. It is a matter of common observation in the arid regions of the Southwest that in a very few days after a rain, whether this comes in July or September, the mesa reveals an abundance of seedlings which spring up and grow vigorously as long as favorable conditions obtain. It is well known that the seeds of some plants, at least, will germinate immediately upon maturity in marked contrast with the period of rest required by the seeds of the majority of the natives of the cooler and moister regions. Something analagous appears to be true regarding the development of the stroma from the sclerotium of this ergot. The proper conditions of heat and moisture cause them to develop immediately upon maturity, while, as is well known, the same structures in *Claviceps purpurea* apparently require a longer or shorter period of rest.

The sclerotia of this ergot were collected on the 16th of October in a sticky viscid condition. They were removed from the glumes of the grass and planted in clean building sand in the university greenhouse on the 26th of the same month. On the 25th of November, stromata containing mature ascospores were found in abundance. Previous experience in the germination of sclerotia led me to examine the cultures but casually, because they were not expected to develop inside of about two months. Not knowing, therefore, just when the stromata first appeared in this culture another lot of sclerotia was planted on the following day. These were carefully watched and sprinkled with water once each day for twenty days when mature stromata were again secured from the most superficial sclerotia. Both of the cultures continued to produce stromata until the first of January when they were abandoned. The development of mature stromata within twenty days of planting, especially when planting follows so closely upon the maturity of the sclerotia, I believe to be out of the ordinary experience.

It will be of interest to compare the above periods of development with the following data taken from my notes upon uncom-

Host plant.	Date of Collection.	Locality.	Date of Planting.	Date of Maturity of Stroma.	Period of Development.
Setanion elymoides.	Aug. 30, '98	Billings, Mont.	Oct. 29, '98	Feb. 20, '99	114 days
Elymus condensatus.	Aug. 22, '98	Buffalo, Wyo.	Oct. 29, '98	March 15, '99	137 days

pleted and unpublished experiments conducted in the greenhouse of Columbia University during the winter of 1898–99.

The above were planted under practically the same conditions as the Arizona specimens. The sclerotia from fifteen species of northwestern grasses were planted at this time, but only these three grew. On the 19th of January, duplicates of these fifteen specimens were planted, thoroughly moistened, and placed out of doors during freezing weather for two days. The first to show development were those of *Agropyron spicatum* which produced mature stromata in forty-four days. Without check cultures it can not be positively stated whether the shortening of the period was due to the freezing or to the natural consequence of the period of rest. The main point of interest results from a comparison of these periods of development with those of the Arizona species.

This species, which is very distinct in the sclerotial stage from all published species, may be characterized as follows:

Claviceps cinereum sp. nov.

Sclerotia clavate, gradually tapering upward, straight, curved, twisted or contorted, 1.5 to 3 cm. in length by 1.75 to 2.5 mm. in diameter at the base, very viscid while developing, the base permanently invested by the flowering glumes of the host, which are smooth, shining, black and closely adherent; smooth as far as covered by the glumes, but reticulated for some distance above this; the reticulations gradually disappearing upward and merging into closely placed longitudinal striations which in turn disappear near the apex, where the surface is nearly smooth or irregularly roughened; dark gray at base, but gradually fading out to a very light gray or almost white at the apex. In section the base possesses an external zone of a dark gray color on the outside, within which is a much wider distinctly marked zone of a very light gray, while the center, less definitely bounded, is almost pure white; at the apex these divisions are absent. Stroma erect, erumpent with a cylindrical or usually slightly fusiform, short, stout almost white stalk, and a subglobose head usually slightly flattened below and overlapping the upper end of the stalk, 1.75–2.75 mm. in diameter; head light gray, almost smooth, viscid, punctiform with small darker points indicating positions of perithecia. Perithecia sunken, not projecting above stromatic mass, ovate to very slightly pyriform, 190–225 $\mu \times$ 60–90 μ. Asci 8-spored, fasciculated, narrowly cylindrical, slightly narrowed below into rather long stout pedicels, and slightly enlarged at attachment, rounded above, $135-150\,\mu \times 4-5\,\mu$. Paraphyses wanting. Spores nearly parallel, filiform, coarsely but rather indistinctly guttulate, $100-120\,\mu \times 1-1.5\,\mu$.

Growing in inflorescence of *Hilaria mutica* and *H. cenchroides*, Cochise, Arizona, October, 1900.

UNIVERSITY OF ARIZONA, March, 1901.

Notes on Fournier's Mexican Species and Varieties of Bromus*

By C. L. Shear

In the spring of 1900, Mr. A. H. Baldwin, an artist of the Department of Agriculture, then employed in the Division of Agrostology, visited Paris and while there examined some of the specimens of *Bromus* cited by Fournier and preserved in the Herbarium of the Museum of Paris. Through the courtesy of the Director he was permitted to make sketches of these plants and to take spikelets from each; he also made notes in connection with his sketches, and by aid of these it has been possible to identify some of the forms treated by Fournier. While there is still much to be desired in order to make a thoroughly satisfactory disposition of the Mexican species, it is thought best to present the information thus acquired in the hope that it may be of some use to students of Mexican grasses.

With the exception of *Ceratochloa festucoides* the species and varieties are taken up in the order in which they are given by Fournier in his work.

Bromus exaltatus Bernh. Linnaea, **15**: Lit. 90

B. subalpinus Rupr. Bull. Acad. Roy. Brux. **9**: 237. 1842, is cited as a synonym of this. Consultation of this citation shows this name to be a *nomen nudum*. A comparison of three of the specimens cited by Fournier (Gal. 5769 & Liebm. 488 and 501) with the original description of Bernhardi leaves considerable doubt as to whether they are correctly referred. Only an examination of the type which we have been unable to locate will decide the question. Dr. Trelease informs me that it is not in the Bernhardi Herbarium. No. 925, C. L. Smith, Sierra de San Felipe, Sept., 1894, seems to belong here.

Bromus anomalus Rupr. Fourn. Mex. Pl. 126. 1886

This is attributed to Ruprecht in Bull. Acad. Roy. Brux. **9**[2]:

* Fournier, Mexicanas Plantas, etc., Pars secunda. Graminae, 125–128. 1886.

236. 1842. It is, however, without description in the place cited by Fournier and must be regarded as first published by him as cited. The question arises, however, as to what should be considered the type of this species. Ruprecht l. c. cites a single specimen, no. 5757 H. Galeotti collected "dans les forêts du Cerro San Felipe près d'Oaxaca à 8000 pied d'élèvation." The same number is also cited by Fournier and his specimen should, we think, be considered the type of the species rather than the first specimen cited by him which it seems to us best to take as a rule. The sketch and spikelet from Galeotti's no. 5757 in the Museum oi Paris shows this plant to be inseparable from *Bromus Porteri* (Coult.) Nash. Fournier speaks in his description of a conspicuous tongue-shaped ligule, but Mr. Baldwin's sketch of the specimen does not show a ligule any larger than is usually present in *Bromus Porteri*, and we feel safe in referring *Bromus anomalus* to *B. Porteri* (Coult.) Nash as a synonym.

All the following forms belong to the subgenus *Ceratochloa*.

CERATOCHLOA FESTUCOIDES Beauv. Fourn. *l. c.*

This name used by Beauvois in the index to his Agrost. 158, is taken up for the *Ceratochloa unioloides* Beauv. Agrost. Ind. 164 and Explan. Pl. 11. 1812. We can find nothing in Beauvois to justify the assumption that these were regarded by him as synonyms. The inference we make from a comparison of similar cases in Beauvois is that he was either proposing a new species or transferring Link's *Bromus festucoides* to *Ceratochloa*. From the fact that he uses the combination *Ceratochloa unioloides* in his explanation of plates it appears to be clear that he did not intend to supplant the name *Festuca unioloides* by *Ceratochloa festucoides*. Supposing, however, that it were a clear case of synonymy, we can see no reason for adopting the name *festucoides* instead of *unioloides*. In any case its use in the genus *Bromus* is invalidated by the existence of an earlier *Bromus festucoides* Link, Schrad. Journ. **2**: 315. 1799.

An examination of a drawing of the type of *Bromus unioloides* H.B.K. and a spikelet from the same shows that the doubt indicated by the writer in Bull. **23**: 50. Div. Agrost. U. S. Dept. Agr. regarding the synonymy of the species was well founded and that the *Festuca unioloides* Wild. is specifically distinct from *Bromus unioloides* H.B.K.

Kunth.* regarded the two as distinct and proposed the name, *Bromus Willdenowii* for Wildenow's plant. *Ceratochloa Schraderi* Kunth has priority but is also a doubtful synonym, so that we regard the adoption of *Bromus Willdenowii* Kunth. as the safest.

Bromus Willdenowii is evidently not common in Mexico, as there are no specimens in the National Herbarium and Fournier, l. c. says that he has seen no Mexican specimens. He, however, cites two numbers—Aschenb. 146, 674—on the authority of some one else apparently. We have seen none of the specimens cited by Fournier, but his description appears to have been based upon a form of *Bromus Willdenowii*, probably the one which we called *B. unioloides haenkeanus* (Presl.) Shear † but which should stand according to our present understanding of the matter **B. Willdenowii haenkeanus** (Presl) n. comb. Fournier restricts *Ceratochloa* to this one species, but according to our interpretation of it as a subgenus all the following forms should also be referred to it.

BROMUS HOOKERI Fourn. Mex. Pl. 127. 1886

This name was proposed by Fournier for the plant referred by Hooker and Arnott in the Botany of Capt. Beechey's Voyage 119. 1841 to *B. purgans* Rich. What Hooker's plant really was we are unable to say. It was collected in Kamtschatka. The name *B. Hookeri* we do not regard as tenable, however, in any case, as there was already a *Bromus Hookerianus* Thurber, Wilkes U. S. Expl. Exp. **17**[2]: 493. 1874.

BROMUS HOOKERI var. *a* SCHAFFNERI Fourn. *l. c.*

This plant as shown by the drawings and spikelet from Fournier's type no. 42 Schaffner in Herb. Franq., can not be separated from *B. carinatus Hookerianus* (Thurb.) Shear, so far as we can determine from a careful comparison of the spikelets from the two types. Fournier's plant has a panicle rather more lax than typical *Bromus carinatus Hookerianus*, otherwise the plants appear alike and can not be satisfactorily separated.

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* Kunth. Rev. Gram. **1**: 134. 1835.

† Bull. Div. Agrost. U S. Dept. Agr. **23**: 52. 1900.

BROMUS HOOKERI var. β MARGINATUS Fourn. *l. c.*

This is given as a synonym of *B. marginatus* Nees in Steudel Syn. Pl. Gram. 322. 1854, but differs from that plant as we understand it in its rather lax, somewhat drooping panicle, longer, more acute, and smooth empty glumes, and scabrous flowering glume. We propose for this plant the name *Bromus proximus* nom. nov. The specimen from which the spikelet examined was taken and the sketch made was no. 1488 Botteri & Sumchrast. The first specimen cited by Fournier, which we should prefer to regard as the type of the species, is no. 961 F. Mueller, collected at Orizaba. Nos. 5, 7, 226, Dr. E. Palmer, Saltillo, 898 and no. 171a of the same collector from the city of Durango and vicinity, June, 1896, we should refer to this species.

BROMUS HOOKERI var. γ SCHLECHTENDALII Fourn. *l. c.*

We have drawings and spikelets from two of the specimens cited by Fournier—no. 402 Berlandier "inter Tampico et Real del Monte" and no. 1420 bis Virler, San Luis de Potosi. The spikelet from Berlandier's specimen does not agree with the description which says the flowering glume is very shortly and sparsely pilose. The plant is closely related to *Bromus proximus*, and may perhaps be best referred to it as a variety until more information can be secured regarding it. According to the description, sketches, and spikelets it differs from *Bromus proximus* in the slightly longer and more acute empty glume, and somewhat pubescent flowering glume with a slightly longer awn and a small contracted panicle. This plant we would designate **Bromus proximus Schlechtendalii** n. comb. We would refer no. 734 Dr. Edward Palmer's collection, September, 1896, from the city of Durango and vicinity, to this variety.

BROMUS HOOKERI var. δ GENUINUS Fourn. *l. c.*

This the author regards as synonymous with *Bromus purgans* L. Sp. Pl. ed. 2. **1**: 113. 1762. The misinterpretation of Linnaeus's species is evidently due to his reference l. c. to Feuillet's plate. Fournier's variety was founded upon a part of Bourgeau's no. 220, collected "in sylva de la desierta Vieja." According to the sketches and spikelets from the specimen in the Museum of

Paris this differs from *B. proximus Schlechtendalii* in having a large drooping panicle. There is some doubt in our mind as to whether the spikelet we have is from the particular plant of Bourgeau's that was taken by Fournier as his type. The form is of doubtful varietal value but may stand until better known as *Bromus proximus genuinus* n. comb. No. 171 E. Palmer, Durango, June, 1896, belongs here. *B. Schaffneri* (Fourn.) Scribn. & Merrill U. S. Dept. Agr. Div. Agrost. **24**: 30. 1901 was founded in part upon the specimen first cited.

BROMUS HOOKERI var. ε PUBESCENS Fourn. *l. c.*

This he regards a *B. pubescens* Muhl. which he wrongly interpreted, that plant belonging to the subgenus *Zerna*. According to the sketches and spikelets from 1417 and 1420 collected by Virler at San Luis de Potosi this cannot be distinguished from *Bromus proximus genuinus* and we regard it as a synonym of that variety.

BROMUS HOOKERI var. ζ CANADENSIS Fourn. *l. c.*

This plant he regarded as *B. Canadensis* Mx. We unfortunately have no sketch or spikelets from any of the specimens referred to this variety. From the description we infer, however, that it is at least varietally distinct from the other forms described, but before giving it a name, we prefer to wait until we have had an opportunity to examine authentic specimens of the plant.

The other forms treated by Fournier are *Bromus Hookeri* var. *η ciliatus*, incorrectly regarded as *Bromus ciliatus; Bromus Hookeri* var. *θ pendulinus*, regarded as synonymous with *Bromus pendulinus* Sesse, and the two subvarieties *α brevicaulis* and *β longicaulis* without descriptions.

There are several species of the older authors described from Mexican material whose identity is still doubtful and must remain so until the types, if extant, can be studied and redescribed, and no permanent or satisfactory disposition of the Mexican material can be made until these older specimens are understood.

WASHINGTON, D. C.

Teratology of Arisaema

By Rosina J. Rennert

Variations of form in the inflorescence of *Arisaema triphyllum* have frequently been noted. Double spathes, which included a single spadix, were described by W. W. Bailey in 1884.* A curious case was reported by August F. Foerste who published an account † of a specimen of *A. triphyllum* which bore two leaves upon the same petiole. Arising from the axil of the double leaf was a double flowering stalk. The stems of the spathes were united below, but the spathes were separate and placed back to back. Each had a perfectly normal spadix bearing ovaries.

Double spadices also were described by Bailey. ‡ The two spadices were completely separate, in his specimen, only in the upper sterile portion. At the flower-bearing part, the two columns were completely fused. One of the spadices was deformed and much shorter than the other, being flattened below and dilated at the tip.

In *Arum maculatum*, a European aroid, similar monstrosities have been noted by Masters and Braun. The former described a case in which the spathe had taken the form of a stalked leaf.§ In another instance the number of spathes was increased.|| In another the spadix was flattened,¶ and in a fourth case, a genuine perianth was developed about the flowers on the spadix.** Braun reported the occurrence of a branching spadix, and the multiplication of spathes in several instances.††

Dr. MacDougal has collected and grown several specimens which illustrate variations in the inflorescence of *Arisaema tri-*

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* Botanical Gazette, 9 : 177. 1884.

† Botanical Gazette, 19 : 464. 1894.

‡ Bulletin Torrey Club, 9 : 91. 1882.

§ Vegetable Teratology, 245. 1869.

|| Ibid., 358.

¶ Ibid., 329.

** Ibid., 225.

†† Verhandlung Bot. Vereins Brandenberg, 1 : 93, 95. 1859.

phyllum, and *A. Dracontium*. No description of these deformations has yet been published. One of these examples is a flowering stalk of *Arisaema triphyllum*, in which the spathe is abortive, being represented only by an irregular rudimentary scale on the axis some distance below the pistils (Fig. 1, *E*). The spadix of this specimen has too confluent stigmas not represented in the drawing.

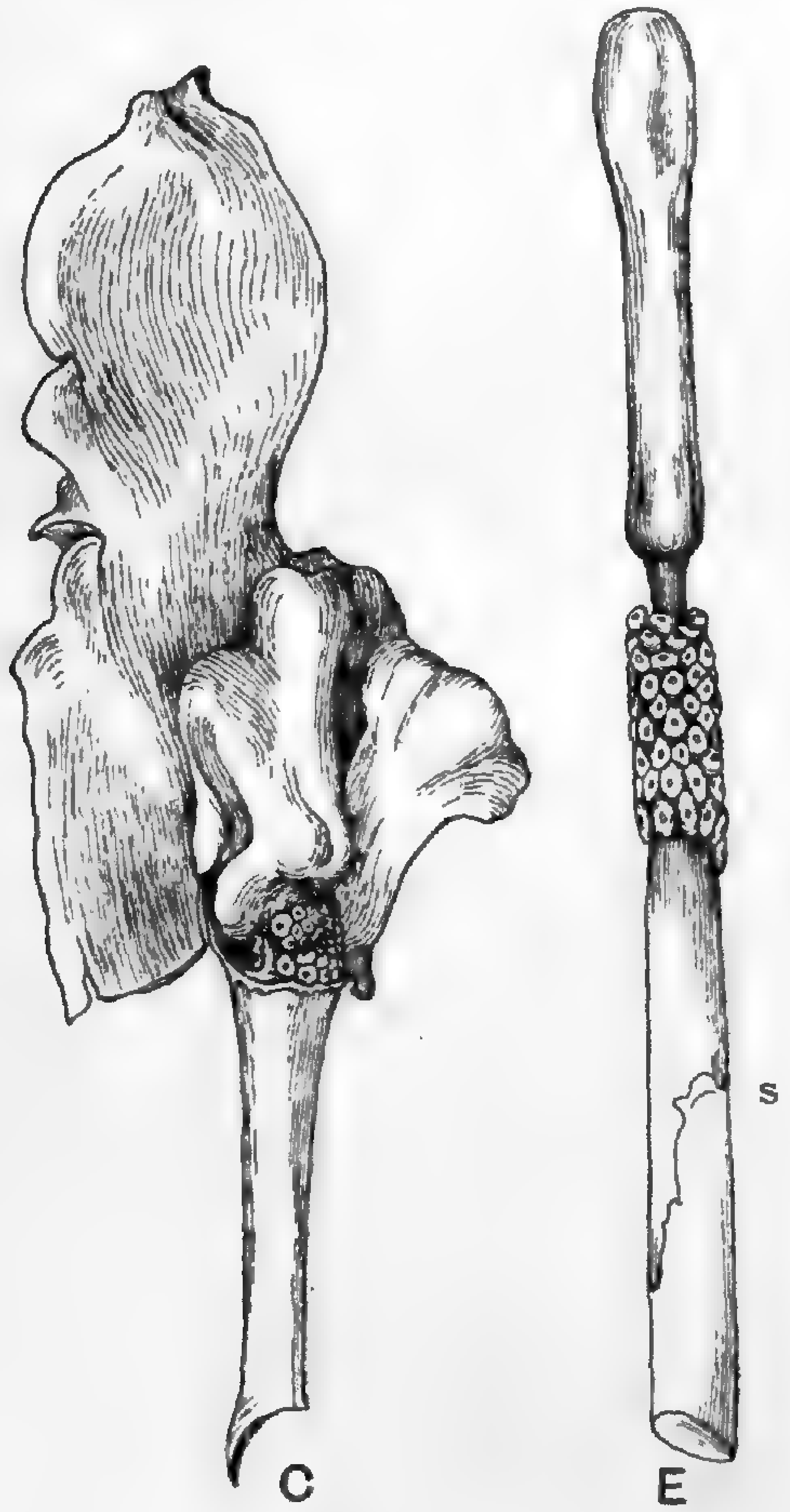

FIG 1.

FIG. 2.

FIG. 1. Teratological formations of *Arisaema triphyllum*. *C*, inflorescence with 3-lobed column; *E*, inflorescence with spathe represented by rudimentary scale, *s*.

FIG. 2. Teratological formations of *Arisaema*. *M*, inflorescence of *A. triphyllum* with branching spadix, and shortened spathe; *N*, tip of spadix of *A. Dracontium* with hooked apex.

In this case the stigmas on two adjacent ovaries are removed from their normal central position, to one at the side where the broad tops of their ovaries are in contact and their stigmatic surfaces are confluent. As neither is at all diminished in size, the united stigmas present a broad elliptical surface. The ovaries which bear these united stigmas are entirely distinct, however. The sterile portion of the spadix, although rather long and thick, is normal.

Another specimen bears a branched spadix resembling the double spadices described by Bailey. In this case however, it appears that the two sterile columns borne at the top of the fertile portion of the spadix are not the tips of two separate spadices which are confluent below, but rather two sterile branches of a single spadix; for the fertile portion shows no trace either external or internal, of a division into two columns which we might expect were two spadices united here. The branching takes place just below the tip of the pistil-bearing part of the spadix and both branches are entirely sterile. The actual tip of the fertile portion between the branches is covered with ovaries. The spadix might be described as very much shortened and fertile throughout its entire length, bearing two sterile branches very near its tip. The two branches are not of equal size. The shorter one is a trifle thinner and slightly deformed. Another instance of fused stigmas occurs here. The stigmas are displaced and united as before and the stigmatic surface so formed is twice the size of that of a single normal stigma. No fusion has occurred between the ovaries. The spathe in this case is shortened and does not extend to the tip of the longer branch of the spadix (Fig. 2, *M*).

In a third specimen, the stalk of the inflorescence is greatly flattened at the point of insertion of the spathe and spadix. The spadix is also flattened and very fleshy, bearing ovaries at the base closely crowded together. Its fertile portion is however, less than half the depth of the flower-producing part of a normal spadix. Above the fertile region, the spadix is greatly expanded. It has a broad insertion across the top of the flat fertile portion and becomes wider rapidly, being somewhat unsymmetrically obovate in general outline. It is very unevenly cleft into three lobes, the upper edge of the formation is somewhat dilated, resembling the normal dilatation at the tip of the spadix of *A. triphyllum*. The lower portion of one of the lobes is fertile, bearing a single ovary a short distance above its base (Fig. 1, *C*). It is worthy of note that the majority of individuals of *A. triphyllum* which show variations are pistillate.

A specimen with a similar malformation developed in the experimental greenhouse of the N. Y. Botanical Garden. In this case, however, the flower-bearing axis is normal, except that the terminal sterile portion is expanded into a laminar structure of irregular outline, and showing a few plaited foldings.

No records have been found of monstrosities in *Arisaema Dracontium.* One specimen of *A. Dracontium* in Dr. MacDougal's collection shows a curious malformation of the tip of the spadix. The spathe and spadix of this plant seem to be normal in every respect except that the tip of the spadix has grown out into a crescent-shaped process, on one horn of which a minute elevation may be seen (Fig. 2, *N*).

Other malformations in both species of *Arisaema* are produced by the action of the *Aecidium* with which they are often infected. The infected individuals develop earlier than the normal ones and show leaves with diminished surfaces, crinkled laminae, and inrolled margins. The spadices are variously distorted, and the spathes have the terminal portion, constituting the hood, in an erect position instead of drooping over the spadix. It is not known whether the specimens developing earliest are most subject to infection, or whether the presence of the fungus in the plant induces earlier activity, although the latter seems more probable.

The leaves of seedlings and offsets exhibit reversions to unusual forms in a very interesting manner, and will be discussed in a future article.

Proceedings of the Club

Tuesday Evening, February 12, 1901

This meeting was held at the College of Pharmacy, with Dr. Rusby in the chair; 14 persons present.

The committee to consider the proposed transfer of the Club herbarium to the Botanical Garden reported in favor of donating the Club herbarium in accordance with the following recommendations; which were thereupon adopted by vote of the Club:

The Torrey Botanical Club offers to donate its herbarium to the New York Botanical Garden, under the following regulations:

(*a*) That the Torrey Botanical Club herbarium should constitute the nucleus of the separate local collections of the Garden, to be known as the Torrey Botanical Club Local Herbarium, or by some similar name agreed upon.

(*b*) That the Garden take proper care of the same, supplement it from its own collections, and from future gifts from members of the Club and other persons, so that it may contain representations of all of the species growing within the 100-mile limit.

(*c*) That the members of the Garden staff keep the specimens properly named and labelled so that the collection may be of the best possible service.

(*d*) That all members of the Club shall have full and free access to this collection.

The scientific progam followed, introduced by a paper by Dr. J. K. Small, "Notes on some Species of *Rudbeckia*."

Dr. Small exhibited a series of specimens of *Rudbeckia* illustrating groups typified by *R. hirta*, *R. triloba*, *R. laciniata*, etc. Numerous critical characters depending on style-tips, form, serration or lobation of leaves, etc., were discussed. About 25 species occur east of the Rockies, 3 native to our own vicinity.

All evidence shows *Rudbeckia hirta* to be an introduced plant in the northeastern states, perhaps from Maryland northward. Dr. Underwood remarked that *R. hirta* seemed to be first introduced into Central New York about 1864. Dr. Rusby referred to its rarity within his memory in the vicinity of New York City and to the recently discovered medical value of the related genus *Branneria.*

Dr. Britton called attention to the supposed variants of *R. hirta* with parti-colored rays, as suggested by plants from near Philadelphia and from Staten Island.

Dr. Britton presented the subject of the relationship of our woodland species of *Circaea*, *C. Lutetiana* being the representative near New York City, and extending widely around the world. The characteristic bristles of the fruit fail to appear in a remarkable specimen from Ohio which was exhibited. *C. intermedia* of Central Europe was also discussed in its relations to the foregoing.

Dr. Britton exhibited a series of specimens of *Antennaria neodioica* Greene, a species which seems to be easily distinguished from the others of eastern North America by its spatulate basal leaves, distinctly mucronate, tapering rather abruptly from well above the middle into a long narrow base, which, however, can scarcely be called a petiole. He showed specimens of the plant collected in company with Professor Greene at Bushkill, Pa., on the Club's Field Meeting, May 30, 1897, at which time Professor Greene first insisted on its specific difference from *A. plantaginifolia* with which it grew. The series included authentic specimens of *Antennaria rupicola* Fernald, which differs from the typical specimens of *A. neodioica* only in the yellowish involucre, and slightly less abruptly tapering leaves, collected by Mr. Fernald at Island Falls, Aroostook Co., Maine, also specimens of *A. neodioica attenuata* Fernald, and of *A. neodioica grandis* Fernald, discussing their relationships with previously described species.

Dr. Rusby referred to the similar variability of Andean species of *Gnaphalium* as seen by himself and other botanists in Bolivia.

Dr. Howe discussed the relationship of *Riccia Beyrichiana*, the hepatic which he had considered to be probably identical with one discovered by Mr. R. M. Harper near Athens, Georgia, last summer. The loan of the type-specimen from Vienna now shows that the two are wholly distinct, Mr. Harper's plant representing a new species, described in the Bulletin for March. *Riccia Beyrichiana* seems therefore to be still known only from the original collection of 1833.

Adjournment followed.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Arnoldi, W. Beiträge zur Morphologie einiger Gymnospermen. I. Die Entwickelung des Endosperms bei *Sequoia sempervirens*. Bull. Soc. Imp. des Naturalistes de Moscou, II. **14**: 329–341. *pl. 7, 8.* 1900.

Arnoldi, W. Beiträge zur Morphologie und Entwickelungsgschichte einiger Gymnospermen. II. Ueber die Corpuscula und Pollenschläuche bei *Sequoia sempervirens*. Bull. Soc. Imp. des Naturalistes de Moscou, II. **14**: 405–422. *f. 1a, 1b, 1c, 2. pl. 10, 11.* 1900.

Atkinson, G. F. Lessons in Botany. Pp. i–xiv, 1–365. *f. 1–277.* New York. 1900.

Bailey, L. H. Botany. An elementary Text for Schools. Pp. 1–356. *f. 1–500.* New York, 1900.

Bergen, J. Y. Foundations of Botany. Pp. i–vi, 1–257. *f. 1–301.* Boston, 1901.

Boyer, C. S. The biddulphioid Forms of North American Diatomaceae. Proc. Acad. Nat. Sci. Phila. 1900: 685–748. F. 1901.

Clements, F. E. & Cutler, J. S. A Laboratory Manual of High School Botany. Pp. 1–123. *f. 1–10.* Lincoln, Neb., 1900.

Coulter, J. M. Analytical Key to Plants. New York, 1900.

Coulter, J. M. Plant Studies. An elementary Botany. Pp. i–vii, 1–392. *f. 1–336.* New York, 1900.

Coulter, J. M. Plants. A Text Book of Botany. Pp. i–vii, 1–264; i–vii, 1–348. *f. 1–206, 1–289.* New York, 1900.

Consists of "Plant Relations" and "Plant Structures," by the same author, bound together.

Dallas, E. M., & Burgin, C. A. Among the Mushrooms. A Guide for Beginners. Pp. 1–175. *pl. 1–10.* Philadelphia, 1900.

Dusén, P. Några viktigare växtfynd från nordöstra Grönland. Bot. Notiser. 1901: 73–76. 1901.

Earle, F. S. Fungi. Pl. Baker. **2**: 1–30. 25 N. 1901.

New species from Colorado in *Phragmidium*, *Dasyscypha* (2), *Lachnella*, *Niptera*, *Karschia*, *Heterosphaeria*, *Tryblidiopsis*, *Tryblidium*, *Hysterographium*, *Lophium*, *Allantonectria* (gen. nov.), *Otthia* (2), *Strickeria* (5), *Trematosphaeria* (3), *Lophiotrema*, *Platystomum* (2), *Schizostoma*, *Myco-sphaerella* (2), *Leptosphaeria* (2), *Pleospora* (3), *Pyrenophora* (3), *Valsa*, *Coniothyrium* (2), *Cytospora*, *Phoma* (3), *Rhabdospora* (2), *Stagonospora*, and *Tubercularia*.

Fernald, M. L. A new Variety of *Juncus tenuis.* Rhodora, **3**: 59, 60. *pl. 23.* Mr. 1901.

Juncus tenuis Williamsii.

Fernald, M. L. The northern Carices of the Subsection Vesicariae. Rhodora, **3**: 43–56. Mr. 1901.

C. saxatilis rhomalea, C. rostrata ambigens, and *C. vesicaria jejuna,* new varieties. *C. bullata Olneyi, C. vesicaria monile, C. vesicaria Raeana,* and *C. retrorsa Macounii,* new combinations.

Freer, P. C. & Clover, A. M. On the Constituents of Jamaica Dogwood. Pharm. Archives, **4**: 21–28. F. 1901.

Graves, C. B. Noteworthy Plants of Southeastern Connecticut.—II. Rhodora, **3**: 63–65. Mr. 1901.

Greene, E. L. *et al.* Plantae Bakerianae, Vol. 2. Fascicle 1. Fungi to Gramineae. Washington, D. C., 25 Mar. 1901.

Enumeration of plants collected by Carl F. Baker in Colorado in 1899.

Harger, E. B. A Colony of Waifs of the Helianthoideae. Rhodora, **3**: 69. Mr. 1901.

Harshberger, J. W. An ecological Study of the New Jersey Strand Flora. Proc. Acad. Nat. Sci. Phila. 1900: 623–671. F. 1901.

Hervey, E. W. The yellow-fruited Form of *Ilex opaca* at New Bedford, Massachusetts. Rhodora, **3**: 58, 59. Mr. 1901.

Holm, T. Studies in the Cyperaceae. XV. Carices (Vigneae) astrostachyae. Am. Journ. Sci. IV. **11**: 205–223. *f. 1–5.* Mr. 1901.

H[ooker], J. D. *Agave Peacockii.* Curt. Bot. Mag. III. **57**: *pl. 7757.* 1 F. 1901.

Native of Central Mexico.

H[ooker], J. D. *Neillia Toneyi.* Curt. Bot. Mag. III. **57**: *pl. 7758.* 1 F. 1901.

Native of the Rocky Mountains.

Jones, L. R. Report of the Botanist. Rep. Vt. Exp. Sta. **13**: 268–332. 1 F. 1901.

Keeler, H. L. Our native Trees and how to Identify Them. Pp. i–xxiii, 1–533. *f. 1–350.* New York, 1900.

Lovell, J. H. The Colors of northern Apetalous Flowers. Am. Nat. **35**: 197–212. Mr. 1901.

MacElwee, A. The Flora of the Edgehill Ridge near Willow Grove and its Ecology. Proc. Acad. Nat. Sci. Phila. 1900: 482–484. 485–490. F. 1901.

Meehan, T. *Equisetum arvense.* Meehan's Monthly, **11**: 33, 34. *pl. 3.* Mr. 1901.

Owen, M. L. Ferns of Mt. Toby, Massachusetts. Rhodora, **3**: 41–43. Mr. 1901.

Peck, C. H. Report of the State Botanist, 1899. Rep. N. Y. State Mus. **53**: 823–867. *pl. A–D.* 1901.

Contains new species in *Amanita*, *Clitocybe*, *Pleurotus*, *Hygrophorus*, *Russula* (4) *Entoloma*, *Hebeloma*, *Psilocybe*, *Hydnum* (2), *Odontia*, and *Grandinia*, besides several new varieties.

Pepoon, H. S., Mitchell, W. R., & Maxwell, F. B. Studies of Plant Life. Pp. i–xii, 1–95. Boston, 1900.

Perkins, J. R. Berträge zur Kenntniss der Monimiaceae III. Monographie der Gattung Siparuna. Engler's Bot. Jahrb. **28**: 660–705. *pl. 12–14.* 11 Ja. 1901.

Many new species among 89 species described.

[Piper, C. V.] Notes on *Melica* and *Stipa*. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 10. 4 D. 1900.

Melica bella and *Stipa Thurberiana*, new names.

Saunders, C. F. The Pine Barrens of New Jersey. Proc. Acad. Nat. Sci. Phila. 1900: 544–549. F. 1901.

Schulz, O. E. Mongraphie der Gattung *Melilotus*. Engler's Bot. Jahrb. **29**: 660–735. *pl. 6–8.* 12 F. 1901.

Mentions a few species introduced in America.

[Scribner, F. L.] Nomenclature Notes. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 9. 4 D. 1900.

New names and combinations in *Panicum*, *Agropyron*, and *Elymus*.

Scribner, F. L. The Grasses in Elliott's "Sketch of the Botany of South Carolina and Georgia." Circ. U. S. Dept. Agric. (Div. Agrost.) **29**: 1–12. *f. 1–4.* [F. 1901.]

Panicum amaroides Scribn. & Merrill, new name, and *P. subbarbulatum* Scribn. & Merrill, new species.

[Scribner, F. L. & Merrill, E. D.] A new Variety ot *Panicum Nashianum*. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 9. 4 D. 1900.

P. Nashianum patulum, from Florida and Mississippi.

Scribner, F. L. & Merrill, E. D. The Grasses in the Herbarium of Dr. H. Muhlenberg. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 1–6. 4 D. 1900.

[Scribner, F. L. & Merrill, E. D.] Two new species of *Eatonia*. Circ. U. S. Dept. Agric. (Div. Agrost.) **27**: 6–8. 4 D. 1900.

E. pubescens and *E. aristata*; also *E. pallens* (Spreng.) Scribn. & Merrill, new combination.

Smith, E. F. Wakker's Hyacinth Germ, *Pseudomonas Hyacinthi*.

Bull. U. S. Dept. Agric. (Div. Veg. Phys. & Path.) **26**: 1–45. *f. 1–6. pl. 1.* 21 F. 1901.

Torrey, J., Jr. Raising Mushrooms in a Cellar. Rhodora, **3**: 57, 58. Mr. 1901.

Wiley, H. W. The Sunflower Plant: its Cultivation, Composition, and Uses. Bull. U. S. Dept. Agric. (Div. Chemistry) **60**: 1–31. *f. 1–2. pl. 1.* 1901.

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COLUMBIA UNIVERSITY, NEW YORK CITY.

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BULLETIN

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Memoirs (See last page of cover.)

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BULLETIN

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TORREY BOTANICAL CLUB

MAY 1901

Ceramothamnion codii, a new Rhodophyceous Alga

BY HERBERT M. RICHARDS

(WITH PLATES 21, 22)

While in Bermuda during February, 1898, the writer collected a quantity of *Codium tomentosum* which proved on examination to have growing upon it an epiphytic rhodophyceous alga that is decidedly peculiar in character. More material was obtained during the February of the following year and from these collections the following account of the morphology of this alga was written. *Codium tomentosum* is common enough in the waters about the islands, but only that obtained at two localities on the south shore proved to have growing upon it this *Callithamnion*-like alga. *Codium* is a favorite abiding place of many small algae and it is very common to find the fronds fringed with small species of *Callithamnion*, *Ceramium*, *Ectocarpus*, *Goniotrichum*, etc. The form, however, which is the subject of this paper is not so conspicuous, scarcely more than slightly reddening the parts on which it grows, the filaments being so short and so fine as to be scarcely visible to the naked eye. Only occasionally are small tufts found in the dichotomies of its host and even these would be hardly noticed were it not for their red color.

In habit it suggests a form like *Rhodochorton Rothii*, there being a prostrate filament which sends up at irregular intervals erect filaments, that are always unbranched except under certain

[Issued May 21]

conditions of fruiting. Since this plant lives upon the soft tissues of another alga there are also developed well-marked rhizoids which penetrate between the external cells of the *Codium* (Fig. 1).

The prostrate and upright filaments are alike in structure, differing only in the somewhat larger size of the former, which measure from 30–50 μ in diameter at the internodes, while the latter vary from about 20–35 μ. The structure of the fiiaments is peculiar, and at once attracts attention, from its similarity yet unlikeness to that of two other genera of algae. They are monosiphonous as to the elongated internodal cells (which average 50 μ long), while at the nodes there are rows of small cells. Such a condition suggests at once *Ceramium* but the general appearance of the cells is far more like those of *Callithamnion* (Fig. 2). The wall is somewhat thick and the sides parallel, never bulging as in *Ceramium*, while the chromatophore is very distinct and made up of thickened strands as is usual in *Callithamnion*. In consequence of this the internodes are distinctly red in color, never, as is often the case in *Ceramium*, quite diaphanous, and it may be added the tips of the young branches are straight, never circinate. The nodal cells, which in the oldest part of the frond are in from three to four rows, lie closely packed between the adjoining internodes. They do not ever, even in the oldest portions of the plant, proliferate downwards and upwards to form a cortication, but only overlap the somewhat tapering ends of the internodal cells, lying in the constrictions formed between the latter, so that they do not produce any marked nodal swellings. Their chromatophores are of the same appearance as those of the internodes, but the granulation of the contents is more marked and consequently it is of a deeper color. One might describe the general appearance of the filament as that of *Callithamnion* and its allies with the addition of nodal cells.

At the tips of the filaments are found small apical cells, from which the formation of nodes and internodes takes place in an entirely regular manner (Figs. 2, 3). There is first cut off from the apical cell by a transverse basal wall a single indifferent cell. This indifferent cell soon divides from its upper end, by four obliquely anti-clinal walls of small cells which when seen in optical section are naturally triangular; the hypothenuse being the newly-formed wall. These are the young nodal cells and their formation does not appear to be always simultaneous, nor when successive, in any particular order. The next step in the formation of the node is the rounding off of these cells and their transverse division. There are now two rows of cells, which subsequently may become by division two double rows of eight cells each, or sixteen cells in all at the nodes. Sometimes but one of the original two rows divides again transversely, in which case there will be but twelve cells in the node, disposed in one single and one double row. But in the older parts of the filaments the rows ultimately become displaced, owing to irregular divisions of some of the cells.

The internodal cells develop by enlargement in all directions, particularly in length, and the original tapering end caused by the obliquely formed walls of the nodal cells increases rather than diminishes. It is this constriction between the internodes which is, as has before been said, closely packed with the nodal cells, the outline of the filament being almost straight and continuous. The erect branches arise from the nodes of the procumbent filaments, one of the nodal cells on the upper surface taking on the function of the apical cell of the branch. Each node may produce its branch, but no cases were observed where more than one arose from a single node (Fig. 1). The rhizoids which grow into the tissue of the *Codium* also originate from nodal cells of the main filament, but from the under side of course, and make their way downwards into the tissue of the host. They are colorless, or almost so, and often sparingly dichotomous, exhibiting no especial peculiarities. Branching of the upright filaments is seen only in connection with the formation of certain forms of the fruit which will be considered later.

Some of the material collected was found to be provided with hairs which arise from the nodal cells. While usually short (Fig. 4) they are sometimes prolonged as in Fig. 5. The short hairs cannot be considered simply younger ones for they are often found on fully matured portions of the filament. Their contents indicate that they are simply sterile hairs, as it is very scanty and gathers at the end in the way common among such organs. They were also found on material in all conditions of fructification.

The fact that they must be regarded as merely sterile is of importance in another consideration to be taken up later. While the bulk of the material examined was quite destitute of them it is barely possible, although not at all probable, that this condition was brought about by the shedding of the hairs, since indications were seen of their abstriction in certain cases.

While the structure of the frond of this alga is not without interest the fruit, at least the tetraspore, is more especially noteworthy. Indeed as regards certain features in the growth of the tetraspores the writer has found no mention of a similar condition among other Florideae. As would be supposed the tetraspores are formed at the nodes in the younger portions of the upright branches ; one can easily observe almost all stages on a single filament (Fig. 8). The tetrasporangium itself always arises from a cell in the upper of the two rows of cells at a young node, only a single one developing at one node. After a slight enlargement, chiefly elongation, of this mother cell of the tetraspores the adjoining nodal cells are seen to become actively concerned in the growth (Fig. 8). They begin to grow outwards and around the young tetrasporangium forming bract-like enveloping branches, something like a stichidium with but a single group of tetraspores. The extent to which the enveloping branches develop varies, sometimes only one is produced (Fig. 13), representing the prolongation of a single row of nodal cells, sometimes the single row itself branches and forms an almost complete covering to the tetrasporangium, while again several separate rows of nodal cells may develop in this fashion. The tetraspores are not tetrahedral, but are arranged rather in the cruciate fashion, where however the longitudinal divisions following the first transverse division of the mother cell, are in planes at right angles to each other. When the filaments lie in the position which they naturally assume when attached to the basal prostrate filament, it appears that it is always the distal or upper cell in the young tetrasporangium which has divided in a plane at right angles to the field of vision (Figs. 10, 12, 13). After the spores are ripe the outer wall of the sporangium, which is often considerably thickened, breaks open at the apex and they escape, leaving the empty shell attached to the plant. Then follows a peculiar proliferation, if one may term it so, of the cell which lies at the base of the tetrasporangium. From this a new tetrasporangium starts up, growing into the cavity of the old one and provided with its own thickened wall. This is in turn replaced by another, and yet another, so that one often finds a young tetrasporangium surrounded by the remains of the walls of perhaps four or five earlier ones (Figs. 10, 11), something in the manner of the proliferation often noticed in the zoösporangia of *Saprolegnia.* In no instance was more than a single ripe tetrasporangium observed at each node; in the case shown in Fig. 12, the new one has begun its development somewhat earlier than is usual, but no doubt had the older tetraspores been discharged it would have been forced into the empty cavity. This condition of the successive formation of new tetrasporangia within the older ones does not seem to have been noted in any other form, a fact which makes the appearance presented by this alga in its tetrasporic stage very characteristic.

The antheridia, which like the antheridia of the bulk of the Florideae, consist of an aggregation of small cells each containing a single spermatium, originate from the outgrowth of the nodal cells. The latter, dividing into many small cells, spread upwards and downwards from the nodes, usually completely covering the intervening internodal cells (Fig. 22); sometimes considerable portions of a filament are so modified to form one long antheridium, or, to speak more strictly, a collection of the unicellular antheridia. The spermatium-bearing cells may remain closely appressed to the sides of the internodal cell as is shown in the section in Fig. 22, or, by reason of a growth more rapid than the lengthening of the internodes, may bulge outwards in more or less rounded masses (Fig. 21). The antheridia were never seen on the same plants as the tetraspores, but usually occur alone, although in a few cases they were observed on the same plant or even the same filament as certain polyspores.

These polyspores which first attracted attention in their mature condition naturally aroused the suspicion that they might be favellae of the *Callithamnion* type, especially since the well-defined antheridia described above were also seen. But as the following description shows the most careful search failed to substantiate any such idea, although the development of these spores were worked out in detail. Unfortunately nothing which could be called a trichogyne or trichophoric apparatus was revealed. The polyspores occur as considerable aggregations, enclosed in a definite wall, and borne in the axils of certain specially developed branches (Fig. 20). It is only in this connection that the upright filaments ever branch; an irregular whorl of branches is formed with the main axis of the filament continuing above them, and at their bases are formed one or more large favella-like masses of irregularly arranged spores. The branches, which vary from two to as many as five in number, usually assume ultimately an equal length with the original axis, sometimes even surpassing it in importance and in so doing often push it to one side, making it quite indistinguishable. In consequence of this the masses of mature polyspore often appear to be borne terminally on an irregularly forked filament. By following their development it can be seen, however, that these branches arise as lateral outgrowths from the cells of the younger nodes (Figs. 15, 16, 17), originating in all respects after the manner in which the upright filaments spring from the prostrate one, except that two or more arise from each node. After the beginning of these outgrowths it appears that the axis from which they spring ceases to develop to any extent, all of its vitality being spent in the production of the polyspores and the accompanying whorl of branches. In a few instances a second node below also produces a few side branches, but these never develop to any great length, nor were polyspores seen to be borne in their axils. In the formation of a branch one of the nodal cells takes on the function of an apical cell while the surrounding ones multiply somewhat and as the new internodal cell formed from the apical cell enlarges from around its base a junction with the parent axils, four or five nodes, and occasionally many more are formed before any activity in the direction of the origin of the polyspores is to be observed. For this reason it is often difficult to trace the exact point of origin of the latter. The polyspores, however, were found to originate always from the node of the main axis immediately above the one which gave rise to the whorl of branches (Figs. 16, 17, 18). The cells begin to multiply more rapidly, and form groups of four or five cells; these ultimately by still further division and by great increase in size produce the favella-like masses figured in Fig. 20. First one group develops, then another closely following, and perhaps even a third and fourth mass of spores is formed, reminding one of the polyspores found in certain species of *Ptilota.* In the older stages it is impossible to tell where the spores are attached, they are often so displaced as to appear to have to do with the next node below the one from which they really arose, although in following their development no case —with the possible exception of the one shown in Fig. 17—was observed where any other than the first node above the whorl of secondary branches produced any outgrowth. Signs of a slight activity in the nodes above were occasionally noted, but this never led to the formation of polyspores.

The masses of polyspores, apparently mature, vary in size from about 50–80 μ by 35–60 μ, they are never spherical, and vary also in the number of spores contained, which was from twelve to twenty, in specimens counted. The spores themselves are also irregular in shape and size being, irregularly polyhedral from compression, and measuring from 15 to 20 μ in their greatest diameter.

In connection with the development of these apparently wholly non-sexual spores, it is necessary to refer again to the hair-like processes found springing from the cells in some instances. As has been previously noted, some of the material collected showed the hairs while other material was devoid of them. When first observed on a polysporic specimen it was hoped that they were, indeed, trichogynes, but subsequent investigation showed that these hairs also occurred on antheridial and even tetrasporic specimens (Figs. 9 and 23), and that their lack of contents except at the very tip placed them undoubtedly in the category of the hair-like processes common with other algae. Nor was anything in the nature of trichophoric apparatus found in connection with them. Even where they were present on the same node with the young polyspores (Fig. 16) there was no connection apparent. In short, they lacked the easily recognized appearance of trichogynes and trichophoric cells, which is familiar to any one who has studied Florideae.

To sum up, it may be said that this alga, epiphytic on *Codium tomentosum*, is in habit similar to *Rhodochorton*, and in the general appearance of the cell and its chromatophore like other forms of the genus *Callithamnion;* that it has, as to the filament as a whole, the structure of a *Ceramium* with its clustered nodal and bare internodal cells, and that it is furnished with polyspores reminiscent of those of *Ptilota*. The general appearance, however, is very dissimilar to any of these, and it is further marked by the peculiarity of the proliferating tetrasporangia. Since it is, therefore, impossible to place this form satisfactorily in any of the established genera, and since its peculiarities are sufficiently marked, it seems justifiable to assign it to a new genus, the diagnosis of which is appended.

Ceramothamnion gen. nov.

Plant consisting of prostrate filaments giving rise above to erect filaments, and below to rhizoids. Erect and prostrate filaments same in structure, monosiphonous throughout with small cells collected at nodes : growing tip straight, never circinate : chromatophores rhodophyceous, in elongated bands running almost the length of the internodal cells : tetraspores, antheridia and polyspores present : tetrasporangia borne at nodes : cruciate ; provided with enveloping sterile cells, proliferating by successive formation of new tetrasporangia inside of the old.

Ceramothamnion codii sp. nov.

Prostrate filaments 30–50 μ in diam., never branched except for erect filaments which arise at nodes : erect filaments 20–35 μ in diam., from 0.5 to 1.5 mm. long, sterile, always unbranched, branches arising in connection with polyspores ; outer wall usually unbroken and continuous, but at times pierced by sterile hairs which arise from the nodal cells ; nodal cells in maturity usually 12–16 at each node, never forming a complete cortication to the internodal cells ; mature tetrasporangia single at node, 30–45 × 20–30 μ, partially covered with enveloping sterile cells : proliferating as described above : polysporangia variable in size, 35–60 × 50–80 μ arise laterally from the erect filaments, and consist at maturity of clusters of from 10 to 20 polyspores : several of the clusters—from two to four—are grouped together and are surrounded by protecting branches. Procarpes and cystocarps not observed. Antheridia in masses sheathing the internodal cells, or forming more or less rounded masses from node to node. Polyspores and antheridia usually on separate plants, occasionally on same filament.

Habitat.—Forms minute tufts or small expanses on *Codium tomentosum* among the cortical ramifications of which its rhizoids penetrate. Collected in February on the south shore of the main island of Bermuda.

Explanation of Plates 21, 22

PLATE 21

FIG. 1. Habit, showing the prostrate and erect filaments, rhizoids and masses of polyspores.

FIG. 2. Growing tip, showing also the appearance of the chromatophores in the internodal cells.

FIG. 3. Same in different stage of division.

FIG. 4. Tip provided with short hairs.

FIG. 5. Tip where the hairs are greatly elongated.

FIGS. 6 and 7. Formation of new apical cells in a broken filament.

FIG. 8. Tetrasporangia in various stages of development.

FIG. 9. Tetrasporangia on same filament with hairs.

FIGS. 10 and 11. Tetrasporangia developing within the empty walls of previous ones.

FIG. 12. Tetraspores almost ripe with young tetrasporangium developing.

FIG. 13. Fully developed tetrasporangium showing bract-like covering.

FIG. 14. Empty sporangium after discharge of spores.

PLATE 22

FIG. 15. Showing the origin of whorl of secondary branches.

FIGS. 16, 17, 18. Various stages in development of polyspores.

FIG. 19. Abnormal development of polyspores at an early stage.

FIG. 20. Mature polyspores.

FIG. 21. Mature antheridium.

FIG. 22. Optical section of antheridium.

FIG. 23. Young antheridia developing. The nodal cells above have produced hairs.

All the figures were drawn with an Abbe camera. 1, $\times$ 30 diam.; 2–14, $\times$ 420 diam.; 15–23, $\times$ 480 diam., and reduced about one third. The drawings were made from specimens preserved in alcohol and treated with lactic acid causing the outer wall to swell away from the contents to some extent.

Studies on the Rocky Mountain Flora.—V.

By P. A. Rydberg

Sporobolus aristatus sp. nov.

Vilfa depauperata var. *filiformis* Wats. King's Exp. 5: 376, in part (as to the awned form). 1871. Not Thurb.

Perennial with short branching rootstock. Culm usually only 4–6 cm. high: internodes short, usually covered by the open strongly striate sheath; ligules lanceolate, acute, about 1.5 mm. long: leaf-blades 8–14 mm. long, and about 1 mm. wide, striate and puberulent on the upper surface: panicle few-flowered, very narrow, with short erect branches; empty glumes almost equal, or the inner slightly longer, 1–1.25 mm. long, less than half as long as the flowering glume, ovate, acutish or obtuse and somewhat erose at the apex: flowering glume about 2.5 mm. long, strongly veined, long-strigose on the veins and tipped with an awn .5–1 mm. long; palet almost equal to the flowering glume (awn excepted) in length, acuminate, but not awned, strigose.

This species is closely related to *S. filiformis* (Thurb.) Rydb. differing in the lower habit, less exserted panicle, firmer empty glumes and the presence of a distinct awn. It grows in wet places at an altitude of 2000–2500 m.

Wyoming: Big Horn Mountains, Sheridan Co., 1899, *F. Tweedy, 2196* (type); Spread Creek, 1897, *27*.

Utah: Bear River Cañon, 1869, *S. Watson, 1281*.

Poa platyphylla Nash & Rydb.

Poa trivialis var. *occidentalis* Vasey, Desc. Cat. Grasses 85. 1885. Not *Poa flexuosa* var. *occidentalis* Vasey. 1878.

Poa occidentalis Vasey, Cont. U. S. Nat. Herb. 1: 275. 1893.

Carex ebenea sp. nov.

Perennial by a cespitose rootstock. Stem 2–4 dm. high, strongly striate; sheath with a conspicuous membranaceous ligular portion, ligule proper rounded, about 2 mm. long; leaf-blades flat, 1–2 dm. long, 3–6 mm. broad, strongly nerved: spikelets about 1 cm. long in a dense globular or rounded-conical head:

shining, brownish black with a lighter midrib, lanceolate, acute, 3–4 mm. long: perigynia lanceolate, tapering gradually into a long beak, with the beak about 5 mm. long, dark brown; staminate flowers at the base and mixed with the pistillate: upper portion of the wings and the beak scabrous on the margins; teeth at the apex of the beak very short, subulate: styles 2: achene oblong, lenticular, nearly 2 mm. long and fully 1 mm. broad.

This species is nearest related to *C. festiva* and has been labeled *C. festiva Haydeniana*, but it is not the same as the original of that variety, which has broadly ovate perigynia. *C. ebenea* differs also from all forms of *C. festiva* in the form of the perigynia and in the dark glossy color of the bracts and perigynia.

COLORADO: Pikes Peak, 1900, *F. Clements* (type); Windy Point, 1900; Mt. Harvard, 1896, *7*; Grecian Bend, 1896, Bottomless Pit, and Saddle, *Clements*; between Cheyenne Mountain and Seven Lakes, 1896, *E. A. Bessey*; Ironton, 1899, *C. C. Curtis*; Telluride, 1894, *F. Tweedy, 194*; Chambers Lake and Cameron Pass, 1896, *C. F. Baker*; Clear Creek Cañon, 1878, *M. E. Jones, 267*; Silver Plume, 1895, *Rydberg, 2460*; Pagosa Peak, 1899, *C. F. Baker, 233*.

✓ **Streptopus curvipes** Vail sp. nov.

Simple, glabrous, except the margins of the leaves and the peduncles. Stems 1–3 dm. high, from a slender rootstock covered with few fibrous rootlets: leaves sessile, oval or oblong-lanceolate, 3–8 cm. long, acuminate at the apex, rounded and slightly clasping at the base, 3–5-nerved, the margins finely glandular-ciliate: flowers 3–5, solitary: peduncles not geniculate, 5–15 mm. long, glandular-pubescent: flowers pale purple or rose-colored: perianth-segments lanceolate, 5–7 mm. long, minutely glandular-pubescent on the inner surface: anthers 2-beaked; beaks slender, about half the length of the anther: style 3-cleft, the spreading branches stigmatic along the inner side: berry globose, when mature brick red, 7–9 mm. in diameter: seeds clavate, 3–4 mm. long, with many cross-striate ridges.

Differs from *Streptopus roseus* in its simple habit and the non-geniculate and much shorter peduncles. The beaks of the anthers seem to be a trifle longer than in *S. roseus*. It is closely related to *S. brevipes* Baker, but is larger and coarser in every respect. The flowers of the latter species are not known.

BRITISH COLUMBIA: Asulkan Pass, alt. 4400 ft., June to July, 1897, *Mrs. Zoë W. Palmer* (type); Glacier, alt. 4122 ft., June to July, 1897, *Mrs. Zoë W. Palmer;* Glacier, June, 1897, *Mr. & Mrs. Cornelius Van Brunt.*

ALASKA: Juneau, along the mountain side, July 24, 1891, *Miss Grace E. Cooley;* Yes Bay, July 10, 1895, *Thomas Howell, 1664* (all in Herb. N. Y. Botanical Garden or Columbia University); *Ferd. Bishoff.*

OREGON: *E. Hall, 521.*

WASHINGTON: Skamania Co., Aug., 1886, *Suksdorf;* Mt. Adams, 3–400 ft., *Suksdorf, 44;* June, 1879, *J. Howell* (the last five specimens in Herb. Gray).

✓ **Vagnera brachypetala** sp. nov.

A tall stout perennial, 5–8 dm. high. Stem striate, puberulent, especially the upper portion: leaves subsessile or short-petioled, oval or ovate, 8–18 cm. long, 4–7 cm. wide, often short-acuminate and twisted at the apex, with 5–7 stronger nerves and numerous weaker ones: panicle on a peduncle 4–5 cm. long, rather dense, 3–10 cm. long and 2–5 cm. broad: petals and sepals oblong, 1–1.5 mm. long, scarcely half as long as the broadly dilated, lanceolate-subulate petaloid filaments: style about .5 mm. long: berry dark purple, about 6 mm. in diameter.

This species is closely related to *V. racemosa* and *V. amplexicaulis*, perhaps most nearly to the former, but is easily distinguished by the short petals and the purple fruit. In *V. racemosa* the petals and sepals are almost as long as the filaments and the fruit is 7–8 mm. in diameter and red with purple spots. *V. brachypetala* grows on hillsides up to an altitude of 2500 m.

BRITISH COLUMBIA: Glacier, at the "Loup," 1897, *Mr. & Mrs. Cornelius Van Brunt* (in fruit, type); Deer Park, Columbia River, 1890, *John Macoun;* Victoria, Vancouver Island, 1893, *John Macoun, 5998.*

WASHINGTON: Seattle, 1891, *C. V. Piper, 198.*

IDAHO: Lake Waha, 1892, *Sandberg, MacDougal & Heller, 228.*

✓ **Vagnera leptopetala** sp. nov.

A slender glabrous perennial, 2–3 dm. high. Rootstock very slender for the genus, white, only about 2 mm. in diameter: stem erect, strict or the upper portion somewhat zigzag, striate and pale: leaves oblong-lanceolate, 6–8 cm. long, 1–2 cm. wide, light green, sessile, long-acute, with 3–5 stronger nerves and 12–14 weaker ones: raceme terminal, simple, 3–6-flowered: pedicels 5–8 mm. long: petals and sepals linear, acute, about 4 mm. long and less than 1 mm. wide, very thin, white: fruit not seen.

This species is nearly related to *V. stellata* and *V. liliacea*, but differs in the narrow petals and sepals, the slender rootstock and the lighter green foliage. It grows in rich soil in cañons at an altitude of 2000–2100 m.

COLORADO: Headwarters of Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 6441* (type); Dark Cañon, Pikes Peak, 1900, *Fred Clements.*

Limnorchis purpurascens sp. nov.

A rather stout plant, 3–5 dm. high, with fleshy-fibrous roots. Leaves ovate to lanceolate, acute, 6–10 cm. long, 1.5–3 cm. wide, dark green: bracts lanceolate, the lower exceeding the flowers: spike rather dense: flowers 10–12 mm. long: lateral sepals green, oblong-linear, or linear, obtuse, 4–5 mm. long; the upper sepal tinged with purple, broadly ovate, erect, obtuse: petals slightly shorter, erect, purple, lanceolate, oblique: lip broadly linear-lanceolate, about 5 mm. long, purplish, scarcely at all dilated at the base, the edges almost straight: spur scarcely more than half as long as the lip, much thickened and saccate.

This species belongs to the *L. hyperborea* group, and is perhaps nearest related to that species. It differs, however, in the purple petals and lip and the shorter and more saccate spur. The spur has almost the same form as that of *L. stricta*; but from that species it differs in the dense spike and the broader lip. *L. purpurascens* grows in damp woods at an altitude of 2700–3000 m.

COLORADO: Iron Mountain, 1900, *Rydberg & Vreeland, 6414* (type); Manitou, 1900, *Fred Clements, 172*; Georgetown, 1878, *M. E. Jones, 314.*

Piperia gen. nov.

Montolivaea Rydb. Mem. N. Y. Bot. Gard. **1**: 106. 1900. Not Reichenb.

Professor C. V. Piper of the Agricultural Experiment Station at Pullman, Washington, has called my attention to the fact that the genus *Montolivaea* was based not on *Platanthera elegans* Lindley, or *Habenaria elegans* Bolander; but on *Montolivaea elegans* Reichenb., or *Habenaria elegans* Jackson, of a much later date. The genus that I shortly characterized under the name of *Montolivaea* in the Memoir cited above, is therefore without a name. As I find that no genus has at yet been dedicated to Professor Piper, I take the pleasure in naming this for him. The genus contains at least three species, viz.

Piperia elegans (Lindl.)

Platanthera elegans Lindl. Gen. & Sp. Orch. 285. 1835.

Habenaria elegans Boland.; Wats. Bot. Calif. **2**: 133. 1876.

Montolivaea elegans Rydb. Mem. N. Y. Bot. Gard. **1**: 106. 1900. Not Reichenb.

Piperia Unalaschensis (Spreng.)

Spiranthes Unalaschensis Spreng. Syst. **3**: 708. 1826.

Habenaria Unalaschensis Wats. Proc. Am. Acad. **12**: 277. 1876.

Montolivaea Unalaschensis Rydb. Mem. N. Y. Bot. Gard. **1**: 107. 1900.

Piperia elongata sp. nov.

A slender strict plant, 4–7 dm. high. Corm ellipsoid, about 2 cm. long and 1 cm. in diameter: leaves 2, near the base; blades lanceolate or oblanceolate, acute, 8–15 cm. long, 1–2 cm. wide: spike elongated and lax, 2–3 dm. long: flowers about 1 cm. long: sepals green, about 5 mm. long, the upper lanceolate, the other two linear obtuse: petals lanceolate, oblique, equalling the sepals: lip entire, broadly lanceolate: spur slender, scarcely clavate, almost cylindrical, arcuate, 10–12 mm. long, about .7 mm. thick.

This is somewhat intermediate between the two preceding. It has almost the same flowers as the first and the general habit of the second. *P. elegans*, with which it has generally been confused, has a stouter, more fleshy stem, thicker bracts and a short crowded spike. *P. Unalaschensis* has the same habit as the present species, but the spur is very short and saccate. *P. elongata* grows in open woods, up to an altitude of 700 m.

IDAHO: Priest Lake, near lower end, 1900, *D. T. MacDougal, 168* (type); Priest River Valley, *134*.

WASHINGTON: W. Klickitat County, 1885, *W. N. Suksdorf*; Seattle, 1889, *C. V. Piper, 1081*.

Corallorrhiza Vreelandii sp. nov.

Scape rather stout, 2–4 dm. high, dark purplish brown. Sheaths, especially the lowest one, much inflated, purplish brown with dark purple striations: flowers 6–15, about 15 mm. long, in fruit drooping: sepals oblong, 7–8 mm. long, brown with 3 purple stripes: petals similar but slightly broader and with 4 stripes: lip ovate, entire, with a small gibbosity at the base: spur none.

This is nearest related to *C. striata*, from which it differs in the smaller flowers and narrower sepals and petals. The type was found growing among alders and willows at the margin of a small lake, at an altitude of about 2700 m. It was first discovered by Mr. F. K. Vreeland, my enthusiastic associate and pleasant companion in field work last summer.

COLORADO: Veta Mountain, 1900, *Rydberg & Vreeland, 6418.*

Salix Wyomingensis sp. nov.

A shrub 1 m. high or less. Bark of the main trunk gray; that of the branches dark-brown or grayish, shining, somewhat flaky; young branches appressed-villous; buds brown, shining, pubescent when young: leaves small, rather crowded; petioles 2–4 mm. long; blade oval or obovate, acute, 1–3 cm. long, entire or exceedingly minutely callous-denticulate, upper surface green and shining, slightly pubescent when young, glabrate in age; lower surface pale bluish green, appressed silky-villous: aments borne on very short leafy branches, about 3 cm. long, 8–10 mm. in diameter: bracts brown, oblong or ovate, obtuse: pedicels scarcely 1 mm. long: ovary villous, but green, when fully developed only about 3 mm. long: style .5 mm. long: stigmas short, slightly 2-cleft.

This species is nearest related to *S. glaucops* Anderson, but differs in the small oval or obovate leaves and the much smaller and greener ovaries. It grows at an altitude of 2100–2700 m.

WYOMING: Eastern Slope of Big Horn Mountains, headwaters of Clear Creek and Crazy Woman River, 1900, *F. Tweedy, 3434* (type) and *3433*.

Salix stenophylla sp. nov.

A shrub 2–5 m. high. Bark of older stems light brownish green, smooth; that of the slender strict branches brown: young shoots silvery pubescent: leaves narrowly linear, 3–7 cm. long, about 3 mm. wide, acute, entire or minutely and distantly denticulate, permanently finely silky strigose, but not white: pistillate aments 3–4 cm. long at the ends of short leafy branches: bracts yellow, oblanceolate, deciduous, acute, 2–2.5 mm. long, rather sparingly silky-villous: pistil green, about 4 mm. long, glabrous except the swollen portion at the end just below the red stigma: stipe about 1 mm. long: style none: stigma minutely 4-lobed: fruit glabrous, narrowly ovoid-conic, about 6 mm. long, and 1.5 mm. in diameter: staminate aments 2–3 cm. long, 5 mm. in diameter: bracts like those of the pistillate aments, but more obtuse and more villous: stamens 2, about twice as long as the bracts: filaments slightly hairy, especially below.

This species is a member of the *longifolia* group and nearest related to *S. exigua* Nutt., at least as understood by Professor Rowlee; but differs in the narrower leaves, the distinct stipe and the peculiar swelling just below the stigma. It grows on river banks up to an altitude of 2500 m.

COLORADO: Cuchara River, below La Veta, 1900, *Rydberg & Vreeland, 6392* (staminate flowers) and *6393* (pistillate, type); Mancos, 1898, *Baker, Earle & Tracy, 127* (staminate) and *102* (pistillate in fruit).

NEW MEXICO: 1851–2, *Wright, 1874* and *1875*; 1847, *Fendler, 813*.

ARIZONA: San Francisco Mountains, 1881, *Rusby, 371*.

Salix padifolia sp. nov.

A shrub 1–7 m. high, with light brown smooth bark. Young twigs strict, glabrous and shining, yellow, or often brown or purple: stipules ovate or rounded, glandular-dentate: leaves with petioles 5–8 mm. long; blade oval or broadly elliptic, crenate, short-acute or obtusish, rounded at the base, 3–5 cm. long, 1.5–2 cm. wide, when young sparingly covered with silky hairs, but soon glabrate, dark green above, paler beneath: pistillate aments 3–4 cm. long, densely flowered, appearing usually before the leaves, borne on very short branches and subtended by 1–4 small leaves: bracts obovate, fuscous, covered on the outside with white wool: pistils nearly sessile, glabrous: style about 1.5 mm. long: stigmas 2, nearly 1 mm. long, 2-cleft: capsules ovate-conic, about 6 mm. long: staminate aments almost sessile, 2–3 cm. long, 10–12 mm. in diameter: bracts as those of the pistillate aments: stamens 2; filaments glabrous.

This is a species of the *cordata* group and nearest related to *S. Mackenziana*; but differs in the shorter oval leaves, the shorter and thicker aments and the exceedingly short stipes. It has generally been referred to *S. cordata*; but has much thicker and shorter aments and the leaves are quite different, thin, very short and broad, never acuminate and never sharply serrate. It grows along streams at an altitude of 2000–3000 m.

COLORADO: Tributaries of Turkey Creek, 1900, *Rydberg & Vreeland, 6389* (fruit, type); Ojo, *6386* (staminate) and *6387* (pistillate); Pass Creek, *6388* (pistillate); Los Pinos, 1899, *Baker, 271;* Bob Creek, 1898, *Baker, Earle & Tracy, 175;* Silverton, 1895, *F. Tweedy, 268* (?).

WYOMING: Golden Gate, 1899, *Aven & Elias Nelson, 5549.*

MONTANA: Ten miles east of Monida, 1899, *Aven & Elias Nelson, 5427.*

Salix flava sp. nov.

A shrub or small tree, 4–7 m. high, with grayish yellow rough bark. Branches short and divergent, light yellow, smooth and shining: stipules rounded, entire: leaves with petioles 2–6 mm. long; blades lanceolate, short-acuminate or acute, entire or indistinctly crenulate, rather firm, yellowish green, glabrous on both sides, 3–7 cm. long: pistillate aments 2–3 cm. long, almost sessile, subtended by 1–2 leaves or naked: bracts very short, obovate, fuscous, densely long-woolly: pistil stipitate, glabrous; stipe in fruit often 2 mm. long: style about .5 mm. long: stigmas oblong, subentire: capsule ovate, about 6 mm. long: staminate aments 2–3 cm. long, sessile: bracts as in the pistillate aments: stamens 2; filaments glabrous.

This is also a member of the *cordata* group and nearest related to *S. lutea* Nutt., differing in the less acuminate and subentire leaves, which are not paler beneath, and the longer stipes. It grows along streams at an altitude of 1500–2000 m.

WYOMING: Green River, 1895, *Rydberg* (type); Spread Creek, 1897, *F. Tweedy, 302.*

MONTANA: Boulder River, 1888, *F. Tweedy, 63.*

IDAHO: Beaver Cañon, 1895, *Rydberg.*

NEVADA: Unionville, 1868, *S. Watson, 1097.*

UTAH: Wahsatch Mountains, 1869, *S. Watson, 1096,* in part.

COLORADO: South Park, 1873, *J. Wolfe;* Cucharas Valley, near La Veta, 1900, *Rydberg & Vreeland, 6377;* Manitou, 1878, *M. E. Jones, 30.*

Blitum hastatum sp. nov.

A slender annual, 2–4 dm. high. Leaves very thin; blades

3–7 cm. long, ovate or ovate-lanceolate in outline, but often hastately lobed at the base, which is broadly cuneate and decurrent on the slender petiole; the upper ones smaller and generally not hastate: lower petioles 2–4 cm. long; flowers in small glomerules in the upper axils and on a slender interrupted terminal spike: seeds brownish black, smooth and shining, about 1 mm. long.

This species differs from *B. capitatum* in the hastate or entire, never toothed, thin leaves and in the inflorescence which is more inclined to be naked above, more lax and with smaller glomerules. It grows at an altitude of 2000–3000 m.

WYOMING: Buffalo, 1900, *F. Tweedy, 3295* (type).

UTAH: Alta, Wahsatch Mountains, 1879, *M. E. Jones, 1181.*

NEVADA: Above Thousand Springs Valley, 1868, *S. Watson, 977.*

Alsine Curtisii sp. nov.

Slender, erect, branched, 2–6 dm. high with a slender horizontal rootstock. Stem sharply 4-angled, glabrous, except at the inflorescence: leaves linear or lance-linear strongly 1-nerved, sessile, rounded and half clasping at the base, long-attenuate at the apex, 3–6 cm. long, 3–5 mm. wide, those of the inflorescence smaller: branches of the many-flowered cymes divergent, very viscid-pubescent: sepals about 3 mm. long, thick, ovate-oblong, obtuse or acutish with a narrow white margin: petals about 7 mm. long, cuneate with a broad and deep sinus at the apex: seeds very few, dark brown, almost 2 mm. in diameter.

This species is nearest related to *A. Jamesii* and has been confused with it; the differences are mostly in the leaves and sepals. In *A. Curtisii* the former are scarcely half as wide as those of *A. Jamesii*, and the sepals of the former are rather thick while in the latter almost membranous. *A. Curtisii* grows at an altitude of 1800 to 3000 m.

WYOMING: Headwaters of Cliff Creek, 1900, *C. C. Curtis* (type).

UTAH: Wahsatch Mountains, 1869, *S. Watson, 159* (in part); Beaver Valley, 1877, *E. Palmer, 51½*; Alta, Wahsatch Mountains, 1879, *M. E. Jones, 1160.*

NEVADA: East Humboldt Mountains, 1868, *S. Watson, 159* (in part).

ARIZONA: Mogallon Mountains, 1881, *H. H. Rusby.*

Arenaria confusa sp. nov.

A slender diffuse plant with cespitose, perennial, but not ligneous base. Stems slender, branched, 4–6 dm. long, finely puberulent: leaves opposite, linear-lanceolate, pointed, with a strong midrib, puberulent, 1–2 cm. long: pedicels in fruit divergent, about 1 cm. long, slightly bent under the calyx: sepals linear-lanceolate, acuminate, scarious-margined, not tuberculate-punctate, about 3 mm. long: petals about three fourths as long as the sepals: capsule broadly ovoid, about 4 mm. long.

This species is related to *A. lanuginosa* and *A. saxosa*, and somewhat intermediate between the two. In habit it resembles most the former, but does not have the subverticillate or fascicled leaves; the sepals are narrowly lanceolate instead of ovate and not tuberculate-punctate, the stem is not retrorsely pubescent as in that species and the petals are larger. In all specimens of *A. lanuginosa* seen by me the petals are either lacking or not more than half as long as the sepals. *A. saxosa* is subligneous at the base, has low stems, short leaves, mostly less than 1 cm. long and sepals even in flower 4–5 mm. long. Dr. B. L. Robinson, in the Synoptical Flora, remarks under *A. alsinoides* (*A. lanuginosa*): "A more western form, represented from New Mexico by Fendler's 58 and 62 and Wright's 864, has slightly firmer stems, more numerous subpaniculate flowers, and leaves less narrowed at the base. In all these respects it shows a transition to the following." I have not seen the numbers of Fendler's collection cited; but Wright's 864 as represented in Columbia University Herbarium belongs to *A. confusa*. On the sheet of Rusby's 38, cited below, found in the Columbia University herbarium, Dr. Robinson has written in pencil: "Apparently this is merely a lax form of *A. saxosa* Gray. The earliest leaves are crowded, the upper internodes much elongated, and later flowers are always smaller. (B. L. R.)" Wilcox's plant cited below was also determined by Dr. Robinson as *A. saxosa*. Both of these agree perfectly, however, with Wright's specimens; but neither with our material of *A. lanuginosa* from the Southern States and Mexico, nor with the type of *A. saxosa*. *A. confusa* grows in cañons at an altitude of 2000–3500 m.

NEW MEXICO: White Mountains, 1897, *E. O. Wooton, 295* (type); 1851, *C. Wright, 864;* Burrow Mountains, 1880, *H. H. Rusby, 38.*

ARIZONA: Ft. Huachuca, 1892, *T. E. Wilcox;* Rincou Mountains, 1891, *Neally, 119;* Flagstaff, 1894, *J. W. Toumey.*

COLORADO: La Plata Mountains, 1896, *F. Tweedy, 426;* Wahatoya Creek, 1900, *Rydberg & Vreeland, 6274;* Pagosa Peak, 1899, *C. F. Baker, 309.*

Delphinium ramosum sp. nov.

A tall perennial, often 2 m. high. Stem glabrous and shining up to the inflorescence, often tinged purplish or bluish: petioles 1–1.5 dm. long; leaf-blade glabrous above, finely puberulent beneath, divided near the base into 5–7 segments, which are 4–7 cm. long, oblanceolate or obovate, cuneate in outline, unequally 3-cleft and these segments again cleft into oblong or lanceolate lobes 3–6 mm. broad: inflorescence with slender branches, these sparingly and finely puberulent: bracts linear-subulate, 5–10 mm. long: pedicels slender, 1–3 cm. long: bractlets filiform, 2–5 mm. long, inserted 2–5 mm. below the calyx: sepals dark blue, striately nerved, slightly brownish at the base, about 1 cm. long, ovate; the upper and lower ones acute; the lateral ones obtuse, all puberulent: spur about 1 cm. long, straight, or slightly curved at the apex: upper petals dirty-white, tinged with brown and blue, about 8 mm. long: spur slender, almost 1 cm. long: lateral petals dark blue, bearded, with a slender claw, somewhat corniculate, bent at right angles and only slightly 2-lobed at the apex: follicles 3, 12–15 mm. long, somewhat spreading and with divaricate beaks.

This species has without doubt been included in *D. scopulorum*, but is evidently distinct from the type of that species. It is taller, with more branched inflorescence, glabrous stem and the flowers are usually tinged with brown at the base. The type of *D. scopulorum* has narrow, very acute and divergent lobes of the leaves and the calyx is purely dark blue. *D. ramosum* grows at an altitude of 2000–3000 m.

COLORADO: North Cheyenne Cañon, 1896, *E. A. Bessey* (type); also in Williams Cañon, Artists Glen and other places near Pikes Peak; "Colorado," 1889, *Alice Eastwood.*

Delphinium robustum sp. nov.

A tall and stout perennial, often 2 m. high or more. Stem leafy, striate, puberulent throughout, often 1 cm. in diameter at the base; petioles 1–2 dm. long, puberulent; leaf-blade finely and sparingly puberulent on both sides, divided to the base into 5–7 segments, which are 6–12 cm. long and twice cleft into linear lobes 3–5 mm. broad: inflorescence branched, densely many-flowered: pedicels 1–3 cm. long, rather stout, usually equalled or surpassed by the linear bracts: bractlets filiform, 5–10 mm. long, inserted close under the calyx: sepals dark blue, paler at the base, elliptical, all except the upper one obtuse, 12–15 mm. long; spur 12 mm. long, slightly curved: upper petals narrow, light brownish, striate: lateral petals with slender claws bent at right angles, bearded only within, deeply 2-cleft at the apex.

This species in perhaps closest related to *D. cucullatum* A. Nelson but differs in the longer and narrower leaf-segments, the more branched inflorescence, the stouter habit, the longer bracts and bractlets and narrower upper petals. It grows at an altitude of about 2500 m.

COLORADO: Wahatoya Creek, below the Spanish Peaks, 1900, *Rydberg & Vreeland, 6217* (type); Colorado Springs, 1895, *E. A. Bessey;* Ruton, 1840, *Albert.*

Erysimum alpestre (Cockerell)

Erysimum asperum f. alpestre Cockerell, Bull. Torr. Club, **18**: 168. 1891.

A tall strigose perennial with a deep tap-root: stem strict, simple, 3–6 dm. high, striate: basal leaves linear or narrowly linear-oblanceolate, 5–10 cm. long, 2–7 mm. wide, subentire or sinuately denticulate, grayish strigose, gradually tapering below with a short petiole: stem leaves mostly narrowly linear, the upper sessile: raceme at first short and corymbiform, in fruit much elongated: pedicels short, in fruit scarcely 1 cm. long, ascending: calyx 10–12 mm. long, yellow: two of the sepals strongly saccate at the base: petals with slender claws: blades broadly obovate-cuneate, slightly emarginate, about 8 mm. long and broad, varying from orange or brown to rose-purple or the older pale yellow: pods four-angled, slender, erect, 7–8 cm. long and 1.5 mm. in diameter: style about 2 mm. long, stout.

In general habit, this species closely resembles *E. asperum.* Mr. Cockerell, who seems to have been the first to observe this interesting plant of the Sangre de Christo region, took it to be a form of *E. asperum* with peculiarly colored petals, found only at high altitudes. I was first of the same opinion until I saw the fruit in the type number and still better developed in Mr. Bessey's specimens. This resembles more that of *E. asperrimum* (*Cheiranthus asperrimum* Greene) than that of *E. asperum*. The present species is also less densely and more finely strigose than either of them. *E. alpestre* grows at an altitude of 2500 m. or more.

COLORADO: Headwaters of Pass Creek, 1900, *Rydberg & Vreeland, 6200* (type); mountain near Veta Pass, *6199*; Veta Mountain, *6197*; tributary of Turkey Creek, *6198*; East Indian Creek, *6196*; Ojo, *6202*; Bald Mountain, near Pikes Peak, 1896, *E. A. Bessey*.

✓ **Draba aureiformis** sp. nov.

A slender grayish stellate plant with perennial tap-root: stem strict, 2–4 dm. high, simple or branched above, with slender erect branches: basal leaves spatulate, 2–3 cm. long, acute, entire: stem-leaves closely sessile, oblong-lanceolate, acute, entire or sinuately denticulate: petals sulphur yellow, 3–4 mm. long, broadly spatulate: pedicels ascending: pod erect, linear-oblong-lanceolate, 10–15 mm. long, about 3 mm. wide, slightly if at all twisted, stellate: style about 1 mm. long.

This species is nearest related to *D. aurea*, but characterized by the small light yellow petals, the slender style, the less dense pubescence, and slender stem. It grows in dry soil at an altitude of 2700–3300 m.

COLORADO: Headwaters of Pass Creek, 1900, *Rydberg & Vreeland, 6157* (type); Middle Park, 1861, *C. C. Parry, 103*; Graymount, 1885, *G. W. Letterman, 28*.

Physaria vitulifera sp. nov.

A densely tufted finely stellate-pubescent perennial with deep tap-root. Basal leaves numerous, fiddle-shaped, the larger 4–5 cm. long; terminal lobe nearly orbicular to broadly obovate, subentire, obtuse; upper sinuses rounded: lateral lobes 1–2 pairs, much smaller: stems ascending, or decumbent, 1–2 dm. high: stem-leaves 1–2 cm. long, obovate or oblanceolate, entire: pedicels short, usually curved in fruit: sepals about 4 mm. long, oblong, acute: petals clawed, 8–9 mm. long: fruit obtuse at the base, deeply divided above; cells much inflated, round-obovate, divergent, about 5 mm. in diameter: style about 5 mm. long.

This species, as well as the two following, differs from *P. didymocarpa* in the smaller fruit, which is divided only above, not at the base. In this respect they resemble *P. Newberryi;* but the fruit is much smaller and not flattened on the sides. *P. vitulifera* differs from the following in the form of the leaves and the curved pedicels. It grows in dry places at an altitude of about 2500 m.

COLORADO: Idaho Springs, 1895, *P. A. Rydberg* (type); Middle Park, 1861, *C. C. Parry, 101.*

Physaria floribunda sp. nov.

Densely tufted perennial with thick tap-root. Flowering stems very numerous, ascending or almost erect, 1–2.5 dm. high: basal leaves less crowded and more erect than in the preceding, oblanceolate or spatulate, sinuately toothed, acute, 5–10 cm. long: stem-leaves oblanceolate, entire, about 3 cm. long: sepals about 5 mm. long, linear-lanceolate: petals bright yellow, 8–9 mm. long, oblanceolate with broad claws: fruit obtuse or slightly cordate at the base, deeply divided above: cells much inflated, about 8 mm. in diameter, almost globular: style 6 mm. long.

In the size and form of the fruit, this species is intermediate between the preceding and *P. didymocarpa;* but it is taller than either. Sometimes the leaves are deeper sinuate, and then become slightly fiddleform; but the terminal lobe is sinuately toothed and acutish. From *P. didymocarpa* it differs in the smaller fruit, which is less cordate at the base, and the longer, more acute leaves. It grows in loose sandy soil in mountain valleys at an altitude of 2000–2700 m.

COLORADO: Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 6135* (type) and *6136;* Hills about Golden, 1892, *Crandall, 53.*

Physaria acutifolia sp. nov.

A small tufted perennial with a deep rather slender tap-root. Basal leaves numerous, 1.5–2.5 cm. long, oblanceolate or obovate, acute, entire or slightly wavy, very finely stellate: stem-leaves rather few, oblanceolate: flowering stems 4–6 cm. long, ascending or depressed: fruit small, obtuse or slightly cordate at the base, deeply divided above: cells inflated, almost spherical, 4–6 mm. in diameter: style about 5 mm. long.

This species differs from *P. didymocarpa* in the smaller size, in the acute leaves, and the smaller fruit, which is more deeply divided above and less so below. In general habit it resembles more *P. Geyeri*, from which it differs in the turgid more spherical cells. It grows in the mountains, reaching an altitude of 3000 m.

COLORADO: Grand Junction, 1893, *Alice Eastwood* (type).
WYOMING: Mount Leidy, 1897, *F. Tweedy, 391*.

Cardamine cardiophylla sp. nov.

Stem stout, 3–10 dm. high, densely hirsute with short white hairs, almost pilose: leaves rounded-cordate or the lower reniform, simple, coarsely sinuately toothed: blades 3–4 cm. broad, more or less pubescent: petioles more or less densely pilose, those of the basal leaves 5–8 cm. long, those of the upper stem-leaves very short: sepals also pubescent, about 3 mm. long: petals white, broadly spatulate, about 8 mm. long: pedicels in fruit spreading, 1.5–2 cm. long: pods 2.5–3.5 cm. long, ascending, 1.5 mm. wide.

This species is nearest related to *C. cordifolia*, and differs mainly in the thicker leaves and the dense pubescence. It reaches an altitude of 3300 m.

COLORADO: Tennessee Pass, Lake County, 1900, *Geo. E. Osterhout, 2178* (type); 1893, *De Alton Saunders*; Camp beyond Bent's Fort, 1845, *Fremont, 429*.

Thlaspi Coloradense sp. nov.

Perennial; rootstock or caudex cespitose, the branches rosuliferous at the apex. Basal leaves broadly spatulate, 1–2 cm. long, fleshy, 4–7 mm. wide, sinuately crenate or subentire: flowering stems 2–8 cm. long, leafy: stem-leaves oblong or obovate, 3–10 mm. long, obtuse: inflorescence short and dense, even in fruit seldom over 2 cm. long: sepals rounded-ovate, obtuse, with a white margin, about 2 mm. long: petals large, obovate-spatulate, 5–6 mm. long: silicle obovate, about 6 mm. long, only slightly emarginate at the apex: wing-margins very narrow; carina on the sides rather prominent: seeds red, about 1 mm. long.

This species has been included by American authors in *T. alpestre*, which is not found in America. The European species has very small flowers and a different pod which is obcordate with a narrow and deep sinus at the apex. Professor Greene has determined *T. Coloradense* as *T. Fendleri* Gray. The latter was described from flowering specimens and might be the present species; at least it is much like it. Specimens in fruit from the same region as the type of *T. Fendleri* were collected later and were referred by Dr. Gray to *T. Fendleri*; in these the fruit is larger, decidedly inverted triangular in outline, broader margined at the corners and almost truncate at the apex.

T. Coloradense grows at an altitude of 2500 m. or more, among rocks.

COLORADO: Bald Mountain near Pikes Peak, 1896, *E. A. Bessey* (type); South Cheyenne Cañon, Colorado Springs, 1900, *Rydberg & Vreeland, 6126*; West Spanish Peak *6127* and *6128*; Pikes Peak, 1894, *E. A. Bessey*; Pikes Peak and Baldy, 1896, *F. Clements*; Pikes Peak and Tennessee Pass, 1893, *De Alton Saunders*; Laramie County, 1893, *C. S. Crandall*, 60; Pikes Peak, 1891, *Dr. E. Penard, 54*; Arapahoe, *55*; Los Pinos, 1899, *C. F. Baker*; Cheyenne Mountain and Seven Lakes, 1896, *E. A. Bessey.*

Thlaspi purpurascens sp. nov.

Perennial with a tap-root crowned by a very short caudex and a rosette of leaves; flowering stems generally several, less than 1 dm. high: basal leaves oval or broadly spatulate, 2–3 cm. long, petioled, usually more or less sinuate-dentate: stem-leaves ovate, obtuse, with a truncate base, closely sessile: sepals 2.5–3 mm. long, oblong-oval, obtuse, purplish with broad white margins: petals broadly spatulate, about 6 mm. long: silicle triangular-obovate, distinctly winged above and with a very broad and shallow sinus at the apex, 7–8 mm. long.

This species is closely related to the preceding and intermediate forms are not lacking. The principal difference is in the fruit, which in *T. purpurascens* is comparatively broader, distinctly winged and with a broad and open sinus at the top, almost truncate and less keeled on the sides. The sepals in all specimens seen are purplish and broader, the stem leaves are larger, more ovate and usually with a truncate base, and the branches of the caudex are very short.

ARIZONA: 1876, *E. Palmer, 571* (type); San Francisco Mountains, 1881, *H. H. Rusby, 28*; 1887, *Dr. E. A. Mearns, 34*; Flagstaff, 1898, *D. T. MacDougal, 228.*

COLORADO: Headwaters of Sangre de Christo Creek, 1900, *Rydberg & Vreeland, 6125*; Iron Mountain, *6124.*

Sophia glandulifera sp. nov.

Biennial. Stem simple below, branched above, about 6 dm. high, slightly grayish pubescent with branched hairs, decidedly glandular-viscid above; branches spreading, with upwardly curved ends: leaves pubescent and viscid, bipinnately divided; segments linear-lanceolate or of the upper leaves filiform, acute or attenuate: flowers light yellow: petals scarcely exceeding the sepals: pedicels very short in flower; in fruit 4–6 mm. long, ascending or almost erect: pods 8–10 mm. long, erect, more or less curved, especially those of the branches, scarcely exceeding 7 mm. in width, more or less constricted between the seeds; beak slender, short, about .5 mm. long: seeds uniserial, red, a little over 1 mm. long.

This species has the short pedicels and erect pods of *S. Hartwegiana*, but the pod of the latter is more slender, and often curved, the whole plant is greener and conspicuously glandular, and the segments of the leaves are more slender. The latter character and the short ascending or erect pedicels distinguish it from *S. incisa* Engelm. It grows at an altitude of 1000–1500 m.

WYOMING: Rolling plains between Sheridan and Buffalo, 1900, *F. Tweedy, 3592.*

✓**Sedum frigidum** sp. nov.

Perennial with a fleshy rootstock, dioecious. Stems usually less than 1 dm. high, light green: leaves flat, 1–1.5 cm. long and 5–7 mm. wide, sessile, obovate or oblong-obovate, often dentate above the middle, or entire, acute: inflorescence dense, usually dark purple: flowers 4–5-merous, usually 5-merous: sepals of the staminate flowers lanceolate, acute, 1.5–2 mm. long, dark purple or rarely greenish: petals oblanceolate or oblong, acute, about 3 mm. long, dark purple or very rarely greenish tinged with purple: filaments filiform, purple, about one third longer than the petals, the pistillate similar but with somewhat shorter and more obtuse petals: follicles 3–5 mm. long, oblong, with a very short beak about .5 mm. long, divergent or at last recurved.

This species has gone under the name of *S. roseum* (L.) Scop., but is quite unlike the northern European plant, which must be regarded as the type of *Rhodiola rosea* L. This has a very short, almost tuberous rootstock, more oblanceolate leaves about 3 cm. long, usually with very sharp dentations, usually yellow petals, longer filaments almost twice as long as the petals and follicles, 6–8 mm. long. This form is also found in the mountains of southern Europe; but there seems to be another European plant; this is described and figured under the name *Rhodiola rosea* in the "Flora von Deutschland" published by Schlechtendal, Langethal and Schenk. It resembles more the Rocky Mountain plant in the purple, flowers and short stamens, but it has more inversely deltoid leaves, the fertile flowers have very minute petals or none and the follicles have long beaks. In all systematic botanies of Scandinavia and Russia, *S. roseum* is described as having yellow petals, which is never the case in the Rocky Mountain and Alaskan plants. In this respect plants from eastern North America agree with the European.

S. frigidum is an alpine-arctic plant growing in Colorado at an altitude of 3000 m. or more. In Montana it is found at an altitude of about 2700 m. and in Alaska at low altitudes. It grows among rocks, associating with several species of *Saxifraga* and *Adoxa Moschatellina*.

MONTANA: Old Hollow Top, 1897, *Rydberg & Bessey, 4248* (type); Long Baldy, 1896, *Flodman, 513;* Haystack Peak, 1899, *P. Koch.*

COLORADO: West Spanish Peak, 1900, *Rydberg & Vreeland, 6112* (♀); *6114* (♂) and *6115* (with greenish, merely purple-tinged flowers); Grayback Mining Camp, *6116;* Pikes Peak, 1900, *F. Clements;* 1821, *Dr. James;* Arapahoe Peak, 1891, *Dr. E. Penard;* Pikes Peak, 1894, *E. A. Bessey;* 1893, *De Alton Saunders.*

NEVADA: Mineral King, Sierra, Nevada, 1891, *Coville & Funston, 1529.*

IDAHO: Packsaddle Peak, 1892, *Sandberg, MacDougal & Heller, 860.*

WASHINGTON: Mt. Paddo, 1886, *W. H. Suksdorf, 859.*

ALASKA: Muniak Island, 1891, *Jas. M. Macoun, 48;* Shumagin, 1871–1872, *M. W. Harrington*; King Island, 1897, *E. A. McIlhenny, 83.*

✓ **Sedum polygamum** sp. nov.

Perennial with a thick fleshy rootstock. Stem 1–3 dm. high: leaves obovate or oblanceolate, acute, sessile, flat, entire or minutely denticulate, 1.5–2.5 cm. long: inflorescence dark purple, dense: flowers dioecio-polygamous: sepals of the staminate ones lanceolate, 2 mm. long, acute: petals oblanceolate, dark purple, about 3 mm. long: filaments about half longer than the petals, purple, broader than in the preceding species, abruptly acuminate above: fertile flowers with more lanceolate petals and usually with stamens which however have shorter filaments scarcely exceeding the petals: follicles 6–8 mm. long with an ascending or spreading beak, about 1 mm. long.

This species is closely related to the preceding, but is stouter, the fertile flowers usually with stamens, the follicles larger and with less divaricate beaks. It has also been included in *S. roseum*, but is really nearer related to *S. atropurpureum* of eastern Asia, which however has larger leaves. *S. polygamum* grows at an altitude of 3000 m. or more.

COLORADO: West Spanish Peak, *1900*, *Rydberg & Vreeland, 6113* (type); Silverton, 1895, *F. Tweedy 124;* Mt. Hesperus, 1898, *Baker, Earle & Tracy, 481;* Basin Creek, La Plata Mountains, *480;* Mt. Lincoln, 1873, *J. M. Coulter;* Chambers Lake, 1894, *C. S. Crandall.*

NEW MEXICO: White Mountains, 1897, *E. O. Wooton, 677.*

Structure and Nature of Tremella mycetophila Peck.

By Edward A. Burt

(With Plate 23)

During protracted wet weather in August, *Tremella mycetophila* Peck is occasionally found in northern New York and Vermont on the stems and pilei of *Collybia dryophila.* Its fructifications occur as distortions on the host plant and are conspicuous and characteristic, as shown in Fig. 1, which is a copy of the illustration given with the original description.* These distorting fructifications sometimes become an inch in diameter (Fig. 2) and are then thin-walled, hollow sacs, as shown in section in Fig. 3.

In the original description, the fructifications are stated to be tremelloid-fleshy, but this term seems to me to be applicable only to old specimens collected during rainy weather; under more normal conditions the fungus is simply fleshy. That the substance is fleshy rather than tremelloid or gelatinous is shown also by the dried specimens, which do not assume the appearance of dried gum or resin upon drying and do become soft and pliant much more readily upon being moistened than is the case with tremelloid species.

Several collections of *Tremella mycetophila* which have been made in recent years and an especially fine specimen contributed by Professor Peck last August, while we were at Floodwood, N. Y., and preserved in alcohol, have made it possible to supply the microscopical characters for this fungus and to give its generic location on the basis of this more complete knowledge of its nature.

Vertical sections of the fructifications show at the surface a hymenium consisting of basidia of the usual simple, cylindric type, $40 \times 5–7\ \mu$, each bearing at its outer end on short sterigmata four hyaline spores (Figs. 4, 5). These basidiospores are even, inequilateral or slightly curved, $5–7 \times 1\frac{1}{2}–2\frac{1}{2}\ \mu$ (Fig. 6); they are white when collected in quantity on a glass slip.

* Rep. N. Y. Mus. **28**: 53. *pl. 1. f. 4.* 1879.

The deeper tissue from which the basidia arise, consists of compactly arranged, sharply outlined, even-walled, cylindric hyphae and of innumerable minute conidial spores, which occupy the spaces between the hyphae (Fig. 7). The hyphae are usually 3–5 μ in diameter but with some slender branches (Fig. 8). Clamp connections are sometimes, but not usually, present at the septa.

The conidia are hyaline, even, about $2 \times 1\frac{1}{2} \mu$ (Fig. 9). They are present in abundance in the specimens which I have collected during eight seasons in the widely separated localities, East Galway and Floodwood, N. Y., and Ripton, Vt., but are most abundant in comparison with the basidiospores in the large fructification of Figs. 2 and 3; they are perhaps always produced by this species.

It has been difficult to make out the mode of origin of the conidia on account of their minute size and position between crowded hyphae. I have found, however, that if thin sections, cut free-hand, are stained in a saturated alcoholic solution of eosin and then mounted in water and potassium hydrate after washing away the superfluous eosin, the tissues of these sections will retain their intense red color for half an hour or longer and may be dissociated sufficiently for study by gentle pressure on the cover-glass. By the examination of such preparations with a $\frac{1}{12}$-in. objective, the conidia are seen to be formed in bead-like chains by the constriction of the smaller hyphal branches (Figs. 10, 11).

Reference is not often made to the production of a crop of conidia in addition to the basidiospores regularly produced by a toadstool, yet several instances are known in the Tremellaceae, Agaricaceae and Polyporaceae and they do occur occasionally in the Thelephoraceae, I find. They should not be regarded as entitling the present fungus to special generic rank.

The genus *Tremella* has basidia longitudinally and cruciately divided and subhymenial hyphae with the outer portion of the cell wall indistinct through gelatinous modification; the fructifications as a whole are also distinctly gelatinous and even tremulous in wet weather. The fungus under consideration can not therefore be a *Tremella;* in fact its structural characters are such that it should not be included in the Tremellaceae but in the Thelephoraceae, provided the distortions are not merely monstrous growths of *Collybia dryophila* itself—which I do not believe after microscopic comparisons with the lamellae of *C. dryophila.* I would transfer the fungus to the genus *Exobasidium*, with the original description of the species changed as follows:

EXOBASIDIUM MYCETOPHILUM (Peck) Burt

Tremella mycetophila Peck, Rep. N. Y. Mus. **28**: 53. *pl. 1. f. 4.* 1879.

Suborbicular, depressed, gyrose-plicate, fleshy, slightly pruinose, yellowish or pallid, .35–1 inch broad; basidia simple, cylindric, 4-spored: basidiospores simple, hyaline, even, inequilateral or slightly curved, 5–7 × 1.5–2.5 μ; conidia simple, hyaline, even, 2 × 1.5 μ, concatenate at the ends of slender subhymenial hyphae. (Plate 23.)

On stem and pileus of *Collybia dryophila*, August.

NEW YORK: Oneida, *Warne;* North Elbe, and Floodwood, *Peck;* East Galway and Floodwood, *Burt;* Syracuse, *Underwood;* New York, *Cushier.*

NEW HAMPSHIRE: Shelburne, *Farlow.*

VERMONT: Ripton, *Burt.*

MIDDLEBURY COLLEGE, MIDDLEBURY, VT.

Explanation of Plate

FIG. 1. Three fructifications of *Exobasidium mycetophilum* on *Collybia dryophila*, natural size (after Peck).

FIG. 2. A large fructification of *E. mycetophilum*, nat. size; and Fig. 3, a longitudinal section through the same and the stem, *s.* of *C. dryophila.*

FIGS. 4 and 5. Basidia bearing basidiospores, × 1140.

FIG. 6. Three basidiospores, × 1760.

FIG. 7. Part of a section, showing groups of conidia, *c*, between the hyphae of the deeper tissue of the fructification, × 500. Fig. 8. Portion of a hypha, showing slender branches.

FIG. 9. Conidia, a connected group of four at the left, × 1760.

FIG. 10. A conidium borne at the end of a slender hypha, × 1140.

FIG. 11. A chain of four conidia at the end of a slender hypha which lies between coarser hyphae, × 1760.

An undescribed Species of Paronychia from California

By Alice Eastwood

√ **Paronychia Franciscana** sp. nov.

Perennial from a woody tap-root, with the thread-like fibers numerous: stems wiry, slender, diffusely spreading, prostrate, forming mats often 4 dm. in diameter, branching about midway, glabrous, with internodes 2–15 mm. long, generally shorter than the leaves or even the stipules: lower part of stems simple with knotted nodes which are without leaves but generally with ragged, persistent stipules: leaves opposite, oblong-linear, 5–8 mm. long, 1–2 mm. wide; apex tipped with a callous point and a weak bristle, the latter about 1 mm. long; base tapering to a short petiole which is horny at its intersection with the stipules; surface more or less clothed with a stiff, scattered, upwardly spreading pubescence of short hairs papillate at base and forming cilia on the margins, veinless except for the midrib which is elevated on the lower side: stipules silvery scarious, thin, tapering to a weak filiform apex, ciliate-laciniate on the margin, 2–2.5 mm. wide at base, 5–6 mm. or more long, thickened at base and together with the hardened bases of the petioles forming a horny ring around the stem at the nodes: flowers few in the axils on very short pedicels which are 1 mm. or more in length: calyx 2 mm. long, green or purplish, with 5 somewhat unequal divisions; these connivent, oblong, veiny with a prominent midvein and a simple or branched one on each side; apex cucullate on the three narrower divisions, less so on the two broader, tipped with a spine .5–2 mm. long, rather densely hairy at summit, glabrous below except at the very base: stamens minute with short slender filaments and biglobular anthers: ovary orbicular, styles 2: fruit a utricle with thin membranous papillate coat, loosely investing the flat round brown seed which is attached and almost encircled by a ribbon-like funiculus having a central vein.

This species is common on grassy hillocks at the Presidio, San Francisco, from which there are specimens in the herbarium of the California Academy of Sciences, collected by Dr. E. L. Greene, Mrs. Brandegee, and Miss Evelina Cannon; also one from Bodega Port collected by the writer.

This species was identified with *Paronychia Chilensis* DC., by Dr. E. L. Greene, in West American Scientist, **3**: 156.

While engaged in identifying the plants collected by the author at Bodega Port, the error was discovered. On consulting the original description the Californian specimens were found to be dissimilar. An inspection of the herbarium disclosed two different species both marked *P. Chilensis* DC. and both from the Province of Aconcagua, Chili. Specimens were sent to the Gray Herbarium but they were unable to look into the matter though they kindly sent some scraps of the species collected by C. Gay, the author of a Flora of Chili. This only served to deepen the mystery, so specimens were sent to the Royal Herbarium at Kew.

The following note from Dr. Otto Stapf clears the whole matter. "Of the two Chilian specimens named *P. Chilensis*, the one having smaller flowers and submuticous sepals is the true *P. Chilensis* DC. It agrees very well with a specimen from Concepcion (the locus classicus of this species) in our herbarium and corresponds to the description in DC. Prodr. **3**: 370, with the exception that it is more pubescent.

"The other specimen which, in my opinion, is identical with the plant from San Francisco is *P. Chilensis, C. Gay, non DC.* Rohrbach pointed out Gay's mistake in Fl. Bras. **14**^{2}: 254; but he was wrong in referring it to *P. Brasiliana* DC., although it is certainly nearly allied to it. I am not aware of any distinct name for it. Lechler distributed it as *P. Chilensis* var. *setigera* Fenzl, but Fenzl does not seem to have published a description of it. I might perhaps mention that there is a *Herniaria setigera* Gill., which is a true *Paronychia*, and certainly distinct from *P. Chilensis* C. Gay."

Shrubs and Trees of the Southern States.—III.

By John K. Small

1. HITHERTO UNDESCRIBED SPECIES

Prunus Cuthbertii

A tree 6 m. tall and sometimes 1.5 dm. in diameter near the base, with tomentose twigs. Leaf-blades leathery, normally obovate, varying to oval or fiddle-shaped, 4–9 cm. long, blunt or notched at the apex, shallowy serrate, not markedly biglandular at the often cuneate base, dull green above, pale or glaucescent beneath, the midrib and petioles copiously tomentose and the lateral veins slightly so: racemes 5–8 cm. long, terminating short leafy branches, the rachis and pedicels pubescent like the twigs: pedicels clavate, 3–5 mm. long during anthesis, becoming 8–11 mm. long: sepals broader than long, obtuse, shorter than the hypanthium: petals suborbicular, about 2 mm. in diameter, crisped: drupes subglobose, mostly 8–9 mm. in diameter, red.

In rich woods, near Augusta, Georgia.

A relative of *Prunus serotina* differing in the decidedly obovate blunt leaf-blades and the tomentose glandless petioles and tomentose veins of the blades and the similarly pubescent racemes. The flowers are smaller and the very blunt sepals are much broader than the acute sepals of *P. serotina.* The fruit also furnishes a character in its decidedly red color. The original specimens were collected by Mr. A. Cuthbert in the vicinity of Augusta, Georgia, on July 17, 1898, and June 2, 1899. Type in the herbarium of the New York Botanical Garden.

Leucothoë platyphylla

A straggling shrub 0.5–1 m. tall, with spreading and drooping branches. Twigs and branches finely pubescent: leaf-blades suborbicular to oval, broadly oblong or oblong-ovate, 5–8 cm. long, abruptly pointed or slightly acuminate, serrate with very fine spinulose teeth, especially above the middle: petioles stout, 4–8 mm. long, pubescent: racemes 2–5 cm. long, the rachis pubescent like the twigs: pedicels 3–5 mm. long: calyx glabrous; longer sepals orbicular-ovate: corolla white, 6–8 mm. long: capsule 5.5 mm. broad, 4 mm. high.

In low thickets, Georgia to Alabama. Spring.

Leucothoë platyphylla differs from *L. axillaris* in its broader leaf-blades, orbicular larger sepals, smaller corollas and larger capsules.

The specimens on which the species is founded were collected by the writer near the Ochlockonee River about Thomasville, Georgia, in May and June, 1895. Type in the herbarium of Columbia University.

Hypericum splendens

An erect much branched shrub 0.5–1.5 meters tall, with 2-edged glaucous twigs. Leaves firm, numerous; blades oblong, 1.5–2.5 cm. long, obtuse or rounded at the apex, slightly revolute, glaucous, especially beneath, narrowed at the sessile base: buds conic: flowers very showy, several or many in terminal or axillary cymes: sepals unequal, oblong, firm, apiculate, the outer about 8 mm. long, the inner 5 mm. long: corollas 3.5–4 cm. broad: petals golden, cuneate, oblique, 1.5–2 cm. long: stamens very numerous, orange-colored: styles 3, slender: capsules often crowded, conic, 1.5 cm. high, acuminate at the apex, partially 3-celled, about thrice as long as the sepals with 3 narrow wings and 6 obtuse angles: seeds cylindric, 1.3 mm. long, longitudinally ribbed and transversely wrinkled, resembling ears of corn.

On granite slopes, Stone Mountain, Georgia. Summer.

This is perhaps the most showy North American *Hypericum* and is related to *H. aureum* from which it differs in the smaller firmer leaves, the more distinctly pedicelled flowers and the conic buds.

The original specimens were collected by the writer on Stone Mountain, Georgia, in July and August, 1893, and August 6, 1895. Type in the herbarium of Columbia University.

2. THE GENUS PTELEA IN THE SOUTHEASTERN UNITED STATES

PTELEA L.

The genus *Ptelea* differs from *Helietta*, its only close relative in North America, in its pubescent filaments, and in the fruit which is winged all around and does not separate into distinct carpels.

Key to the Species

Parts of the flower usually in 5's: leaflets relatively small.

Filaments slightly pubescent at the middle: petals glabrous within: Floridian.

1. *P. Baldwinii.*

Filaments pubescent throughout: petals pubescent within: Texano-Mexican. 2. *P. angustifolia.*

Parts of the flower usually in 4's: leaflets relatively large.

Samaras obovate.

Leaflets with sharply serrate blades: samaras 16–19 mm. long, acute at the base, the body merely glandular-dotted. 3. *P. serrata.*

Leaflets with entire or merely undulate blades: samaras 8–11 mm. long, or rarely longer, rounded or truncate at the base, the body pitted. 4. *P. microcarpa.*

Samaras suborbicular.

Leaflets with entire or merely crenulate blades, the terminal one much longer than broad, acute or slightly acuminate. 5. *P. trifoliata.*

Leaflets with crenate or crenate-lobed blades, the terminal one only slightly longer than broad, blunt.

Blades of the leaflets not lustrous: filaments nearly glabrous: anthers rounded or retuse at the apex. 6. *P. rhombifolia.*

Blades of the leaflets lustrous above: filaments densely pubescent below: anthers apiculate. 7. *P. Toxicodendron.*

1. PTELEA BALDWINII T. & G.

A shrub about 3 dm. tall, with irregularly branched stems. Leaflets 3; blades oval or ovate, 1–2 cm. long, obtuse at both ends, or the terminal one cuneate at the base, sessile, glabrous except the midrib and the ciliate margins when they are young: panicles few-flowered: flowers with the parts mostly in 5's: calyx 1.5 mm. broad: sepals oval, less than 1 mm. long, acutish, ascending: petals 4, oblong-oblanceolate, 4 mm. long, obtuse, undulate: stamens shorter than the petals: filaments stout, hairy at the middle.

In the vicinity of St. Johns, eastern Florida. Spring.

2. PTELEA ANGUSTIFOLIA Benth.

A little known species originally described from Mexico, with pubescent foliage, wholly pubescent filaments and pubescent petals, is said to occur in southern and western Texas.

3. **Ptelea serrata** sp. nov.

An irregularly branched shrub, 1–2 m. tall, with glabrous foliage. Leaflets 3; blades thinnish, oval, elliptic or elliptic-obovate, 2.5–7 cm. long, sharply acuminate, or rarely only acute, rather shallowly but sharply serrate, deep green above, very pale green beneath, the terminal one with a slender base: panicles few-flowered: samaras obovate, 16–19 mm. long, acute at the base, the wing rather delicate, the body glandular-dotted.

On granite slopes, Stone Mountain, Georgia. Spring.

Ptelea serrata is not closely related to any described species. It differs from the other species in the sharply acute or acuminate and sharply serrate blades of leaflets and the obovate samaras with their acute bases.

The specimens on which the species is founded were collected by the writer on Stone Mountain, Georgia on July 3, 1893. Type in the herbarium of Columbia University.

4. **Ptelea microcarpa** sp. nov.

A shrub 1.5–3 m. tall, with branching stems and glabrous foliage. Leaflets 3; blades firm, elliptic, oval or oblong-lanceolate, 4–10 cm. long, bluntly pointed or acutish, often slightly acuminate at both ends, entire or nearly undulate, slightly paler beneath than above, the terminal one not conspicuously narrowed at the base: panicle many-flowered: samaras suborbicular or orbicular-obovate, 8–11 mm. in diameter, or rarely larger, rounded or truncate at the base, the wings slightly crisped, the body pitted.

On limestone or granite ridges, Tennessee, Georgia and Alabama. Spring.

Ptelea microcarpa is most closely related to *P. serrata*, but differs in the firmer longer entire or merely undulate blades of the leaflets, and the samara with its pitted body, and the wing which is rounded or truncate at the base.

The original specimens were collected by officers of the Biltmore Herbarium (no. 4437^b), at Nashville, Tennessee, August 9, 1897. The type is in the herbarium of the New York Botanical Garden.

5. PTELEA TRIFOLIATA L.

An aromatic shrub or tree sometimes 8 m. tall, the foliage glabrous or sometimes densely pubescent. Leaflets 3; blades ovate, oval, elliptic, oblong, oblong-lanceolate or oblanceolate, 4–12 cm. long, acute or acuminate, entire or sometimes undulate or partially crenulate: panicles many-flowered: sepals ovate, 1.5 mm. long, obtuse: petals narrowly oblong, 4–5 mm. long: samaras suborbicular or oval-orbicular, 2–2.5 cm. long, rounded or notched at the base.

In rich soil and on river banks, Long Island to Ontario, Minnesota, Florida and Texas. Spring. The form with pubescent foliage is *Ptelea trifoliata mollis* M. A. Curtis and is most common in the Gulf States.

6. PTELEA RHOMBIFOLIA Heller

A shrub 2–2.5 m. tall, branching above, the foliage densely pubescent. Leaflets 3; blades rhombic-ovate to rhombic-orbicular, 2.5–5 cm. long, blunt, crenate, dull green above, the terminal one but little longer than broad: petals pubescent without, about 4 mm. long: filaments slightly pubescent near the base: samaras nearly orbicular, 1.5–2.5 cm. broad.

In open woods, southern Texas. Spring.

7. **Ptelea Toxicodendron** sp. nov.

A branching shrub 1–2 m. tall, with glabrous foliage. Leaflets 3; blades oval or rarely oval-ovate, 1.5–6 cm. long, rounded or blunt at the apex, crenate or somewhat crenate-lobed, dark green and lustrous above, slightly paler beneath: panicles few-flowered: petals about 5 mm. long, glabrous: filaments densely pubescent below: mature fruit not seen.

In gravelly soil, near Kerrville, Texas. Spring.

A species most closely related to *Ptelea rhombifolia*, but easily distinguished by its glabrous or nearly glabrous leaflets whose blades are lustrous above, the filaments which are densely pubescent below and the apiculate anthers.

The original specimens were collected by Mr. A. A. Heller at Kerrville, Texas, and distributed in his Plants of Southern Texas, under no. 1690. Type in the herbarium of Columbia University.

Further Notes on the Agrimonies

By B. L. Robinson

In the December issue of Rhodora I discussed the identity of our New England agrimonies. The chief points of the argument were: (1) That *Agrimonia Brittoniana* must be reduced to *A. striata* Michx.; (2) That the plant which has been passing as *A. striata* must receive another name; (3) That the one-word descriptions of Muhlenberg's Catalogue are insufficient for definite interpretation and therefore furnish no proper basis for nomenclature in this group. As all the conclusions of my brief article have since been called in question I see that I was at fault in not stating more fully the substantial data upon which they were founded, as my reasons will, I think, carry conviction to most persons who examine them carefully.

The correct names for the two species passing in the Illustrated Flora as *A. Brittoniana* and *A. striata* depend, of course, upon an accurate determination of *A. striata* Michx. The exact identity of this species is, fortunately and notwithstanding a recent statement to the contrary, quite evident from the original description, for the characters mentioned therein apply to but one of our species. Happily, the agrimonies, while possessing considerable habital similarity, exhibit some good characters in the fruit. This in *A. Brittoniana* is turbinate, conspicuously sulcate-striate, crowned at the summit by connivent hooked bristles, and in maturity strongly reflexed against the rachis. In the small-fruited species, however, which has been passing as *A. striata,* the fruit is hemispherical, suberect, spreading, as moderately deflexed and marked by such shallow broad furrows as to appear ribbed by the narrow intervening elevations rather than sulcate-striate by the depressions. In the plant which I have called *A. gryposepala* Wallr. (the *A. hirsuta* of the Illustrated Flora) as well as in the tomentose species of more southern range, the bristles even at an early stage spread widely, concealing to some extent the middle portion of the fruit and preventing it from lying close back against the rachis in a manner to suggest the term reflexed. Let us now turn to the original description of *A. striata* Michx. It is as follows: *A. spicis virgatis: fructibus reflexis, turbinatis, sulcato-striatis, apice tantum et quasi coronatim hispidis. Flores albidi. Hab. in Canada.*

To anyone who knows our agrimonies it will, I think, be quite clear which was meant. The turbinate form of the fruit at once cuts out the hemispherical-fruited species which has been passing as *A. striata,* as do also to some extent the words *sulcato-striatis,* since this trait must have been a pronounced feature in the Michauxian plant to have suggested the specific name. In *A. gryposepala* and the tomentose species the fruit is seldom if ever so strongly deflexed as to suggest the name *reflexis,* nor would it have been described as covered with bristles *only at the summit.** It is, therefore, clear that the description applies only to *A. Brittoniana* and that it fits this in all respects except as to *Flores albidi,* a very pardonable slip upon the part of Richard (no personalities intended), early corrected by Dr. Gray.

As I have stated in Rhodora the type of *A. striata* is in existence and well preserved. It is an exact match for Mr. Fernald's plant from St. Francis, Maine, which in its turn is the first mentioned type of *A. Brittoniana.* The Michauxian type is labeled *A. striata, Canada,* in the hand of Michaux, and it is against this specimen that Dr. Gray has written in his unmistakable hand *A. Eupatoria f. minor.* It is to be remembered, however, that this was done at a time when most of our American agrimonies were grouped together as *A. Eupatoria* and some decades before a keen-sighted investigator had pointed out after special study of much material both in the field and herbarium the characters which now clearly distinguish the plants in question. Such a determination, even by Dr. Gray, can scarcely have great weight when we consider that he was engaged in looking up hundreds of other matters and had never devoted special attention to the habitally similar species of *Agrimonia.* There is, however, another plant in the Michaux herbarium which, as it does not affect the identity of the type had, at least as to its locality, escaped my recollection until

*It is to be noticed that Michaux used the expression "*apice tantum et quasi coronatim hispidis*" in contradistinction to the "fructibus *divaricato-hispidis* of his *A. Eupatoria* which, although a mixture of *A. parviflora* Ait., and *A. incisa* Gray, shows clearly how Michaux would have described the very similar and also widely spreading bristles of *A. gryposepala.*

I recently looked up some herbarium notes made in Paris. It is a rather poor fragment representing the small-flowered species with thickened roots which has been passing as *A. striata.* It bears two labels. The first and apparently original one bears a curious mixture of Latin and French and reads *Agrimonia an species nova? Sitas fruits sont globulaires innominata,* while the other runs *Agrimonia striata Chicoutoumé Dodecand. 2-gynie, 11–2.* Not knowing at the time the location of the little Indian village Chicoutoumé (or as it is now written Chicoutimi) I did not recognize the geographical significance of this specimen and it soon passed out of mind in the pressure of other matters of interest, which naturally crowd upon an American botanist examining the herbarium of Michaux. Fortunately I preserved notes and a transcription of the labels. While this specimen may account for Dr. Gray's determination, which is, however, as I have stated, recorded against the other specimen, it cannot have formed any part of the type since Michaux himself had noted that the fruit was *globulaire,* nor are the fruits significantly striate or reflexed. The history of the specimen seems clear. Michaux having noted its globular fruit and probably its different foliage, regarded it at first as a new species. For some reason, however, probably from the fragmentary nature of the specimen, it was "lumped" with *A. striata* rather than characterized as a separate plant. But I feel sure that anyone who will read with attention the original description of *A. striata* will see that this second specimen with hemispherical or subglobular neither conspicuously striate nor markedly reflexed fruit can have had nothing to do with the characters given. Its locality, however, is highly interesting since, if there has been no confusion of labels, it extends the known range of the small-fruited species from southern Connecticut to the upper part of the Saguenay.

From the facts here stated there can surely be no doubt that *A. Brittoniana* should hereafter be called *A. striata* Michaux, a species intelligibly characterized by the original author and clearly shown by a well-preserved and unmistakable type, labeled in the hand of Michaux and bearing out in all details but the color of the petals the published description. This also appears to be the species which Ledebour characterized in 1823 as *A. pilosa.** At least, careful examination has failed as yet to reveal a single constant difference. The species passes across the continent to the northwest (although extending far southward along the Rocky Mountains), then continues through northern Asia to central Europe. It is, in fact, one of many circumboreal species which, although on each continent subject to some trifling variations, pass from one continent to the other without noteworthy change.

Regarding the first specific names of *A. mollis* and of the small-fruited plant which has been passing as *A. striata* I was misled (as my critic appears also to have been in his earlier work) by an insufficient study of Wallroth's treatment. From further examination I see the doubt as to the application of *A. microcarpa* and *A. platycarpa* and, as my sole purpose in this whole matter has been to carry species back no further than could be accomplished with definiteness, I am very ready to adopt for the plants in question the names *A. rostellata* Wallr. and *A. pubescens* Wallr. concerning the application of which there can, I think, be no serious doubt.

As to the names *A. hirsuta*, *A. glabra*, and *A. pumila*, founded upon brief references in Muhlenberg's Catalogue, I must repeat my earlier view that they are *nomina subnuda*, and should give way to later names, the application of which can be established with greater certainty. While it is quite possible to advance ingenious and plausible hypotheses regarding Muhlenberg's agrimonies, they are after all only conjectures, and what is worse can never be anything more. For instance, all our species of agrimony, not even excepting the tomentose ones, are apt to be covered on the older stems by the thickened and indurated bases of the longer hairs, which thus render the stems decidedly scabrous to the touch. Under these circumstances the one-word description "rough-haired" will not possess for most persons working in the interests of "sound botany" that "exact sufficiency and beautiful adequacy" which has been ascribed to it.

The distinction between a described species and an undescribed one should not, it is true, be stated very dogmatically. The ele-

* It has been recently stated that this name is antedated by the specific combination *A. Dahurica*. This, I believe, is not the case although the varietal designation in the form *daurica* was employed a year or so earlier than Ledebour's name. The point, however, is not significant.

ment of judgment, that *bête noire* in matters nomenclatorial, cannot here be entirely excluded. But judgment will pretty generally require that a characterization of a species, to be valid, must state at least several features of the plant described, for such a combination diminishes in an almost geometric ratio, to the number of characteristics mentioned, the chance that a given description will apply to more than one plant. To permit the mere vernacular translation of a specific name to count as an adequate characterization is to remove all real distinction between *nomina nuda* on the one hand and described names on the other. "*Agrimonia pumila*" tells quite as much as "*Agrimonia pumila*,—little." To maintain that the former is unworthy of notice, and the latter is adequately described, is to make an arbitrary distinction based in no way upon the sufficiency of the information given.

The argument that *Agrimonia Eupatoria hirsuta* of Muhlenberg must have been the species later taken up as *A. hirsuta*, since otherwise Muhlenberg could not have known our commonest agrimony, seems to me to be a kind of reasoning very likely to lead to error. Experience has shown that the type of a species, when looked up, is often quite different from the plant suggested by a brief description, and the unexpected is constantly happening in such matters. The early tropical explorers, for instance, overlooked many plants which later investigation has shown extremely abundant in the regions they traversed, and on the other hand, they secured many plants of such rarity that it has taken years of patient search to rediscover them. To me it would seem quite possible that Muhlenberg was describing as "rough-haired" merely one of the most pubescent states of the plant which has been passing as *A. striata*, while his var. *glabra* may well, as suggested, have been the smoother although never really glabrous form of the same plant, for this species varies in pubescence and at times becomes distinctly scabrous without change of the fruit characters. When we see that such an acute observer and wide traveler as Michaux never recognized the plant which has been passing as *A. hirsuta*, I can see no convincing proof that Muhlenberg must have done so.

As the precedence of the earlier varietal name has been mentioned in connection with this genus, it is worth while here to ex-least, careful examination has failed as yet to reveal a single constant difference. The species passes across the continent to the northwest (although extending far southward along the Rocky Mountains), then continues through northern Asia to central Europe. It is, in fact, one of many circumboreal species which, although on each continent subject to some trifling variations, pass from one continent to the other without noteworthy change.

Regarding the first specific names of *A. mollis* and of the small-fruited plant which has been passing as *A. striata* I was misled (as my critic appears also to have been in his earlier work) by an insufficient study of Wallroth's treatment. From further examination I see the doubt as to the application of *A. microcarpa* and *A. platycarpa* and, as my sole purpose in this whole matter has been to carry species back no further than could be accomplished with definiteness, I am very ready to adopt for the plants in question the names *A. rostellata* Wallr. and *A. pubescens* Wallr. concerning the application of which there can, I think, be no serious doubt.

As to the names *A. hirsuta*, *A. glabra*, and *A. pumila*, founded upon brief references in Muhlenberg's Catalogue, I must repeat my earlier view that they are *nomina subnuda*, and should give way to later names, the application of which can be established with greater certainty. While it is quite possible to advance ingenious and plausible hypotheses regarding Muhlenberg's agrimonies, they are after all only conjectures, and what is worse can never be anything more. For instance, all our species of agrimony, not even excepting the tomentose ones, are apt to be covered on the older stems by the thickened and indurated bases of the longer hairs, which thus render the stems decidedly scabrous to the touch. Under these circumstances the one-word description "rough-haired" will not possess for most persons working in the interests of "sound botany" that "exact sufficiency and beautiful adequacy" which has been ascribed to it.

The distinction between a described species and an undescribed one should not, it is true, be stated very dogmatically. The ele-

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* It has been recently stated that this name is antedated by the specific combination *A. Dahurica*. This, I believe, is not the case although the varietal designation in the form *daurica* was employed a year or so earlier than Ledebour's name. The point, however, is not significant.

ment of judgment, that *bête noire* in matters nomenclatorial, cannot here be entirely excluded. But judgment will pretty generally require that a characterization of a species, to be valid, must state at least several features of the plant described, for such a combination diminishes in an almost geometric ratio, to the number of characteristics mentioned, the chance that a given description will apply to more than one plant. To permit the mere vernacular translation of a specific name to count as an adequate characterization is to remove all real distinction between *nomina nuda* on the one hand and described names on the other. "*Agrimonia pumila*" tells quite as much as "*Agrimonia pumila*,—little." To maintain that the former is unworthy of notice, and the latter is adequately described, is to make an arbitrary distinction based in no way upon the sufficiency of the information given.

The argument that *Agrimonia Eupatoria hirsuta* of Muhlenberg must have been the species later taken up as *A. hirsuta*, since otherwise Muhlenberg could not have known our commonest agrimony, seems to me to be a kind of reasoning very likely to lead to error. Experience has shown that the type of a species, when looked up, is often quite different from the plant suggested by a brief description, and the unexpected is constantly happening in such matters. The early tropical explorers, for instance, overlooked many plants which later investigation has shown extremely abundant in the regions they traversed, and on the other hand, they secured many plants of such rarity that it has taken years of patient search to rediscover them. To me it would seem quite possible that Muhlenberg was describing as "rough-haired" merely one of the most pubescent states of the plant which has been passing as *A. striata*, while his var. *glabra* may well, as suggested, have been the smoother although never really glabrous form of the same plant, for this species varies in pubescence and at times becomes distinctly scabrous without change of the fruit characters. When we see that such an acute observer and wide traveler as Michaux never recognized the plant which has been passing as *A. hirsuta*, I can see no convincing proof that Muhlenberg must have done so.

As the precedence of the earlier varietal name has been mentioned in connection with this genus, it is worth while here to examine more carefully the factors which enter into an ultimate settlement of that matter. Our nomenclature includes three very important classes of names, generic, specific, and varietal.* The first two have without objection or serious inconvenience been maintained as independent groups of names. A similar treatment of the second and third groups, which stand to each other in a somewhat similar relation, will I am confident, greatly simplify the whole problem of botanical nomenclature. There are several reasons for this. In the first place each category is already so large that the problem of determining the validity of a particular name in one would obviously be much simplified by excluding from competition the names in the other. In the second place varietal names have from the earliest times been used with greater laxity and diversity of method, not to say carelessness, than have specific names. This, however, is by no means all, the variety has been given, in general, only a very brief and *comparative* description, which is often intelligible only on the assumption that the plant in question is really a variety of the species to which it is attached. Varietal names as well as varietal descriptions are in many instances comparative and when separated from their original species may become not only ludicrously inapplicable to independent species but positively misleading when so applied. Precedence of the earlier varietal name may, perhaps, be a desirable principle in systematic zoölogy. But the chief difficulty in admitting the varietal name into full competition with the specific in botany is one which is likely from lack of parallel to be underrated by our zoölogical colleagues, namely the difficulty arising from the vast array of unclassified, unindexed, and ill-described horticultural varieties. To say that these are not botanical is quite idle. No one can possibly place a limit between botanical and horticultural varieties nor between botanical and horticultural descriptions. Already a tendency has in some quarters been manifested to change valid botanical names owing to the existence of purely horticultural homonyms. Why should we adopt rules which will so greatly increase the difficulty of the already intricate problem of nomenclature?

GRAY HERBARIUM.

* The categories of subspecies, variety, subvariety, and form are so closely connected that they may as to nomenclature practically pass as one since they have been used more or less interchangeably and have not been very successfully differentiated.

An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885-1886, XXXI.

By H. H. Rusby

(Continued from Bull. Torr. Club, **27** : 137. 24 Mr. 1900.)

Euphorbia pilulifera L. Pl. Sp. 454. Yungas, 4000 ft., 1885 (no. 1945). Also seen at Guanai, where the Indians are said to use it as an instillation to diseased eyes.

Euphorbia thymifolia L. Sp. Pl. 454. Falls of Madeira, Brazil, Oct. 1886 (no. 894).

Euphorbia cymbiformis Rusby, Mem. Torr. Club, **4**: 255. Yungas, 4000 ft., 1885 (no. 895).

Phyllanthus orbiculatus L. C. Rich. Act. Soc. Hist. Nat. Par. 113. 1792. Falls of Madeira, Brazil, Oct. 1886 (no. 903).

Hevea Spruceana Muell. Arg. Linnaea, **34**: 204? 1865–66. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 885) The principal rubber-yielding tree of the Beni district.

Jatropha Curcas L. Sp. Pl. 006. Reis, 1500 ft., June, 1886 (no. 889). The plant is used to form hedges and the seeds are used as a purge, under the name "Piñon."

Croton chamaedryfolius Griseb. Fl. Brit. W. Ind. 41. Mapiri, 5000 ft., Apr. 1886 (no. 901), and Falls of Madeira, Brazil, Oct. 1886 (no. 902). The same as Holton's no. 849.

Croton micans argyrophyllus Linnaea, **34** : 96. 1865–66. Unduavi, 8000 ft., Oct. 1885 (no. 2623).

Croton Rusbyi Britton, Mem. Torr. Club, **6**: 119. Mapiri, 2500 ft., May 1886 (no. 1224). No. 1223 is probably the same ; my specimen is very poor.

Croton Spruceanus Benth. in Hook. Kew. Journ. **6**: 375. 1854. Falls of Madeira, Brazil, Oct. 1886 (no. 2622). A small tree of some 15 ft., growing on the bank of a stream.

Croton Urncurana Baill. Adansonia, **4**: 335. 1863–64. Mapiri, 2500 ft., May 1886 (no. 1197). Yungas, 4000 ft., 1885 (no. 1236b), and Unduavi, 8000 ft., Oct. 1885 (no. 900).

Manihot utilissima Pohl. Pl. Bras. Ic. **1**: 32. *pl. 24.* Cult. at Mapiri, 2500 ft., May 1886 (no. 887).

Manihot Aipi Pohl. *l. c.* 29. *pl. 23.* Cult. at Mapiri, 5000 ft. Apr. 1886 (no. 886).

Manihot Rusybi Britton sp. nov.

Inflorescence gray-tomentellate, the leaves puberulent on the veins underneath : stems slender, terete, pale : petioles 4–7 cm. long, stoutish, rigid: blades varying from entire, broadly ovate, 3-ribbed, to deeply 3-lobed or nearly 3-foliolate, the lobes ovate, acuminate and acute, .7–1 dm. long, 3–5 cm. broad, entire, thin, pale: racemes several, terminal, 3 or 4 cm. long, short-peduncled: pedicels 1 or 2 mm. long, stout: buds pyriform. Staminate flowers only seen : perianth 1 cm. long, open-campanulate, lobed about half way, the lobes ovate, obtuse, purple with yellowish summits; longer filaments about equalling the corolla, coiled, the shorter about half as long : anthers linear, nearly 3 mm. long: disk fleshy, yellowish, deeply 10-lobed or of 10 almost distinct incurved narrow rib-like glands: pistil not perceptible.

Falls of Madeira, Oct. 1896 (no. 888). "Perhaps the same as Mathews no. 1022 from Peru" [N. L. B.].

Acalypha hibiscifolia Britton, Mem. Torr. Club, **4**: 257. Yungas, 6000 ft., 1885 (no. 1275).

Acalypha communis Muell. Arg. Linnaea, **34**: 23. 1865–66, *fide* Britton, Unduavi, 8000 ft., Oct. 1885 (no. 1265) and Yungas, 6000 ft., 1885 (no. 1267).

Acalypha mollis H.B.K. Nov. Gen. et Sp. **2**: 94, *fide* Britton. Sorata, 8000 ft., Feb. 1886 (no. 1257). Another collection from the same locality, and unfortunately bearing the same number, is probably a large-leaved form of the same.

Acalypha scandens Benth. Hook. Kew Journ. **6**: 329. 1854. Falls of Madeira, Brazil, Oct. 1886 (no. 1258). The same as Spruce's no. 1000.

Acalypha sidaefolia Muell. Arg. Linnaea, **34**: 11. 1865–66. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (nos. 1263 and 1266) and Yungas, 6000 ft., 1885 (no. 1262 and perhaps no. 1276).

Acalypha capillaris Rusby, Mem. Torr. Club, **4**: 257. Mapiri, 5000 ft., Apr. 1886 (no. 1259).

Acalypha cuspidata Jacq. Hort. Schoenb. **2**: 53. *pl. 243.* Falls of Madeira, Brazil, Oct. 1886 (no. 1274. 1273 from Yungas, 6000 ft. is regarded by Dr. Britton as of this species also).

Acalypha macrostachya Jacq. Hort. Schoenb. 2 : 63. *pl. 245.* Unduavi, 8000 ft., Oct. 1885 (no. 1268. 1269, from Mapiri, 2500 ft., May 1886, may be a form of this, but my specimen is fragmentary).

Acalypha villosa Jacq. Enum. Pl. Carib. 32, *fide* Britton. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1271) and Falls of Madeira, Brazil, Oct. 1886 (no. 1272).

Acalypha callosa Benth. Pl. Hartw. 252, var., *fide* Britton. Unduavi, 8000 ft., Oct. 1885 (no. 1270).

Acalypha Brittoni sp. nov.

Branchlets, petioles, and principal veins of the lower leaf-surfaces gray-puberulent ; branches slender, elongated, terete, striate, reddish : stipules 5 or 6 mm. long, linear-attenuate, reddish : petioles 5 or 6 cm. long, very slender : blades .75–1.25 dm. long, 4–6.5 cm. broad, ovate, lightly cordate at the base, abruptly contracted into an attenuate acumination at the apex, sharply serrate, very thin, the venation lightly prominent on both sides, the secondaries about 6 pairs, strongly ascending, connected by numerous straightish tertiaries : pistillate spikes only seen, the peduncles terminal, solitary, 2 or 3 cm. long, sharply angled, the spike 5–7 cm. long, 2.5 cm. broad, densely flowered, obtuse : bracts nearly 1.5 cm. long, two thirds as broad, 5-parted nearly to the base, the segments lanceolate, attenuate, the middle much the largest, the outermost a little shorter than the intermediate : ovary blackish, tuberculate, globose-oval, lightly lobed, the styles very stout, much broader upward, long-pinnatifid.

Mapiri, 5000 ft., May 1886 (no. 1260).

Acalypha inaequalis sp. nov.

Leaves gray and somewhat scurfy underneath : branchlets numerous, slender, flexuous, purple : stipules 3–5 mm. long, tapering regularly from the base to the acute point, thickish, rigid, keeled : petioles .5–1 cm. long, stout, strongly channeled above : blades 3–8 cm. long, 1–2.5 cm. broad, lanceolate, blunt at the base, acuminate and obtusish at the apex, finely serrate, thickish, pale green, the venation prominent underneath, the secondaries about 8 pairs, stout, strongly ascending or suberect, connected by the straightish tertiaries : spikes (staminate only seen) sessile, 3–7 cm. long, 1.5 mm. thick, pendulous, densely flowered, gray: flowers 1 mm. broad.

Yungas, 6000 ft., 1885 (no. 1947).

Acalypha Benensis Britton sp. nov.

Densely gray-tomentose, the upper leaf-surfaces strigose: branchlets stoutish, flexuous, very leafy: stipules 2 mm. long, linear or almost setiform: petioles 1.5–2 cm. long, stout: blades .5–1 dm. long, 2.5–4 cm. broad, lance-ovate, rounded at the base, acuminate and very acute at the apex, finely serrate, entire toward the base, thickish; venation lightly prominent both sides, the 10 or 12 pairs of secondaries strongly ascending, connected by the straightish tertiaries: staminate spikes sessile, 4 or 5 cm. long, 3 mm. thick, gray, densely flowered: pistillate spike (but one seen) 1.25 dm. long, nearly 1 cm. broad, densely flowered: scales of the pistillate flowers strongly veined, densely pilose, 5–7 mm. broad, 4 mm. long, inclusive of the (about 10) slenderly subulate teeth, which are about 1.5 mm. long and separated by broad rounded sinuses: ovary strongly pilose, depressed-globose, deeply 3-lobed, about 2 mm. broad.

Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1264). "Near *A. Tarapotensis* Muell. Arg." [N. L. B.].

Acalypha grandispicata Britton sp. nov.

Petioles, peduncles and youngest parts of the branchlets grayish-puberulent: stipules about 5 mm. long, 1 mm. broad, tapering regularly from the base to the acute apex, brown, membranaceous, lightly keeled: petioles 2–6 cm. long, stout but weak, coarsely angled: blades 2–3 dm. long, .6–1 dm. broad, oblong, acute at the base, abruptly acuminate and acute at the apex, finely short-serrate, very thin, glabrate, the secondaries 14–16 pairs, strongly ascending, connected by the tertiaries: only one (pistillate) spike seen, the peduncle 4 cm. long, stout, the spike more than 2 dm. long, 2.5 cm. broad, rather densely flowered: scales more than 1 cm. long, their breadth greater, strongly concave, deeply cleft into about 11 lanceolate acuminate segments, the middle longest, the outer regularly smaller: ovary depressed-globose, minutely tuberculate, lightly lobed, the styles short and broad.

Mapiri, 5000 ft., Apr. 1886 (no. 1261).

Acalypha Lechleri Britton sp. nov.

Youngest portions and inflorescence finely gray-tomentellate; stems stout, costate: stipules about 5 mm. long, the basal portion broadly ovate, keeled, rather abruptly contracted into a linear attenuate termination, petioles .25–1 dm. long, rather weak, channeled above, striate underneath : blades 1.5–3 dm. long, 6–8 cm. broad, oblong or oval, blunt or rounded at the base, very abruptly short-pointed at the apex, finely or obtusely serrate-dentate, thin, bright green, the venation prominent underneath, the secondaries about 12 pairs, strongly incurved, mostly connecting at the margin and connected by the numerous crooked tertiaries : dioecious, the staminate spikes from the upper axils, .8–1.25 dm. long, 3 mm. thick, sessile, densely flowered, gray.

Unduavi, 8000 ft., Oct. 1885 (nos. 1420 and 2610).

Dr. Britton says "The same as Lechler's no. 2408, the pistillate spike terminal, 1 dm. long, 6 mm. broad." This agrees with Mr. Bang's specimens of the pistillate plant (no. 2610), in which the pistillate spike is gray and densely flowered; scales thick, 5 mm. broad when flattened, completely enclosing the ovary, about 1 mm. long, exclusive of the (about 14) linear acuminate acute teeth, the central 3 mm. long, gradually shorter toward the edges, the outermost 1 mm. long; sepals thick, broadly ovate, about 1 mm. long; ovary 1 mm. long, densely pilose; style and stigma blood-red, 2 mm. long, 1 mm. broad, thickish, strongly pinnatifid.

Acalypha erosa sp. nov.

Leaf-surfaces minutely papillose, inflorescence pubescent : branchlets elongated, slender, irregularly striate : stipules 3 or 4 cm. long, lance-ovate, acuminate and acute, brown : petioles 1–2 cm. long, stoutish : blades 1–2 dm. long, 5–7 cm. broad, oblong to obovate, narrow but slightly cordate at the base, abruptly short-pointed but obtuse at the apex, very coarsely and irregularly dentate, thin, the midrib and 14–16 pairs of lightly upcurved slender secondaries prominent on the lower side, the venation lightly reticulate : only young staminate spikes seen, the largest 7 cm. long, 3 mm. thick.

Guanai, 2000 ft., May 1886 (no. 1757).

Alchornea latifolia Sw. Prod. Veg. Ind. Occ. 98, *fide* Britton, Mapiri, 2500 ft., May 1886 (no. 2656).

Alchornea Pearcei Britton sp. nov.

Leaves minutely downy on the lower surfaces, pilose in the axils of the midrib : branches elongated, densely leafy : petioles 1–2 cm. long, very stout : blades 1–1.5 dm. long, 4–6 cm. broad, oblanceolate or obovate, rounded at the narrow base, very short-pointed and very obtuse, distantly and coarsely serrate, very thick, 3-ribbed, the venation lightly prominent above, very prominent underneath, the stout secondaries about 4 pairs, the venation very finely reticulate: raceme (but one seen) 2 dm. long, very slender, pendulous, very loosely flowered: flowers purple, scarcely 1 mm. broad.

Mapiri, 5000 ft., Apr. 1886 (no. 1975). "Collected by Pearce at Maro, 3000–4000 ft., 1886. Male inflorescence branched, female simple. Styles 2, 1 mm. long, ovary and young fruit with minute stellate hairs" [N. L. B.].

Conceveiba Guianensis Aubl. Pl. Gui. **2**: 924. *pl. 353*. Mapiri, 2500 ft., May 1886 (no. 2656).

Conceveiba pubescens Britton sp. nov.

Staminate plant:—Branchlets, lower leaf-surfaces, etc., stellate-pubescent, the younger portions ferruginous: branchlets stout, purple, very leafy: petioles 2–4 cm. long, very stout, dilated at the insertion, striate, reticulate, deep-purple: blades 1.5–2 dm. long, .75–1 dm. broad, ovate, rounded to subcordate at the base, abruptly and obtusely short-pointed, coarsely sinuate-serrate, extremely thick and rigid, smooth above with the midrib and secondaries impressed, the venation strongly and sharply prominent underneath, the secondaries about 6 pairs, strongly ascending and connecting near the margin, the lowest pair much stronger, the straightish tertiaries connecting the secondaries: panicles solitary in the axils, short-peduncled, subulate-bracted at the base, the peduncle and rachis sharply angled, nearly 1 dm. long, the branches few and short, the flowers closely aggregated on the very short branchlets; buds globose, about 1 mm. broad.

Pistillate plant (if Mr. Bang's no. 2375 is the same): leave-much thinner, the pubescence nearly obsolete, the lowest seconds aries much longer: spikes almost simple, very slender, very loosely flowered: the flowers sessile and solitary (rarely geminate) at the nodes: calyx parted nearly to the base, the lobes oblong-ovate, obtuse, 1.5 mm. long: ovary 2.5 mm. long, densely white-pilose, ovoid: styles barely connate at the base, 4 or 5 mm. long, strongly flattened, oblong, blunt, purple at the tip, thick and fleshy.

Yungas, 4000 ft., 1885 (no. 2655, as to the staminate plant). Same locality, Aug. 6, 1894 (Bang, no. 2375, as to the pistillate plant). Mr. Bang says, "A shrub 10 to 15 ft. high, with green flowers, in wet forest-mould."

Cleidion tricoccum Baill. Adansonia, **4**: 370. 1863–64. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 2652).

Tragia Fendleri Muell. Arg. Linnaea, **34**: 179. 1865–66. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1863).

TRAGIA SELLOWIANA **glabrifolia** Britton var. nov.

Differs from the type chiefly in its subglabrous, larger leaves, Reis, 1500 ft., June 1886 (no. 1285).

Tragia volubilis L. Sp. 980. Guanai, 2000 ft., May 1886, (no. 2595). The same as Mandon's no. 1069.

Dalechampia Burchellii Muell. Arg. Mart. Fl. Bras. **11**^{2}: 649, *fide* Britton. Reis, 1500 ft., June 1886 (no. 2088. No. 2162 from Falls of Madeira appears to me identical).

Dalechampia scandens L. Syst. ed. XIII, 720. Guanai, 2000 ft., May 1886 (no. 1347).

Dalechampia triphylla Lam. Encyc. **2**: 258. Guanai, 2000 ft., May 1886 (no. 1215).

Mabea fistulifera Mart. Reise Bras. 479. Guanai, 2000 ft., May 1886 (no. 1178).

Mabea angustifolia longifolia Britton, Mem. Torr. Club, **4**: 258. Mapiri, 2500 ft., May 1886 (no. 1177).

Mabea paniculata Spruce ex Benth.; Hook. Kew Journ. **6**: 367. 1854. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 2711), and Falls of Madeira, Brazil, Oct. 1886 (no. 2609).

Omphalea diandra L. Syst. ed. X., 1264. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1251).

Maprounea Guianensis Aubl. Pl. Gui. **2**: 893. *pl. 342.* Yungas, 4000 ft., 1885 (no. 1176).

Sapium biglandulosum Muell. Arg. Linnaea, **32**: 116. 1863. Falls of Madeira, Brazil, Oct. 1886 (nos. 1238 and 1239).

Sapium rhombifolium sp. nov.

Glabrous: branches elongated, erect or strongly ascending, slender, flexuous, the internodes about 1–2 cm. long: petioles .5–1 cm. long, purple: blades .5–1 dm. long, 2.5–4 cm. broad, rhomboidally ovate, acute at the base, abruptly short-acuminate and obtuse at the apex, thickish, pale green, shining above, the venation sharply prominent on both sides, the secondaries about 10 pairs, slender, diverging at an angle of about 45°, the veins coarsely and irregularly reticulate: spikes simple, recurved, .5–1 dm. long, 2 or 3 mm. broad, the rachis thickish, rather loosely flowered: staminate flowers bright yellow, 1 mm. broad: pistillate flowers solitary near the base of the spike, very stoutly peduncled, the greenish perigone 3-lobed, the lobes thin, broadly ovate, erose, the stigmas very large and thick, fleshy, tapering, strongly circinately recurved.

Falls of Madeira, Oct. 1886 (no. 1824).

Pera distichophylla (Mart.) Baill. Etud. Gen. Euph. 434 (*Spixia distichophylla* Mart. Herb. Fl. Bras. 270). Falls of Madeira, Brazil, Oct. 1886 (no. 2597).

Pera sp. near *P. oppositifolia?* Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 2646).

Pera sp.? Guanai, 2000 ft., May 1886 (no. 1247). I have little doubt of the genus, though the specimen exhibits neither flower nor fruit.

No. 2633, from Falls of Madeira, Brazil, Oct. 1886, is a Euphorbiaceous plant in fruit, which Dr. Britton regards as an *Alchornea*. No. 713, from Junc. of Rivers Beni and Madre de Dios, is the same.

URTICACEAE

Celtis morifolia Planch. in Ann. Sci. Nat. III. **10**: 311. 1848. Yungas, 6000 ft., 1885 (no. 1755). The same as Bang's no. 1902 and (*fide* Britton) Matthew's no. 826.

Celtis Iguaneus (Jacq.) Sarg. Silva, **7**: 64, ex Rusby Ms. Yungas, 6000 ft., 1885 (no. 1286). The same as Bang's no. 1539.

Trema micrantha (L.) Blume Mus. Bot. Lugd. Bat. **2**: 58 (*Rhamnus micrantha* L. Syst. ed. X. 937). Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1474). The same as Bang's no. 2065.

Trema affinis Blume l. c. Yungas, 6000 ft., 1885 (no. 1473).

Chlorophora tinctoria (L.) Gaud. Freyc. Voy. Bot. 108, in note (*Morus tinctoria* L. Sp. 986). Beni River, July 1886 (no. 1284).

Ficus Mathewsii Miq. Ann. Mus. Bot. Lugd. Bat. **3**: 298 (*Urostigma Mathewsii* Miq.; Hook. Lond. Journ. Bot. **6**: (1847) 549). Mapiri, 5000 ft., Apr. 1886 (no. 2496). The same as Mathew's 2059 and Traill's no. 715 from the Amazon.

Pharmacosycea Brittoni sp. nov.

Glabrous, or the petioles and midribs minutely puberulent: branchlets very stout, but weak, coarsely angled, somewhat verrucose: petioles 5 cm. or more long, slender for the size of the leaf, channelled above: blades 1–2.5 dm. long, .75–1 dm. broad, obovate, rounded at the base, very abruptly short-pointed and obtuse at the apex, entire, the venation inconspicuous above, prominent underneath, the secondaries about 18 or 20 pairs with intermediate lesser ones, at an angle of about 75° with the midrib, interarching near the midrib: fruit globose, 2 cm. long, the persistent thin margin reflexed, sinuately lobed: akenes on filiform upwardly thickened pedicels, oval or obovoid with a broad apex, 1.5 mm. long, 1 mm. broad.

Guanai, 2000 ft., May 1887 (no. 2640).

Sorocea muriculata Miq. in Mart. Fl. Bras. **4**[1]: 113. Junc. of Rivers Beni and Madre de Dios, Aug. 1886 (no. 2217), and Falls of Madeira, Brazil, Oct. 1886 (no. 2578). A widely branching shrub, 6–10 ft. in height.

Cecropia sp. The specimen is not fit for a diagnosis.

Urtica purpurascens Nutt. Trans. Am. Phil. Soc. **5**: 169. 1837. Unduavi, 8000 ft., Oct. 1885 (no. 2561).

Urtica Magellanica Juss. ex Poir. Encyc. Suppl. **4**: 223. Vic. La Paz, 10,000 ft., Apr. 1885 (no. 1254).

Urtica ballotifolia Wedd. Ann. Sci. Nat. III. **18**: 197. 1852. Unduavi, 8000 ft., Oct. 1885 (no. 1256).

Urtica flabellata H.B.K. Nov. Gen. et Sp. **2**: 40. Yungas, 4000 ft., 1885 (no. 1255).

Urera Caracasana (Jacq.) Griseb. Fl. Brit. W. Ind. 154 (*Urtica Caracasana* Jacq. Hort. Schoenb. **3**: 71. *pl. 386*). Yungas, 4000 ft., 1885 (no. 1464); Guanai, 2000 ft., May 1886 (no. 1468) and Beni River, July and Aug. 1886 (nos. 1465, 1466 and 1472).

Urera baccifera (L.) Gaud. Frecy. Voy. Bot. 497. Mapiri, 2500 ft., May 1886 (no. 1467). As large as a small apple tree, the trunk and branches thickly beset with brittle, stinging red and white prickles several inches in length and very slender.

Urera sinuata Wedd, Ann. Sci. Nat. III, **18**: 201. Yungas, 6000 ft., 1885 (no. 1470).

Urera rugosa sp. nov.

Hispidity confined chiefly to the inflorescence : branchlets stout, soft and weak, light brown : stipules about 7 mm. long, 4 mm. broad, the body broadly ovate, with an attenuate acumination : petioles 2.5–4 cm. long, very stout, weak ; blades 1–1.5 dm. long, 6–8 cm. broad, ovate or oval, rounded at the base, perfect apex not seen, coarsely short-dentate, the teeth obscurely apiculate : leaf very thin, dark green above, bright green underneath, subtrinerved, the venation inconspicuous above, prominent underneath, the midrib and six to eight pairs of strongly ascending secondaries dark purple, coarse, broad, nerved, connected by the straightish tertiaries : panicles 1 dm. or more long, densely branched, drooping, the rachis thick and fleshy, sparsely white-hispid : berries nearly globose, 4 mm. long, tipped with the short and very stout yellowish style.

Unduavi, 8000 ft., Oct. 1885 (no. 1471).

Urera filiformis sp. nov.

Leaf-surfaces and inflorescence minutely grayish-puberulent : branchlets stout, purple, terete : stipules 7–9 mm. long, purple, ovate, long-acuminate, keeled : only the younger leaves seen, the petioles 1 cm. long, broad, the blades 6–9 cm. long, 2.5–3 cm. broad, oblong-ovate, rounded at the base, acute, sharply serrate-dentate, thin, 3-nerved, the venation lightly prominent underneath, the secondaries about 10 pairs, the venation coarsely reticulate : panicles numerous, about 1 dm. long, consisting of few elongated, filiform branches along which the very small flower-clusters are rather densely disposed.

Yungas, 6000 ft., 1885 (no. 1469). This seems to be the same as E. P. Johnson's no. 97, from Tobasco, in Herb. Kew. under *U. microcarpa*.

Urera Rusbyi Britton sp. nov.

Glabrous, except the minute puberulence on the lower leaf-surfaces : branches coarse, deep purple, coarsely angled : stipules not seen : petioles 2–4 cm. long, very slender : blades 1.25–2 dm. long, 5–7.5 cm. broad, oval, narrowed but blunt at the base, abruptly short-acuminate and obtusish at the apex, shortly crenate-dentate, 3-nerved, the lateral nerves originating near the base, the very slender and inconspicuous venation coarsely reticulate : panicle shortly and stoutly peduncled, 2 or 3 dm. long and broad, the branches very numerous and very slender, the flower-clusters rather loosely disposed, the flowers nearly 3 mm. broad.

Yungas, 6000 ft., 1885 (no. 1774).

Pilea anomala Wedd. in Am. Sci. Nat. III, **18**: 217. 1852. Sorata, 8000 ft., Feb. 1886 (no. 1480) and Yungas, 6000 ft., 1885 (no. 1478). The same as Mandon's no. 1104.

Pilea rotundata Griseb. Fl. Brit. W. Ind. 158. Unduavi, 8000 ft., Oct. 1885 (no. 1483).

Pilea dauciodora Wedd. in Am. Sci. Nat. Ser. **18**: 223. 1852. Unduavi, 8000 ft., Oct. 1885 (nos. 1479 and 1485).

Pilea cymbifolia sp. nov.

Leaf-surfaces minutely stellate; stems erect, flexuous, stoutish, in my specimen nearly 4 dm. long, the internodes about 3 cm. long: stipules 6 or 7 mm. long, ovate, obtusish, brown, scarious: petioles 1.5–2 cm. long: blades .7–1 dm. long, 1.5–2 cm. broad, oblong and highly inaequilateral, blunt or rounded at the base, abruptly short-acuminate and obtuse at the apex, apparently disposed with the edges vertical, the upper edge nearly straight, the lower convex, finely serrate, the teeth varying from acute to rounded, thin, strongly 3-nerved, the lateral nerves starting from near the base, the venation little prominent on either side: peduncles 1.2–2 cm. long, very slender, erect, the globose heads nearly 1 cm. broad, densely flowered, fully expanded flower nearly 4 mm. broad, the divisions oval, obtuse, very thin, a little shorter than the filaments: anthers 1 mm. long and nearly as broad.

Yungas, 6000 ft., 1885 (no. 1482).

Pilea filipes sp. nov.

Very minutely puberulent: stems 2 to 4 dm. long, ascending, thickish but weak: stipules .5–1 cm. long, broadly ovate, exceedingly thin, transparent, reddish-brown: petioles 1.5–2.5 cm. long, slender: blades 2.5–6 cm. long, 1.5–3 cm. broad, ovate, rounded or blunt at the base, very short-pointed and acute or obtuse at the apex, crenate-dentate, very thin, pale below, 3-nerved: peduncles 4 or 5 cm. long, filiform, nearly erect, the cyme racemiform and secund, one or two cm. long, the flowers cymosely clustered at intervals of about 3–7 mm.: bracts 2 mm. long, broadly ovate, acute: pistil conical, a little shorter than the bract: the stigma capitate, small. Staminate flowers not seen.

Yungas, 6000 ft., 1885 (no. 1756). The same as Bang's no. 1788. Species near *P. ciliaris*.

Pilea sublobata sp. nov.

Younger portions and lower leaf-surfaces sparsely short-pilose:

stems 1–2 dm. long, rooting at the base, ascending, very slender, subsimple: stipules 2 or 3 mm. long, broadly ovate, blunt, scarious, brownish: pedicels 2–7 mm., slender: blades 1–2 cm. long, .5–1 cm. broad, ovate, blunt or rounded at the base, obtuse, deeply crenate-dentate or lobed, the teeth or lobes 3–5 pairs, thin, deep green: peduncles .5–1 cm. long, filiform: head about 3 mm. broad, densely few-flowered, the flowers purplish.

Unduavi, 8000 ft., Oct. 1885 (no. 1484).

Pilea urerifolia sp. nov.

Upper leaf-surfaces minutely stellate: stems blackish, stout but weak: stipules 5–7 mm. long, 2 or 3 mm. broad, tapering from the base, brown-scarious petioles 1.5–4 cm. long, weak: blades 1–1.2 dm. long, 4–6 cm. broad, oblong or oval, highly inaequilateral, obtuse at the base, abruptly contracted into a tapering acute summit, crenate-dentate, dark green, very thin, strongly 3-ribbed, the ribs blackish, the branches from the midrib meeting those from the laterals about one third of the distance from the latter: peduncles 1–3 cm. long, slender, weak, blackish: heads globose, yellow, about 1 cm. in diameter: pedicels 1.5 mm. long, transparent; calyx campanulate, nearly 2 mm. long and broad, deeply 4-lobed, the lobes oval, elliptical, transparent: filaments thick, as long as the perianth, fleshy: anthers oval, half as long as the filament. Pistillate flowers not seen.

Unduavi, 8000 ft., Oct. 1885 (no. 1481). Also collected by Mr. Bang at Sacramento, Yungas, Aug. 6, 1894 (no. 2374). Mr. Bang says, "A small plant, a few feet high, with white flowers, abundant in rich forest-mould."

Boehmeria brevirostris Wedd. Ann. Sci. Nat. IV, **1**: 201. 1854. Unduavi, 8000 ft., Oct. 1885 (nos. 1280 and 1281). The same as Mathews' no. 2039.

Boehmeria caudata Sw. Prod. Veg. Ind. Occ. 34. Yungas, 6000 ft., 1885 (no. 1277). The same as Mandon's no. 1107.

Boehmeria sp. near *B. Pavonii* Wedd. Ann. Sci. Nat. IV, **1**: 202. 1854. Yungas, 6000 ft., 1885 (no. 1278). The same as Bang's no. 328.

Boehmeria tenuistachys sp. nov.

Ferruginous-pilose, the lower leaf-surfaces somewhat tomentose, the upper strigose: branches mostly erect or strongly ascending, 1 dm. or more long, somewhat angled: stipules caducous, 6–8 mm. long, lanceolate, tapering regularly from the base to an acute point: petioles 1.5–3 cm. long, slender: blades 3–6 cm. long 1.5–3 cm. broad, ovate, subrotund at the base, short-acuminate and acute, sharply serrate, thickish, strongly 3-nerved from the base, above finely bullate with the impressed venation, the venation prominent underneath: spikes simple, sessile or short-peduncled, 5–8 cm. long, 3 or 4 mm. thick, the rachis slender, pilose, the flower-clusters dense, rather closely disposed: fully expanded perigone 3 mm. broad, divided nearly to the base, transparent, brownish, the segments triangular-ovate, acutish.

Unduavi, 8000 ft., Oct. 1885 (no. 1475).

Pouzolzia asper Wedd.; DC. Prod. **16**[1]: 233 (*Margarocarpus asper* Wedd. Ann. Sci. Nat. IV. **1**: 204. 1854). Yungas, 6000 ft., 1885 (no. 2636). The same as Matthews' no. 2036.

Phenax ballotifolius (Kunth.) Wedd. Ann. Sci. Nat. IV. **1**: 192. 1854. Unduavi, 8000 ft., Oct. 1885 (nos. 1279 and 1282), and Beni River, July 1886 (no. 1283).

Phenax pauciserrata (Wedd.) (*P. Sonneratii pauciserrata* Wedd.; DC. Prod. **16**[1]: 235). Sorata, 8000 ft., Feb. 1886 (nos. 1476 and 1477).

Juglans sp.

Entire leaf (only the uppermost seen) about 3 dm. long, the petiole about 1 dm. long: leaflets 7 ½ pairs, sessile, 4.5–8 cm. long, 2–3 cm. broad, ovate, highly inaequilateral, rounded to subcordate, acuminate and acute, obscurely serrate, glabrate above, ferruginous-tomentose with branched or tufted hairs underneath; midrib and 12–14 pairs of crooked upcurved secondaries prominent on the under side, the latter connected by the tertiaries.

Sorata, 8000 ft., Feb. 1886 (no. 744). Dr. Britton regards this as an undescribed species, but the fruit specimen having been lost, a full description is impossible.

CASUARINEAE

Lacistema aggregata (Berg.). Yungas, 6000 ft., 1885 (no. 2704).

Index to recent Literature relating to American Botany

Andrews, A. L. Some Observations on Orchid Fragrance. Rhodora, **3**: 84–87. Ap. 1901.

Atkinson, G. F. On the Homologies and probable Origin of the Embryo-sac. Science, II. **13**: 530–538. 5 Ap. 1901.

Banker, H. J. A preliminary Contribution to a Knowledge of the Hydnaceae. Bull. Torr. Club, **28**: 199–222. 18 Ap. 1901.

Includes *Hydnum albo-magnum*, a new species from Alabama.

Barnhart, J. H. Heteromorphism in *Helianthemum*. Bull. Torr. Club, **27**: 589–592. 14 N. 1900.

Beadle, C. D. A shrubby Oak of the southern Alleghanies. Biltmore Bot. Stud. **1**: 47, 48. 8 Ap. 1901.

Quercus Boyntoni new.

Beadle, C. D. New Species of Thorns from the Southeastern States. Biltmore Bot. Stud. **1**: 25–47. 8 Ap. 1901.

C. Buckleyi, *C. tecta*, *C. pallens*, *C. dispar*, *C. lassa*, *C. frugiferens*, *C. ignava*, *C. regnis*, *C. quaesita*, *C. consanguinea*, *C. condigna*, *C. lepida*, *C. invicta*, *C. munda*, *C. vulsa*, *C. opima*, *C. incilis*, *C. signata*, *C. teres*, *C. sinistra*, and *C. tetrica*, new.

Beadle, C. D. & Boynton, F. E. Revision of the Species of *Marshallia*. Biltmore Bot. Stud. **1**: 3–10. *pl. 1–11*. 8 Ap. 1901.

M. grandiflora, *M. Mohri* and *M. ramosa*, new.

Best, G. N. Revision of the North American Species of *Heterocladium*. Bull. Torr. Club, **28**: 123–131. *pl. 13, 14*. 2 Mr. 1901.

H. Macounii and *H. heteropteroides* new.

Bicknell, E. P. The Genus *Teucrium* in the Eastern United States. Bull. Torr. Club, **28**: 166–172. 27 Mr. 1901.

T. littorale, *T. roseum*, *T. boreale*, and *T. menthifolium* new species.

Bicknell, E. P. The Nomenclature of the New England Agrimonies. Bull. Torr. Club, **28**: 102–108. 2 Mr. 1901.

Boynton, C. L. & Beadle, C. D. Notes on certain Cone-Flowers. Biltmore Bot. Stud. **1**: 11–18. 8 Ap. 1901.

Rudbeckia Chapmani, *R. Sullivanti*, *R. umbrosa*, *R. palustris* and *R. Missouriensis*, new.

Britton, E. G. Bryological Notes.—I. Bull. Torr. Club, **27**: 648, 649. 29 D. 1900.

Britton E. G. & Taylor, A. Life History of *Schizaea pusilla*. Bull. Torr. Club, **28**: 1–19. *pl. 1–6*. 31 Ja. 1901.

Britton, N. L. The Application of Precedence of Place in Nomenclature. Science II, **13**: 588, 589. 12 Ap. 1901.

Burglehaus, F. H. Fertilization of the closed Gentian by Bumblebees. Plant World, **4**: 33. F. 1901.

Burnham, S. H. A February Outing in California. Plant World, **4**: 28, 29. F. 1901.

Chodat, R. Plantae Hasslerianae soit enumeration des Plantes récoltées au Paranay. Bull. Herb. Boiss. II. **1**: 395–442. 31 Mr. 1901.

New species in *Croton* (4), *Julocroton*, *Bernardia*, *Euphorbia*, *Wissadula* (3), *Pavonia*, *Melochia*, *Angelonia*, *Brunsfelsia*, *Buddlea*, *Spigelia* (2), *Vernonia* (5), *Eupatorium* (5), *Amaryllis*, *Gomphrena* (2), and *Polygala* (3).

Clark, H. L. Notes on the Flora of Woods Hole, Massachusetts. Rhodora, **3**: 87–89. Ap. 1901.

Clinton, G. P. Two new Smuts on *Eriocaulon septangulare*. Rhodora, **3**: 79–82. *f. 1, 2*. Ap. 1901.

Tolyposporium eriocauli and *Ustilago eriocauli*.

Cockerell, T. D. A. A new *Sophia*. Bull. Torr. Club, **28**: 48, 49. 31 Ja. 1901.

Sophia andrearum and var. *osmiarum*.

Collins, J. A. Two Wool-waste Plants at Lawrence, Massachusetts. Rhodora, **3**: 92. Ap. 1901.

Coville, F. V. The Home of *Botrychium pumicola*. Bull. Torr. Club, **28**: 109–111. *pl. 7*. 2 Mr. 1901.

Davenport, G. E. *Botrychium matricariaefolium* A. Br. Fern Bull. **9**: 37, 38. Ap. 1901.

De Candolle, C. Piperaceae et Meliaceae Brasilienses a cl. W. Schwacke lectae. Bull. Herb. Boiss. II. **1**: 353–366. 31 Mr. 1901.

New species in *Piper* (5), *Peperomia* (4), *Trichilia* (4) and *Cabralea* (2).

Eames, E. H. *Callitriche Austini* in Southwestern Connecticut. Rhodora, **3**: 89, 90. Ap. 1901.

Eastwood, A. Some small-flowered Species of *Nemophila* from the Pacific Coast. Bull. Torr. Club, **28**: 137–160. *pl. 15–20*. 27 Mr. 1901.

N. humifusa Kellogg, *N. quercifolia*, *N. Austinae*, *N. macrophylla*, *N. inconspicua*, *N. pustulata*, *N. micrantha*, *N. Kelloggii*, *N. Plaskettii*, *N. humilis*, *N. nana*, *N. Congdoni*, *N. hispida*, *N. divaricata*, *N. tenera*, *N. gracilis*, *N. nemorensis*, *N. glauca*, *N. fallax*, *N. exigua*, *N. pulchella*, *N. alata*, and *N. rotata*, new species.

Eaton, A. A. The Genus *Equisetum* with Reference to the North American Species. Seventh Paper. Fern Bull. **9**: 33–37. Ap. 1901.

Ellis, J. B. & Everhart, B. M. New Species of Fungi from various Localities. Bull. Torr. Club, **27**: 571–578. 14 N. 1900.

New species in *Asterina*, *Dothidella*, *Urocystis*, *Puccinia*, *Phyllosticta* (2), *Phoma* (2), *Sphaeropsis*, *Hendersonia*, *Septoria* (2), *Melanconium*, *Melanconiopsis* gen. nov., *Cylindrosporium* (2), *Pestalozzia*, *Ramularia* (2), *Cercospora* (2), and *Cercosporella*.

Flett, J. B. Ferns and Allies at Unalaska and Nome City. Fern Bull. **9**: 31–33. Ap. 1901.

Gilbert, B. D. The ternate Botrychia in Central New York. Fern Bull. **9**: 25–28. Ap. 1901. [Illust.]

Gould, C. N. Range of the Mistletoe in Oklahoma. Plant World, **4**: 32. F. 1901.

Greene, E. L. A new Northern *Eupatorium*. Rhodora, **3**: 83, 84. Ap. 1901.

Eupatorium boreale.

Greene, E. L. Derivation of Columbine. Plant World, **4**: 31, 32. F. 1901.

Greene, E. L. Some literary Aspects of American Botany. Catholic Univ. Bull. 1901: 147–157. Ap. 1901.

Griffiths, D. Contributions to a better Knowledge of the Pyrenomycetes.—II. A new Species of Ergot. Bull. Torr. Club, **28**: 236–241. *f. 1, 2.* 18 Ap. 1901.

Claviceps cinereum new species.

Harbison, T. G. New or little-known Species of *Trillium*. Biltmore Bot. Stud. **1**: 19–24. 8 Ap. 1901.

T. stamineum, *T. Ludovicianum*, and *T. Vaseyi* new.

Hemsley, W. B. *Castilloa australis* Hemsl. (sp. nov.). Hook. Ic. Plant. IV. **7**: *pl. 2676.* F. 1901.

Native of Peru.

Hemsley, W. B. *Sapium Mexicanum* Hemsl. Hook. Ic. Plant. IV. **7**: *pl. 2680.* F. 1901.

Plate of *S. Mexicanum* accompanied by descriptions of two new species from Mexico, *S. Mexicanum* and *S. lateriflorum*.

Hemsley, W. B. *Sapium aereum* Klotzsch. Hook. Ic. Plant. IV. **7**: *pl. 2682.* F. 1901.

Native of Peru.

Hemsley, W. B. *Sapium ciliatum* Hemsl. (sp. nov.). Hook. Ic. Plant. IV. **7**: *pl. 2683.* F. 1901.

Native of Northern Brazil.

Hemsley, W. B. *Sapium subsessile* Hemsl. (sp. nov.). Hook. Ic. Plant. IV. **7**: *pl. 2684.* F. 1901.

Native of South America.

Hemsley, W. B. *Sapium Moritzianum* Klotzsch. Hook. Ic. Plant. IV. **7**: *pl. 2677.* F. 1901.

Native of South America.

Hemsley, W. B. *Sapium Poeppigii* Hemsl. (sp. nov.). Hook. Ic. Plant. IV. **7**: *pl. 2678.* F. 1901.

Native of Peru.

Hemsley, W. B. *Sapium cupuliferum* Hemsl. (sp. nov.). Hook. Ic. Plant. IV. **7**: *pl. 2679.* F. 1901.

Native of Argentina.

Hemsley, W. B. *Sapium suberosum* Muell. Arg. Hook. Ic. Plant. IV. **7**: *pl. 2681.* F. 1901.

Native of Barbados.

H[ooker], J. D. *Masdevallia deorsum.* Curt. Bot. Mag. III. **57**: *pl. 7766.* 1 Mr. 1001.

Native of New Grenada.

H[ooker], J. D. *Hymenocallis schizostephana.* Curt. Bot. Mag. III. **57**: *pl. 7762.* 1 Mr. 1901.

Native of Brazil.

Horton, F. B. The Discovery of a plumose Variety of the ebony Spleenwort. Plant World, **4**: 29, 30. F. 1901.

Howe, M. A. *Riccia Beyrichiana* and *R. dictyospora.* Bull. Torr. Club, **28**: 161–165. 27 Mr. 1901.

Riccia dictyospora new species.

Howe, M. A. The Allen Collection of Characeae. Jour. N. Y. Bot. Garden, **2**: 52–54. Ap. 1901.

Howell, T. A Flora of Northwest America. fasc. 4. Liguliflorae to Hydrophyllaceae. 387–474. Portland, Oregon, 21 Mr. 1901.

New species in *Hieracium, Agoseris, Vaccinium, Arbutus, Arctostaphylos, Pleuricospora, Dodecatheon, Steironema, Erythraea, Gentiana* (3), *Navarretia* (2), *Polemonium*, and *Nemophila.*

Huber, J. Plantae Cearenses; Liste des plantes phanérogame récoltées dans l'etat Brésilien a Ceara en septembre et octobre 1897. Bull. Herb. Boiss. II. **1**: 290–329. 28 F. 1901.

New species and varieties in *Canna, Piper* (2), *Triplaris, Gomphrena, Mimosa* (2), *Caesalpinia, Centrosema, Clitoria, Zornia, Trichilia, Bunchosia, Polygala, Pavonia, Davilla, Ouratea, Vismia* (2), *Mentzelia, Begonia* (3), *Mouriria, Pterolepis, Eugenia Myrcia, Mimusops, Jacquemontia* (2), *Solanum*, (2), *Herpestis, Hygrophila, Diodia, Mapouria, Mitracarpus, Psychotria, Eclipta, Eupatorium*, and *Stilpnopappus*; the Piperaceae, Meliaceae and Begoniaceae by C. DeCandolle, the Polygalaceae by Chodat, and the Verbenaceae and Labiatae by Briquet.

Huntington, J. W. *Webera proligera* in Amesbury, Massachusetts. Rhodora, **3**: 91, 92. Ap. 1901.

Lloyd, F. E. & Tracy, S. M. The insular Flora of Mississippi and Louisiana. Bull. Torr. Club, **28**: 61–101. *pl. 8–11.* 2 Mr. 1901.

Long, W. H., Jr. The local Distribution and Occurrence of the Fungi of Austin, Texas, and Vicinity. Bull. Torr. Club, **27**: 579–588. 14 N. 1900.

MacDougal, D. T. Measurement of Growth. Jour. N. Y. Bot. Garden, **2**: 54, 55. *f. 3.* Ap. 1901.

Maxon, W. R. A List of Pteridophyta collected in Alaska in 1900 by Mr. J. B. Flett, with a Description of a new *Dryopteris*. Bull. Torr. Club, **27**: 637–641. 29 D. 1900.

Dryopteris aquilonaris, new species, allied to *D. fragrans*.

McKenney, R. E. B. Notes on Plant Distribution in Southern California, U. S. A. Bot. Centralb. Beiheft. **10**: *f. 1–7.* 1901. (Also separate 1–11.)

Meehan, T. *Asarum Canadense.* Meehan's Monthly, **11**: 49, 50. *pl. 4.* Ap. 1901.

Meehan, T. *Polypodium incanum.* Fern Bull. **9**: 28, 29. Ap. 1901.

Merrill, E. D. A Criticism on certain new Species of *Panicum*. Bull. Torr. Club, **27**: 593–597. 14 N. 1900.

Mez, C. Bromeliaceae et Lauraceae novae vel adhue non satis cognitae. Engler's Bot. Jahrb. (Beiblatt 67) **30**: 1–20. 12 Mr. 1901.

New species in *Bromelia* (4), *Canistrum* (2), *Portea*, *Dyckia* (2), *Lindmania*, *Hechia* (2), *Vriesea* (2), *Tillandsia* (6), *Cryptocarya*, *Ajouea* (3), *Persea* (2), *Phoebe* (2) and *Ocotea* (9).

Morris, E. L. North American Plantaginaceae.—II. Bull. Torr. Club, **28**: 112–122. *pl. 12.* 2 Mr. 1901.

P. verticillata, *P. picta*, *P. oblonga*, *P. ignota*, *P. speciosa* and *P. obversa* new.

Nelson, A. New Plants from Wyoming.—XIII. Bull. Torr. Club, **28**: 223–235. 18 Ap. 1901.

New species in *Ligusticum*, *Pseudocymopterus*, *Musineon*, *Lomatium*, *Dodecatheon*, *Swertia* (2), *Phacelia*, *Asclepias*, *Pentstemon*, *Castilleja*, *Valeriana*, *Chrysopsis*, *Machaeranthera* and *Rudbeckia*.

Palmer, W. Deforested Cuba. Plant World, **4**: 21, 22. *pl. 2.* F. 1901.

Parish, S. B. Southern Extension of the Range of *Polypodium Scouleri*. Fern Bull. **9**: 40–42. Ap. 1901.

Patouillard, N. Champignons de la Guadeloupe recueillis par la R. P. Duss. Bull. Soc. Myc. de France, **16**: 175–188. *pl. 7.* 28 F. 1901.

New species in *Marasmius*, *Androsaceus*, *Leptonia*, *Flammula*, *Laschia*, *Boletus*, *Melanopus*, *Phaeoradulum*, *Stereum* (2), *Corticium*, *Septobasedium*, *Cycloderma*, *Humaria*, *Helotium*, *Belonedium*, *Erinella*, *Leptosphaeria*, *Nectria*, *Stilbocera*, n. gen. *Stilbum*, *Isadia*.

Peck, C. H. New Species of Fungi. Bull. Torr. Club, **27**: 609–613. 29 D. 1900.

New species in *Amanita* (2), *Amanitopsis*, *Lepiota*, *Armillaria* (2), *Tricholoma*, *Omphalia*, *Boletus* (2), and *Boletinus*.

Peck, C. H. Report of the State Botanist on edible Fungi of New York, 1895–1899. Mem. N. Y. State Mus. **3**: 131–234. *pl. 44–68.* 1901.

Piper, C. V. New and noteworthy Northwestern Plants. Bull. Torr. Club, **28**: 39–45. 31 Ja. 1901.

New species in *Arabis, Trifolium, Astragalus, Solidago, Erigeron, Antennaria, Artemisia, Crepis, Dodecatheon, Gilia, Phacelia, Lappula*, and *Mimulus.*

Rennert, R. J. Teratology of *Arisaema.* Bull. Torr. Club, **28**: 247–250. 18 Ap. 1901. [Illust.]

Rolfe, R. A. *Habenaria repens* Nutt. Hook. Ic. Plant. IV. **7**: *pl. 2686.* F. 1901.

Native of America, from South Carolina to Brazil.

Rolfe, R. A. *Gymnopodium floribundum* Rolfe. Hook. Ic. Plant. IV. **7**: *pl. 2699.* F. 1901.

A new monotypic genus, from British Honduras.

Rothrock, J. T. The Willow Oak and swamp Hickory. Forest Leaves. **8**: 24. Ap. 1901. [Illust.]

Rydberg, P. A. Further Studies on the Potentilleae. Bull. Torr. Club, **28**: 173–183. 27 Mr. 1901.

P. horrida, P. New Species in *Potentilla* (10), *Horkelia*, and *Drymocallis.*

Rydberg, P. A. Studies on the Rocky Mountain Flora.—III. Bull. Torr. Club, **27**: 614–636. 29 D. 1900.

New species in *Stenotus* (2), *Macronema* (2), *Sideranthus* (3), *Pyrrocoma* (5) *Balsamorrhiza* (2), *Thelesperma* (2), *Hymenopappus* (4), and a new genus *Stenotopsis.*

Rydberg, P. A. Studies on the Rocky Mountain Flora.—IV. Bull. Torr. Club, **28**: 20–38. 31 Ja. 1901.

New species in *Arnica* (2), *Artemisia, Picradenia, Antennaria, Aster, Townsendia, Erigeron* (3), *Valeriana, Campanula, Castilleja* (3), *Mimulus, Pedicularis, Pentstemon* (2), *Polemonium* (2), *Gilia, Phacelia, Lappula, Cryptanthe, Mertensia* (4), *Impatiens, Geranium, Lupinus* (2), *Astragalus* (2), *Trifolium*, and *Lathyrus.*

Sargent, C. S. Notes on a Collection of *Crataegus* made in the Province of Quebec near Montreal. Rhodora, **3**: 71–79. Ap. 1901.

C. suborbiculata, C. Canadensis, C. anomala, C. densiflora, C. Laurentiana and *C. integriloba*, new.

Saunders, C. F. The climbing Fern in Spring. Fern. Bull. **9**: 30, 31. Ap. 1901. [Illust.]

Schumann, K. Chilenische Kakteen. Monats. für Kakteenkunde, **11**: 5–9. 15 Ja. 1901; 26–29. 15 Feb. 1901; 43–45. 15 Mr. 1901. [Illust.]

Schumann, K. *Pilocereus Schottii* Lem. Monats. für Kakteenkunde **11**: 9–11. 15 Ja. 1901. [Illust.]

Setchell, W. A. Notes on Algae. I. Zoe, **5**: 121–129. 1901.

New species in *Laminaria, Hedophyllum* gen. nov. (2), *Pleurophycus* gen. nov., *Iridaea, Fauchea, Constantinea*, and *Weeksia* gen. nov.

Shear, C. L. Notes on Fournier's Mexican Species and Varieties of *Bromus*. Bull. Torr. Club, **28**: 242–246. 18 Ap. 1901.

Thaxter, R. Preliminary Diagnoses of new Species of Laboulbeniaceae.—III. Proc. Amer. Acad. Arts and Sci. **36**: 397–414. Mr. 1901.

New species in *Stigmatomyces* (13), *Arthrorhynchus* (2), *Rhizomyces*, *Ceraiomyces* gen. nov., and *Dimeromyces* (3).

Toumey, J. W. An undescribed *Agave* from Arizona. Rep. Mo. Bot. Gard. **12**: 75, 76. *pl. 32, 33*. 6 Ap. 1901.

Tracy, S. M. & Earle, F. S. Some new Fungi. Bull. Torr. Club, **28**: 184–188. 27 Mr. 1901.

New species in *Meliola*, *Hystereostomella* (2), *Lembosia* (2), *Acanthostigma*, *Plowrightia*, *Cercospora* (2), and *Passalora*.

Trelease, W. A cristate *Pellaea*. Rep. Mo. Bot. Gard. **12**: 77. *pl. 34*. 6 Ap. 1901.

Underwood, L. M. A new *Adiantum* from New Mexico. Bull. Torr. Club, **28**: 46, 47. 31 Ja. 1901.

Adiantum modestum allied to *A. capillus-Veneris*.

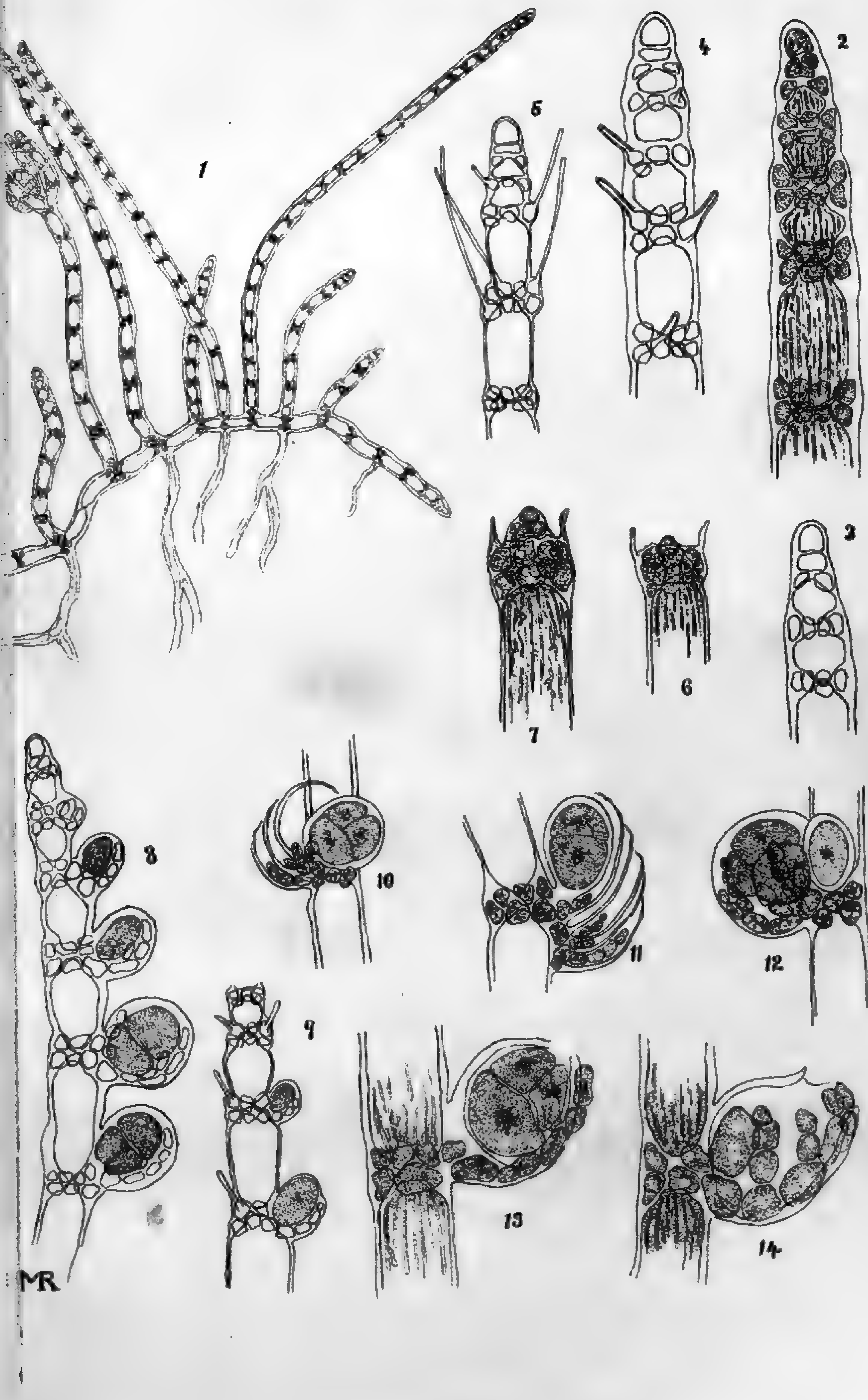
Urban, I. Plantae novae Americanae imprimis Glaziovianae III. Engler's Bot. Jahrb. (Beiblatt 67) **30**: 27–38. 12 Mr. 1901.

New species in *Vismia*, *Euplassa* (2), *Roupala*, *Weinmannia*, *Metrodorea*, *Aspidosperma*, *Oxypetalum*, *Barjonia*, *Trichilia* (5) *Cabralea*, *Celosia*, and *Gomphrena* (4).

Williams, E. M. The masked Tricholoma. (*Tricholoma personatum* Fr.) Plant World, **4**: 25–27. F. 1901. [Illust.]

Zahlbrückner, A. Beiträge zur Flechten-Flora Süd-Californiens. Bull. Torr. Club, **27**: 642–647. 29 D. 1900.

New species in *Lecidea* (2), *Dirina*, *Platygrapha*, *Chiodecton* and *Arthothelium*.



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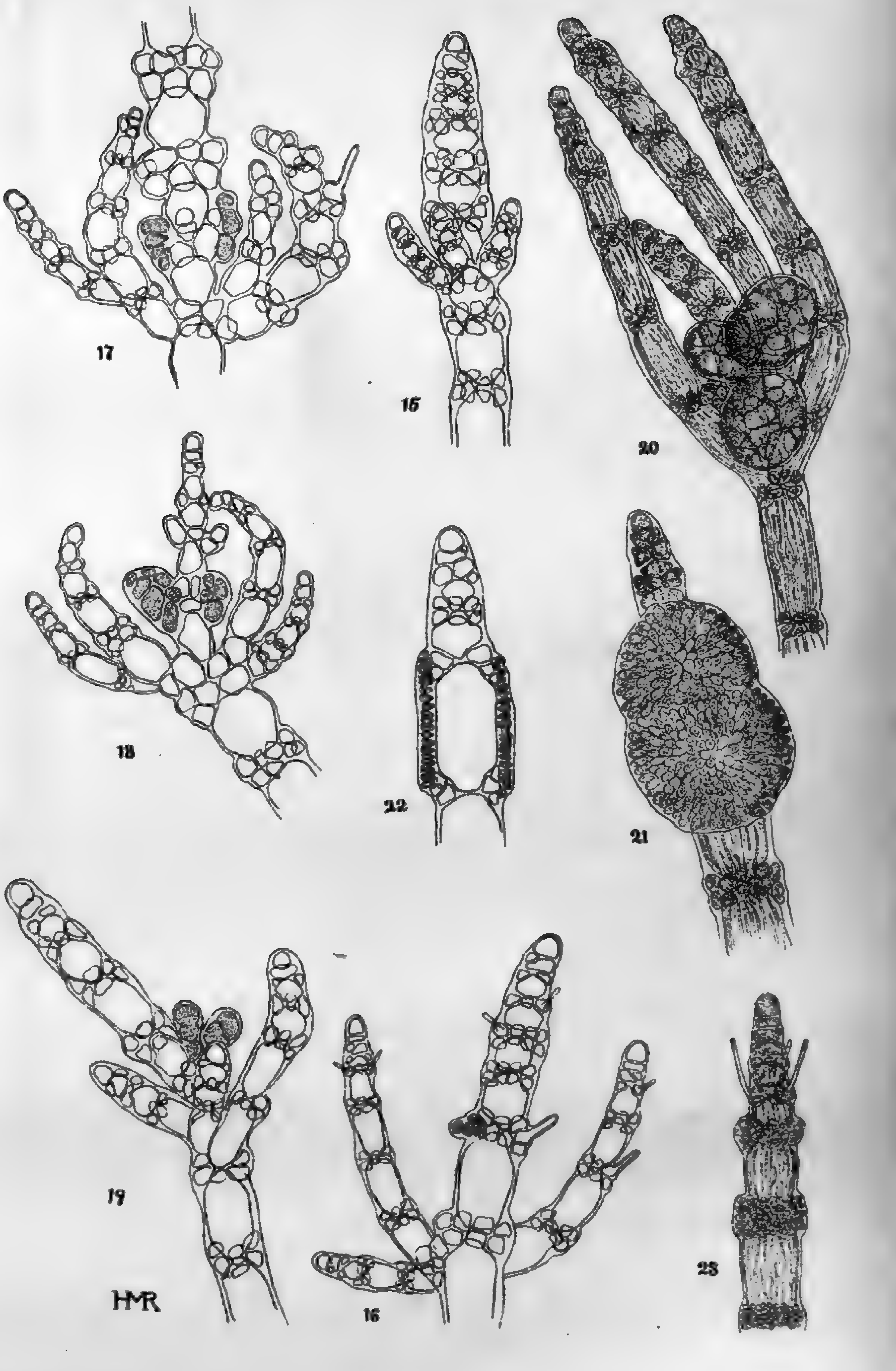

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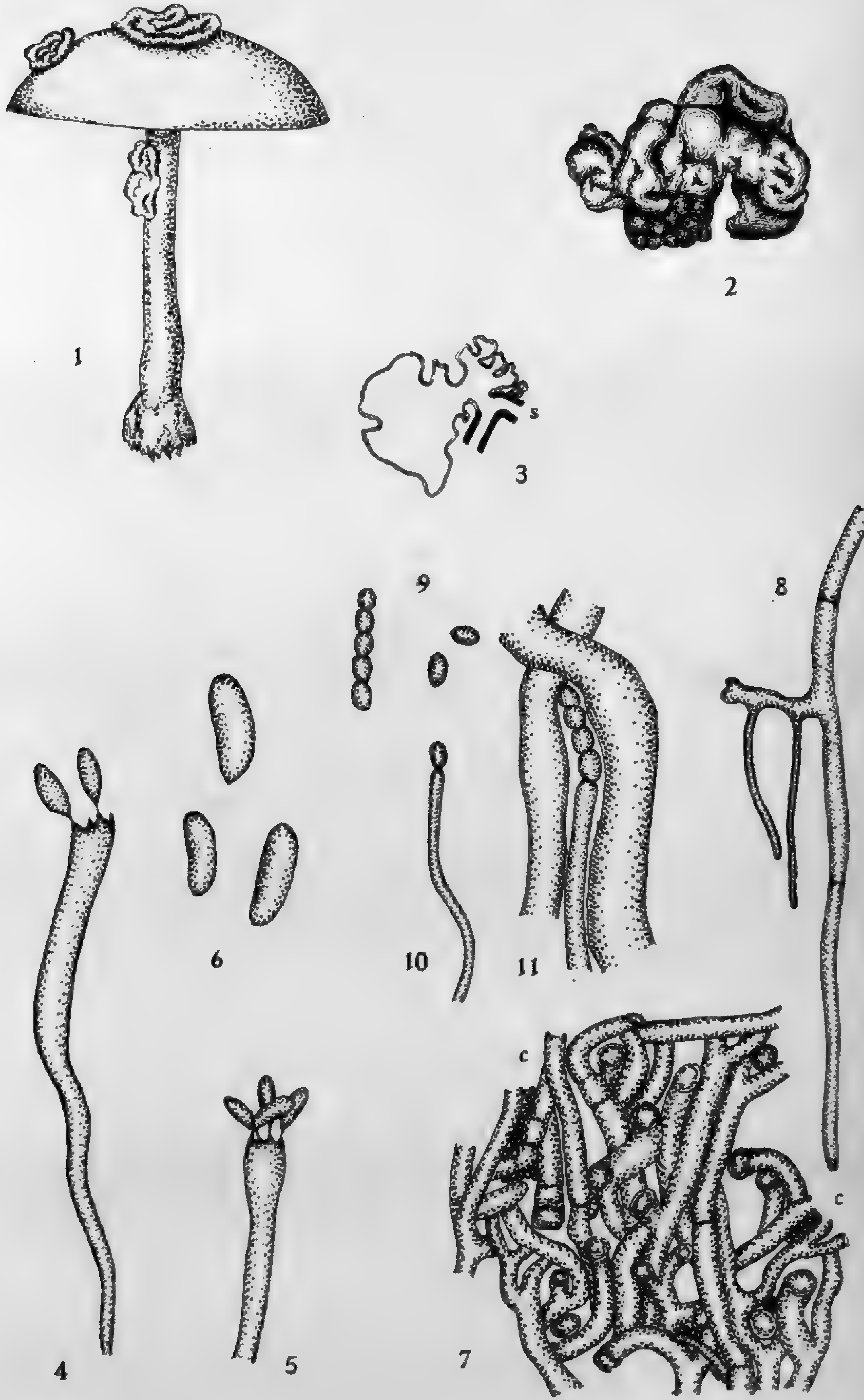

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CONTENTS

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Memoirs (See last page of cover.)

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BULLETIN

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TORREY BOTANICAL CLUB

JUNE 1901

Observations on the Algal Genera Acicularia and Acetabulum

BY MARSHALL A. HOWE

(WITH PLATES 24 AND 25)

I. ACICULARIA SCHENCKII (Möb.) Solms

1. **Historical.**—The material from which *Acicularia Schenckii* was originally described came from Cabo Frio, Province of Rio de Janeiro, Brazil, where it was collected by Professor H. Schenck in May, 1887. It was first made known under the name *Acetabularia Schenckii* by Dr. M. Möbius in Hedwigia for 1889 (**28**: 318–320. *pl. 10. f. 8–12*). But in this species the aplanospores surround themselves each with a thick calcareous shell and these shells adhere, so that the aplanospores, by the decay of the sporangium wall, are left in a single coherent mass, retaining more or less the form of the sporangium; and on this ground, Graf zu Solms-Laubach in his Monograph of the Acetabularieae, published in 1895,* refers the species to the genus *Acicularia*, previously recognized only in the fossil state. The genus *Acicularia* was founded in 1843 by the French paleontologist d'Archiac,† the original species being *Acicularia Pavantina* from the Middle Eocene at "Pisseloup près Pavant." It was referred to the animal kingdom by d'Archiac, and this opinion as to its nature was generally held until

* Trans. Linn. Soc. Bot. II. **5**: 1–39. *pl. 1–4*.

† d' Archiac. Description géologique du Départment de l'Aisne. Mém. de la Soc. géol. de France, 5^2: 386. *pl. 25. f. 8.* 1843.

1877, when Munier-Chalmas * placed it among the Algae next to *Acetabulum.* This idea Count Solms considers to be confirmed in a brilliant fashion by the discovery of a living species the spores of which are surrounded with lime and are coherent in masses strongly resembling the fossil "spiculae" on which alone the genus *Acicularia* was established. The description and figures given by d'Archiac of his "*polypier aciculaire*" deal only with its external characters, and if the more detailed account of *Acicularia Pavantina* given by Reuss † in 1861 can be depended upon, the affinities of this organism would seem to be still open to question, for the cavities supposed by Munier-Chalmas and Solms-Laubach to have been occupied by the aplanospores would appear from Reuss's figures to be somewhat narrowly and irregularly conical with the point directed inward. And in writing of the mouths or openings which are seen on the surface of the spicula, Reuss states, "Sie führen in nicht sehr tiefe Zellen, die in ihrer ganzen Weite ausmünden. Jede derselben ist, wie bei den Eschariden und Celleporiden, mit jeder der nebenliegenden durch einen feinen kurzen Canal verbunden." Count Solms ‡ remarks that he saw only one complete spicula of *Acicularia Pavantina* and is not able to express an opinion as to the internal form of the cavities. We have made several efforts to locate the type material of *Acicularia Pavantina*, with the hope of being able to see it and of being thus in a better position to hold an opinion as to whether the original *Acicularia Pavantina* and the *Acicularia Schenckii* are really congeneric, but our attempts thus far have been unsuccessful. § That the more recently described fossils, *Acicularia miocaenica* Reuss and *Acicularia Andrussowii* Solms, are closely allied to the living *A. Schenckii* would seem from published descriptions and figures to be very clear. The calcareous coating of the spore-walls and

* Observations sur les Algues calcaires appartenant au groupe des Siphonées verticillées (Dasycladées Harv.) et confondues avec les Foraminifères. Comptes-rendus de l'Acad. **85**: 814–817. 28 O. 1877.

† Reuss, A. E. Ueber die fossile Gattung *Acicularia* d'Arch. Sitzungsberichte der k. Akad. Wiss. **43**[1]: 7–10. *pl.* 1861.

‡ Trans. Linn. Soc. Bot. II. **5**: 35. 1895.

§ An intimation as to the whereabouts of the d'Archiac collection comes to hand when the publication of this paper is so far advanced as to render further delay inadvisable.

the cohesion in a single mass are the only characters separating *Acicularia*, as defined by Solms-Laubach, from the genus *Acetabulum*, and while a segregation on this ground is doubtless defensible, the propriety of thus using the generic name *Acicularia* perhaps awaits the further study of the fossil remains on which the genus *Acicularia* was founded.

The specimens on which the following observations were made were collected by the writer at Hungry Bay, Bermuda, on June 25, 1900. The plants were growing on small stones at about the low tide mark in a shallow creek leading out from a mangrove thicket. Through the kindness of Professors Möbius and Schenck we have been permitted to see the original Brazilian material of *Acicularia Schenckii*. A careful comparison of this and the Bermudian specimens reveals a few slight differences which are not, we believe, of specific significance. The differences are referred to below. Count Solms states that Goebel collected beautiful specimens of this species in Curaçoa and that it has been collected also in Martinique and Guadaloupe. But its occurrence now in Bermuda, about a thousand miles farther north, is in itself a point of some little interest.

2. Descriptive.

ACICULARIA SCHENCKII (Möb.) Solms, Trans. Linn. Soc. Bot. II. **5**: 33. *pl. 3. f. 9, 11, 12, 14, 15.* 1895.

Acetabularia Schenckii Möb. Hedwigia, **28**: 318–320. *pl. 10. f. 8–12.* 1889.

Green at first, becoming strongly calcified and chalky white with age: disc very nearly flat, solitary, 4–6 mm. in diameter, the margin crenulate; sporangia 30–42, cuneate, strict, firmly connate at maturity except as to the rounded-obtuse minutely mucronate apex, the free extremities conical when young; coronal processes mutually free, emarginate or emarginate-bilobed, with or without a transverse invagination, each bearing two caducous polytomous branches or the rudiments or scars thereof; hypopeltal processes emarginate-bilobed, sometimes twice dichotomous: aplanospores 100–200 in a sporangium, globose, 66–84 μ in diameter; the calcareous massula subcuneate, rounded or somewhat truncate at the distal extremity, exposing the imbedded aplanospores over its entire surface, usually thicker in the vertical plane than in the horizontal (tangential), the radial sides often concave toward the enlarged outer end: rhizoids often irregularly inflated and filled with densely granular reserve-food materials: stipe 1–2.5 cm. (mostly 1.5 cm.) long, .28–.48 mm. in thickness: primary sterile branches 8–18 in a whorl (commonly solitary), finally 4 times (rarely 5 times) polytomous, the ramuli usually in 4's, the ultimate often in 3's or 2's.

The membranes throughout are thinner in the Bermudian plants than in the Brazilian, though susceptible to some variation in both. The wall in the apical region of the mature sporangium is in the former mostly about 9 μ in thickness while in the latter it ranges from 12 μ to 24 μ (measured after decalcification in both). But in only one sporangium, out of many examined, of the specimens collected by Dr. Schenck, have we seen the membrane relatively so thick as is indicated in Möbius' figure 12 (Hedwigia, **28**: *pl. 10.* 1889). Again, the coronal processes in the Bermudian plant are less emarginate or lobed and the hypopeltal processes less often show a tendency to become twice dichotomous, but these characters are extremely variable in both.

Professor Schenck writes that his specimens also were collected in a mangrove formation.

Apart from the other important differences, *Acicularia Schenckii* is very distinct from *Acetabulum crenulatum* (Lamx.) Kuntze in general habit and appearance, differing at first sight in being much smaller in all its parts and in the nearly flat discs.

By using some care, the contents of a mature sporangium can be removed in a single coherent conico-prismatic or subcuneate mass (Figs. 37 and 38), as happens in nature by the decay of the sporangium wall. By reflected light, under low magnification, one of these bodies appears white, with the light green aplanospores occupying slight depressions or pits on the surface, but higher magnification shows that the pitted appearance is largely an optical illusion; for unless the aplanospores have collapsed in the process of preservation — which sometimes happens even in formalin material—their outer surface is on about the same level with the surrounding matrix. It is a point of some biological interest that the side of the aplanospore which lies toward the surface of the massula is always the one which bears the lid, and in the lid region, so far as we have observed, is always free from the calcareous incrustation ; and every spore seems to have a surface exposure. When the massula, viewed from above, appears unusually broad, it can be shown to be hollow toward the larger end. In most cases, however, it is solid, except for the small interstices, and toward the larger extremity is concave at the sides (Figs. 37 and 38), so that a vertical transverse section has somewhat the form of a biconcave lens. This arrangement, whereby each aplanospore has its lid-bearing surface exposed and uncalcified, is an interesting adaptive feature which seems to have escaped formal recognition hitherto. Count Solms-Laubach in figuring * a portion of the surface of a massula does not fail to indicate that the lids of some of the spores are visible, but in describing the "lime-spicula" (our *massula*) he writes † as follows: "It consists of a strongly calcified substance enclosing numerous cavities lying near the surface, and consequently transparent. In each of these and completely filling it there is a spore of the same structure as those of *Acetabularia*. It follows that the pits of the fossil forms are the spore-containing cavities from which the spores have disappeared and the external lime-covering has not been preserved, so that they appear as opening outwards."

In the Bermudian specimens, and in the Brazilian so far as we have seen them, the spore-cavities not only lie "near" the surface but actually reach the surface and for a region approximately corresponding to the spore-lid there is no "external lime-covering" to disappear; and the cavities not only "appear as opening outwards," but such is actually the case from the beginning. This is shown in an especially striking fashion when massulae from formalin-preserved material are allowed to dry on a glass slide and are observed under comparatively low magnification with reflected light. The spores in shrinking away from the surface leave actual openings. It can be determined more accurately by use of high powers and transmitted light that the lid is either wholly free from the calcareous coating or is at most but partially covered with an unimportant amount of it.

By transmitted light, the matrix is yellowish, minutely granular, and somewhat waxy in appearance. As has already been

* *l. c., pl. 3. f. 9.*

† *l. c.* 10.

remarked by Solms-Laubach, the calcareous matter seems to envelop each spore separately like a shell, with a definite though commonly irregular boundary, and the massula (spicula) is apparently formed by the cohesion of these shells. Empty interstices, triangular or varied in form, are often to be seen among adjacent shells. Solms-Laubach inclines to the view that a sort of slime is formed from the outer surface of the spore-wall and that the lime is deposited in this, a cuticle being afterwards reformed inside the shell of lime. An alternative supposition, namely, that the lime is first deposited in a residual substance left in the sporangium after the formation of the spores, seemed to him less probable on account of the peculiar distribution of the lime. With the hope of throwing a little more light on this point, we have made an effort to see the spores in the earlier stages of development, using both dry material and that preserved in formalin. We are confident that in the great majority of cases, at least, the lime first appears as a very delicate coating on the outer surface of the spore-wall and that this coating gradually increases in thickness. The presence of a coating of slime or mucilage could not be demonstrated with certainty at any stage, though the ordinary mucilage tests were employed. Nevertheless, certain optical appearances give ground for the suspicion that something of the kind is present. The few cases in which the lime seemed to make its first appearance in a possible residual matter of the sporangium could be attributed to a disturbance of the natural relations in manipulating the specimen. The sporangium walls are more or less calcified and opaque when the formation of the spores begins and it therefore becomes necessary to remove or decalcify the walls before a clear view of the contents can be obtained, but decalcification is naturally out of the question when the mode of origin of the calcareous shells of the spores is the point under investigation.

3. **Developmental.**—It was noted by Strasburger* in 1877 that *Acetabulum Androsace* (Pallas) Kuntze [*Acetabularia Mediterranea* Lamx.] has a perennial basal portion consisting of rhizoids densely filled with reserve food materials. Similar rhizoidal reservoirs which apparently persist are now found in *Acicularia Schenckii* (Fig. 1).

* Bot. Zeit. **35**: 715–718. 1877.

As has already been described for *Acetabulum Androsace* and *A. crenulatum*, the young shoot in *Acicularia Schenckii* is an erect cylindrical or often somewhat curved tube, with a tapering subacute or rounded apex. In two cases out of the many young plants examined, we have observed the beginnings of a dichotomous branching (Fig. 22); in all other cases the shoots have been simple. The development of the primary whorls of articulated sterile branches offers no peculiarities worthy of special mention except the fact that we have been unable to find more than one whorl of such branches persisting at any one time. Harvey* figures in the young plant of *Acetabulum crenulatum* previous to the formation of the fertile disc three whorls of sterile branches and the beginning of a fourth and Woronin † gives a similar figure for *Acetabulum Androsace.* In *Acicularia Schenckii* two or three whorls are sometimes developed in succession before the formation of the disc, but in such the lower whorl has fallen by the time the next higher appears, and only scars remain to testify to its former existence. We have found no conclusive evidence that a plant of *A. Schenckii* ever matures more than one fertile disc. One case has been met with, in which a single shoot bore the beginnings of two discs separated by the scars of a whorl of sterile filaments, but in this the lower of the two rudiments showed unmistakable indications of arrested development in small size, unequal growth, and occasionally exfoliated members, and the suspicion that it was destined to no further growth seems well grounded. A case in which the development of a disc seems similarly arrested and the continuation of the axis shows the beginnings of a sterile whorl is represented in Fig. 20. Fig. 21 shows the scars of a delapsed disc and the prolification of the axis, but there is no proof that the delapsed disc reached maturely or that, if it did, another disc would actually reach the spore-bearing stage. Yet it must be admitted that cases like those just described suggest the possibility that a plant may occasionally mature two discs.

With the aid of material preserved in formalin, we have been able to follow out stages in the development of the disc which have been observed hitherto only in *Acetabulum Androsace* and

* Ner. Bor.-Am. **3** : *pl. 42.* 1858.

† Ann. Sci. Nat. Bot. IV. **16** : *pl. 8.* 1862.

more completely in some respects than is indicated in the recorded observations on that species. This practically complete series of early stages in the development of the disc seems to confirm, with much certainty, the morphological explanation of the disc put forward by Count Solms-Laubach in 1895, and perhaps justifies carrying his idea a little further. The disc begins as a whorl of ovoid protuberances, which are at first free from each other, though in close juxtaposition. A little later, these processes become oblong-cylindrical or somewhat tongue-shaped in outline (Figs. 6–8). The formation of the partial partition constituting the distal boundary of the vestibule at the base of each process begins very early (Figs. 6 and 7). In fact it seems to be formed almost simultaneously with the process itself, for we have been able to find no stage so young as to show no trace of it. The next step is the appearance of the rudiments of the two articulated sterile branches (Fig. 8), which begin as dome-shaped protuberances at the apex of the process. It is of interest that these protuberances commonly do not at first stand one in front of the other or in line with the radius of the disc, as they usually seem to do at a later time, but are almost side by side in line with a tangent to the disc. And when, as rarely happens, three rudiments of sterile branches appear instead of two, the three are never in a straight line but form an evident terminal verticil. The later development commonly thrusts them nearly into a radial line, but there are some exceptions to this as will be seen from our Fig. 30. In the course of time, each of these outgrowths becomes strongly constricted in the zone of emergence from the body of the original process and is at length in communication with it only by a narrow slit which is bounded by a callus-like thickening of the membrane. And this narrow slit is evidently closed in the scars which remain after the fall of the sterile filaments. Closely following the appearance of the rudiments of the sterile branches, the first indication of the origin of the sporangium may be recognized. The sporangium begins as a rather broad out-pocketing on the outer face of the original process at about its middle or sometimes nearly as low as the basal third (exclusive of vestibule). It is from the first broader than the rudiments of the sterile branches and though it becomes somewhat constricted at its base this constriction is not so pronounced as in the case of the sterile branches. The young sporangia are at first abundantly free from each other. They are at an early stage short-cylindrical or somewhat club-shaped, with a rounded-obtuse apex (Figs. 12, 13, 15), but a little later, when they come to be coherent laterally, each has a free apex that is decidedly conical or conico-mammillate (Fig. 19). While, however, the disc is still very small, the end of the sporangium broadens out and nothing but a small mucro remains to represent the conical apex of the earlier stage, and even this mucro is sometimes obscure or obsolete. The hypopeltal process (segment of the *corona inferior* of Solms-Laubach) originates a little later than the sporangium. It begins as a broad dome-shaped outgrowth involving the whole region between the base of the sporangium and the vestibule-wall. Its further development offers nothing worthy of special comment unless it be the fact that it becomes strongly emarginate or emarginate-bilobed. That the hypopeltal process bears neither polytomous filaments nor the rudiments of them is well understood. It has already been noted that the rudiments of the polytomous filaments at the time of their emergence from the previously undifferentiated primordial ray are terminal in position. Later, however, the region just below them on the side toward the sporangium grows out into what is finally the emarginate or emarginate-bilobed apex of the coronal process. In reality, the organic apex of the ray as a whole is doubtless still to be found somewhere between the points of insertion of the two polytomous branches or their rudiments, having been thrust into an apparently lateral position by the development of the three superposed lateral outgrowths, namely, the sporangium, the hypopeltal process, and the terminal portion of the coronal process. The developmental history of the ray thus forces us to accept in the main the views of Solms-Laubach in regard to the morphological homologies of the disc and its parts, as opposed to the views of Falkenberg,* Cramer,† and Wille.‡ *The whole disc or cap* (including sporangia, coronal and

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* Falkenberg, P. Schenck, Handbuch der Botanik, 2: 270. 1882.

† Cramer, C. Denkschr. Schweiz. natf. Gesellsch. Zurich, 30:—(35). 1887.

‡ Wille, N. Engler & Prantl, Die natürlichen Pflanzenfamilien, 1²: 152–159. 1890.

hypopeltal processes, polytomous disc-filaments, etc.) *evidently is not a complicated aggregation of whorls of primary branches and the sporangia are, with little doubt, not to be compared with the ordinary verticillate branches or branchlets.* As Solms-Laubach has maintained, the sporangia in the Acetabuleae are most naturally to be compared with those of *Bornetella,* in which genus the sporangia arise laterally and irregularly from the primary whorled branches (*i. e.*, from the branches of the "first generation") and have no evident homologies with the verticillate sterile branches. It may be remarked that, according to Cramer, the sporangia in *Bornetella nitida* (Harv.) Mun.-Chal. occur singly on the branches of the first order, while in *B. capitata* (Harv.) J. G. Ag., they are more numerous, ranging from 9 to 35 for a single branch. Now in view of the fact that in the Acetabuleae (if our observations on *Acicularia Schenckii* and *Acetabulum crenulatum* * may be considered typical for the group) the hypopeltal process and the distal portion of the coronal process are lateral outgrowths like the sporangium, we are of the opinion that these structures are best looked upon as abortive sporangia. The logical result of this comparison of the ontogeny of the ray with the relation of parts in *Bornetella* is the conclusion that *the whole cap, with all its radially arranged parts except the vestibules, corresponds to a single primary whorl of branches.* The original outgrowth which gives rise to the terminal rudiments and to the lateral sporangia is the branch of the first order (*i. e.*, corresponds to the first segment of the ordinary primary branch), whence it follows that the sterile polytomous filaments which may arise from it later are branches of the second order. The *velum partiale,* as it might be called, which separates the base of the ray (the chamber of Cramer's "Zwischenstück") from the vestibule (Figs. 33 and 34) is evidently homologous with the constriction which separates the base of the primary sterile branch from the main axis of the plant. It is here that the ray detaches itself when the cap finally falls—though the fertile sporangia alone are often first detached. In this connection, it is of interest to note that the primary sterile branches show at their beginning distinctly recognizable basal cushions corresponding to

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* See page 331.

vestibules, though these afterward become obscure. It may be remarked, too, whether significant or not, that the vestibule communicates with the base of the ray by an elongated slit (Fig. 35) lying transverse to the main axis of the plant and that the passageway at the base of the primary sterile branch just previous to its final closure is a similar slit also transverse to the main axis of the plant (see scars in Figs. 5 and 6).

II. ACETABULUM CRENULATUM (Lamx.) Kuntze

Acetabulum crenulatum, like *Acetabulum Androsace*, as described by Strasburger,* and *Acicularia Schenckii*, as described above, has more or less enlarged rhizoids densely filled with a finely granular material which presumably serves as a reserve food supply. The mode of development of the disc and its parts is essentially as is described above for *Acicularia Schenckii*. As in that plant, one very rarely finds incipient rays which bear rudiments of three polytomous filaments instead of two and these are always equidistant in a terminal whorl. One such case is represented in our Fig. 17. It would be of interest if those who have access to the growing *Acetabulum Androsace* with its more numerous coronal "hairs" or hair-rudiments would determine whether or not these 4–7 outgrowths orginate in a perfect verticil. We are familiar only with the figures of Solms-Laubach bearing upon this point. His figure 4 (*l. c., pl. 1*) indicates the possibility of such an arrangement, but his Fig. 7, in which the sporangium is still in a very young stage shows the rudiments of the sterile branches in a straight radial row. From analogy with *Acicularia Schenckii* and *Acetabulum crenulatum* and from the relations of these parts as described by Solms for the matured *Acetabulum polyphysoides* and *Acetabulum Möbii*,† it is to be expected that the coronal "hairs" of each ray in *Acetabulum Androsace* also will be found to exhibit a terminal verticillate arrangement at the time of their origin.

III. ACETABULUM CARAIBICUM (Kütz.) Kuntze

Acetabulum Caraibicum,‡ in our opinion, cannot be satisfactorily distinguished from *A. crenulatum*. Through the courtesy of

* Bot. Zeit. **35**: 715–718. 1877.

† *Acetabularia Möbii* Solms, Trans. Linn. Soc. Bot. II. **5**[1]: 30. *pl. 4. f. 1.* 1895.

‡ *Acetabularia Caraibica* Kützing, Tab. Phyc. **6**: 33. *pl. 93.* 1856.

Mme. Weber-van Bosse, we have been able to see four of the six individual plants, by which, she writes, the evident type of the species is represented in the Kützing herbarium.

Graf zu Solms-Laubach, though admitting the close relationship of *Acetabulum crenulatum* and *A. Caraibicum*, attempts the following distinctions in his key * to the species of the genus:

"Disci infundibuliformes saepius plures superpositi, radiis apiculo convexo." *A. crenulatum*

"Discus planus, radiis apice emarginatis, apiculum parvum gerentibus." *A. Caraibicum.*

The alleged difference in the form of the disc appears not to be borne out either by Kützing's original figures or by the specimens preserved in his herbarium. In all the latter, so far as we have seen them, with one exception, the disc is as strikingly infundibuliform as in any condition of *A. crenulatum*; and this one exception, if it may be so called, is a disc which has been artificially flattened on a piece of mica and evidently decalcified. Moreover, the discs are sometimes superposed in pairs in *A. Caraibicum*, as shown in the original figures and in the specimens themselves. The plants with two discs were made by Kützing to constitute his variety *calyculata*, but they were apparently growing with the others and do not deserve a varietal name any more than the similar conditions which have long been recognized in *A. crenulatum*. In regard to the apiculum, there is little difference. In Kützing's plants it is very conspicuous when the sporangium is young, but becomes more or less obscure with age—as also is generally acknowledged to be sometimes the case in *A. crenulatum*. The apiculum is, however, discernible in each of the four Kützingian plants examined. The paucity of the original material forbade any extended observations on the form of the apex of the mature sporangium in the soaked-out condition, but we found none so strongly emarginate as figured by Kützing. The apices of the matured sporangia appear rather to be merely truncate or slightly retuse, more as figured by Count Solms (*l. c., pl. 1. f. 10*), and we think it must be admitted that a subtruncate sporangium-apex is quite normal in *A. crenulatum*. Solms-Laubach mentions also the "slightly calcified cap" as one of the characters by which *Acetabulum Caraibicum*

* *l. c.* 20.

may be generally distinguished, but it seems to us that this description cannot well be applied to the plants of Kützing.

By way of further description of Kützing's specimens, it may be remarked that the number of sporangia in a disc varies from 32 to 52, that the largest disc seen is 7 mm. in diameter, and that the emarginate coronal processes bear two "hair-scars" or two undeveloped rudiments. The pocket in the Kützing herbarium bears the inscription, "*Acetabularia caraibica* Lamx.," though why the name should be attributed to Lamouroux is not quite clear. Another specific name, with "Kg." after it, was first written, but was so effectually scribbled out that we were unable to decipher it. The pocket is numbered 103 and at the bottom is written "Von den Antillen. Koch."

Explanation of Plates

PLATE 24

1–16 and 18–22. *Acicularia Schenckii* (Möb.) Solms.

17. From *Acetabulum crenulatum* (Lamx.) Kuntze.

1. Basal portion, showing rhizoidal food-reservoirs, × 28.

2. Apical portion of a young plant, × 16.

3. A later stage, showing beginnings of a primary whorl of sterile branches, × 55.

4. Apex of plant crowned with well-developed primary whorl of sterile polytomous branches, × 55.

5. Apex of plant at a little later stage; primary branches falling and main axis continuing its upward growth, × 55.

6. Apical portion of plant, showing beginning of a disc, × 55.

7. Three of the tooth-like processes constituting the young disc in Fig. 6, × 245, outer (distal) aspect.

8. Process from a slightly older cap-rudiment, distal aspect, × 245. At the apex (*a*) are seen the beginnings of what afterward will become the disc-filaments or the abortive rudiments of such.

9. The same a little more advanced, showing at *b* the first indication of the sporangium, × 245.

10. A similar process viewed laterally, × 245. The beginning of the sporangium at *b*.

11. A primary process from a more advanced stage of the disc, in lateral view, showing now at *c* the beginning of the hypopeltal process, × 245.

12–15. Similar and later stages from various young discs, lateral views, × 245.

16. A primary disc-forming process at a little later stage than the preceding, in distal view, × 245; *b*, the sporangium; *c*, the hypopeltal process. The true apex, with its two rudiments of disc-filaments, is hidden behind *b*.

17. A primary disc-forming process from *Acetabulum crenulatum*, showing rudiments of three disc-filaments in a terminal whorl, × 193.

18. Young disc of *Acicularia Schenckii*, seen from above (slightly flattened under cover-slip), × 18. At this stage, with the present magnification, scarcely anything more than the conspicuously pointed young sporangia is visible.

19. Terminal portions of young sporangia from the preceding, × 40.

20. Prolification of axis, × 16. At about the lower third are scars left by the fall of a whorl of primary sterile branches; above this an apparently abortive disc-rudiment; at the apex, the beginnings of another whorl of primary sterile branches.

21. Prolification after the fall of a disc, × 16.

22. Prolification and dichotomy, × 16.

PLATE 25. *Acicularia Schenckii* (Möb.) Solms.

23. Plants with mature discs, natural size.

24. A mature disc viewed from above, × 7.

25. Apex of mature sporangium, surface view, showing the small terminal apiculum, × 40.

26. Another sporangium-apex in optical section after decalcification, × 40.

27. Coronal processes, × 55.

28. Coronal process, with two scars left by the fall of disc-filaments, × 245.

29. Coronal process with transverse invagination, one disc-filament-scar, and one abortive rudiment of a disc-filament, × 245.

30. Coronal process with transverse invagination, after decalcifying, × 245.

31. Hypopeltal processes, × 55.

32. A single hypopeltal process, with vestibule below, × 245.

33 and 34. Slightly diagrammatic radial sections, showing relations of the various parts of the disc, × 180. *a*, the disc-filaments or their rudiments; *b*, the sporangium; *c*, the hypopeltal process; the dotted line marks the inner lateral boundary of the vestibule. In Fig. 33 the coronal process shows a transverse invagination.

35. Vestibules viewed from the main axial cavity of the plant, × 245. In each, the passage-way leading into the coronal chamber is seen to be elongated transversely to the plant axis; the appearance of this passage-way in vertical section is shown in Figs. 33 and 34.

36. A single mature sporangium viewed from above, showing toward the apex the falling away of the sporangium wall and the resultant exposure of the aplanospores, × 16. Drawn from a glycerine mount. The aplanospores are as a rule less clearly visible through the sporangium wall, even in a glycerine mount, than the present figure would indicate.

37. A spore-mass (massula) removed from the sporangium entire, viewed from above or below (using these terms with reference to its former position in the disc), × 16.

38. The same massula in lateral view, × 16.

39. Portion of massula in surface view, × 55.

40. A single aplanospore with its calcareous incrustation, in optical section, × 193.

41. Aplanospore with calcareous coating fallen away, × 193.

42. Aplanospore, showing operculum, after treatment with strong acetic acid, × 245.

43. The operculum and adjacent portions of the aplanospore wall, in optical section, after treatment with strong acetic acid, × 750 (reduced from 1500).

COLUMBIA UNIVERSITY, May 16, 1901.

The Work Performed in Transpiration and the Resistance of Stems

By Carlton C. Curtis

It is a matter of some difficulty to make a clear demonstration of the amount of work performed by a plant in transpiration. The usual method of measuring the extent of this important operation, *i. e.*, through the lifting power of the transpiration current, is open to objection, since the stem usually allows the air to infiltrate and stop the rise of the column of mercury long before the measure of the force of transpiration has been reached.

A nearer approach to the extent of this force may be attained by subjecting a given length of the stem to pressure and forcing water through it at a rate equalling that of the transpiration stream. This may be easily accomplished, after determining the rate of transpiration with a Darwin potometer, by removing the capillary tube from the potometer and attaching it with a short piece of rubber tubing, about 20 cm., to one end of the stem, while the other end of the stem is connected with a burette by means of a longer length of tubing, so as to allow wide latitude in the amount of pressure applied. The tubings are filled with water before attachment to the stem, and care must be exercised to exclude the entrance of any air, since the latter acts as an effectual block to the passage of water. These connections are effected under water with more ease and safety from introduction of air. For short lengths of stem an apparatus stand will give sufficient elevation to the burette to furnish the necessary pressure.

The burette and tubings having been properly attached, any water that passes though the stem escapes through the capillary tube. By pinching the tube connected with the capillary tube between the fingers, a given amount of water can be forced out and absorbed with a blotter, and with the removal of the pressure the water in the tube will be drawn back. With a few trials it is possible to judge accurately just how much water to force out in this way, so that the capillary tube will be left nearly empty upon releasing the pressure. The water passing through the stem will cause the water to flow again through the tube, and the current may be timed over the same course as in the transpiration tests. The base of the capillary tube is attached to the rubber tubing in order that the same lapse of time may intervene before measuring the rate as is utilized in the measurements with the potometer. It is important that no more water than the volume of the capillary tube should be forced out, otherwise air will be drawn back into the rubber tube and introduce sooner or later troublesome Jamin's chains in the tests. While it is feasible to test only short lengths of stems by this method, the considerable resistance offered by such pieces gives a very striking and accurate basis for an estimate of the work performed in transpiration. The objection might be raised that in subjecting stems to pressure in this way histological elements would become active in the transmission of water that were functionless in transpiration. While it must be conceded that all cells may not be equally active or are quite functionless, in such stems as may be tested by a potometer, we are dealing with only a few annual zones of growth—frequently but one—and therefore no considerable error is encountered from this source. The demonstration by Strasburger that at least several annual zones assist in transpiration, as may also readily be observed in sections of stems that have imbibed colored solutions, renders it possible that under the pressures required for short sections of most woody plants the ordinary conducting cells are alone active in the transmission. In the case of some stems of high resistance, noticeably succulents, it is very obvious that a pressure that will force water through the stem at a rate equalling that of transpiration causes a considerable exudation from the extra-xylar tissues of the pith and cortex. In such cases, certainly, the action of these normally feebly transmitting cells would lower somewhat the resistance encountered by the passage of water through the xylem.

I.

	1	2	3	4		1	2	3	4
Abutilon	48	45	49	10 × .8	*Acalypha*	13	13	29.5	10 × .5
	46	45				12	13		
	47	46				13	13.5		
	48	47				13	14.5		
	48	48				13.5	16		
	48	48				13.5	17		

Abutilon	63.5	65	41	10 × .7	*Acalypha*	48	47	32	10 × .8
"	2^{27}	2^{28}	20	10 × 1.0	"	63	65	26	10 × .9
"	1^{58}	2^{56}	28	10 × .7	*Salix*	6	7	53	10 × 1.0
"	1^{34}	1^{36}	38	10 × .8	*Ailanthus*	8	7	29	10 × .9
Taxus	1^{20}	1^{19}	48	10 × .8	*Cornus*	7.5	6.5	71	10 × .9
	1^{22}	1^{21}				8	7		
	1^{21}	1^{20}				8	7		
	1^{20}	1^{22}				7	8		
	1^{21}	1^{23}				7	8.5		
	1^{21}	1^{23}				8	9		
Taxus	3^{50}	3^{45}	25	10 × .6	*Cornus*	13	13	39	10 × 1.0
"	2^{40}	2^{43}	42	10 × .6	"	12	13	51	10 × .8
"	12	12	105	10 × 1.0	"	13	14	48	10 × .7
"	59	58	52	10 × .8	*Viburnum*	73	71	38	10 × .6
						36	38	64	10 × 1.0

The experiments given in the first table are examples from a great number that have been performed in our laboratory and are representative of the variation and extent of the resistance that the transpiration current must overcome. The stems were usually tested after standing over night in water or less commonly three or four hours in water. In the first column opposite the name of the plant is recorded the transpiration rate. In four examples, *Abutilon*, *Acalypha*, *Taxus* and *Cornus*, six consecutive readings are given to show the variations that are characteristic of the transpiration rate when conditions are as constant as possible and for comparison in the second column are six readings from a length of stem under pressure. In the other examples averages only of a series of readings are given. The pressure required to produce the rate approximating that of transpiration is found in the third column and in final division are the dimensions in cm. of the stems subjected to the pressure. In the majority of these and subsequent experiments filtered tap water was used and fresh cuttings of the ends of the stems were made in setting up the experiments if any considerable lapse of time intervened sufficient to produce a marked variation in the readings. In the case of stems under pressure this was very quickly effected, and distilled water gave the same though slower declines. This difference in the rates of consecutive readings shown in columns 1 and 2 are rather suggestive of the processes employed in maintaining the current in transpiring stems. Pressures result in a fairly constant rate. The same is true of suction. In some of the experiments under discussion, also in tables 2 and 6, the pressure was replaced by attaching the stems to an air pump and recording the amount of suction required to draw water through the stem at the transpiration rate. The results are the same in either case. The transpiration current is an irregular one not indicative of a pull or pressure while the distribution of water in the stem can hardly be reconciled with the existence of such a condition.

Another interesting feature is the wide variation in the resistance of the stems, not alone of various plants but of the same species.

The tests were made on vigorous stems, entirely free of branches below, such as may be obtained from vigorous plants. In such cases the wood is exceptionally regular owing to the early suppression of all lateral organs. In some instances, however, the cause of the variations of rate was apparent, on splitting the stems, in irregularities of growth due to branching or other causes. The presence of these resistances becomes more apparent if transpiring stems are allowed to imbibe solutions of eosin when the difficulty of the fluid in passing the nodes or any obstruction due to irregularities in the grain of the wood is very apparent. More frequently the cause of the resistance cannot be accounted for on this ground and must be due to the specific pecularities of the individual elements rather than to any grouping of tissues that is apparent to the eye. Such may be the explanation of the high resistance of *Pelargonium* for there is sufficient carrying capacity in the water conduits to render unnecessary the high pressure required.

While as a rule the resistance increases with the rate there is no regularity in this ratio, as will be noted in comparing the second and third columns. However, it is to be noted that when a given pressure produces a certain rate of flow any increase or decrease of pressure causes about the same fluctuations of rate as would be found in capillary tubes. Two examples will illustrate this relation, the first number to the left being the pressure and the succeeding ones in the same line the rate of transmission.

Acalypha	24	63	63	64	65	65	*Taxus*	58.6	61	61	61	62	62	63
	30	55	55	56	56	57		68.6	51	51	51	51	52	52
	36	48	48	48	49	49		78.6	45	45	44	45	46	46
	42	42	43	43	44	44		48.6	77	77	77	77	78	78

RELATION OF LENGTH TO PRESSURE

The following experiments illustrate the variations in resistances of different portions of the same stem. As in the first table the transpiration rate follows the name of the plant, in the second column is the rate obtained by pressure, next the pressure employed and the dimensions of the stem. Columns 5, 6 and 7 give the rates when $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ respectively of the stem had been removed.

II.

	1	2	3	4	5	6	7
Abutilon	38.5	42	79	40 × 1.1	32	27	23
	40	42			32.5	26.5	23
	41	42.5			32.5	27	23.5
	39	42.5			32	27.5	23
	39.5	43			32.5	27.5	23
	40.5	43			32	28.1	25.5
Abutilon	2^{1}	1^{58}	66.5	40 × .9	52	20	15
"	1^{47}	1^{43}	37.4	40 × .8	1^{26}	58	34
Syringa	60	61	220	40 × .8	34	30	15
	58	61			34	31	16
	56	63			35	31.5	16
	59	64			35	31	17
	58	64			36	31.5	18
	58	64			39	32	18
Syringa	58	61	190	30 × 1.0	43	30	21
"	4^{50}	4^{50}	103	30 × 0.6	2^{30}	1^{20}	40
Viburnum	63	58	195	40 × .6	43	39	16
	61	58			44	40	15
	60	59			43	38	15
	59	60			41	39	16
	62	59			41	38	16
	61	59			40	39	16
Viburnum	56	65	186	40 × 1.0	20	16	9
"	48	48	222	40 × .9	31	20	15
Pelargonium	1^{5}	5^{37}	186	40 × 1.0	2^{34}	1^{27}	1^{4}
	1^{9}	5^{52}			2^{34}	1^{28}	1^{5}
	1^{6}	6			2^{35}	1^{26}	1^{6}
	1^{10}	5^{58}			2^{37}	1^{27}	1^{6}
	1^{8}	5^{56}			2^{38}	1^{28}	1^{7}
	1^{5}	5^{56}			2^{38}	1^{28}	1^{8}
Pelargonium	1^{50}	3^{56}	186	40 × .9	2^{12}	42	23
"	1^{22}	3^{10}	186	40 × .8	2^{26}	1^{53}	1^{38}
"	1^{20}	1^{24}	186	20 × 1.0	47	26	14

Here again it is evident that only in the remotest way is there any conformity to the law of Poiseuille for capillary tubes, at least the ratio of rate, length, radius and pressure can hardly be said to show a variation in conformity to this law. Some stems offer a resistance out of all proportion to their dimensions and the volume of transpiration. *Pelargonium* is a striking example of this. It is possible that this may be due in part to blocking by substances escaping from the cut stems. In other instances equally striking examples are sometimes met, the pressures ranging from .08 to .2 of an atmosphere per sq. cm. in the short lengths of stems mentioned above. The irregularities shown in the 2d, 5th, 6th and 7th columns of the first experiment with *Viburnum* are doubtless due to the fact that the negative pressure was not satisfied. It was frequently noticed in such cases and particularly with stems tested in the winter that they would show for hours an irregularity and even an acceleration of rate. The rapid decline in the rate in the short lengths is, of course, due to increased volume transmitted.

ELECTRICAL CURRENTS AND CONDUCTIVITY

In some work, conducted two years ago at the Physical Laboratory, a slight difference of potential was shown to exist between the top and bottom of trees. Haacke has also demonstrated the presence of weak currents circulating in the plant cells. In view of these facts and the marked effect of electrical currents upon plants, lengths of stems under pressure and also transpiring stems with potometer attached were submitted to currents from a double 18-inch plate, Winshurst static machine and also to the street current, 110 volts. The current was applied to the stems by removing two strips of the cortex 10 cm. apart and wrapping the electrodes about the wood.

III.

	C		C			RC		RC
Acalypha	39	39.5	42	39.5	52.5	54	54	56
	39.5	40.5	41.5	40.5	53	53	56.5	55
	39.5	40.5	42	40.5	54	53	57	54.5
	39	41.5	39.5	40.5	54	51	56	54
	39	41.5	39	41	54.5	51	57.5	53
	38.5	42	39.5	41.5	55	51	57.5	54
	38	42	38					

		C		C		C		C		C.
Abutilon	57	55	60	57	63	59.5	1^{40}	2^{29}	2^{34}	2^{31}
	56	55	60	57	62	60	1^{50}	2^{30}	2^{31}	2^{30}
	57	54	60	56	61	58	2^{20}	2^{28}	2^{29}	2^{29}
	57	54	61	56	61.5	59	2^{22}	2^{27}	2^{32}	2^{29}
	56.5	54.5	61	56	62	58.5	2^{25}	2^{26}	2^{35}	2^{30}
	57	54	62	55	62	59	2^{26}	2^{26}	2^{36}	2^{30}

The columns marked C give the rate with the current on, RC with the current reversed, those unmarked without the current.

The results as far as showing any effect upon the conductivity of the xylem is negative. The current from the static machine and also weak dynamic currents had no effect.

The variations in the above examples which are taken from experiments with street current are due to the high resistance of the stem to the current. This resulted in a rise of temperature and the change of rate. The records of temperature in the preceding work have not been given inasmuch as the examples selected for illustration have not been subjected to any variations in this respect that are of importance. In the test upon *Abutilon*, for the purpose of producing variations in the conductivity of the stem, a 1% NaCl and an isotonic cane-sugar solution were used in place of water, the measurements with the latter occurring in the four right-hand columns. The results are the same as with water.

SALT SOLUTIONS AND RATE

The marked influence of salt and sugar upon the rate in the last experiment led to some further tests for the purpose of determining if there was any specific peculiarity in the cell wall that might be revealed by the rate of transmission. Solutions of $ZnCl_2$ and sugar were prepared isotonic with a decinormal solution of NaCl and stems were subjected to these different solutions under constant pressure.

IV.

	H_2O	NaCl	H_2O	$ZnCl_2$		H_2O	NaCl	H_2O	$ZnCl_2$
Taxus	2^{34}	2^{20}	2^{24}	2^{18}	*Acalypha*	1^{20}	52	64	61
	2^{34}	2^{21}	2^{25}	2^{21}		1^{19}	52	69	59
	2^{34}	2^{32}	2^{32}	2^{31}		1^{18}	51	70	59
	2^{35}	2^{36}	2^{34}	2^{40}		1^{18}	50	72	62
	2^{35}	2^{34}	2^{35}	2^{34}		1^{19}	49	74	63
	2^{35}	2^{34}	2^{40}	2^{36}		1^{18}	49	78	63

	H_2O	$C_6H_{22}O_{11}$	H_2O	NaCl		H_2O	$C_6H_{22}O_{11}$	H_2O	$ZnCl_2$
Taxus	33	48	53	50	*Acalypha*	50	52	62	59
	33	54	54	50		51	54	63	58
	33	58	56	51		51	61	62	58
	34	61	60	51		52	62	62	62
	33	73	61	50		52	63	63	62
	33	74	62	51					

The few examples here given are typical of the variations resulting upon a change of solution. The results seem to indicate that in the case of NaCl and $ZnCl_2$ there is not apparent any specific relationship between the wall and any of the substances different from that existing between the wall and water. Investigations upon this point have not been completed. The accelerating effect following the substitution of salt solutions for water appears to be due to the osmotic action of the two fluids thus brought together acting through the walls of the living cells. The fact that the rate often accelerated for some time but finally declined would indicate this relation. It is not probable that the dead cells play any rôle in the acceleration of the rate. The measurements with sugar, however, indicate that the molecules are not freely transmitted and so act as an effectual block to any osmotic action while the introduction of another solution would tend to remove the obstruction and allow a renewal of osmotic action in the cells. This result would appear to throw considerable light upon the manner of transmission of sugars through the stem and account for their meager occurrence in the sap.

Solutions of 50 per cent. alcohol had a very marked effect upon the conductivity of the cells, causing a marked and rapid decline which was not changed with the introduction of water. Thus with a rate of 46, 46, 47, 47, 47 under water pressure, with alcohol the readings were 60, 61, 63, 63, 64, followed with water 82, 83, 84, 85, 85. The results are evidently due to a molecular change in the walls whereby their power of transmission has been materially interfered with. The feeble attraction between the alcohol and the molecules of the cell wall would tend to prevent imbibition and doubtless leaves them less attractive to water.

TEMPERATURE AND RESISTANCE

For the purpose of comparison with effects upon capillary tubes, observations were made upon the action of temperatures on the conductivity of stems. In the first example the stem above the potometer for about 35 cm. was covered with a layer of snow about 2 cm. thick and bound with sheet rubber so that there could be no drip upon the potometer. A thermometer was placed among the leaves, 5 cm. above the jacket of snow in order to determine whether any variation of rate could be explained by a lessened action of the transpiring organs rather than by the increased resistance of the stem. The snow was applied for about one half hour, producing a fall of temperature among the leaves of only 2.8 degrees. The wide variation from the normal transpiration rate of 16.4 to 36.2 cannot of course be attributed to so slight a fluctuation of temperature and the delayed approach to the normal rate also clearly indicates that the greatly reduced temperature of the stem is the chief factor in the reduction of the rate. It is apparent that the wide variation is not at all in keeping with the fluctuations to be noted in capillary tubes and the marked changes of rate may probably be accounted for as principally due to reduction in the size of the cell cavities.

V.

Abutilon	16	12^{50}	20.5°	19.6	1^{10}	18.6°	35	1^{25}	17.7°	34.6	1^{40}	19.4°
	16 8			20.2			36.2			33.8		
	16.5			21			36			34.5		
	16			22.5			37			33.4		
	16.4			23			36.4			32		
Citrus	25	11^{20}	18.3°	28.	11^{45}	15.5°	33.5	12	16.5°	27	12^{20}	19.4°
	26			28.6			33.5			26		
	25.6			31.			33.5			25		
	26.2			32.			33			25.5		
	26			32.5			33			24.		
Abutilon	55	2^{20}	23°	1^{20}	2^{30}	8°	1^{25}	2^{50}	20.6°			
	56			1^{33}			1^{20}					
	56			1^{35}			1^{11}					
	57			1^{34}			1^{6}					
	56			1^{34}			1^{9}			22		
Abutilon	54.3	3^{15}	24.7°	1^{10}	3^{40}	8°	1^{14}	3^{50}	12°	13	4^{20}	21°
	54.5			1^{13}			1^{8}		14°	1		23°
	55			1^{15}			$1^{8.5}$			58		
	54.5			1^{18}			1^{7}			58		
	54.5			1^{19}			1^{6}		16°	56		24°

The branch of *Citrus* was treated in the same way, about 20 cm. of the stem being covered with snow, with practically the same results. It is to be noted that the rise of temperature in the room during the experiment was sufficient to cause a much quicker acceleration of rate than in the preceding example.

In the third experiment a length of stem immersed in water at 23° was tested under pressure. The rate of 55.8 was lowered, when the stem was covered with water at 8°, within five minutes to 1^{20}, and dropped rapidly to 1^{34}. Water at 25° was now introduced and the first measurement a few minutes later showed a rate of 1^{25} followed by a sharp rise. The temperatures given are probably near those of the stem since the thermometer was lying in the dish against the stem and they would not vary materially in taking on the temperature of the surrounding media. The final test illustrates the variations of rate at different temperatures. The readings are not consecutive. The results are rather suggestive as indicating the very considerable additional work placed upon the plant by variations of temperature. These changes are often sudden and not only act upon the transpiring organs but also introduce a very considerable resistance that is frequently overlooked.

RESISTANCE INTRODUCED BY CUTTINGS

The localization of resistances noted above led, for the purpose of comparison, to measurements on the effect of the introduction of resistances by cutting. The tests were confined to *Taxus* as these plants will better stand the treatment without flagging. In the first column is given the transpiration rate of the branch and in the second and third columns the rates when the stem was cut ½ and ¾ through. The fourth column shows the rate when the column was reduced to a few sq. mm., indicated at the right of the column.

VI.

					sq. mm.						sq. mm.	
Taxus	8	9	14	13	6	9.5	24	12	19	29	8	8 × 1.5
	8.1	9.5	13.5	12.8		10		14	20	34		
	8	8.9	13.2	12.2		9		16	20	34		
	8.4	8.4	13	13		9		16	20	37		
	8	8.9	13.6	13		10		15	21	36		
	8.2	9	12	13		10.5		14	22	37		
Taxus	28.5	29.5	30.8	35	2	29	15	44	90	184	7	7 × .9
	28	29	30.4	36		30		45	98	196		
	29.2	29	30	35		29.5		48	102	186		
	28.5	28.5	30.1	39		29.5		46	96	200		
	28.4	29	29.5	36		30		47	98	189		
	28.5	28.5	30	36		29		46	98	198		

Taxus	6.7	8	13.6	15.5	9	7.2	58	15.6	34	52	8	7×1.0
	7	7.5	13.9	15.5		7.2		17	36	58		
	6.8	7.5	12.2	16		7.4		18	36	59		
	7	7.2	13.8	15.6		7.4		17	35	59		
	7.2	7.1	12	15.1		7.4		18.2	37	60		
	7.2	7.1	11.6	15.6		7.4		18.5	36	61		

The second part of the table gives the results when lengths of stems under pressure were treated in the same way. The number to the right of the first column indicates the pressure required and the three succeeding columns record the results of cutting ½ and ¾ through and to a few sq. mm. The final numbers give the dimensions of the stem. The lengths of these stems also indicate the distance above the potometer at which the cuttings were made.

These cutting experiments of Dufour are among the most important that can be performed in transpiration since they give a very clear demonstration of the vital action of the living cells in maintaining the transpiration stream. The recovery from the effect of cutting noted in the first part of the table is entirely done away with in the second series of measurements upon the stems under pressure. In fact the results in this latter case are practically the same as those obtained in the different lengths of stems in Table II. These results were certainly not to be expected and may be accounted for, I believe, on the ground that the velocity of the fluids at the point of cutting is so enormously increased that a resistance is generated quite out of proportion to that acting on the stem at the normal rate and sufficient to reduce the rate practically to that of stems increased in length in proportion to the depths of cutting.

RELATION OF CONDUCTING AREA IN STEM TO VOLUME OF FLUID

The ability of the plant to maintain the water current unchecked through so small an area of stem led to some investigation upon the extend of the area at the disposal of the plant for the conduction of fluids and the precentage of this space actually utilized. To determine the percentage of cavity in the stem microscopic cross sections were prepared and areas, representative of the various growths of the stem were drawn on sheets of tinfoil with a camera lucida. The weight of the areas bearing the tracings of the wood sections having been determined, by cutting out the lumen of the cells and determining their weight, the percentage of cavity could be determined. This appears to be fairly accurate. The tinfoil selected showed but slight variations in weight and the tracings, cutting and weighing can be made with accuracy. In the following experiment with *Acalypha* a potted plant was placed in a glass jar and the mouth of the jar covered so as to prevent evaporation from the soil. The amount of transpiration for two hours was found to be at the rate of 7.1 grm. per hour. The stem was then cut under water and allowed to stand three hours. It was then allowed to absorb water from a florence flask plugged with cotton for two hours, the loss per hour being 4.53 grm. The stem being transferred to a solution of eosin for one hour the ascent of the fluid was found to be 75.4 cm. From cross sections of the stem the following area of lumen and percentage of cavity was obtained:

Weight of area adjoining pith	3.030	
" " cavity in this area	1.726	Percentage of cavity 56.9
Weight of area in middle of xylem	3.047	
" " cavity in this area	1.709	Percentage of cavity 56.1
		Average 56.5.

The area of the cross section of the stem was 23.15 sq. mm. This would give a water conduit of 13.08 sq. mm.

It is interesting to note the relation of this latter area to the rise of eosin in the stem and the absorptions both in the case of the cut and uncut stem. Taking the rise of the eosin, 75.4 cm. as an approximation of the rate of absorption of the cut stem it is seen that only 6.01 sq. mm. would be required to carry 4.53 grm. to a height of 75.4 cm. Considering the absorption of the uncut branch if the entire area at the disposal of the stem for the conduction were utilized the 7.1 grm. would rise only 54.2 cm.

Two similar tests were made on *Abutilon.* The potted plant transpired 3.25 grm.; cut, 2.95 grm. per hour. Percentage of cavity, 50.1. Area of wood, 37.75 sq. mm. Area of cavity 18.91 sq. mm. 3.25 grms. would consequently rise 17.18 cm. if entire area was utilized. Recorded rise of eosin, 23.5 cm. This would require an area of 13.84 sq. mm.

Another plant transpired 4.73 grm.; cut, 3.9. Percentage of cavity, 55.6. Area of wood, 47.56. Area of cavity, 26.45. This would necessitate a rise of only 17.5 cm. while the eosin solution reached a height of 43.4 cm., requiring an area of 10.1 sq. mm.

A branch of *Taxus* was tested in the same way. Measurements of different sections from the cross section of the stem gave exceptionally uniform results. The area of the wood, 29.3 sq. mm. Percentage of cavity 35.5. Area of cavity, 10.40 sq. mm. Absorption by stem 2.19 grm. The rise therefore would be 20.2 cm. Recorded rise of eosin 31 cm.; necessitating an area of 6.77 sq. mm. It should be stated that the above-mentioned tests were made on plants with small transpiring leaf areas, as the amount of absorption indicates.

It will be seen that the percentages secured in these experiments correspond in the main with results obtained by Rb. Hartig and Sachs and it would appear that there is less opportunity for the introduction of error in this method while in addition the directness of obtaining the results renders the process more available than the specific gravity method.

It is very evident that the carrying capacity of the water conduits is greatly in excess of any demands made upon it by the plant and it is reasonable to suppose that the proportions expressed above between the volume of water and the area of cavity of the stems fairly represent the conditions that obtain in these plants. It will be noted that the percentage of air space is not necessarily larger in the more actively transpiring plants. These relations render quite unnecessary the supposition of Vines that the walls under certain conditions may serve as channels in the transmission of water.

SUMMARY

By means of pressure tests a definite measure of the resistance of a given length of stem to the transpiration current may be obtained and the work actually performed by the plant can be computed. More frequently in the case of small plants by the lifting method of measuring this force a partial estimate of what the plant can do rather than what it is doing is obtained.

The resistance overcome by the transpiration current is often much higher than can be measured by the suction of the transpiring shoot and is subject to extensive variations in different species

of plants and among plants of the same species. Various parts of a stem differ widely in the resistance offered and consequently there is no ratio in the rate of transmission of a stem under pressure and the length of stem.

The rate of transmission is not affected by electric currents and various solutions as in capillary tubes. The former has no effect while the relation of the character of the wall to the nature of the solution may have a marked effect in the rate of transmission. Changes of temperature produce marked fluctuations in the amount of resistance, due largely to variations in the lumen area of the cells.

Partial severing of the water conduits by cuttings does not produce variations in the rate corresponding to those brought about by constricting the bore of tubes at a given point. On the contrary the resistances so introduced are practically equivalent to an increase in the length of the stem proportional to the extent of the cutting. Only a portion of the lumen area is utilized by the plant. This condition may be maintained within certain limits either in slowly or actively transpiring plants through variations in the rate of transmission.

Studies in North American Discomycetes. I. The Genus Holwaya Sacc.

By Elias J. Durand

(With Plate 26)

In the autumn of 1895, I collected a discomycete on a large prostrate log in the vicinity of Ithaca, which I determined at the time as *Holwaya ophiobolus* (Ellis) Sacc., since it agreed in all respects with the specimens in Ellis's N. A. F., No. 996. My plants were accompanied by a Hyphomycetous fungus referable to genus *Graphium*. The possible connection of the two forms suggested itself to me at the time, but I thought no more about it until the winter of 1898, when Professor Burt read a paper before the Society for Plant Morphology and Physiology, at Ithaca, on the subject, "Is there a Basidiomycetous stage in the life history of some Ascomycetes?" Since that time I have been collecting notes and observations on which the present paper is based.

The genus *Holwaya* was described by Saccardo in 1889, to include a Bulgariaceous discomycete externally resembling *Bulgaria inquinans* (Pers.) Fr., but differing from it in the possession of filiform, multiseptate spores. The genus was based on *Bulgaria ophiobolus* Ell., which had already been described from material collected in Iowa by Holway, and distributed in Ellis's N. A. F., No. 996. According to the original description the plant is "composed of two layers, separated by a gelatinous stratum." This gelatinous character was not evident in my material (Fig. 8).

A second species in the genus, *H. tiliacea* E. & E., was described in 1897, from material collected in Canada, on the bark of dead *Tilia*. The differences between this and the first species are not very evident from the descriptions. In 1899, Professor Burt sent me specimens collected on basswood logs, at Middlebury, Vt., and determined by Mr. Ellis as *H. tiliacea* E. & E. In an accompanying note Professor Burt said that he did not see why *H. ophiobolus* was not the same thing. After a careful comparison of this material with that in the N. A. F., No. 996, I must confess that I can detect no difference. They are alike in all essential respects (Fig. 7).

In 1878, Dr. Peck described a discomycete collected on rotten maple bark, which he called *Patellaria leptosperma* Pk. Saccardo later transferred this species to *Lecanidion* on account of its hyaline spores. It is interesting to note that some of Professor Burt's material already mentioned was sent to Dr. Peck, who named it *Lecanidion leptospermum* (Pk.) Sacc. Furthermore, I recently sent some of my 1895 collection to Dr. Peck, with the request that he compare it with his species. He referred it to *Patellaria leptosperma*. Dr. Peck was also good enough to send me specimens of this species, collected at Copake, N. Y. They agree in every respect with the specimens mentioned in the preceding paragraphs (Fig. 6).

But this is not all. In 1893, there was published under the name *Chlorosplenium Canadense* E. & E. the description of a discomycete collected in Canada, on rotten basswood bark, by Prof. John Dearness. According to the descriptions this seems to differ from *Holwaya* principally in the tomentose stem. Mr. Dearness very kindly sent me recently three specimens from as many gatherings, all of which evidently belong to the same species. One of these specimens was a part of the original material from which *C. Canadense* E. & E. was described. Although the specimen is too young to show spore characters, in all other respects it agrees with specimens of *Holwaya ophiobolus, H. tiliacea*, and *Lecanidion leptospermum.* The original description of the spores shows that they, also, are alike. The other specimens from Mr. Dearness exhibit these characters plainly (Fig. 5). With regard to the tomentose character of the stem, a study of specimens has revealed the presence of the olive-brown tomentum on the stems of all examined. In the structure of the sterile layers of the ascoma we find further evidence of the specific identity of these plants. I have made careful paraffin sections of specimens from Professor Burt, from Ellis's N. A. F., No. 996, and of plants collected at Ithaca in 1900, and find that the structure is exactly the same in all. (Fig. 3). In the light of what has been said, therefore, I cannot but regard *Holwaya ophiobolus* (Ell.) Sacc., *H. tiliacea* E. & E., *Lecanidion leptospermum* (Pk.) Sacc., and *Chlorosplenium Canadense* E. & E. as one and the same species.

Turning now to the subject of a conidial phase of this species, I find that a plant called *Stilbum giganteum* Peck was described in 1871. Saccardo, however, transferred it to the genus *Graphium*. The first mention of this plant as a possible imperfect stage of an ascomycete was made by Dr. Peck in his thirty-first report written in 1878, where he said: "I find this associated with *Patellaria leptosperma* Pk. in such a way as to suggest the probability, at least, that it is a form of the latter species." Ellis and Everhart in their descriptions of *Chlorosplenium Canadense* and *Holwaya tiliacea* in each case call attention to the fact that *Coryne Ellisii* Berk. (*Stilbum magnum* Pk.) was found associated with the species, of which it might be a conidial stage. As a matter of fact the association of the two forms has been noted in the great majority of the records of occurrence. The fact that it has not been mentioned in the other cases does not, by any means, go to show that they were not growing together, for such association might have been overlooked. Regarding "*Stilbum magnum* Pk.," Dr. Peck assures me that he never has published such a species, but that the occurrence of the name in the literature is probably due to a slip of the mind or pen, *Stilbum giganteum* being intended in each case.

Coryne Ellisii Berk. was published in 1873 from material found by Ellis, on basswood logs, at Potsdam, N. Y. No asci were present in the original specimens, but the plant was referred to *Coryne* probably on account of a superficial resemblance to the members of that genus. Indeed, Berkeley remarked that an examination of fresh material was desirable. The matter was further greatly complicated when Massee, in 1894, redescribed the type of *Coryne Ellisii*, making it one of the types of a new genus of the Basidiomycetes, called *Dacryopsis*. Our plant was given the name *D. Ellisiana* Massee. The basidia were described as "cylindrical, bifurcate, aseptate, springing from the interlaced layer of hyphae at the apex of the stem, either contemporaneous with, or later than, the gonidiophores."

Such was the state of knowledge regarding this plant when

Professor Burt presented the paper mentioned in the first paragraph. His conclusions may be summarized as follows: "Specimens of the *Dacryopsis* collected in August, October, November and December show only the conidial condition, and no true basidia and basidiospores. Until the presence of basidia is demonstrated, *Graphium giganteum* (Pk.) Sacc. should be regarded as a conidial rather than a basidiomycetous stage of the ascomycete *Lecanidion leptospermum* (Pk.) Sacc." My own results only confirm those of Professor Burt. I have examined many specimens of the *Graphium* from several localities, and of various ages, and have made careful paraffin sections, but as yet I have found no structure which might be interpreted as a basidium.

In the autumn of 1900, specimens of the *Holwaya* were found growing on a rotten basswood log in woods not far from Ithaca. A few days later others were found on oak in the same woods. The *Graphium* was present in both cases. Inasmuch as it seemed desirable to determine definitely, if possible, the relation between the two forms, cultures were made from the specimens on oak in the following manner: Agar was prepared using a decoction of dead oak bark as a nutrient base. A bit of the hymenium was then taken up with a sterilized scalpel, and crushed in boiled water on a flamed slide. Dilution cultures were made on acidified medium in the usual manner. The same was done with the conidia. Ascospores were present in considerable numbers, and could easily be recognized in the agar, with the aid of the microscope. The cultures were examined at intervals for two or three days, but no signs of germination appearing, they were, unfortunately, neglected for a day or two. When next they were examined, numerous small colonies were present in the cultures of the ascospores. Examination with the microscope showed that the spore could still be made out in the center of many of the colonies, with threads actually attached to it, although some of the colonies were so far advanced that the spore was obliterated. There could be no doubt, therefore, that the colonies came from the ascospores. The cultures were allowed to stand a week, when it was found that plate number two of the set contained a pure culture, except for a single colony of *Penicillium*. Some of the colonies were then carefully transferred to sterilized bean stems, and dead oak stems and bark. On the bean stems growth was very slow, but after a week, mycelial threads could be seen extending into the liquid at the bottom of the test-tube. Soon these formed a felty mass on the surface of the water. After two weeks minute dark points appeared on the bean stems. These rapidly increased in size, until they assumed all the appearances of normal *Graphium giganteum*, except that they were smaller than those grown under natural conditions. This was to be expected. Examination with the microscope revealed conidia in great numbers, and of the normal form, borne on conidiophores likewise normal. No growth occurred on the oak bark. The original cultures of the conidia failed to produce germination. Attempts to repeat the germination of the ascospores also failed. As yet after more than three months no ascomata have appeared.

These cultures seem to remove all doubt that *Graphium giganteum* (Pk.) Sacc., and the ascomycete forming the genus *Holwaya* are different stages in the development of the same plant. The question now arises, What shall this plant be called? The first name applied to the *ascus* stage was *leptosperma* Peck. If that name be applied our plant would be called *Holwaya leptosperma* (Pk.) Durand. But if the first name applied to the plant *in any of its forms* be used, it should be called *Holwaya gigantea* (Pk.) Durand. The latter combination seems the more logical, and has the sanction of precedent. But what is the systematic position of the plant? It has already been placed in three different families, viz.: Pezizaceae, Patellariaceae and Bulgariaceae. Saccardo placed it in the last-named group on account of its "gelatinous stratum" mentioned in the first description of *Bulgaria ophiobolus* Ellis. I have examined a large number of plants, both fresh and dry, but I cannot detect any indication of a gelatinous nature; certainly none such as exists in *Bulgaria* or *Coryne*. On the contrary the substance is rather a fleshy-mealy when fresh, becoming hard and brittle when dry. The flesh is dark brown in color. A section shows that the paraphyses are longer than the asci, and cohere at the tips into a thick black epithecium covering the hymenium. These characters locate it in the Patellariaceae where Dr. Peck first placed it. This, I think, is its proper position. *Holwaya* is nearest related to *Lahmia* Körb., from which it differs in its stipitate habit, dark hypothecium, and tomentose stem.

I add a description and synonymy.

HOLWAYA Saccardo, Syll. Fung. **8**: 646. 1889

A genus of the Patellariaceae. Ascomata stipitate, stipe tomentose; hypothecium and excipulum dark brown; sporidia 8, hyaline, filiform, multiseptate, not breaking up at maturity.

Holwaya gigantea (Peck) Durand

Ascus form.

Patellaria leptosperma Peck, Reg. Rep. **30**: 62. 1878.

Bulgaria ophiobolus Ellis Am. Nat. **17**: 193. 1883.

Holwaya ophiobolus (Ell.) Sacc. Syll. Fung. **8**: 646. 1889.

Lecanidion leptospermum (Pk.) Sacc. Syll. Fung. **8**: 800. 1889.

Chlorosplenium Canadense E. &. E. Proc. Phil. Acad. Nat. Sci. **41**: 146. 1893.

Holwaya tiliacea E. & E. Am. Nat. **31**: 427. 1897.

Conidial form.

Stilbum giganteum Peck, Reg. Rep. **24**: 93. *pl. 3. f. 7–9.* 1871.

Coryne Ellisii Berk. Grev. **2**: 33. 1873.

Graphium giganteum (Pk.) Sacc. Syll. Fung. **4**: 611. 1886.

Dacryopsis Ellisiana Massee, Jour. Myc. **6**: 181. *pl. 7. f. 19–21.* 1891.

Ascus form.—Caespitose or single, scattered, stipitate. Disk cup-shaped, becoming plane, or the margin reflexed and umbilicate, orbicular, or irregular from mutual pressure, when fresh .75–1.5 cm. in diameter, greenish-black, externally same color, pruinose or granular. Stem .25–.75 cm. high, tapering downward, greenish-black, covered with an olive-brown tomentum, which often disappears with age. Flesh dark brown to black. In drying the plant shrinks to less than one-half its former size and becomes black. Hypothecium well-developed, of intricately interwoven hyphae; excipulum of slender interwoven hyphae, passing into a cortical layer of pseudo-parenchyma, of polygonal cells about 10 μ in diameter, which project from the surface in groups giving it a granular appearance. This layer is confined to the sides of the cup and upper part of the stem. Stem composed of closely interwoven hyphae which project from the surface forming the tomentum of septate, sparingly branched threads, 2 μ thick. Asci narrowly and evenly clavate, apex rounded, not blue with iodine, variable in size in the same individual, 120–200 × 10–12 μ. Sporidia 8, fascicled or multiseriate in the ascus, filiform-cylindrical, or very narrowly clavate-cylindrical, ends rounded, or sometimes acute at one end, straight, curved, or slightly sigmoid, hyaline, multinucleate, becoming 14–20-septate into cells about as long as wide, very variable in size, 30–75 × 3–4 μ. Paraphyses filiform, slender, longer than the asci, globose at the tips which cohere, and with amorphous matter form the epithecium.

Conidial form.—Gregarious or single, fleshy-gelatinous, stem cylindrical or tapering upward, 3–10 × 2 mm., black. Head broadly elliptical, soft, viscid, pallid, 2–6 × 2–4 mm. Conidiophores very slender, branched. Conidia hyaline, elliptical, 3 × 1 μ.

On prostrate rotten logs, usually in crevices and depressions in the bark, also on the bare wood, oftenest on *Tilia*, but also on *Acer*, *Quercus* and *Magnolia*. October and November.

Vermont (Burt)!; New York (Peck!, Clinton, Durand!); Ohio (Kellerman)!; W. Virginia (Nuttall); Iowa (Holway)!; Canada (Macoun, Dearness!).

Explanation of Plate

Figures 2, 4, 5, 6, 7 and 8 were drawn to the same scale. Figures 1–4 are from specimens collected at Ithaca, October, 1900.

1. Longitudinal section of whole ascoma to show form and tomentose stem.

2. A portion of the tomentum, showing connection of the threads with the hyphae of the stem.

3. A longitudinal section of the cup a short distance from the margin.

4. Asci, paraphysis and sporidia.

5. Ascus and three sporidia of *Chlorosplenium Canadense* E. & E., from specimens collected at London, Canada, by Professor Dearness (no. 2032 B).

6. Asci, paraphysis and sporidia of *Lecanidion leptospermum* (Pk.) Sacc., from specimens collected by Dr. Peck, at Copake, N. Y.

7. Ascus, paraphysis and sporidia of *Holwaya tiliacea* E. & E., from specimens collected at Middlebury, Vt., by Professor Burt.

8. Ascus, paraphysis and sporidia of *Holwaya ophiobolus* (Ell.) Sacc.; from specimens in Ellis's N. A. F., no. 996.

BOTANICAL LABORATORY, CORNELL UNIVERSITY.

Shrubs and Trees of the Southern States.—IV.

By John K. Small

1. THE EBENACEAE IN THE SOUTH

Two types with as divergent characters as those possessed by *Diospyros Virginiana* and the so-called *D. Texana*, cannot with the least degree of systematic order, be referred to the same genus. The two plants are of wholly different habit, and the flower-structure of the two is so distinct that I cannot understand on what grounds they have been associated with each other in the same genus. The distinguishing characters of the two trees, which I shall treat as two distinct genera, may be compared by means of the following synopsis:

EBENACEAE

A family of about 6 genera and 275 species, most abundant in tropical regions. Only the following representatives are now known to occur in the United States.

Key to the Genera

Styles distinct: anther-sacs opening by longitudinal slits: filaments pubescent: pistillate flowers without staminodia. 1. Diospyros.

Styles united: anther-sacs opening by subapical pores; filaments glabrous: pistillate flowers with 8 staminodia. 2. Brayodendron.

1. DIOSPYROS L.

1. D. Virginiana L. Sp. Pl. 1057. 1753

In woods and fields, Rhode Island to Kansas, Florida and Texas. As now limited this species may be an aggregate. One or two additional species may be separable in the south Atlantic and Gulf States.

2. **Brayodendron** *

1. **B. Texanum** (Scheele)

Diospyros Texana Scheele, Linnaea, **22**: 145. 1849.

Along or near streams in river valleys, southern Texas and adjacent Mexico.

* Named for Prof. W. L. Bray, head of the School of Botany, University of Texas.

2. HITHERTO UNDESCRIBED SPECIES

✓Quercus microcarya

A shrub, or a small tree sometimes 5 m. tall, with very smooth branches and glabrous foliage. Leaves deciduous; blades thin, spatulate in outline, 5–10 cm. long, undulate or shallowly lobed, gray-green above, yellowish green beneath, short-petioled, the small bristles terminating the lobes early deciduous: acorns sessile, less than 10 mm. long; cup deep saucer-shaped, 6–7 mm. broad; nut globose-ovoid, often nearly one-half included in the cup.

On granite outcrops, Little Stone Mountain, Georgia.

Related to *Q. nigra*, but more delicate in all its parts. The leaf-blades are relatively thin and more irregularly lobed, while the very small acorns, always, as far as I have observed, less than 10 mm. in length, with their relatively deep saucer-shaped cups, are very distinct from the larger fruit of *Q. nigra* with its very shallow cup. The fruit is much smaller than that of any of the species of the group to which this plant belongs.

The original specimens were collected by the writer on Little Stone Mountain, Georgia, September 11, 1894. Type in the herbarium of the New York Botanical Garden.

✓ Quercus fusiformis

A shrub 1.5–3 m. tall, with slender or switch-like stems or branches. Leaves persistent; blades leathery, oblong or ovate-oblong, 3–5 cm. long, entire or sparingly spiny-toothed on the twigs, gray-green and lustrous above, paler and scurfy-tomentose beneath, slightly revolute, rounded or truncate at the oblique base, short-petioled: acorns numerous, solitary or several on slender peduncles; cup turbinate, 10–12 mm. high, gray; nut fusiform, 2–2.5 cm. long. long, acute, conspicuously striate, thrice surpassing the cup.

On arid limestone and granite hills, central Texas.

Quercus fusiformis belongs to the group formed by *Q. minima*, *Q. geminata* and *Q. Virginiana*. It is most closely related to *Q. Virginiana*, but differs in the much elongated acorn with its turbinate cup and fusiform nut.

The original specimens were collected on Lacey's Ranch near Kerrville, Texas, by Mr. Howard Lacey during the years 1899–1900, and given to me by Professor W. L. Bray, of the University of Texas. Locally known as LIVE OAK. Type in the herbarium of the New York Botanical Garden.

Quercus Laceyi

A shrub or small tree, becoming 6 m. tall, with a rough deeply and irregularly grooved bark. Leaves deciduous but rather tardily so, numerous; blades oblong and with 3–5 shallow lobes, or oblong-obovate and more prominently 3-lobed below the apex, 4–8 cm. long, olive-green and with a waxy lustre above, grayish and slightly and minutely scurfy beneath, sometimes truncate or subcordate at the base, short-petioled: acorns sessile or nearly so; cup shallowly saucer-shaped, very thick and corky; nuts oblong to oblong-ovoid, 15–19 mm. long, often depressed at the apex: seed very bitter.

On the summits of Caprina limestone hills, north-central Texas.

Related to *Q. breviloba* but differing markedly in the glabrous leaves, the thick corky coarsely warty cup of the acorn and the oblong or ovoid-oblong nut.

The original specimens were collected on Lacey's Ranch near Kerrville, Texas, by Mr. Howard Lacey during the years 1899–1900, and given to me by Professor W. L. Bray, of the University of Texas. Locally known as Bastard Oak. Type in the herbarium of the New York Botanical Garden.

Quercus Brayi

A large tree sometimes 18 m. tall, or more, with a pale flaky bark. Leaves very numerous, deciduous; blades thin, cuneate, 10–20 cm. long, abruptly acuminate at the apex, regularly and coarsely sinuate-toothed nearly to the base, glabrous, with relatively few, prominent and regularly placed lateral ribs, deep green above, slightly paler and rather olive-green beneath; petioles 1.5–2.5 cm. long; acorns sessile or nearly so; cup hemispheric, 2–2.5 cm. broad, the lower scales somewhat warty on the back; nut oblong or ovoid, 2.5–3 cm. long, about 1.5 cm. thick: seed rather sweet.

In cañons, central Texas.

Quercus Brayi is most closely related to *Q. Michauxii*, but differs conspicuously in the membranous and glabrous leaf-blades with their few coarse teeth and lateral ribs, and the shorter and warty-thickened scales of the cup of the acorn. The original specimens were collected on Lacey's Ranch near Kerrville, Texas, by Mr. Howard Lacey in the years 1899–1900, and sent to me by Professor W. L. Bray. It is locally known as White Oak. Type in the herbarium of the New York Botanical Garden.

AEsculus austrina

A shrub several meters tall, with pubescent foliage and inflorescence. Leaf-blades 1–3 dm. broad, long-petioled; leaflets 3–5, firm or leathery, oval or oval-ovate, short-acuminate at both ends or acute at the oblique base (except in the case of the terminal one), lustrous and glabrate above, except on the tomentose nerves, densely tomentose beneath, sharply serrate, commonly quite long-petioluled: panicles 1–1.5 dm. long, tomentose: flowers deep red, about 3 cm. long: calyx tubular, red, 10–14 mm. long, glabrous; lobes ovate, rounded: petals minutely glandular, those of the upper pair with oval blades about as long as the slightly villous claws, those of the lateral pair with obovate blades which are exceeded several times in length by thair claws: stamens exerted; filaments sparingly villous.

In low grounds, Louisiana.

Most closely related to *AEsculus Pavia*, from which it differs in the foliage and flowers. It is *AEsculus Pavia β discolor* of Torrey and Gray,* in part, but not the *AEsculus discolor* of Pursh.† Torrey and Gray's disposition of this plant is the most nearly correct interpretation we have yet had. Dr. Gray later referred it to his *AEsculus flava* var. *purpurascens*, a species with which it has but distant relationship.

The specimen on which the species is founded was collected in Louisiana by Dr. Hale and is preserved in the herbarium of Columbia University.

Hypericum interior

A much branched shrub, several dm. tall, with sharply angled branches and glabrous foliage. Leaves rather numerous; blades narrowly oblanceolate to narrowly linear-oblanceolate, 1–3 cm. long, acute, slightly revolute, pale beneath, narrowed into slender petioles: panicles many-flowered: sepals linear or narrowly oblong, 3–4 mm. long, acute, rather rigid, more or less spreading at maturity: corollas yellow, about 1 cm. broad: petals obovate or cuneate-obovate: capsules conic-ovoid, 5 mm. long.

Along streams, Tennessee and Texas. Summer.

A shrubby species related to *Hypericum galioides*, but more corymbosely branched, and with broader leaf-blades. The sepals

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* Fl. N. A. 1: 252.

† Fl. Am. Sept. 254.

are characteristic, being linear or nearly so, instead of manifestly narrowed to the base. The following specimens belong here :

TEXAS : [no locality], *Veatch.*

TENNESSEE : near Dandridge, July, 1842, *Rugel* :—type, in the herbarium of Columbia University.

Azalea candida

A rigid shrub 1–2 m. tall, with wide-branching stems and white-tomentose young foliage, or the twigs sometimes brownish. Leaves numerous ; blades leathery, obovate, oblanceolate or oblong, 1–5 cm. long, acute or apiculate, ciliate, somewhat revolute, thinly tomentose above, densely white-tomentose and somewhat reticulated beneath, short-petioled : corymbs several-flowered : pedicels canescent and copiously glandular-pubescent : calyx-lobes pectinate-ciliate : corolla rose-colored or pinkish, 3–3.5 cm. long : capsules 1.5–2 cm. long, canescent, curved, longer than their pedicels, often twice as long.

In hammocks and river swamps, southern Georgia. Spring.

Related to *Azalea nudiflora*, but easily distinguished by the copious soft pubescence of the twigs, the white-tomentose leaf-blades, the smaller flowers and the smaller softly and closely pubescent capsules. Collected by the writer along the Withlocooche River about Valdosta, Georgia, June 6–12, 1895. Type in the herbarium of Columbia University.

Dendrium Hugeri

An evergreen shrub 2–4 dm. tall, with erect much branched stems. Leaves mainly alternate ; blades leathery, oblong, 1–1.5 cm. long, lustrous and dark green above, paler beneath, obtuse, revolute, somewhat obliquely narrowed into petioles 1–2 mm. long: flower-clusters dense : bracts oblong-ovate, 3 mm. long, obtuse : pedicels 5–10 mm. long, minutely glandular : calyx nearly glabrous ; lobes lanceolate, about 1 mm. long, acute : corolla white ; lobes ovate, 4 mm. long, obtuse : filaments club-shaped, as long as the corolla-lobes : capsules ovoid, 4–4.5 mm. long, glabrous or nearly so, obtusely lobed, twice as long as the calyx-lobes, abruptly contracted into the stoutish style which is about as long as the capsule-body.

On cliffs and rocky mountain summits, North and South Carolina. Spring and early summer.

This overlooked species is most closely related to *Dendrium* *buxifolium* of the Atlantic pine lands; it is, however, larger throughout and more erect. It may readily be separated by the large leaves, the filaments, which are about as long as the corolla-lobes, and the large capsule, which is about twice as long as the calyx-lobes.

NORTH CAROLINA: Top of Hibriten Mountain, Lenoir, Sept., 1896, *A. M. Huger.* Table Rock, *S. B. Buckley; Small & Heller*, 1891.

SOUTH CAROLINA: Top of Table Mountain, August, 1896, *J. K. Small*:—type, specimen in the herbarium of Columbia University.

Proceedings of the Club

WEDNESDAY, FEBRUARY 27, 1901

This meeting was held at the Museum of the New York Botanical Garden. Dr. Allen presided. Twenty-five persons were present. Miss Delia W. Marble was chosen Secretary *pro tem.* Prof. A. D. Selby, Wooster, Ohio, was elected an active member.

The list of committees for 1901 was adopted as follows: Committee on Finance: J. I. Kane, C. F. Cox. Committee on Admissions: Cornelius Van Brunt, 319 E. 57th St., N. Y. City; Delia W. Marble, Bedford Park, N. Y.; John K. Small, Botanical Garden, Bronx Park. Committee on Library and Herbarium: Per Axel Rydberg, R. S. Williams, Anna M. Vail, Alexandrina Taylor. Committees on the Local Flora: Dr. N. L. Britton; Phanerogamia, Eugene F. Bicknell, H. H. Rusby, M.D., Fanny A. Mulford; Cryptogamia, Prof. L. M. Underwood, Marshall A. Howe, Ph.D., Mrs. Elizabeth G. Britton. Committee on Excursions, Dr. L. Schoeney, 1670 Lexington Avenue, New York City; George V. Nash, Eugene Smith, Marie L. Sanial, Miss L. K. Lawall. Committee on Program: N. L. Britton, Marshall A. Howe, L. M. Underwood.

The scientific program followed, introduced by Dr. Britton with a paper, "On some Senecios of the Eastern United States."

The critical study of this genus dates from 1893, when Dr. Rusby collected in the Green Mountains a peculiar plant, described but not published in the middle of the century by Oakes, and named by him *Senecio Robbinsii.* Dr. Rusby described this plant in the BULLETIN in 1893.

While working up the genus for the Illustrated Flora in 1895–6, Professor Britton found that *Senecio aureus* of Gray's Manual included six different things, and the following species were separated:

Senecio obovatus, *S. discoideus*, *S. Balsamitae*, *S. Smallii*, *S. compactus*, *S. Robbinsii*, besides *S. aureus* with two varieties.

Dr. Britton expressed the hope that field notes on this genus would be made during the coming season.

The second paper, also by Dr. Britton, was on *Eupatorium*, and illustrated the three Linnaean species, *E. purpureum*, *E. maculatum* and *E. trifoliatum*. The first two were collected at Copake Iron Works last summer on a field excursion of the Club.

E. purpureum, with thin almost glabrous leaves, with sharp teeth, grows in woodland and copses.

E. maculatum has leaves thick and rugose with prominent veins, broader and more ovate, and not as sharply serrate as the last; stem rough and spotted; grows in open meadows.

E. trifoliatum has been found in the south, as far north as Pennsylvania; it was named by Elliott, *E. ternatum*. The essential distinction of this species is the crenate leaves; the stem is smooth, the leaves narrower and inflorescence often larger than in *E. purpureum*.

Dr. MacDougal exhibited an experiment on the force exerted in the swelling of seeds; a strong iron pipe was filled with peas and water, and a test-tube inserted in the top. In 24 hours from the time the peas were put in a pressure was registered of eight atmospheres, or 120 pounds to the square inch, the highest pressure hitherto recorded by this means. Professor Underwood called attention to the action of fleshy fungi in lifting heavy paving stones in their growth.

Dr. MacDougal also discussed malformations in *Arisaema*. He called attention to the fact that early specimens may be infested with a fungus growth which causes the hood to stand erect.

It was voted that future meetings of the Club at the Garden be held at 3:30 instead of 4 o'clock.

DELIA W. MARBLE,
Secretary pro tem.

TUESDAY, MARCH 12, 1901

The meeting was held at the Museum of the Botanical Garden and was called to order at 4 P. M., with Dr. Allen in the chair. Dr. D. T. MacDougal was appointed secretary pro tem. Thirty persons were present.

The scientific program was presented as follows:

Dr. Marshall A. Howe gave a paper on "The Algal Genera *Acicularia* and *Acetabulum*," which is printed in full in the present issue of the BULLETIN.

The second paper, by Mrs. E. G. Britton and Miss Alexandrina Taylor, was on the life-history of *Schizaea pusilla, Lygodium palmatum* and *Vittaria lineata.*

Living and pressed specimens were shown of all three; also microscopic preparations and drawings illustrating the gametophyte from the spore to the sporophyte in the various stages of development.

For *Schizaea pusilla* the exhibit of the life-history was very complete, and the descriptions and plates have already been published in the BULLETIN for January.

Dr. C. F. Millspaugh, of the Field Columbian Museum, Chicago, spoke briefly on the results of a recent trip to the West Indies for the purpose of studying the economic fruits of the tropics.

D. T. MACDOUGAL,
Secretary pro tem.

Index to recent Literature relating to American Botany

Ashe, W. W. Some East American Species of *Crataegus*. Jour. Elisha Mitchell Sci. Soc. **17**: 4–17. 20 D. 1900.

Twenty-one new species ranging from Illinois and New York to North Carolina.

Bicknell, E. P. A new Horse Gentian (*Triosteum*) common in the Eastern United States. Torreya, **1**: 25–28. 25 Mr. 1901.

Triosteum aurantiacum Bicknell.

Blodgett, F. H. The Erythroniums. Jour. N. Y. Bot. Garden, **2**: 37–39. 1901.

Blodgett, F. H. The *Lygodium* at Home. Torreya, **1**: 19, 20. 23 F. 1901.

Blodgett, F. H. Transpiration of rust-infested *Rubus*. Torreya, **1**: 34, 35. 25 Mr. 1901.

Britton, E. G. The rare Mosses of Bashbish Falls. Torreya, **1**: 9. 29 Ja. 1901.

Britton, N. L. A new *Senecio* from Pennsylvania. Torreya, **1**: 21. 23 F. 1901.

Senecio Crawfordii Britton.

Britton, N. L. Notes on *Rudbeckia hirta*. Torreya, **1**: 1, 2. 29 Ja. 1901.

Britton, N. L. The Morong Herbarium. Jour. N. Y. Bot. Garden, **2**: 35–37. 1901.

Britton, N. L. Weeping American Aspens. Jour. N. Y. Bot. Garden, **2**: 12, 13. *f. 1.* 1901.

Burgess, E. S. Fairylore of Flowers. Jour. N. Y. Bot. Garden, **1**: 161–168. 1900.

Burglehaus, F. H. Note on the involucral Leaves of *Syndesmon*. Ohio Nat. **1**: 72. Mr. 1901.

Carss, E. The Value of Forestry in a Course of Nature Study. Torreya, **1**: 13–16. 23 F. 1901.

Chesnut, V. K. & Wilcox, E. V. The Stock-poisoning Plants of Montana. Bull. U. S. Dept. Agric. (Div. Botany), **26**: 1–150. *pl. 1–36.* 1901.

Cockerell, T. D. A. Flower and Insect Records from New Mexico. Entomol. News, 1901: 38–43. F. 1901.

Cole, E. J. Grand Rapids Flora. A Catalogue of the Flowering Plants and Ferns growing without Cultivation in the Vicinity of Grand Rapids, Michigan. 1–170. 8vo. Grand Rapids, 1901. Map.

Cook, O. F. Priority of Place and the Method of Types. Science, II. **13**: 712, 713. 3 My. 1901.

Coulter, S. A Catalogue of the Flowering Plants and of the Ferns and their Allies indigenous to Indiana. Rep. State Geologist of Indiana, **24**: 554–1074. 1901.

Cowell, J. F. The Buffalo Botanic Garden. Jour. N. Y. Bot. Garden, **2**: 24–26. 1901.

Ferguson, M. C. Notes on the Development of the Pollen Tube and Fertilization in some Species of Pines. Science, II. **13**: 668. 26 Ap. 1901.

Fernald, M. L. Some new Spermatophytes from Mexico and Central America. Proc. Amer. Acad. Sci. & Arts, **36**: 491–506. Ap. 1901.

New species in *Fimbristylis* (4), *Cologania*, *Platanus*, *Alcoceria* gen. nov. *Euphorbia* (5), *Pernettya*, *Arctostaphylos* (2), *Parathesis*, *Evolvulus*, *Ipomoea*, *Cordia*, *Salvia* (5), *Monarda*, *Physalis*, *Ruellia*, *Valeriana*, *Lobelia* (2), *Heterotoma* (2), *Brickellia*, *Xanthocephalum*, *Bigelowia*, and *Solidago*.

Greene, E. L. New Plants from Alberta. Ottawa Nat. **15**: 42. My. 1901.

New species in *Berberis* and *Stellaria*.

Griffiths, D. Thriving under Difficulties. Torreya, **1**: 30–32. 25 Mr. 1901.

Griggs, R. F. Additions to the Sandusky Flora. Ohio Nat. **1**: 97, 98. Ap. 1901.

Harper, R. M. Synonymy of *Burmannia* and *Gyrotheca*. Torreya, **1**: 33, 34. 25 Mr. 1901.

Holm, T. Allies of *Stellaria media* (L.) Cyrillo. Ottawa Nat. **15**: 37–41. *pl. 1, 2.* My. 1901.

Jepson, W. L. A Flora of Western Middle California. 1–625. Berkeley, 16 Ap. 1901.

A descriptive manual, with keys to families, genera, and species. Includes new species and varieties in various genera.

Kellerman, W. A. Minor Plant Notes, no. 3. Ohio Nat. **1**: 98–100. Ap. 1901.

Kellerman, W. A. Notes on the Flora of Sandusky. Ohio Nat. **1**: 82–85. *pl. 8.* Ap. 1901.

Kjellman, F. R. Om Floridé-slägtet *Galaxaura* dess organografi och systematik. Kongl. Sv. Vet.-Akad. Handl. **33**[1]: 1–107. *pl. 1–20.* 1900.

Includes numerous new species from Florida, the West Indies, Mexico, and South America.

Kurtz, F. Collectanea ad floram Argentinam. Bol. Acad. Nac. de Cien. Cordoba, **16**: 224–275. 1900. [Sep. 1–51.]

Leiberg, J. B. The Bitterroot Forest Reserve. Ann. Rep. U. S. Geol. Surv. **19**[5]: 253–282. *pl. 62–73.* 1899.

Leiberg, J. B. The Priest River Forest Reserve. Ann. Rep. U. S. Geol. Surv. **19**[5]: 217–252. *pl. 48–61.* 1899.

Lister, A. Notes on Mycetozoa. Jour. Bot. **39**: 81–90. *pl. 419.* Mr. 1901.

Lloyd, F. E. Notes on the Genus *Lycopodium.* Torreya, **1**: 5, 6. 29 Ja. 1901.

Ludi, R. Beiträge zur Kenntniss der Chytridiaceen. Hedwigia, **40**: 1–44. *pl. 1, 2.* 21 F. 1901.

MacDougal, D. T. A new exhibition Microscope. Jour. N. Y. Bot. Garden, **1**: 139–141. 1900.

MacDougal, D. T. A new Hygrometer suitable for testing Action of Stomata. Torreya, **1**: 16–19. 23 F. 1901. [Illust.]

MacDougal, D. T. Seedlings of *Arisaema.* Torreya, **1**: 2–5. 29 Ja. 1901.

Masterman, E. E. The Sprouting of Cocklebur Seeds. Ohio. Nat. **1**: 69, 70. Mr. 1901.

Maxon, W. R. A List of the Ferns and Fern Allies of North America north of Mexico, with principal Synonyms and Distribution. Proc. U. S. Nat. Mus. **23**: 619–651. 4 My. 1901.

Includes several new combinations of varieties and species.

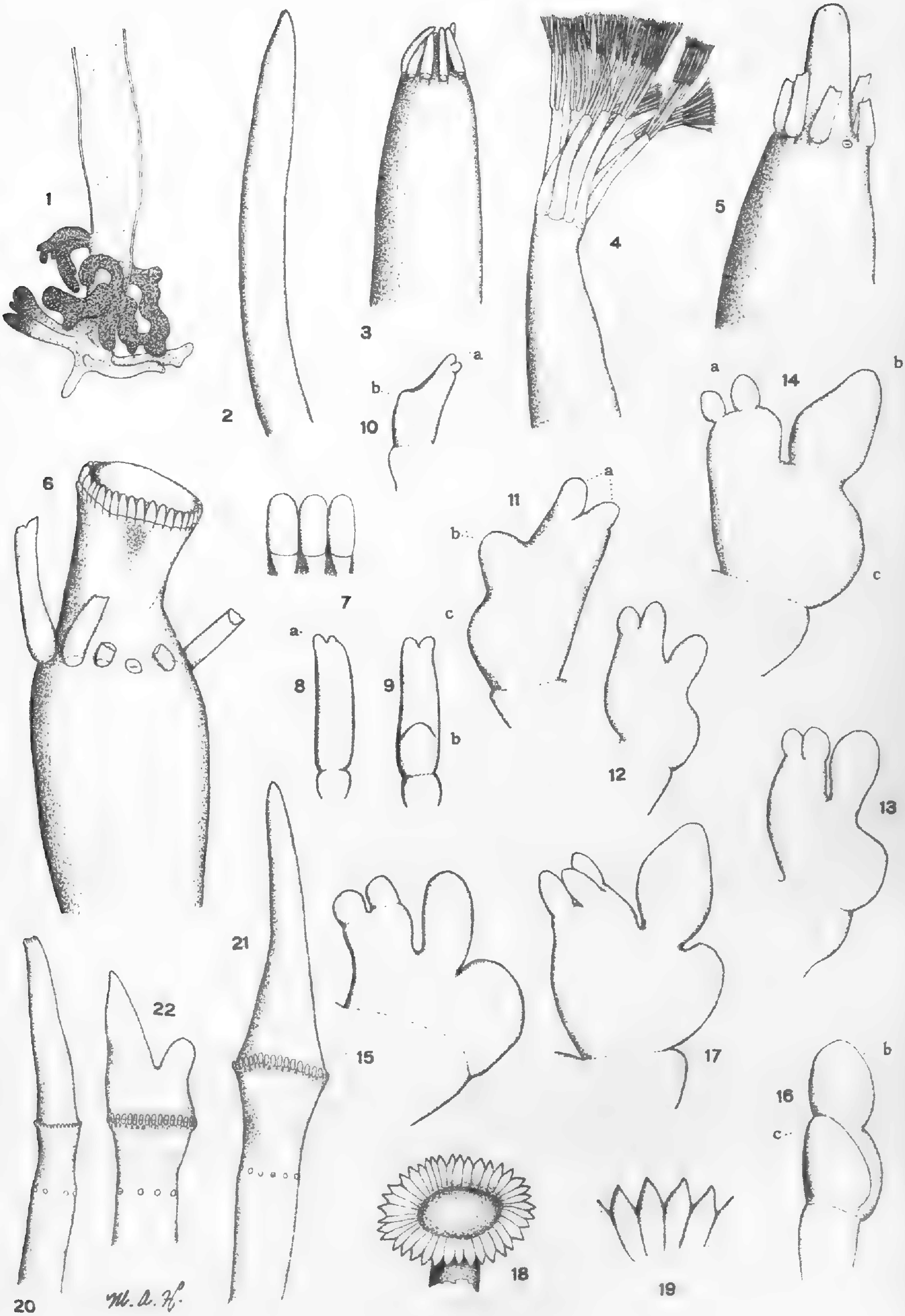
Meehan, T. *Clarkia elegans.* Meehan's Monthly, **11**: 65, 66. *pl. 5.* My. 1901.

Nash, G. V. Native summer Flowers in Cultivation. Jour. N. Y. Bot. Garden, **1**: 121–128. 1900.

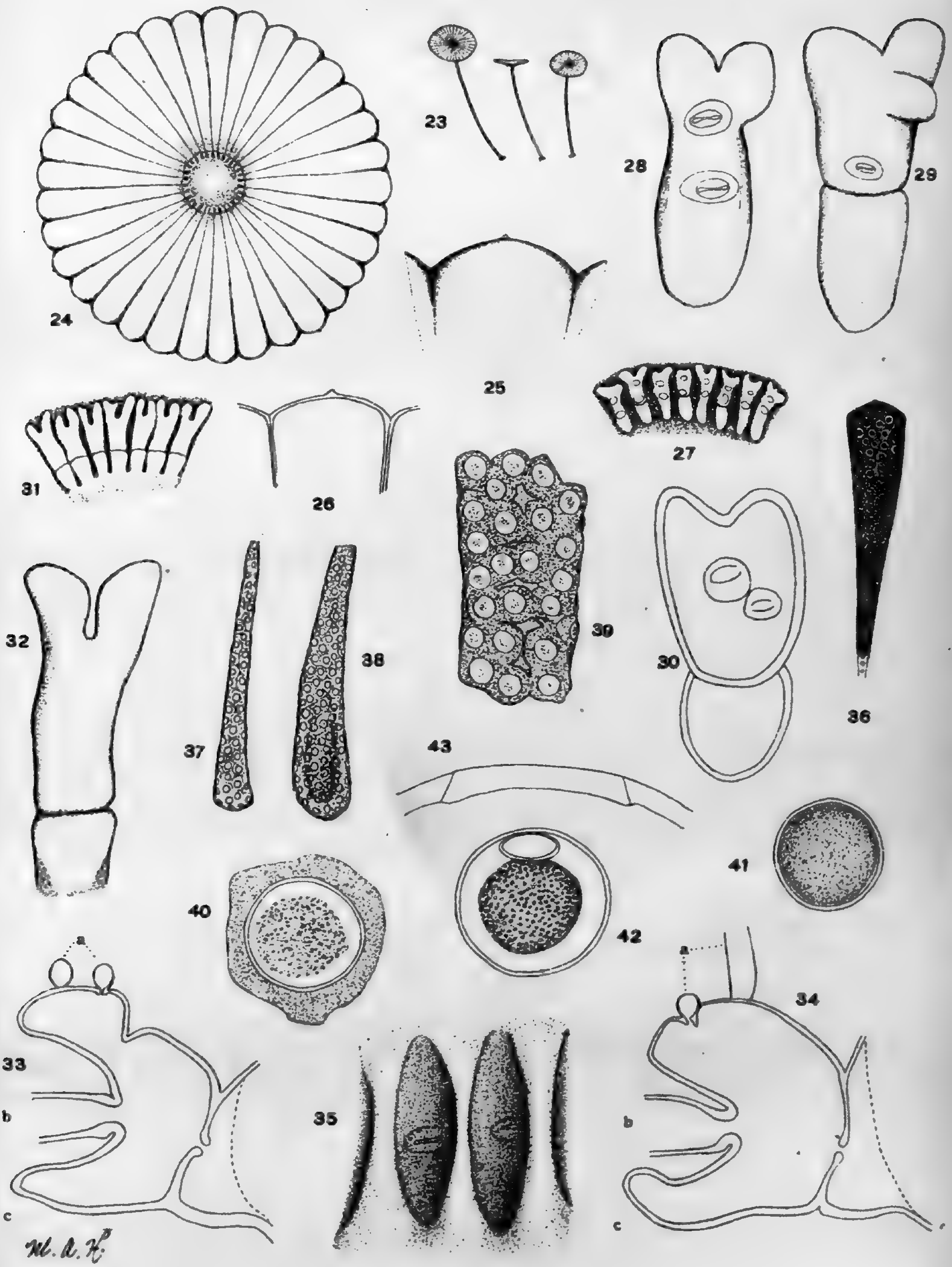
Nash, G. V. The Asters and Goldenrods and their Relatives under Cultivation. Jour. N. Y. Bot. Garden, **1**: 171–174. 1900.

Penhallow, D. P. Notes on the North American Species of *Dadoxylon.* Trans. Royal Soc. Canada II. **6**: 51–95. *f. 1–18.* 1900.

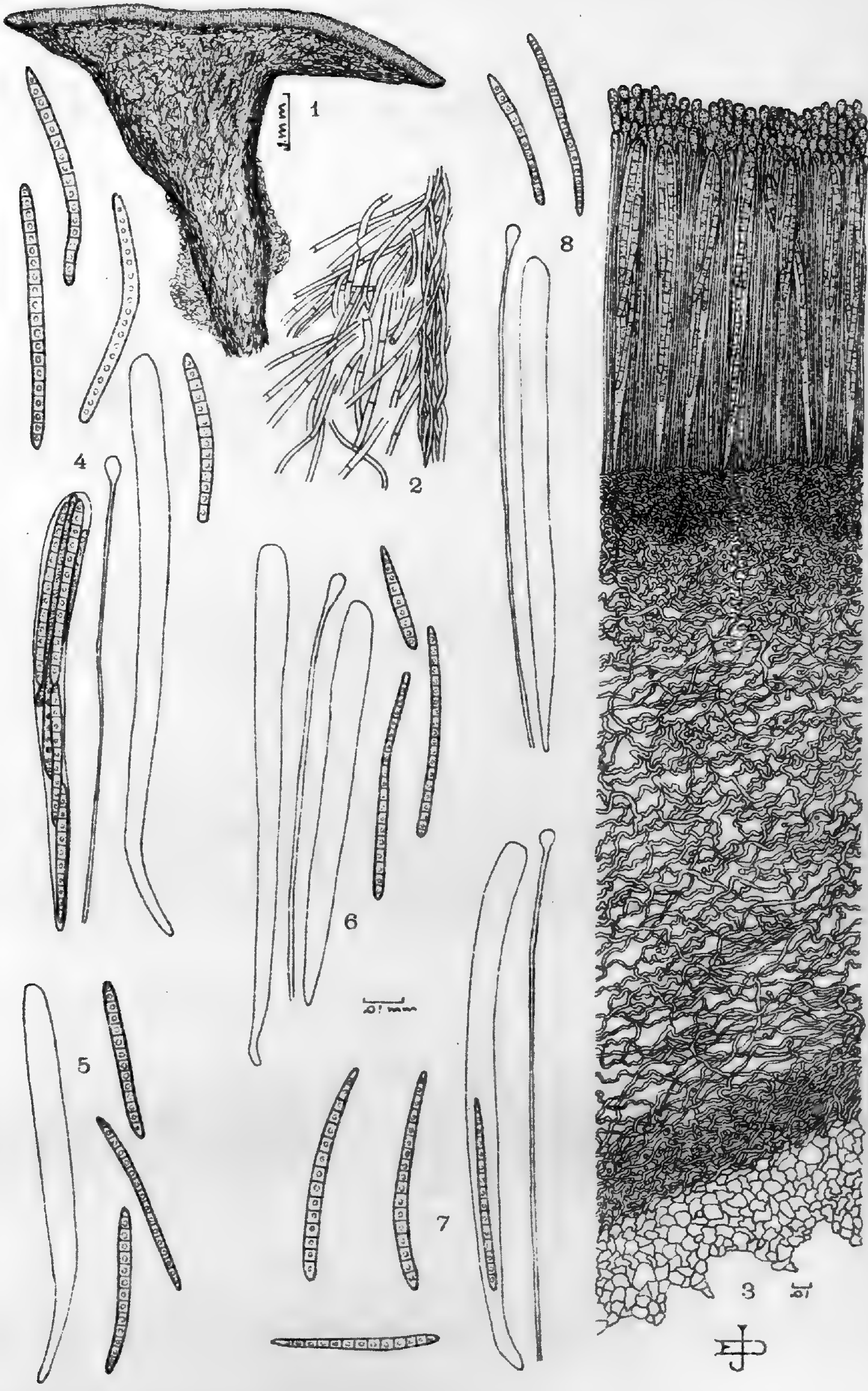
Renauld, F. Note sur un Limnobium de l'Amérique du Nord et ses



1-16, 18-22. ACICULARIA SCHENCKII (Möb.) Solms
17. ACETABULUM CRENULATUM (Lamx.) Kuntze



ACICULARIA SCHENCKII (Möb.) Solms



HOLWAYA GIGANTEA (Peck) Durand

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Vol. 28 JULY, 1901 No. 7

BULLETIN

OF THE

TORREY BOTANICAL CLUB

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Memoirs. (See last page of cover.)

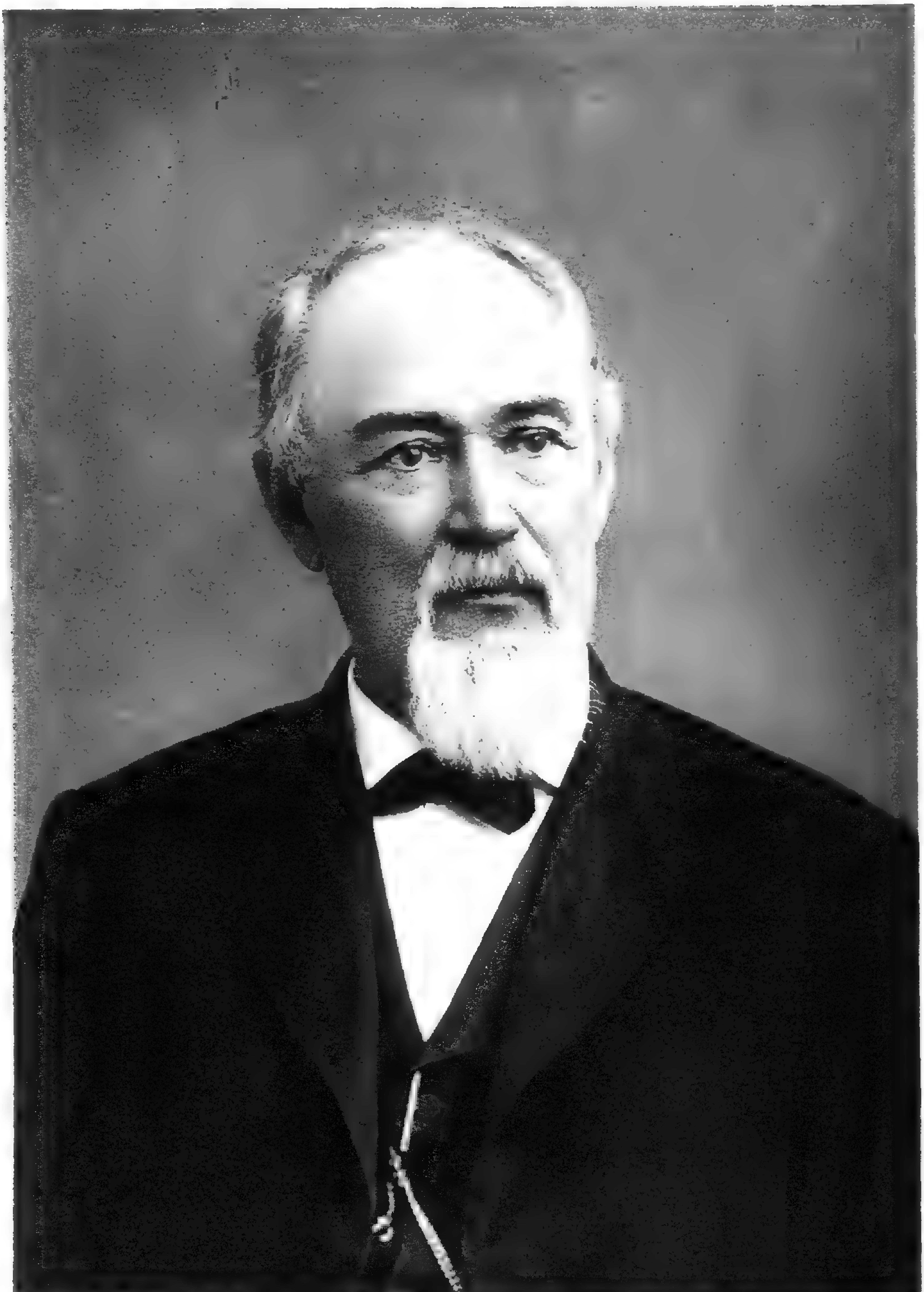

PHOTO. V. A. KREIDLER, SUCCESSOR TO A. L. PACH

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Yrs very truly,
Thos. C. Porter.

Vol. 28 No. 7

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TORREY BOTANICAL CLUB

JULY 1901

Thomas Conrad Porter

By N. L. Britton

(With Portrait)

Professor Porter died suddenly at his home in Easton, Pa., on the evening of April 27, 1901. He was born at Alexandria, Pa., January 22, 1822, and was thus over seventy-nine years of age. His end was painless; he was writing a letter when the stroke came that ended his long and valuable life.

His boyhood was spent at Alexandria and at the Harrisburg Academy, Harrisburg, Pa. He was graduated from Lafayette College in 1840, and received the degree of Master of Arts from that institution in 1843, after studying theology for a time at Princeton Seminary. He was pastor of the Second Reformed Church at Reading, Pa., from 1848 in 1849 and in 1848 was elected to the professorship of natural sciences in Marshall College, Mercersburg, Pa., and subsequently upon the union of that institution with Franklin College forming the present Franklin and Marshall College, he occupied the same chair until 1866, in which year he accepted a call to the Jesse Chamberlin professorship of Botany in Lafayette College, Easton, Pa., which he held until January, 1897, teaching also zoölogy and general geology, thus having served the institution for 30 years. At this time he retired from active professional duties, but retained a connection with Lafayette as Emeritus Professor, Dean of Pardee Hall, and Curator of the Botanical Collections, until his death.

The degree of Doctor of Divinity was conferred upon him by Rutgers College in 1865, and that of Doctor of Letters by Franklin and Marshall College in 1880. As early as 1840 he began the collecting and critical study of the plants of his native State, and this work was continued almost without interruption to the end of his life. He has thus brought together one of the most complete and representative State herbaria yet formed, which Lafayette College will doubtless prize as one of its choicest scientific assets. He was in correspondence with nearly everybody interested in native plants in Pennsylvania during his time, and in personal coöperation with most of his correspondents, stimulating interest in natural objects and natural phenomena in a most valuable way, as he was always willing to supply freely any information at his command. He personally explored, at one time or another, nearly all portions of the State; he was a profuse collector, and a liberal distributer, hence nearly all the permanent herbaria of the country have been enriched directly or indirectly by specimens prepared and named by him, and many have found their way to Europe. He has long had in preparation a volume recording the local distribution of the flora of Pennsylvania. This has been posted up with the numerous new discoveries made by himself and others, and has for several years been essentially ready for publication, but Dr. Porter's ambition was always to make it more and more complete and consequently the more valuable; so much interested was he in this research that he has provided for its ultimate publication in his will.

In 1846 he explored northern Georgia in company with the distinguished naturalist, Dr. Joseph LeConte, of Philadelphia, and brought back a noteworthy collection of botanical specimens, a number of which proved to represent species new to science; this became the nucleus of his general herbarium, which was continuously increased by his personal collections in various parts of the United States and numerous exchanges with American and European botanists, until it became one of the important accumulations of specimens in the country. It was, most unfortunately, somewhat injured by the incendiary fire which seriously damaged the Pardee Hall of Lafayette College in 1897, but it still remains a notable collection; this herbarium contains the records of his important pioneer work in the study of the Rocky Mountain flora in connection with the U. S. Geol. and Geog. Survey of the Territories in 1869–74 under Dr. F. V. Hayden, and these specimens are historically important inasmuch as comparatively few duplicates were obtained. Dr. Porter visited Wyoming and Colorado while engaged in this study in company with his friend Dr. Joseph Leidy, of Philadelphia.

Dr. Porter's generous coöperation in the work which it has fallen to the writer to direct has been of the greatest assistance. I first made his personal acquaintance in 1878, when beginning the bringing together of materials for the Preliminary Catalogue of New Jersey Plants, published by the Geological Survey of that State in 1880. Learning that this work was in progress he promptly offered to put at my disposal all the notes and specimens accumulated by him during many years of observation of the flora of the Delaware River valley and these served to notably improve the records of local distribution and habitat of the plants of the State. During the ten years from 1880 to 1890 while the further botanical exploration of the State was going forward, preparatory to the publication of the Catalogue of Plants, in the final reports of the State Geologist the late Geo. H. Cook, Dr. Porter and I were in constant communication, and he joined me in many collecting trips besides making numerous individual visits to various parts of the State in the interests of this work.

In 1890, when I commenced writing "Illustrated Flora" this coöperation was enthusiastically continued and many of the new facts brought out in that book were obtained from studies with him in the field or in his herbarium; his advice and aid were also freely given during the work for the establishment of the New York Botanical Garden, and he supplied up to the time when failing health restricted his activity many valuable specimens for the collections of that institution. Dr. Porter also contributed much to the building of the botanical collections of the Academy of Natural Sciences of Philadelphia. During the life of the late Dr. Asa Gray he was in constant communication with him relative to the progress of the "Synoptical Flora of North America," and his herbarium was greatly enriched by contributions of Dr. Porter's notes and specimens; his coöperation with Dr. Torrey is also evidenced by the numerous specimens preserved in the herbarium of Columbia University.

Enough has been said in the preceding paragraphs to indicate the bent of Dr. Porter's botanical activity. He was primarily a coöperator in the work of other students; his tendency was to help others, and this almost over-generous nature militated against his own original work becoming as prominent as its importance warranted. His very sociable personality further illustrates this tendency; he disliked to be alone and his best observations were always made in the company of others. He never missed an opportunity of participating in the field excursions of the Torrey Club or of the Philadelphia Botanical Club, both of which organizations claimed him as an honored and active member, and whose formal meetings he occasionally attended. He was a fluent and forceful speaker and his addresses received the closest attention.

Dr. Porter's knowledge of plant habitats and environment drawn from many years of close observation was remarkable. Over and over again I have known him to remark that a locality visited for the first time, was a "likely place" for certain species to grow and the chances were all in favor of the plant being found within the next few minutes. The terminology and philosophic methods of modern ecology came in too late in his life for him to appreciate their true value, but his knowledge of the facts on which that science is based was wonderfully broad.

In recognition of Dr. Porter's services to botanical science the genera *Porterella* in the Lobeliaceae and *Porteranthus* in the Rosaceae, have been dedicated to him; species or subspecies have also been named in his honor in the genera *Gymnolomia*, *Aster*, *Viola*, *Panicum*, *Muhlenbergia*, *Calamagrostis*, *Bromus*, *Eriogonum*, *Ranunculus*, *Crataegus*, *Senecio*, *Desmatodon*, *Orthotrichum*, and others. His published botanical papers include over fifty titles.

He described as new to science species or subspecies in the genera *Aster*, *Solidago*, *Carex*, *Avena*, *Melica*, *Calochortus*, *Habenaria*, *Boehmeria*, *Anemone*, *Clematis*, *Arabis*, *Fragaria*, *Geum*, *Prunus*, *Trifolium*, *Astragalus*, *Gerardia*, *Eupatorium*, *Lacinaria*, *Aplopappus*, *Erigeron*, and *Cyperus*.

While botany is the science in which his life work will most permanently be recorded, it was by no means the only study in which he was interested. Reference has already been made to his theological training, and his interest in the subject was continued throughout his life, he frequently being called on to preach after his early pastoral duties had been exchanged for those of his professorship. Geology and zoölogy each claimed a share in his attention, and in these sciences as in botany he contributed many new facts to students and to investigators of his acquaintance, besides carrying on the pedagogic work in them at Lafayette College during a series of years. Literature was not neglected; it indeed was one of his favorite pursuits, and its enjoyment was shared by his wife, who died only a few weeks before him. His greatest prominence in literary fields came from his contention in 1858, immediately after the first publication of Professor Longfellow's poem "Hiawatha," that its inspiration was derived from the ancient Finnish epic, the Calevala. Dr. Porter publicly maintained that the New England poet had "transferred the entire form, spirit and many of the striking incidents of the old Finnic epic to the North American Indians. The resemblance is so close that it cannot be accidental, and that without the slightest acknowledgment of the source of his inspiration." This statement provoked much controversy, but Dr. John M. Crawford maintains that it is true.

The Anatomy of Phoradendron villosum Nutt.

By W. A. Cannon

(With Plates 27, 28)

The California species of the American mistletoe (*P. villosum*), in the vicinity of Stanford University, is found on several kinds of evergreen and deciduous trees, among which are the following: Common locust (*Robinia pseudacacia*), Lombardy poplar (*Populus nigra*), species of willow, and the Roble, Douglas, Encina, and Kellogg oaks (*Quercus lobata, Q. Douglasii, Q. agrifolia* and *Q. Kelloggii*) and it has been reported from Chico, California, as occurring on the cultivated peach. The parasite is abundant on the Roble oak, and since the latter is common in the vicinity of the university, it was chosen to study as the host.

The present paper deals merely with the anatomy of the mistletoe, but it is intended that it shall be followed as soon as convenient by a contribution from the Botanical Laboratory on the biology of the plant.

The material was collected mainly in the spring and early summer of 1899. It was killed with alcoholic corrosive sublimate, and all of the sections were cut by hand.

This study was carried on under the direction of Dr. G. J. Peirce, to whom I take pleasure in expressing my gratitude for his great helpfulness in this, and in other work.

1. The Leaf

The leaves of the mistletoe are borne in alternating pairs on stout stems, which arise from the host at varying angles in respect to the horizon, and consequently in reacting to the light, the leaves assume a more or less vertical position and become bent in petiole and blade. They are relatively thick, of a yellowish-green color, and are markedly brittle. There is a regular gradation in the size of the leaves throughout the younger portion of the plant, so that it is impossible to assign most of them to a definite season's growth. The mature ones measure 3.25–4 cm. in length by 2.5 cm. in breadth. The youngest leaves which may be seen in early spring measure .3 by .75 cm., while the next older ones are 1–1.25 by 1.75–2.25 cm. There is a like difference in measurement between the second and third sets of leaves, and also, the differences in area of the first two seasons' leaves are generally paralleled by a difference in thickness. The leaves do not increase in thickness after the second season.

The tips of the youngest leaves are projected beyond the growing point of the stem, and their dorsal surfaces are closely pressed together. The surfaces thus in contact are inaccessible to the light and are colorless, while exposed surfaces take on the color characteristic of the plant. A cross section of such a leaf shows that it has a well-defined epidermis, and a mesophyll composed of similar cubical cells with small intercellular spaces. The cuticle of the dorsal surface is noticeably thinner than that of the ventral (Fig. 3) and this, like the coloration, may be in some manner associated with the length of exposure to the light. A relatively large number of epidermal cells on both sides of the leaves are prolonged into long trichomes with bulbous bases, and both trichomes and epidermal cells are well filled with finely granular protoplasm and and are provided with large nuclei. The cells of the mesophyll, in the second season, become elongated and palisade-like, and it is to the lengthening of the mesophyll cells in a direction at right angles to the surface of the leaf, that the increase in thickness, spoken of above, is due. (Fig. 4.) In this regard *P. villosum* recalls *Viscum album.* * The increase in thickness from the first to the second season is as the ratio 1 : 2. † The measurements are .4 mm. for the first, and .79 mm. for the following season. As the leaves mature the cell walls become pitted, a large number of them are found with crystal aggregates (calcium oxalate), and prominent intercellular spaces are developed. Another characteristic of the old leaf is the kind and position of the stomata. The stomata, which are found on both sides of the leaves, are of the xerophytic type described and figured by Schimper, ‡ and while they are con-

* Marktanner-Turneretscher, Sitzungs. d. k. Akad. d. Wissen. Math.-Natur. Classe, 91 : 5 Heft, May, 1885.

† Warming, Pflanzengeographie, 302.

‡ Schimper, Pflanzengeographie, 7.

siderably sunken beneath the surface they are less so than those of the stem. In comparing the stomates of the mistletoe with those of the oak in regard to size and number, it is found that those of the former are about twice as large (Fig. 2) and only approximately half as many to a given area as those of the latter. The number of stomates per square millimeter on each surface of the mistletoe leaf is about 40, while on the oak, where they occur on one side only, there are about 80.

The conductive system of the leaf is poorly developed and the tracheids at the ends of the leaf traces are not swollen as in *Loranthus*, and to some extent in *Viscum*.* No water reservoirs, such as are described by Marktanner-Turneretscher for *Viscum*, the presence of which is denied by Solereder, † are to be found in *P. villosum*.

The color given to the mistletoe by the cuticle, which was spoken of above, has led to a supposition that there is a peculiar quality of chlorophyll in the plant that is in some manner associated with its parasitic habit. This is not at all the case. The external color of the plant is entirely due to the coloration of the cuticle, and the chlorophyll, as far as I could determine, was quite normal. I tried to dissolve out the coloring matter from the cuticle by using the common solvents and thus learn its nature, but in this I was quite unsuccessful.

The leaf of the mistletoe is mechanically very weak. This is partly due to the poor development of supporting tissue, but chiefly to the prominent intercellular spaces. If a leaf is broken in two, and sections are cut at right angles to the fracture, it will be seen that the line of fracture passes between the cells, or that, in other words, it coincides with the intercellular spaces. It is likely here as in the stem that perhaps the main element of strength lies in the unusual development of the outer epidermal wall, the cuticle. This will be spoken of again later in this paper.

2. THE STEM

A cross section of a young stem shows a wood cylinder made up as usual of conductive tissue, medullary rays, wood paren-

* Marktanner-Turneretscher, l. c.

† Solereder, Anatomie der Dicotyledonen.

chyma, and pith, and also, a cortex with a well-defined epidermis. The young epidermal cells are cubical in form, but as the stem increases in diameter they and the underlying cells for some distance become much flattened. The lateral and internal walls of the epidermal cells bear numerous pits (Fig. 6). Some of the outer cells project as trichomes and some are modified to form stomata which are deeply sunken in the older parts of the stem (Fig. 5), and are of the xerophytic type, the stomata of which are placed longitudinally.

The cortex of the young stem is composed of thin-walled cells with intercellular spaces. As the stem becomes larger the walls of these cells increase in thickness until in the older parts they are relatively very heavy. They, at the same time, develop numerous pits. The intercellular spaces also in the older stem take on the characters which we have seen to be so pronounced in the leaves. Groups of grit cells and cells bearing calcium oxalate crystals are noticeable characteristics of the old stems.

Within the cortex of the young stem is a ring of several fibrovascular bundles, of the open collateral type, separated by medullary rays. A group of hard bast fibers, which are derived from the pro-phloëm, is found inside of the pericycle exterior to each bundle. Subsequently no hard bast is formed in the stem. Also, on the inside of each bundle opposite the group of hard bast fibers, is another group of hard bast-like fibers. These two groups of sclerenchymatous tissue can be recognized in the old stems although in these they occupy but a small proportion of the entire area. The first definitive wood elements to be recognized are the ringed tracheids, and later reticulated tracheids, which with the growth of the stem become changed into tracheid-like ducts by the reabsorption of the division walls. But the form of the tracheids of which the ducts are composed is clearly recognizable. Associated with the ducts are elongated cells, which become thick-walled and form the wood fibers of the xylem. When these fibers are young they present much the appearance of slime canals. The contents of the fibers give the sugar reaction with Fehling's solution, and in the younger ones, the walls are cellulose. In all old fibers, however, these walls are lignified. If the fibers function as slime canals at any time they probably cease to do so when the change in composition of the walls takes place. It should be said that the slime canals in *Arceuthobium* are of quite different character, and also that they entirely, or for the most part, occur in the cortex of the stem. Short cells with heavy, pitted walls form the wood parenchyma and constitute a relatively large proportion of the wood elements. Attention may be called here to the structure of the wood cylinder as regards mechanical strength although that will be considered more fully below. The element of strength, the relatively large number of fibers, of the oak stem, is seen to be wanting in the mistletoe, and those kinds of cells which do not contribute primarily to the strength of the stem, the wood parenchyma, and which are present in a small amount in the oak, are again the most abundant in the mistletoe.

The pith of the young stem is composed of cells which are quite like those of the medullary rays and of the cortex, but in the old stem they become heavily walled, and because of the presence of pits, have a peculiarly ragged appearance in cross section. And it should be said that perhaps the most striking character of the stem is the presence in the pith and cortex, mainly in the pith, of heavy walls and of correspondingly deep pits.

The stem of this mistletoe, like the leaf, is mechanically very weak. A comparatively small amount of force is needed to snap it in two, and this weakness is in a measure independent of the size of the stem. The reason for the brittleness can doubtless be found in its structure. Among the factors that make for this condition may be counted the great number of crystal-bearing cells, the large number of grit cells, the presence of prominent intercellular spaces, and of deep pits in the walls of the parenchymatous cells. And to these may be added also the absence of secondary bast fibers, the small number of wood fibers present, the peculiar tracheid character of the wood ducts, and the relatively large amount of xylem parenchyma. The greatest single source of strength is probably the outer wall, the cuticle, of the periderm. If the cuticle is carefully removed for a short distance, say 5 cm., from a portion of the stem, the end of which is firmly secured, and weights are placed on the free end, the stem will bend and finally break in the region from which this has been removed. The in-influence of the weights will hardly be observed in other parts of the stem, and will scarcely affect a similar one from which the cuticle has not been removed. Further, if the fracture of the mistletoe stem be compared with that of an oak a difference characteristic of the structure of the two may be seen. The mistletoe stem breaks straight across with no tendency to split, while the oak breaks irregularly and splits at frequent intervals.

3. THE HAUSTORIA

The mistletoe is attached to its host by haustoria, which in structure and in function show evident differentiation. The young haustoria ramify in all directions in the cortex of the host and they may even quite encircle the central cylinder.* From these others turn sharply toward the center of the host branch, and become partly enclosed by it. These latter are the so-called sinkers of the parasite. Upon a considerable increase in diameter of the cortical haustoria, the cells of the cortex of the host, which are outside of the haustoria, gradually loose their contents and die and the haustoria are in this manner exposed to the air. They undergo considerable change in structure in the meantime. There are thus three easily distinguishable sorts of haustoria, which, for convenience I shall refer to as cortical haustoria, sinkers, and aërial haustoria.

The youngest cortical haustoria are composed throughout of thin-walled parenchyma. All of the cells are densely filled with a coarsely granular material which gives a starch reaction. While the cells of the interior of the haustoria are pretty much alike, those corresponding to the epidermis are somewhat differentiated. In some portions of the haustoria the outer cells appear much like typical epidermal cells, and in others, at the growing parts, they are much elongated and are papilla-like (Fig. 9). The latter recall those in the region of the young haustoria in the dodder,† as well as the epithelial cells in the scutellum of grasses, ‡ and they appear to have a function analogous to both. The elongated cells of the mistletoe haustoria secrete a solvent that is capable of digesting

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* In *Viscum* the haustoria do not surround the stem of the host. Kerner and Oliver, Natural History of Plants, 208.

† Peirce, Annals of Botany, Sept., 1893.

‡ Lermer and Holzner, Beiträge zur Kenntniss der Gerste. Munich, 1888.

most, although it would seem not all, of the cortical tissues of the host. These cells contain finely granular protoplasm, and nuclei which are larger than those in the interior of the haustoria. The host cells which are adjacent to those of the haustoria are rich in food material and they stimulate to great activity the epithelial haustorial cells just described. The adjacent host cells show evident signs of breaking down, and usually a small space intervenes between them and those of the parasite. It has already been stated that the epithelial cells appear to be unable to dissolve certain of the host tissues; these are the sclerenchyma of the oak. The form and size of the digestive cells vary with the changes in structure of the host cells. The former are relatively long when the host tissues furnish them with an abundance of food, but they become short and cubical when the adjacent host cells are poor in food as, for instance, when they are near the surface of the host stem. In the latter case the epithelial cells insensibly merge into the more typical epidermal cells. Not only is the shape and size of the epithelial cells dependent on the character of the adjacent host tissue, but it will soon appear that the ramifications of the haustoria through the cortex are also dependent on the same factor, because the epithelial cells make clear the way for the advancing haustoria.

The tissues within the epidermis of the cortical haustoria become differentiated early into a central conductive system and a surrounding cortex. The cortex is composed of thin-walled cells with intercellular spaces. These cells, like those of the cortical haustoria in general, except the conductive system and the epithelium, are well filled with coarse grains of starch. Grit cells are present in the cortex, but it is not possible in every case to say whether they originated in the cortex of the host or that of the parasite. Sections of young cortical haustoria frequently show numerous masses of fully-developed grit cells in the midst of young and thin-walled parenchyma, and such grit cells have been surrounded, but not digested by the epithelial haustoria cells and come finally to lie wholly within the tissues of the parasite.

The conductive tissues of the cortical haustoria are developed late and possess elements which resemble analogous portions of the stem. Ducts appear in what may be termed the central cylinder, and cambiform cells occur between the cylinder and the cortex. The cortical haustoria do not begin secondary growth until they cease to function as food absorbers and serve the parasite as food conductors, and to some extent as food reservoirs. With this change in function appears a change in structure, and the cortical haustoria pass over into the aërial haustoria which will be spoken of later.

Before examining the structure of the haustoria of the mistletoe further it will be best to briefly glance at the main characters of the structure of the host branch (Roble oak, *Quercus lobata*) on which the parasite grows.

The oak branch is made up of a central cylinder surrounded by a cortex. The cylinder is composed of a relatively large number of fibers, of a small amount of wood parenchyma, of radiating medullary rays, and intermingled with other wood elements, especially in spring wood, are also large and small tracheae, or ducts. The wood parenchyma and medullary rays are living cells and are well supplied with food. The ducts are lifeless and serve for the transport of food materials in solution, which have been taken by the roots of the host plant. Most of the prosenchyma cells have scarcely any lumen and are lifeless, and it may be said in passing that the oak owes its strength to the relatively great amount of wood fibers of the wood cylinder. As indicated above, the wood fibers of the mistletoe are present in relatively small numbers, and in this connection a comparison of the two sorts of stems is of interest.

The cortex of the oak is made up of small parenchymatous cells which are compactly set together, of several concentric rings of sclerenchymatous fibers arranged in groups, and of scattered grit cells. Instead of an epidermis, as in the mistletoe, the oak has a few layers of cork which are derived from a superficially placed cork cambium. A meristematic zone of cells, the cambium, separates the cortex from the central cylinder. The outer fibers are lignified, but the inner are not uniformly so. The grit cells are also lignified. Of these tissues, the parenchyma and the meristematic region are richly supplied with food, and it is among the cells of these that the cortical haustoria of the parasite ramify.

Taking up now the growth of the haustoria in the cortex of the host and their later development into sinkers, it will be seen that the haustoria seek only those cells which contain food; they are chemotactic, and this may be called the positive element in the growth of the haustoria. The negative element is found in those host cells which are either poor in food, or furnish mechanical resistance to the progress of the haustoria, or both. The cells toward the periphery of the branch would represent the first, and the grit cells and fibers the second conditions. How masses of grit cells may affect the growth of the haustoria has already been touched upon. It was found, however, that owing to the characteristic form of these cells the haustoria could envelop them with their own tissues and flow past them, the course of growth not being changed by their presence. The case is somewhat different in regard to the fibers in the cortex of the oak, and they are an important factor in directing the growth of the cortical haustoria as well as those haustoria which penetrate into the xylem of the host. The position and number of sinkers are to a great degree, and perhaps wholly, controlled by the permeability of the inner ring of fibers to the haustoria. From the outer cortical cells of the host the haustoria grope between masses of fibers which compose the outer ring of sclerenchyma to the parenchyma within (Fig. 13), and in a similar manner through the second and each ring of fibers and parenchyma in succession until the inner ring is reached, and the haustoria pass between the gaps in this ring and penetrate the bast and become transformed into sinkers. In every instance the haustoria pass from an area poorer in food to one richer, and they are led in this manner to a position opposite the medullary rays so that with an increase in diameter of the host stem they are in position to supplant them. Such in brief is the origin of the sinkers.

A young sinker is in no respect different from any other part of a cortical haustorium. It originates on that part toward the wood cylinder and, as has just been stated, becomes a sinker by penetrating between some gap in the inner fiber ring of the host cortex. When the phloëm of the host is reached, and especially the cambium, the cell walls of the sinker become somewhat heavier and the end cells shorter than corresponding ones of the cortical haustoria (Fig. 10). The host cells just in front of the tip of the sinker in the cambium or in the bast present a curved appearance as if under pressure. It is not likely that the sinker absorbs the adjacent tissue of the host to any extent because no evidence of this was seen, and, further, there is an absence of epithelial cells, or of cells having that general character, in the sinker. The cells of the young sinker which correspond in position to epithelial cells of the cortical haustoria are cubical, and thick-walled. No cells in mature sinkers exhibit epithelial characters ; the change in structure and in function of these cells takes place in the meristematic region of the host.

A cross section of an oak branch to which a mistletoe is attached shows that the sinkers of the parasite take the position of the host's medullary rays, and that the structure of portions of the sinker varies according to their relative positions. The part of the sinker which is in the cortex of the host agrees very well in structure with the cortical haustoria, but that portion which is within the xylem has a different and a characteristic structure. The sinker taken as a whole is composed of a central cylinder and a surrounding cortex. The central cylinder is, in both portions of the sinker, an almost uniform structure, but the cortex is variable. The cortex of that part of the sinker that is within the cortex of the host is composed of thin-walled cells and has few intercellular spaces. On the other hand, the outer part of the sinker cortex, which is within the wood cylinder of the host, has a denser structure, and is made up of heavy-walled cells with no intercellular spaces. The inner portion of the same part of the cortex is composed of thin-walled cells between which there are small spaces. Between the two sorts of sinker cortex just spoken of, and in a position approximately adjacent to the host cambium is the meristematic portion. Here the cells are brick-shaped, relatively small, and there are no intercellular spaces. The contents of the sinker cells appear to be almost entirely composed of starch in character resembling that of the cortical haustoria. The cells of the sinker cortex remain alive in the oldest material that I examined, and they probably die only as the parts of the host adjacent to them die. The walls of all of the sinker cells which are within the cortex of the host are lignified.

The conductive tissue of the sinker is composed of a few spiral and annular ducts which are enclosed by narrow, elongated thin-walled cells. The latter are densely filled with finely granular matter the nature of which I did not learn. I did not succeed in demonstrating the presence of sieve tubes in the sinkers; their existence may be questioned. The long, thin-walled cells of the central cylinder are gradually shortened, and their walls thickened, as they approach the end of the sinker, and they are there indistinguishable from the other cells that make up the tip. The ducts also, at the end of the sinker, merge into the cells that compose it, so that there is a gradual transition from the cells of the central cylinder to those of the end of the sinker. The cells at the end and on the margin of the sinker are in contact with the host ducts and the union is such a close one that there is apparently only one cell wall between them. The pits of the sinker are in apposition with those of the ducts (Fig. 11) and the status of the parasite as a partial, or water, parasite, is thus established.

In the region of the cambium of the host, as has already been mentioned, the sinker cells are smaller and with thinner walls than those either toward or away from its tip. These cells have large nuclei and dense protoplasmic contents. They are typical meristematic cells. The thickness of this part of the sinker is somewhat more than that of the cambium of the host adjacent to it. By the means of active cell division in the meristematic region of the sinker it is able to accommodate its length to the increasing diameter of the oak branch. And it is also possible that the elevation of the aërial haustoria from the host is in part accomplished by the same agency.

Longitudinal and cross sections of the sinker in the region of its meristem show that the thin-walled conductive system does not unite with the phloëm of the host, sieve-tubes do not unite with sieve-tubes as in complete parasites. There is, however, a transfer of foods from the phloëm of the host to the sinker as in the cortical haustoria, but it takes place by osmosis only, because there do not appear to be any cells of the sinker with epithelial characters. The sinker, because of the lack of cells for digestive purposes, does encroach upon the phloëm of the host. This is shown by longitudinal sections (Fig. 12).

The aërial haustoria are those cortical haustoria which have become more or less freed from the host cortex, are partly or wholly exposed to the air, and have undergone marked changes in structure and in function. As the cortical haustoria increase in bulk and occupy a larger and larger area in the host cortex, the flow of foods and food materials from the central to the more peripheral portions of the cortex is gradually checked, and the outer cells of the host cortex die. The inner cells of the host cortex, however, remain alive, and may form cork cambium between the aërial haustoria and the xylem of the host. By the multiplication of the cortex cells beneath the aërial haustoria, a considerable pressure is brought to bear upon the haustoria, which is exerted in such a way as to tend to push them away from the host branch. A flattening beneath the haustoria of the host cortical cells in question shows this point very plainly.

Parallel to the decadence of the superficial host tissues a change is noted in the structure of the cortical haustoria. This is first seen in the epidermis. The outer walls of the epidermis become greatly thickened and take on the bronze color peculiar to the exposed portions of the plant. This, especially the latter, applies to the parts of the epidermis which are exposed to the air. In sections through the edge of the dying cortex and also through the epidermis of the haustoria, the formation of the cuticle as well as the deposition of the coloring matter in it, under the influence of the light, may easily be seen. Except for the greater irregularity, the absence of trichomes and of stomates, the epidermis of the aërial haustoria agrees very well with that of the stem.

The structure of the cortex of the aërial haustoria is also in the main like that of the stem, but the cells of which it is composed are more irregular in form and in size. Grit cells and crystal-bearing cells are present in the cortex.

Cross sections of the wood cylinder of the aërial haustoria have a striking appearance, which is caused by the unsymmetrical growth of its members, the secondary growth in diameter taking place on one side, toward the outside of the stem of the host, more than on the other. The elements of the central cylinder of the haustoria resemble those of the stem, but the pith, the primary vessels and the central ring of sclerenchyma are wanting. The peculiar structure of many of the fibers, by which they resemble slime canals, and which was spoken of as occurring in the stem, appears in the wood cylinder of the aërial haustoria. However, in the latter case the canals appear to be permanent. This point needs further investigation.

The phloëm consists of bast parenchyma, of sieve tubes, and companion cells. The sieve plates were difficult to demonstrate. The primary hard bast bundles, typical of the stem, are, of course, not found in the haustoria.

In comparing the mass of cortex with the mass of conductive tissue in the cortical haustoria with the same in the aërial haustoria we see a decided difference—the cortex preponderates in the former, the conductive tissue in the latter case. This is correlated with the change which these haustoria have undergone in function. An index of this change is found in the contents of the cortex of the two sorts of haustoria. Starch grains are found in the cortex of the cortical, but they are not present to any appreciable extent in that of the aërial haustoria. That is, the cortex of the aërial haustoria has ceased to function as a food reservoir. The great development of conductive tissue is also indicative of the change from an absorbing organ to a conductive one.

In concluding this account of the haustoria of the mistletoe it should be said that each of these kinds of haustoria are present in the older plants as well as in the young, and in this regard the American mistletoe does not agree with the European species (*Viscum album*). In *Viscum* there is a sort of tap root from which the lateral roots, cortical haustoria, spring. Frank * does not mention the formation of aërial haustoria in *Viscum* and he intimates that such, indeed, are not present, because he says that the connections between the sinkers and the stem, the aërial haustoria, are sooner or later broken. Although I have not made a close study of the oldest plants, I believe from the manner of the formation and development of the aërial haustoria that in the American mistletoe that connection during the life of the plant is never broken. This must necessarily be the case since the aërial haustoria become an integral portion of the stem.

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* Frank, Die Pfilzplanzen, Krankheiten der Pflanzen, 1896, p. 530.

4. Some Biological Considerations

In concluding this sketch of the anatomy of the mistletoe it need hardly be pointed out that, whatever may be the nature of the stimuli, varying pressures or what not, which bring about the characteristic structure of the mistletoe, it is for the most part typical of xerophytes in general. It is to be pointed out however, that the extremely heavy walls of the parenchyma is a feature found in many leaves, and stems of herbaceous species, which live through one or more winters, or inclement seasons. Similar structures are to be seen in coniferous leaves, as well as in leaves of some orchids such as *Aplectrum.* It is also to be said that such strength of wall would give rigidity to the stem during seasons in which turgescence in these cells is an impossible condition.

In the consideration of the growth of the leaves it was shown that they did not reach the normal thickness until the second season, and the mature size was not attained until an indefinite time after that. The youngest leaves are illuminated from one side, the ventral, only, and Fig. 3 shows very imperfectly that there is a corresponding difference in the time of development of the two parts. The portion toward the light appears to have a structure somewhat more fully differentiated than the opposite side. In the mature leaf both surfaces are equally exposed to the light, and show equal development.

Among the many questions which come up for solution in a study of this kind, and which belong to the purely biological side of the general problem, may be counted those which concern the nature of the association of the mistletoe and the oak. Is the relationship between the two entirely of advantage to the parasite, or does the oak also derive benefit from it as is apparently the case in *Viscum album?* * It is clear that at the season of the year when the oak leaves have fallen, and when the plant no longer makes food, the mistletoe might be called upon to give up a portion of the food, which it was manufacturing, to the support of the host. As far as I could learn, however, such is never the case. Material collected at such a time was examined and it was found

* Gaston Bonnier, Sur l'assimilation des plantes parasites à chlorophyll, Comptes Rendus, Paris, **113**: 1074–1076.

uniformly that those parts of the parasite which are the reservoirs of food contained apparently the usual amount, and that the adjacent oak tissues did not show in any way that food passed to them in the manner described. When the structure of the parasite and its relation to the oak are considered it will appear that there is really little opportunity for such a transfer of foods. The parts of the mistletoe that contain food are either in contact with the lifeless host cells (the ducts of the wood), or they are adjacent to host cells which, at the time, are dormant.

The usual conception of the mistletoe as a semi-parasite, or a water parasite, is for the most part a perfectly correct one. But the degree of parasitism varies with the age of the plant, and with the portion of the plant under consideration, for although the main part of the parasite lives on the water and the mineral salts in solution which it gets from the conductive system of the host and the carbon that it gets from the air, a small portion of the cortical haustoria depends upon the host entirely for its food and is therefore totally parasitic. The first assertion, that the degree of parasitism varies with the age of the plant, remains to be demonstrated, but there seems little question that the seedling is a total parasite, just as the cortical haustoria are. In this connection it may be of interest to point out how such a total parasite as *Arceuthobium* may have arisen. *Arceuthobium* lives in the cortex of its host, it gets food already elaborated, and its only appearance in the air is when it sends out the fruiting stalks. Now, if the American mistletoe should acquire the habit of remaining a longer and longer time after germinating in the cortex of the host, either because of difficulty in penetrating the xylem of its host, or for any other reason, it might gradually lose its power of carbon assimilation and become a total parasite like *Arceuthobium.*

The immediate effect of the parasite was not studied, but the ultimate effect, in all cases that came to my notice, is to cause the death of that part of the host which is beyond. There does not, however, appear to be any such striking malformation as in the *Arceuthobium*, or in another species of *Phoradendron* that grows on the juniper (*P. bolleanum*). *Viscum* also causes the decay of the host tissues and in this resembles *Phoradendron villosum*, but the effect is brought about in quite a different way. In *Viscum* the sinkers that have severed their connection with the main part of the parasite through the death of the cortical haustoria, so choke the passages of the host's conductive system that growth ceases and it eventually dies from starvation.* In the American mistletoe, on the other hand, the destruction of the host tissues is brought about by the living sinkers which, while still attached to the cortical, now become the aërial haustoria, occupy the places of the medullary rays (Fig. 8) and absorb so much water that the more distal portions of the host are starved. The position which the American mistletoe often occupies at the extreme tip of a limb is brought about in the manner described with the further note that the parasite may extend its haustoria to include within its grasp the branch of which the one on which it germinated was an offshoot (Fig. 7).

COLUMBIA UNIVERSITY, March 13, 1901.

Explanation of Plates

PLATE 27

1. A cross section of a leaf the same age as the leaf of Fig. 4, showing a stomate, $\times$ 220.

2. Surface view of stomata to show the relative size: *O*, oak, *M*, mistletoe, $\times$ 220.

3. A cross section made in April of a leaf of the first season: *D*, dorsal surface, *V*, ventral surface, $\times$ 76.

4. A cross section of a leaf of the second season made in the spring before the growth in diameter was completed. A few cells with calcium oxalate are shown, $\times$ 76.

5. A cross section of a stem of the same age as that of the following figure, with a characteristic sunken stomate, $\times$ 220.

6. A section of a rather young stem showing the great development of cuticle, $\times$ 320.

7. Oak branch and mistletoe attached: *m*, mistletoe; *Ae*, aërial haustorium; *b*, the branch upon which the mistletoe germinated, the end of which is indicated by the dotted lines. Two thirds natural size.

8. A cross section of an oak branch with a mistletoe. The cortical haustoria have surrounded the wood cylinder of the oak, and sinkers penetrate it from every side; *S*, sinkers, $\times$ (*ca*) 2.

PLATE 28

9. A section through the epithelial region of a cortical haustorium; *P*, parasite; *H*, host, $\times$ 220.

* Frank, *l. c.*

10. A longitudinal section through the bast of the oak and the tip of a young sinker, the cells of which have for the most part lost their epithelial characters: *P*, parasite; *H*, host, × 220.

11. A longitudinal section of the tip of a sinker, radial of the wood cylinder of the oak, which shows the apposition of the pits in the walls of the ducts and in those of the outer cells of the parasite: *S*, sinker; *O*, oak; *D*, ducts of oak; *p*, pits of host and parasite in apposition, × 320.

12. A longitudinal section, partly diagrammatic, of sinker, cross section of the oak, showing the effect of the season's changes in pressure of the oak wood cylinder; *S*, sinker; *C*, cortex of oak with the fiber rings indicated by dotted lines; *cam*, oak cambium; *Sp*, spring; *Sn*, summer wood.

13. A partly diagrammatical sketch of cortical haustorium in oak cortex. The arrow points to the center of the oak stem: *P*, parasite; *C*, oak cortex; *Sc*, sclerenchymatous cells.

A Project for Phytogeographic Nomenclature*

By Ch. Flahault

The rôle of botanic geography is relatively simple. Whatever may be the extent of the territory considered, it proposes to establish statistics of the species which inhabit it, investigate their origin, their migrations and their present and former distributions. It is desirable that in immense countries like the United States of North America, or Russia, on a desert island or in a province, writers may be enabled to employ the same terms to designate the various subdivisions of importance without being misunderstood. Russian botanists divide all the European territory of the Czar's empire into four regions; a recent author recognized six in the little island of Lesbos, the extent of which does not exceed several square kilometers.

While it is unfortunate in some respects that the meaning of a word lacks precision, the subject itself explains enough of that which is in question to cause no serious trouble in the variation of the interpretations; it is easy to return to the subject in question.

This incoherency is the more to be regretted when it occurs in works on botanic geography. Phytogeography becomes more and more an exact science; its principal aim is to make known the multiple relations of vegetation to an environment however varied. To express these relations it is important, then, that we have an all-sufficient vocabulary on which those interested would agree. This is an essential condition to all progress. Now, the greatest disorder prevails in works on the subject of nomenclature and on the subordination of geographic groups. Some use the same term promiscuously for great extents of country and for elevated mountain zones. For some, zones are tracts of land characterized by forms of vegetation peculiar to plains, while regions are applied to the mountains; they say forest region, subalpine, alpine, nival regions, etc. For others, regions are territories in the plains distinguished by peculiar vegetative and floral characters;

* Translation of a paper read by Professor Flahault at the International Botanical Congress, Paris, October, 1900.

region of the steppes, region of coniferous forests, etc. This idea of botanic region, so diversely interpreted, designates geographic units of a superior class, or it is not subordinated to others according to the meaning given it, so that the names of regions, provinces, zones, districts, sectors, etc., designate very different things according to the authors who use them.

A. Engler * has adopted a series of names for phytogeographic units of different classes; but he has not been followed by the majority of botanists, notwithstanding the authority of his writings, as possibly this series does not meet with the requirements of a science which demands more and more precision. Without any doubt, in 1879, Engler did not pretend to regulate a question of method, not wishing to establish a code of phytogeographic nomenclature, *ne varietur.* He intended, it seems to me, only to express clearly the facts which are the object of his memoir; he has chosen the terms that he employs, simply because they appear the most convenient to him, without discussing all their advantages or inconveniences.

The time has come when it appears necessary that a technical terminology should be established or we shall no longer understand each other. A comparison of facts will be facilitated if we adopt a common basis and a sufficient uniformity of expression. We will be enabled to compare comparable units if we restrict the same name for units of the same value. We will be able under these conditions to speak of the temperate regions with or without a dry season; we will be able to draw a parallel between the Mediterranean, Australian, Cape, Californian and Chilian *regions*, the desert *domains* of northern Africa, of western and central Asia, of Australia, of Colorado and Mexico, the *district* of the Vosges and of the Maures, the subalpine and alpine *zones* of the Alps, the Pyrenees and the Caucasus, etc. Dr. O. Warburg, at the geographic congress of Berlin insisted on the necessity of such an understanding as soon as possible.

This article does not pretend to solve the problem; but if the time has come for a statement, the Botanical Congress furnishes an opportunity which must not be allowed to pass. It does not appear useless, at all events, to propose some principles and to advance

* A. Engler, Versuch einer Entwicklungsgesch. der extratrop. Florengebiete.

some ideas, in order to elicit thoughtful discussion, here and elsewhere.

Phytogeographic nomenclature may be applied to two different things:

1. To geographic and topographic substrata of vegetation, *i. e.*, to *geographic and topographic units.*

2. To vegetation itself, grouped in different ways, according to conditions of climate and environment, *i. e.*, to *biologic units.*

Let us then direct our attention to the first.

I. NOMENCLATURE OF GEOGRAPHIC AND TOPOGRAPHIC UNITS

It will be expedient to take as the basis of fundamental divisions, essential facts which dominate all others and which are incontestable in themselves and in their reactions on vegetable life.

The general relations of vegetation to the fundamental conditions of climate need no discussion here. Prof. Drude * was right when he endeavored to represent the fundamental climatic data in such a way as to correlate essential biologic facts with their determining causes. Our lithosphere may thus be subdivided by lines more or less parallel to the equator, into zones distinctly characterized at the same time by climate and by the vegetation which is its expression. In cold countries there is a corresponding form of vegetation, plants of small size with highly developed underground organs, etc.; plants which inhabit them resist very low temperatures during their period of rest, and even during their vegetative period endure temperatures below 0° C.; these are microthermal plants. In warm countries there are corresponding plants which require very high temperatures, perishing at 0° C. or even at temperatures above freezing point; many of them have their activity scarcely interrupted. These are macrothermal vegetations. In temperate countries there are plants which undergo a periodical rest, and which alternately endure low and high temperatures; these are mesothermal.

It is natural then to divide the terrestrial globe into cold, temperate and warm zones, as did William Schimper † following Grisebach. Without becoming unintelligible, distinction may be made

* Drude, Manuel, p. 69, pl. iv.

† Schimper, Pflanzengeographie, 227.

between the cold and temperate zones according to the hemisphere which they occupy. Prof. Drude has done this for the general grouping of the regions of vegetation in publishing sheet 46 of Berghaus' Physical Atlas.

This grouping is only of general value. It permits a first separation, a division of the earth comprehensible to persons who are not prepared for special study. It is destined only to facilitate subsequent grouping, to render it even possible. The tropics are not the limits of the tropical flora; the Arctic circle does not indicate exactly where certain floras either commence or end; for which reasons it seems preferable to express the most important climatic character of each of these zones, to distinguish them simply under the names of warm, temperate and cold (in place of tropical, temperate and arctic). In this case, the word zone is used in the sense that is generally given it in French.

The definition of zone exactly applies to these units of the first order; they are divisions of the sphere's surface included between two parallel lines; this is the signification of the word as adopted by meteorologists, but it seems impossible to us not to apply it to the belts following which the mountain flora becomes divided. Another term cannot be found to replace it; that is why this point will have to be reconsidered later.

The great warm, temperate and cold zones are respectively divided into less important groups. Climatic causes combine in each fundamental zone in different methods, to effectuate, on the whole, very different climates, to allow the development of vegetation of varied aspect and composition. The differences in the character of vegetation of two neighboring countries explains the dissimilarity of their climates, and their resemblance is the expression of their joint climatic factors. In other words, a like ensemble of climatic conditions combining in the same way determines a like *type of vegetation;* other conditions, or only another division of the same conditions, give occasion for the development of types of different vegetation. So it is that the vegetative type of our western Europe is that of the forest composed of trees with deciduous leaves; while that of eastern Europe is the steppe; that of the warm and constantly humid climate of the tropics, is the forest which is always green.

Thenceforth, the fundamental climatic zones divide naturally into large natural *regions of vegetation.* When studying the flora of the world, this division is the most apparent, and it is the most important. The great regions of vegetation are great climatic regions; the map of the distribution of large natural groups coincides with the principal types of climate over the whole earth.

Martius was the first to distinguish regions (Florenreiche).* A. de Candolle defined them with more precision.† The name has been generally adopted; there is then reason to follow tradition. A more or less broad sense has been attributed to it. We think it would be expedient to give it the import which was attributed to it by Grisebach in his principal work. ‡ The vegetative regions of Prof. Drude are the same. § So we say the *Forest region of northern Eurasia*, the *Temperate forest region of western Europe, Mediterranean region, Eurasiatic steppe region.* This is the proper meaning of the word in French; it expresses above everything a "large extent of country" (Littré). The great mountain masses considered as a whole and in their relations to the regions which surround them and to the entire terrestrial surface may also constitute natural regions. The entire group of the Alps constitutes the *Region of the Alps;* the *Region of the Caucasus* is distinguished in the same way, also that of the *Pyrénées*, the *Iberian group* and of the *Balkans.* It will be a question if, according to their relative importance and the relation of their vegetation to that of adjoining units, mountain groups of less importance should have the value of different subordinate units. So that we would say: the domain of the central group of France, domain of the Jura, austro-occidental domains, the central and eastern of the Alps; that we distinguish eastern, central and western sectors of the Pyrenees, the Savoie, Dauphiné, Provençal and Maritimes sectors of the Alps, the districts of the Albères, the Causses and the granitic Cévennes, etc.

The different strata of vegetation which range in echelon over the declivities add a certain number of questions to those which

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* Von Martius, Historia Natur. Palmarum, 1: tab. geogr. III. and IV., 1831.

† A. de Candolle, Introduction Géogr. bot., 1837.

‡ Grisebach, La Végétation du Globe.

§ Drude, Manuel, p. 302.

make up the whole, projected, as it were, on the general surface of the globe, in diversifying biologic conditions and in multiplying phytogeographic problems.

The great fundamental zones are subdivided then into vegetative regions which constitute the most important phytogeographic units. The idea of zones in general answers the need of synthesis and results from a consecutive comparison. The polar tundras appear to us a region contiguous to the forest region of northern Europe before we consider whether each of them should not be classed in a different superior group.

It being so, and because it appears necessary to reserve the name of zone to express parallel belts following which the mountain vegetation is divided, it seems advantageous to give the name of *Groups of Regions* to the fundamental zones.

So we would have a group of cold regions, one of temperate and another of warm regions; the same could be said of groups of boreal, austral and tropical regions.

It has been said that this primary grouping has for its principal purpose the facilitating of a grouping of the second order; it is, therefore, arbitrary; it suffices to make it good that it depends on evident and incontestable facts.

Botanic regions may be subdivided into secondary circumscriptions of variable extent in the determination of which the variations of climate are also secondary, but which depend ordinarily on topographic and geographic conditions.

Thus in the forest region of western Europe, the Atlantic Coast countries are clearly distinguished from the lowlands bordering on the North Sea and from the valleys of the Rhine and Danube. The Mediterranean region south of the Pyrenees has not the same character as in France or in northern Africa.

To these subdivisions of regions Prof. Engler has given the name province; in many countries this word has an administrative or political sense so that its use would give rise to ambiguities. The word *Domain* seems more appropriate.

In the forest region of western Europe there is distinguished then an *Atlantic domain*, a *domain of the plains of northern continental Europe* and one of *central Europe;* in the Mediterranean region there are the Iberian, the Mauritanian, French domains, etc.

Domains themselves may be divided into *sectors;* secondary climatic characters interpreted by vegetation will be taken into account, but the consideration of botanic elements of which we have not had to take account until now, also intervenes. When a portion of a region or a domain may be characterized by a certain number of plants which have entered from other countries, it would constitute a *sector.* In the Atlantic domain an Aquitanian *sector* may be distinguished where there are numerous species which have immigrated from the Mediterranean region, and where these fail, an Armorican *sector;* in the French domain of the Mediterranean region, there is a Provençal *sector* where representatives from the Italian domain are abundant, Roussillon and Corbières *sectors* which have been invaded by Iberian species, notwithstanding the barrier of the Pyrenees; in the Iberian domain an Andalousian *sector* characterized by many Moorish species, etc.

A new distinction may be introduced based either on geographic or topographic causes or on the physicochemic characteristics of the soil influencing vegetation.

District, such as we understand, it together with Prof. Briquet, corresponds to the *Bezirk* of Prof. Engler.

Islands separated from adjoining land by more or less extensive arms of the sea become characterized as districts by the appearance of endemic types. Ridges, exceeding the limits of vegetation, which separate valleys, tend to give to them special characters by preventing migration and in favoring endemism. Mountain ranges of a known mineralogic composition, isolated in the center of a group of different composition, may often be distinguished as districts for the same reason. C. Schröter, John Briquet and Paul Jaccard cite excellent examples of such in the Alps.

In the French domain of the Mediterranean region there are included the calcareous *district of the lower Corbières,* the siliceous volcanic rocky *district of the Maures and the Estérel,* while that of the *Balearic Islands* with their many endemic species, makes a very distinct district in the western sector of the Iberian domain.

Subdistricts may also be distinguished if they prove useful after a careful analysis. It is possible that some day the opportunity may be recognized of distinguishing two subdistricts in the district of the Maures and that of the Estérel, if with the mineralogic differences between the ancient and modern eruptive soils are corresponding botanic differences, which have escaped us as yet.

Prof. Briquet has distinguished several subdistricts in the western Alps and in the Jura.* In France for the same causes, and probably in all countries of ancient civilization where the soil has retained the impress of history, botanic districts often coincide accurately with the ancient "country." In mountain groups the subdivisions recognized by the inhabitants also represent the natural divisions of districts. The names of countries and of mountain groups which are used by the population may often be given to indicate districts or subdistricts without resulting error or ambiguity.

The last term remains to be spoken of, that of *station*, the final one of the series of geographic and topographic units.

In 1844, Wimmer † insisted on the necessity of adding to the morphological diagnosis of each species a phytogeographic description "which will determine with precision and in definite terms all environmental conditions; for a description of this kind contributes not less than the first to a knowledge of the species."

A station is a circumscription of any extent, but oftener limited, and represents a complete and definite ensemble of conditions of existence. Station sums up all that is necessary to the species which occupy it, the combination of climatic and geographic factors with the edaphic and biologic factors, that is to say the relation of each species to the soil and to associated species.

The disappearance or only the modification of an element, a specialization or even a very slight variation of any factor would be sufficient to determine a difference of station. The vocabulary of each country, born of the environment and need that puts a people to the test of expressing facts and phenomena which they observe each day, should furnish the means of designating stations peculiar to the country. The Scotch heaths, the Russian steppes, the moors of Brittany, the prairies of North America, the "près-bois" of our Alps, represent peculiar forms of vegetation which

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* John Briquet, Rech. sur la flore du district Savoisien, 1890.

† Wimmer, Flora der Schlesien, 1844.

may give rise to errors, for those unaquainted with them might deem it possible to correlate them with a form of vegetation of another country. It is necessary then in botanic geography to mistrust translations and not fear to adopt the name of a station which has been furnished us by the indigenous language.

The conception of Savannah as adopted and popularized by our travelers comprises, it appears, varied stations, that the ignorance of botanic geography alone makes confusing. It is important then to accept indigenous names as having a geographic value where their exact synonym is not known in one's own language.

The polar *Tundra*, the Siberian *Taïga*, the *Myrar* of the Swiss, the *Watten* of the coast of the North Sea, the *Llanos*, *carrascos*, *campos*, *potreiros* and *pinhals* of Brazil, the *scrub* of Australia have no equivalent in our language and these names have the same claim for preservation as our *garigues* and *maquis*.

It even happens (and this is the case in our own French language) that far from it being necessary to translate words given to natural features in other languages, the admitted classic vocabulary is not sufficient to explain facts and phenomena which are exhibited in a country, or the objects which are there encountered. In contrast with other languages which are profoundly penetrated by the poetry of nature, resulting from the constant contact of man with nature, our own, however literary and erudite, originating in the salons where polished society formerly gathered, has no words to express that which it has not known. It is from our old language that the words garigue and maquis have come. *Sansouire*, *Erme*, *Casse*, *Campas* have been acquired from ancient dialects. They express things of which our literature has no idea. It is proper to so enrich our language.

In finishing the nomenclature of geographic and topographic units only a few words remain to be said to express the more or less parallel bands which different vegetations follow when they are superimposed in the altitudinal sense.

If a certain parallelism in climate exists between the regions which extend from the equator to the poles and that of mountains considered from their base to their summit, it is now known that this parallelism depends only upon the temperature of the air. Therefore there is no need for them to be confused. Now in France, the word *zone* expresses a space which is clearly limited, as for instance that portion of a sphere's surface which is contained between two parallel lines (and accordingly this name agrees with the fundamental climatic-botanic zones) as a space is compared to a band. The word is used in this sense in geology, astronomy, meteorology and in military science. With this precise signification it expresses better than all others successive stages of vegetation from the base to the summit of mountains. In this exact sense the word has been adopted by French phytogeographers. "At an elevation of 11,000 feet, said Edmond Boissier, in 1839, one may expect to find vegetation distributed in distinct *zones* and this is what actually happens, but settling the delimitation of these *zones* offers many difficulties.* * *" * Dr. Christ has likewise adopted this French interpretation of the word zone when he says that "the differences which occur in the plant world when we ascend from the plain to the snow limit convey to us the principle of *zones*. It is sufficient to cast a glance even from a distance over one of the chains of our Alps to ascertain that the vegetation which covers it is separated into very distinct *zones* with well-accentuated delimitations.†

Let us sum up all that has preceded by enumerating only the series of units covering the general surface of the globe, such as we think possible to subordinate one to another:

1. **GROUP OF REGIONS.**
2. **Regions** (Martius, 1831).
3. **DOMAIN.**
4. **Sector.**
3. DISTRICT (Bezirk, Engler, 1879).
6. SUBDISTRICT.
7. *Station* (Wimmer, 1844).

The word zone would be applied only to those stages of vegetation which are superimposed in altitude, according to the signification given to it by Boissier in 1839.

II. Nomenclature of Biological Units

The nomenclature of biologic units is more simple *a priori.* It is necessary to recognize, however, that although the disorder

* E. Boissier, Voyage dan le midi de l'Espagne, 1: 185. 1839.

† H. Christ, La Flore de la Suisse et ses origines, 12. 1883.

is great in the classing of geographic and topographic units, in biologic units it is extreme. To avoid being misled in this labyrinth it would be well to retrace our steps in the course that we have just followed and consider first the elementary units, those which populate stations. It is very encouraging that good works which have been published during the last few years have commenced to introduce order into the subject by making *Associations* the foundation of critical study of botanic geography.

I did not pretend to make an innovation when I insisted, in 1894, on the necessity of taking the associations of plants living in common in the same station as a starting point for phytogeographic comparisons. It is due to Humboldt that attention was first called to the importance of *Plant Associations.* In his *Essay on the Geography of Plants* * in 1807 he showed that the different associations of plants which succeed one another from the base to the summit of Chimborazo depend strictly on temperature, humidity, atmospheric pressure, etc.

In 1820, A. P. de Candolle † urged the necessity of noting all details relating to associations: the station and its local variations, the degree of frequency or rarity of plants, etc., and their grouping into societies.

This conception therefore has its history. It is necessary that the significance of the term should be precisely stated. Vegetable association is the final expression of vital competition and of adaptation to environment in the grouping of species. Plants which inhabit the same station are not only connected one with another by simple relations of coexistence, but also by a bond of reciprocal interest, for certain of them receive benefit and profit from the conditions caused by the presence of others. The term vegetable association does not imply the harmonious coöperation of diverse tendencies toward a common end of collective advantage, as in all society founded on the principle of division of labor. It applies to the bringing together of specific and morphologic forms which are foreign to one another, for the exclusive profit of each individual; they live side by side, following the conformity or diversity of circumstances that suit them, either in the actual conditions of

* Al. de Humboldt, *loc. cit.*, 1807, p. 14.

† A. P. de Candolle, Projet d'une flore physico-géogr. de la vallée du Léman.

the environment or in the conditions determined by the presence of other plants.

Among the species which go to make up the association, some are *dominant*, either by the action they exert on the habitat in creating, as it were the station, or because they are characteristic of the plants of the country, in the form, size, or numbers of individuals; they form then the foundation of the vegetation. Others are *secondary*, more or less isolated, as if they had been scattered over the fundamental vegetation; or else are they *subordinated* in various degrees, either because they are scarce or rare, or it may be that they cannot live except in the shelter of the first, in their shade, as epiphytes on their aërial organs, or at their expense as parasites. They can also be subordinated by the limited duration of their active life (annuals, biennials, bulbous plants, etc.). The dominating species always characterize the association.

Association, so understood, answers exactly to what we have admitted since 1893, to that which has been described as such by E. Warming, in Denmark; Kerner, in Austria; Robert Smith, in Scotland; F. Höck, in Germany; Schröter, in Switzerland.

The term *Association* (*Plant association*) has been applied to it by English-speaking botanists. Warming called it *Plantesamfund* (in Danish) *Pflanzenverein;* Kerner described it under the term of *Genossenschaft;* Höck also called it by the name of *Bestand.* There are nevertheless divergences of opinion in regard to *Association.* W. O. Schimper regards it as composed of special ecologic groups: "It is the union of plants dependent on one another, some of which have always a dependent character and are unable to live without the help of others."* He recognizes four kinds of ecologic associations of this sort—lianas, epiphytes, saprophytes and parasites; these are groups of biologic forms, not of associations as understood by A. P. de Candolle and Humboldt.

If association is the simplest biologic unit from the geographic point of view, the ultimate expression of the struggle for life and adaptation, biologic forms may be considered as elementary units from a special ecologic point of view, as species are the elementary units which the botanist employs.

Mr. Warming has brought into correlation with the state of our

* W. O. Schimper, Pflanzengeographie, 208. 1898.

biologic and physiologic knowledge, the term *biologic forms* (*Lebensform, Vegetationsform*) which was previously but vaguely understood.

Grisebach understood by it forms of the same character which may or may not have morphologic affinities. It is known now that environment influences structure; this conception has been given precision. For example, when we speak of the ericaceous form we do not intend to treat only of the physiognomy, but also of a number of details of structure of which the outward appearance is but the collective expression.

Grisebach, in giving a vague meaning to *biologic form*, did not think of defining more clearly biologic groups which had as a basis the vague definition of biologic form such as he had conceived it. In 1838 he endeavored to group them under the name of *Phytogeographic formation* (*Pflanzengeographische Formation, Vegetationsformation*). "*Natural formation* includes plants which may be very different, but which have properties and characters in common, which may be summed up by pointing out several species which exemplify the special characteristics of the whole." So understood, forest, prairie and steppe are natural formations. But taking up this definition again to introduce more and more specious distinctions, Grisebach in 1872 distinguished fifty-four formations. Prof. Drude enumerated twenty-seven in the hercynien group.* In 1896 he distributed the different forest types of Germany into fourteen formations.† Kurz saw eight formations in the forest of Burma.‡ Hult divides the vegetation of northern Finland into half a hundred formations.§ The primitive idea has disappeared; thanks to the new interpretation, the ensemble disappears under the details, the tree hides the forest.

This diversity of interpretation has caused great difficulty in expressing facts relative to botanic geography.

Our forests, whether they be composed principally of oaks or of beech, or oaks and beech trees mixed, or associated with hornbeams or maples, etc., correspond none the less to a uniform type.

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* Drude, Ueber die Principien . . . 1889.

† Drude, Deutschlands Pflanzengeographie, 1896.

‡ Kurz, Forestflora of British Burma, 1877.

§ Hult, Fõrsõk till analyt. Behandling, 1881.

This is properly a same *Formation* in the primitive sense of the word. *Association* alone is modified by dominant species and with more or less extended variations that their absence or presence introduces into the relationship of members of the association. Our " moors " of the north and west constitute a formation of the same kind, where the dominating species may be either *Calluna vulgaris* or *Erica cinerea.* Our " maquis " are of infinite variety, a score of the 70 ligneous species of which they are composed may be either dominant or subordinate according to local circumstances.

It is necessary then to distinguish between *Formation* in the broad primitive sense given to it by Grisebach, and formations such as he understood them later. The latter are associations characterized by a physiognomic type instead of by dominant species. But as the most prominent physiognomic type is more often represented by dominant species, it often happens that formation, so understood, corresponds perfectly to association as we have defined it.

Drude, Beck, Kerner, Warming admit the broad sense but with various delimitations; R. Hult, Stebler and C. Schröter agree to the narrower sense of the term. Others complying with the same variations of the definition as Grisebach, have allowed intermediate interpretations.

The result is that for some the definition of *Formation* answers to a general type, as the Forest, while for others it has a special import; the forest then comprises a great many different *Formations.*

This is not all. If in Grisebach's first definition, formation had a purely physiognomic import, if the same word denotes an ensemble of extended or restricted vegetation, the confusion is increased on account of many authors wishing to give it a special signification.

Some, in fact, have reserved for formation a descriptive physiognomic sense, while others, attempting to determine the relations of cause to effect, gave to it a topographic or ecologic sense. For example, W. Schimper considers a formation to be an assemblage of plants determined by qualities of the soil; there are therefore climatic and edaphic formations. Some even interpose origin in the definition of formation, as for example, Celakovsky regards a formation as a group of species which have entered a country at the same time.

It is not to be marveled at that several botanists, who had doubtless lost their way in this confusion, acknowledge having employed the word without thinking of its definition, because others had previously made use of it.

It has not been possible to enumerate all the opinions as to the meaning of the word *formation.* Between the two extremes, the first interpretation by Grisebach and that of R. Hult there is a scale of infinite shades of meaning. The confusion is like that of a labyrinth.

Kerner, however, accepted the word as a necessity "because it had been introduced into science," notwithstanding the fact that he considered it badly chosen. Warming refrained from using it and Robert Smith has followed his example; his works have gained thereby a decided clearness.* We ask that phytogeographers make a decision, but in the meantime when they speak of formation we also ask that they say exactly what they mean by it.

Meanwhile, we readily describe the word *Vegetation* as an indeterminate grouping, as proposed by Warming.

With Warming, the designation of *Group of associations* (*Vereinsklasse*) will be reserved for the designation of several associations subjected as a whole to the same general conditions of environment. The association of beech, of peduncled oak, and of the intermingled forests of our plains, etc., form a *Group of associations of tropophilous trees.* The association of *Pinus sylvestris*, of *P. maritima* and *P. Cembra*, of spruces, etc., form a *Group of associations* of resinous trees with persistent foliage.

The following groups of associations are distinguished in France:

Non-resinous trees with persistent leaves (cork and evergreen oaks).

Coniferous trees with deciduous leaves (larch).

Resinous trees intermingled with other foliage (beech and spruce, beech and Norway spruce, Norway spruce and birch).

Resinous trees and non-resinous trees with persistent leaves (evergreen oaks and Aleppo-pine, cork oak and *Pinus maritima*).

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* Rob. Smith, Plant Association of the Tay Bassin, 1898. On the study of Plant Association, 1899. Botanical Survey of Scotland, 1900.

Shrubs and shrubbery with persistent leaves (garigues and maquis).

Ericaceous shrubs (heather, etc.), etc.

There are continuous groups of homogeneous associations (*geschlossene Formation*) and interrupted groups of associations (*offene Formation*) whose elements are distant from one another, dissociated, as the trees in the "prés-bois" of larches, the thickets in the Mediterranean garigues, the brush wood in the Brazilian campos, the tufts of grass on gravelly shores or on the dunes of the sea coast. The vegetation may be so thinly scattered that the name of the group of associations may be given it by the substratum.

In this way groups of plant associations could be distinguished as of the dunes and beaches of the sea coast, of rocks, of moraines, of the banks of streams and rivers, etc. These details may be easily stated in an exact manner.

Groups of associations may themselves be distributed into large ecologic series based on the uniformity of the factors which determine them, as proposed by M. Warming. There would be series of hydrophilous, xerophilous, halophilous, mesophilous groups of associations which would be designated simply by their substantives: Hydrophytes, xerophytes, halophytes, mesophytes. On this point phytogeographers have but to follow the excellent principles laid down by Warming.*

The great phytogeographic regions are characterized by a peculiar vegetable landscape, by a *type of vegetation* which reflects a distinct result of the reaction of the climate on the plants. Specific units assume the same appearance or a small number of distinct appearances; they resemble one another in aspect, height and form. The tree vegetations of temperate Europe, of North America, of China and Japan have all the same appearance. They belong to the same *type of vegetation.* The herbaceous plants of the Steppe, however different they may be from the specific point of view, have everywhere the same aspect; the tropical forest with its multiple heights of vegetation, its lianas, its epiphytes, its herbaceous carpet of infinite variety, still represents wherever it is seen, the same type of vegetation.

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* Warming, Lehrbuch der oekol. Pflanzengeogr., p. 114.

Good common sense has distinguished by special terms the sum of biologic characters appropriate to each of these types. Science has but to accept them. Trees with deciduous leaves, trees with persistent leaves, shrubs, lianas, mangroves, epiphytes, fleshy plants, herbs, mosses, lichens, algae (independent of all systematic consideration) are types of vegetation. These ecologic groups represent biologic units of the first order. As we have done for geographic and topographic units, let us enumerate the series of phytogeographic terms of biologic order such as it appears possible for us to establish.

1. **TYPE OF VEGETATION** ecologic, denominated as in ordinary usage.

2. Ecologic **series** of **Groups of associations** expressed by a substantive: hydrophytes, xerophytes, etc. (Warming, 1894).

3. GROUPS OF ASSOCIATIONS (Vereinsklasse, Warming, 1894 = Formations, Schimper, 1898, Grisebach, in part).

4. ASSOCIATIONS (Al. de Humboldt, 1807. A. P. de Candolle, 1820 = Formations, Grisebach, 1872).

5. *Biologic form;* this is the simplest ecologic unit, as station is the elementary topographic unit.

I will have attained my aim if the suggestions which I have endeavored to group provoke discussion and influence all those who are inconvenienced by the disorder of phytogeographic nomenclature to agree to put an end to it.

The botanical congress will, perhaps, deem it expedient to commit the care of studying this question to a commission composed of the principal phytogeographers of different countries and invite them to pursue an inquiry, the conclusions of which could be submitted to a subsequent congress. Phytogeographers are unanimous in recognizing the importance of an agreement as soon as possible; we entreat them to be willing to unite their good offices with that object in view.

BIBLIOGRAPHY.

L. Adamovic.—Die Vegetationsformationen Ostserbiens (Engler's botan. Jahrb., XXVI. 1898).

Edm. Boissier.—Voyage dans le midi de l'Espagne, I., 1839–1845.

John Briquet.—Recherches sur la flore du district savoisien et du district jurassique franco-suisse (Engler's botan. Jahrb., XIII. 1890).

——— Le Mont Vuache, Etude de Floristique (Bullet. des trav. de la Soc. bot. de Genève, VII., 1894).

A. de Candolle.—Introduction à l'étude de la Géographie botanique, 1837.

——— Géographie botanique raisonnée; Paris, Masson, 1855.

——— Constitution dans le règne végétal de groupes physiologiques applicables à la Géog. bot. ancienne et moderne (Archives des Sc. phys. et natur. de Genève, 1874).

A. P. de Candolle.—Projet d'une flore physico-géographique de la vallée du Léman, Genève, 1820.

H. Christ.—La Flore de la Suisse et ses origines, Genève et Bâle, 1883.

J. Daveau.—Sur la flore littorale du Portugal (Bulletin de l'herb. Boissier).

O. Drude.—Die Florenreiche der Erde (Petermann's Mitteil., Ergänzungsheft 74).

——— Atlas der Pflanzenverbreitung (Berghaus physik. Atlas) Gotha, 1887.

——— Ueber die Principien in der Unterscheidung von Vegetationsformationen (Engler's bot. Jahrb., XI., 1889).

——— Handbuch der Pflanzengeographie (Edit. franc.), Paris, 1897.

——— Deutschlands Pflanzengeographie, I., Stuttgart, 1896.

——— Die system. und geograph. Anordnung der Phanerogamen (Schenk, Handbuch der Botanik), 1885.

A. Engler.—Versuch einer Entwicklungsgesch. der extratrop. Florengebiete, Leipzig, 1879.

——— Die Entwickelung der Pflanzengeographie in den letzten hundert Jahren, Berlin, 1899.

C. Flahault.—La distribution géograp. des Végétaux dans un coin de Languedoc; Montpellier, 1893.

——— Projet de carte botan. forest. et agric. de la France (Bull. Soc. bot. de France, XLI., 1894).

——— Au sujet de la carte botan. de la France (Annales de Géogr., 1896).

——— Essai d'une carte botan.; Feuille de Perpignan (Annales de Géogr., 1897).

——— Flore de la Vallée de Barcelonnette, Montpellier, 1897.

A. Grisebach.—Ueber den Einfluss des Klimas auf die Begrenzung der natürl. Floren (Linnaea, XII.), 1838.

——— La Végétation du Globe d'après sa disposition suivant les climats. 1877–78.

F. Höck.—Genossenschaften in unserer Kiefernwaldflora (Nat. Wochens., X., 1895).

——— Vergleich des Buchenbegleiter und ihrer Verwandten in ihren Verbreitung mit der Fageen (ibid., IX., 1894).

——— Ueber Tannenbegleiter (OEsterr. bot. Zeitschrift, 1895).

——— Eine Genossenschaft feuchtigkeitsmeidender Pflanzen Norddeutschlands (Allg. bot. Zeitch. für Systematik, 1898).

R. Hult.—Försök till analytisk behandling af Växtformationerna (Meddelelser af soc. pro Fauna et Flora fennica, VIII., 1881 et XIV., 1887).

R. Hult et **Hj. Hjelt.**—Vegetationen och floran i en del af Kemi Lappmark och Norra Osterbotten (Meddel. soc. pro fauna et flora fennica, XII., 1885).

Al. de Humboldt.—Essai sur la Géographie des Plantes, Paris, 1807.

Paul Jaccard.—Etude géo-botan. de la Flore du haut bassin de la Sallenche et du Trient (Revue génér. de Botan., X., 1898).

——— Contribution au problème de l'immigration post-glaciaire de la flore alpine (Bull. Soc. Vaudoise des Sc. natur., 4e Ser., XXXVI., Lausanne, 1900).

Kerner von **Marilaun.**—Das Pflanzenleben der Donauländer, 1863.

——— Pflanzenleben, 2° édit., 1898.

——— OEsterreich-Ungarns Pflanzenwelt; Vienne, 1886.

A. O. Kihlman.—Pflanzenbiologische Studien aus russisch-Lapland (Acta Soc. pro fauna et flora fennica, VI., 1890).

Korshinsky.—Tentamen Florae Rossiae orientalis (Mém. Ac. Imp. Sc. St.-Pétersbourg, 1898).

Kurz.—Forestflora of British Burma, Calcutta, 1877.

A. Magnin.—Recherches sur la végétation des lacs du Jura. (Revue génér. de Botan., V., 1893).

——— Contributions à la connaissance de la flore des Lacs du Jura Suisse (Bull. Soc. bot. de France, XLI., 1894).

Von Martius.—Historia natur. Palmarum I., pl. III. et IV., 1831–1850.

Alb. Nilsson.—Om. Norrbottens Myrar och. försumpade Skogar (Tidskrift för skogshushollning, 1897).

——— Om. örtrika barrskogar (ibid., 1896, Stockholm).

F. Pax.—Grundzüge der Pflanzenverbreitung in den Karpathen (*Die Vegetation der Erde II.*), Leipzig, W. Engelmann, 1899.

R. Pound et **F. E. Clements.**—The Vegetation regions of the prairie province (Botan. Gazette, XXV., 1898).

——— The Phytogeography of Nebraska; Lincoln, Nebr., 1898.

G. Radde.—Grundzüge der Pflanzenverbreitung in den Kaukasusländern (*Die Vegetation der Erde III.*), Leipzig, W. Engelmann, 1899.

W. O. Schimper.—Pflanzengeographie auf physiologischen Grundlage; Leipzig, W. Engelmann, 1898.

Schouw.—Esquisse d'un cours sur la Géographie des plantes (trad. franç. in Ann. Sc. nat. 2e sér., Bot. III. 1835).

——— Grundzüge einer allgem. Pflanzengeogr.—Berlin, 1823.

C. Schröter.—Notes sur quelques associations de plantes rencontrées pendant les excursions dans le Valais (Bull. Soc. bot. de France, XLI., 1894).

Robert Smith.—On the Study of Plant Association (Nat. Sci., XIV., p. 109–120, 1899).

——— Plant Associations of the Tay Bassin (Proc. of Pert. Soc. Nat. Sci., II., 1898).

——— Botanical Survey of Scotland. I., Edinburgh District. II., North Pertshire district. (Scottish Geograph. Magazine, Juillet-août 1900.)

Stebler et C. Schröter.—Beiträge zur Kenntniss der Matten und Weiden der Schweiz (Landwirtsch. Jahrb. Schweiz, X., 1892.)

——— Les meilleures plantes fourragères alpestres, 1896.

Tanfiljeff.—Les domaines physico et phytogéographiques de la Russie d'Europe (en russe); br. 8 av. résumé en allemand, 2 cartes; W. Djenakow, St-Petersbourg, 1897.

——— Géographie des plantes (en russe); (Entsiklopedia polnaia rousskago selskago khoziaïstra, p. 528–570, carte en couleur); 1900.

Trabut.—Les régions botaniques et agricoles de l'Algérie, 1881.

——— L'Halfa, Alger, 1889.

Warburg.—Einführung einer gleichmässigen Nomenklatur in der Pflanzengeographie (Geographische Zeitschrift, Leipzig, 1900, p. 689).

E. Warming.—Lehrbuch der oekologischen Pflanzengeographie, Berlin, 1896.

——— Excursionen til Skagen i Juli 1896 (Botan. Tidsskrift, XXI., 1897).

——— Om Grönlands Vegetation (Meddelelser om Grönland, XII., 1889).

——— Botaniske Excursioner (Vid. Meddelels. fra d. naturh. For. i Kjöbenhavn, 1897).

——— De psamnophile Vegetationer i Danmark (Vid. Meddelels. fra d. naturh. For. i Kjöbenhavn, 1891).

Wimmer.—Flora von Schlesien, 1844.

Proceedings of the Club

Wednesday, March 27, 1901

This meeting was held at the College of Pharmacy, 17 persons present, Dr. Britton presiding in the absence of other officers.

The following were elected to active membership: Mr. A. G. Agnew, 45 Wall Street; Mr. J. M. Hoffman, Tallahassee, Florida; Mrs W. E. Damon, The Chelsea, 222 W. 23d Street, N. Y.; Mr. E. L. Morris, Western High School, Washington, D. C.; Mr. James Walker, 47 Maiden Lane; Miss Mary I. MacDonald, 17 Sylvan Terrace, W. 161st St.; Miss Caroline A. Baer, 102 E. 96th Street; Mr. Roland M. Harper, 1310 Boston Road; Mr. Percy Wilson, Botanical Gardens, Bronx Park, N. Y.

The Field Committee's report for 1900, delayed by illness of the Chairman, Dr. Schoeney, was presented this evening by Mr. Eugene Smith for the committee, and was accepted by the Club. A plea was made by Mr. Smith for more volunteers to act as guides, it having often proved difficult to secure them.

The Secretary announced that the annual grant from the Newberry Fund in aid of scientific research is open to competitors this year until June 1, 1901, in geology or paleontology. Dr. Britton remarked that a friend of scientific investigation had so added to the fund as to bring its award up from $50, as before, to $100, the amount offered this year.

On motion, Dr. A. Hollick was made nominee of the Club for this award for the present year.

The first paper of the evening was by Dr. John K. Small, on "The North American Genera of Mimosaceae." Dr. Small exhibited a uniform series of diagrammatic drawings, illustrating the flowers and fruit of each of these genera, and explained his proposed classification, replacing the previous artificial grouping. The variability of the fruit in valves, margins and cross-partitions was commented on. Discussion of the common sensitive plant followed, in which it was remarked that the sensitiveness to shock is so delicate as to be stimulated by holding a burning-glass near, or by drops of rain-water on first falling, or by holding a sponge of ammonia or of chloroform near. The utility seems unknown, except as the hot sun setting the leaves on edge prevents injury from intense sunlight. Sachs' suggestion was that the depression of the leaves served as a protection from hail; but it now appears that the native center of the plant is chiefly in the Orinoco region where hailstorms are unknown. Much energy is exhausted by folding, and it is well known that the greenhouse sensitive-plants are frequently worked to death by repeated irritation.

The second paper was by Dr. Rydberg, on "The Oaks of the Rocky Mountains." Dr. Rydberg exhibited examples of 28 species of this region. His paper will soon appear in print.

EDWARD S. BURGESS,
Secretary.

TUESDAY, APRIL 9, 1901

The meeting was held at the Museum of the New York Botanical Garden at 3:45 P. M., with Dr. N. L. Britton in the chair. Fifteen persons were present.

The announced scientific program consisted of a "Report of a recent visit to the Royal Gardens at Kew, England," by Mr. George V. Nash. Mr. Nash was absent about six weeks, nearly the entire time on the other side being spent at the Royal Gardens, Kew, securing specimens of living plants for the New York Botanical Garden. The collections were carefully inspected under the guidance of the officers of the institution, and such duplicate material picked out as was desired. In this way much valuable material was secured, both for the outside and conservatory collections. Many of these were procurable only at a botanical garden, and a number of them were not obtainable elsewhere than at Kew. Of the large number of plants selected, over 1000 species have already been received and incorporated in our collections, These include about 550 species of herbaceous plants, 350 shrubs and trees, and 150 succulents. The remainder of the material will follow as fast as the authorities at Kew can select it.

Dr. Britton remarked that the favor accorded by Sir William Thiselton-Dyer in permitting Mr. Nash to select duplicates of living plants from the rich collections at Kew would be most gratefully appreciated not alone by the managers and members of the New York Botanical Garden, but by all American botanists.

Dr. Britton presented a communication on a tree new to the American continent, a white birch from the Alaskan region, collected by Mr. R. S. Williams and Mr. Tarleton, and represented in the U. S. National Herbarium also by two specimens collected by Miss E. Taylor. The tree was described by Regel as *Betula alba*, subsp. *verrucosa*, var. *resinifera*, but is evidently entitled to specific rank.

Adjournment followed.

MARSHALL A. HOWE,
Secretary pro tem.

WEDNESDAY, APRIL 24, 1901

The meeting was held at the College of Pharmacy with Professor Underwood in the chair. Ten persons were present and the following new members were elected: Miss May Palmer, Training Dep't, Normal College, N. Y. City; Miss Nellie Y. Pietsch, 221 East 62d Street, N. Y. City; Mr. George W. Short, 159 West 125th Street, N. Y. City; Miss Ada Watterson, Barnard College, 119th St. and Broadway, N. Y. City.

The announced scientific program consisted of a paper by Professor Francis E. Lloyd, entitled, "The Genus *Lycopodium:* A Criticism," which in the absence of the author was read by the secretary pro tem. This was a review and criticism of the treatment of the genus *Lycopodium* by Pritzel in the recently published part of Engler and Prantl's "Die natürlichen Pflanzenfamilien" dealing with the Lycopodiaceae. The paper will be published in full in an early number of *Torreya.*

Professor Underwood remarked on segregations in the *Selaginella rupestris* group, stating that Dr. Hieronymus of Berlin had recently recognized twenty-seven species in this group, ten of them American, outside of those recently proposed in this country.

MARSHALL A. HOWE,
Secretary pro tem.

Index to recent Literature relating to American Botany

Arnold, A. F. The Sea-Beach at Ebb-Tide. 8vo. Pp. i–x, 1–490; pl. 1–85 and text figures. New York, 1901.
Pages 25–96 and plates 2–37 are devoted to the algae.

Artari, A. Zur Ernährungsphysiologie der grünen Algen. Ber. deutsche Bot. Gesellsch. **19**: 7–10. 20 Feb. 1901.

Barbour, W. C. *Marchantia* and *Conocephalus*. Bryologist, **4**: 34, 35. Ap. 1901. [Illust.]

Barnes, C. R. "A Simple Dynamometer." Torreya, **1**: 47. 19 Ap. 1901.

Beal, W. J. A new *Panicularia*. Torreya, **1**: 43. 19 Ap. 1901.
Panicularia Holmii Beal.

Beardslee, H. C. Notes on the Boleti of West Virginia. Torreya, **1**: 37–39. 19 Ap. 1901.

Benecke, W. Ueber die Diels'sche Lehre von der Entchlorung der Halophyten. Jahrb. wiss. Bot. **36**: 179–196. 1901.

Bessey, C. E. More about Fungus Spores as Bee-bread. Plant World, **4**: 96. My. 1901.

Best, G. N. *Discelium nudum* (Dicks.) Brid. in New Jersey. Bryologist, **4**: 30, 31. Ap. 1901.

Britten, J. Notes on *Lathryus*. Jour. Bot. **39**: 96–101. Mr. 1901.

Britton, E. G. Some Further Observations on *Buxbaumia*. Bryologist, **4**: 33, 34. Ap. 1901.

Britton, N. L. A new *Crataegus* from Washington. Torreya, **1**: 55. 22 My. 1901.
Crataegus Piperi Britton.

Britton, N. L. A new Hawkweed from Florida. Torreya, **1**: 41, 42. 19 Ap. 1901.
Hieracium Floridanum Britton.

Britton, N. L. Report of the Secretary and Director-in-chief. Bull. N. Y. Bot. Garden, **2**: 1–81. 27 My. 1901.

Britton, N. L. & Rydberg, P. A. An Enumeration of the Flowering Plants collected by R. S. Williams and J. B. Tarleton [in Yukon Territory]. Bull. N. Y. Bot. Garden, **2**: 149–187. 27 My. 1901.
New species in *Arctagrostis* (3), *Calamagrostis* (2), *Trisetum*, *Poa* and *Panicularia* by Nash; in *Carex* (3), *Betula*, *Silene*, *Arenaria*, *Ranunculus*, *Roripa*, *Mer-*

tensia, *Valeriana*, and *Petasites* by Britton; in *Polygonum* (2), and *Saxifraga* (2), by Small; in *Plantago* by E. L. Morris, and in *Limnorchis* (2), *Salix* (3), *Erysimum*, *Astragalus* (2), *Aragallus*, *Stenotus*, and *Erigeron* by Rydberg.

Burgerstein, A. Materialien zu einer Monographie betreffend die Erscheinungen der Transpiration der Pflanzen, III. Theil. Verh. k. k. zoöl.-bot. Gesellsch. Wien, **51**: 49–106. 25 F. 30 Mr. 1901.

Burglehaus, F. H. *Circaea* Fruit devoid of hooked Bristles. Torreya, **4**: 55, 56. 22 My. 1901.

Burt, E. A. Structure and Nature of *Tremella mycetophila* Peck. Bull. Torr. Club, **28**: 285–287. *pl. 23*. 21 My. 1901.
Species referred to genus *Exobasidium*.

Cannon, W. A. A Note on the Bladder Kelp, *Nereocystis Lütkeana*. Torreya, **1**: 49–52. 22 My. 1901.

Cook, O. F. Shade in Coffee Culture. Bull. U. S. Dept. Agric. (Div. Botany), **25**: 1–79. *pl. 1–16*. 1901.

Correns, C. Ueber Bastarde zwischen Rassen von *Zea Mays*, nebst einer Bermerkung über die "faux hybrides" Millardet's und die "unechten Bastarde" de Vries. Ber. deutsche bot. Gesellsch. **19**: 211–220. 24 Ap. 1901.

Coville, F. V. The August Vegetation of Mount Mazama. Mazama, **1**: 170–203. My. 1896.
Collomia Mazama is described and illustrated.

Curtiss, A. H. Hints on Herborizing. Plant World, **4**: Ap. 1901; 81–87. My. 1901.

Czapek, F. Der Kohlenhydrat-Stoffwechsel der Laubblätter im Winter. Ber. deutsche bot. Gesellsch. **19**: 120–127. 24 Ap. 1901.

Dangeard, P. A. Etude comparative de la zoospore et du spermatezoide. Le Botaniste, **7**: 269–272. *f. 1–3*. Ap. 1901.

Dangeard, P. A. La reproduction sexuelle des champignons superieurs comparée à celle de l'*Actinospherium*. Le Botaniste, **7**: 273–278. *f. 1*. Ap. 1901.

Dangeard, P. A. Le *Chytridium transversum* A. Braun. Le Botaniste, **7**: 282–284. *f. 1*. Ap. 1901.

Dangeard, P. A. Le *Rhizophagus populinus* Dangeard. Le Botaniste, 285–287. *pl. 2*. Ap. 1901.

Dangeard, P. A. Note sur la structure du sporange chez le *Cystopus trapogonis* Persoon. Le Botaniste, **7**: 279–281. *f. 1*. Ap. 1901.

Dangeard, P. A. Nutrition ordinaire. Nutrition sexuelle et nutrition holophytique. Le Botaniste, **8**: 59–94. Ap. 1901.

D'Arbaumont, J. Sur l'évolution de la chlorophylle et de l'amidon dans la tige de quelques végétaux ligneux. Ann. Sc. Nat. Bot. VIII. **13**: 319–423. 1901.

Dandeno, J. B. The Process of Freezing in Plantes. Science, II. **13**: 914. 7 Je. 1901.

Decrock, E. Anatomie des Primulacées. Ann. Sc. Nat. Bot. VIII. **13**: 65–199. *f. 90.* 1901.

Druery, C. T. Fern Variation in Great Britian. Bot. Gaz. **31**: 347–351. 18 My. 1901.

Durand, E. J. Some further Observations on *Buxbaumia.* Bryologist, **4**: 32, 33. Ap. 1901.

Eastwood, A. An undescribed species of *Paronychia* from California. Bull. Torr. Club, **28**: 288, 289. 21 My. 1901.
P. Franciscana sp. nov.

Eggert, H. A rare Plant from western Texas. Torreya, **4**: 56. 22 My. 1901.
Apodanthes Thurberi (Gray) B. & H.

Ernst, A. Beiträge zur Kenntniss der Entwickelung des Embryosackes und des Embryo (Polyembryonie) von *Tulipa Gesneriana* L. Flora, **88**: 37–77. *pl. 5.* 1901.

Ernst, A. Ueber Pseudo-Hermaphroditismus und andere Missbildungen der Oogonien bei *Nitella syncarpa* (Thuill.) Kutzing. Flora, **88**: 1–36. *pl. 3.* 1901.

Fairchild, D. G. Notes of Travel, IV. Coffee growing in Brazil and the giant Jequitibá Trees. Bot. Gaz. **31**: 352–354. 18 My. 1901.

Fitzpatrick, T. J. & M. F. L. Ranunculaceae of Iowa. Bull. Lab. Nat. Hist. State Univ. Iowa, **5**: 87–137. *pl. 1, 2.* Mr. 1901.

Garjeanne, A. J. M. Beobachtungen und Culturversuche ueber Blütenanomalie von *Linaria vulgaris.* Flora, **88**: 78–93. *pl. 2.* 1901.

Goebel, K. Archegoniatenstudien. IX. Sporangien, Sporenverbreitung, und Blütenbildung bei *Selaginella.* Flora, **88**: 207–228. *f. 16.* 1901.

Goebel, K. Morphologische und Biologische Bemerkungen. 9. Zur Biologie der Malaxideen. Flora, **88**: 94–104. *f. 7.* 1901.

Goldflus, M. Recherches sur l'assimilation chlorophylliene à travers le liège. Rev. Gen. Bot. **13**: 49–92. *pl. 2. f. 2.* 1901.

Greene, E. L. A new *Arnica* from Oregon. Torreya, **1**: 42, 43. 19 Ap. 1901.

Arnica aurantiaca Greene; *A. crocina* nom. nov.

Greene, E. L. Derivation of *Mimosa*. Plant World, **4**: 95, 96. My. 1901.

Grout, A. J. The Peristome—I. Bryologist, **4**: 31, 32. Ap. 1901. [Illust.]

Gruber, C. L. Naturalized or adventive Narcissi. Torreya, **1**: 43. 19 Ap. 1901.

Gruber. Ueber das Verhalten der Zellkerne in den Zygosporen von *Sporodinia grandis* Link. Ber. deutsche bot. Gesellsch. **19**: 51–55. *pl. 2. f. 1–15.* 26 Mr. 1901.

Halsted, B. D. The Asparagus Rust. Plant World, **4**: 88–94. *f. 1–4.* My. 1901.

Halsted, B. D. The Mignonette as Class Illustration for Ascent of Sap. Torreya, **4**: 56. 22 My. 1901.

Harris, C. W. Lichens—*Alectoria, Evernia, Ramalina.* Bryologist, **4**: 36–39. [Illust.]

Heydrich, F. Die Befruchtung des Tetrasporangiums von *Polysiphonia.* Ber. deutsche Bot. Gesellsch. **19**: 55–71. *pl. 3. f. 1–21.* 26 Mr. 1901.

Holferty, G. M. Ovule and Embryo of *Potamogeton natans.* Bot. Gaz. **31**: 339–346. *pl. 2, 3. f. 1.* 18 My. 1901.

Holway, E. D. W. Mexican Fungi, III. Bot. Gaz. **31**: 326. 18 My. 1901.

New species in *Uromyces* (6), *Puccinia* (18), *Uredo, Ravenelia, Endophyllum, Stichospora* and *Coleosporium* (3).

Holzinger, J. M. *Grimmia Holzingeri* once more. Bryologist, **4**: 24, 25. Ap. 1901. [Illust.]

Holzinger, J. M. *Hypnum Bestii.* Bryologist, **4**: 22–24. Ap. 1901. [Illust.]

Howe, M. A. An Enumeration of the Hepaticae collected by R. S. Williams, 1898–1899. Bull. N. Y. Bot. Garden, **2**: 101–105. *pl. 14.* 27 My. 1901.

Includes *Scapania imbricata*, new species.

Howe, M. A. Remarks on the Use of *Funaria hygrometrica* in Botanical Teaching. Torreya, **1**: 39–41. 19 Ap. 1901.

Howell, T. A Flora of Northwest America, **1**: 275–378. 21 Au. 1900.

Contains descriptions of new species in *Machaeranthera*, *Erigeron*, *Wyethia*, *Eriophyllum*, *Arnica*, and *Senecio*; several varietal names raised to specific rank.

Ikeno, S. Contribution à l'étude de la fécondation chez le *Gingko biloba*. Ann. Sc. Nat. Bot. VIII. **13**: 305–318. *pl. 2.* 1901.

Jadin, F. Contribution à l'étude des Simarubacées. Ann. Sc. Nat. Bot. VIII. **13**: 201–304. *f. 57.* 1901.

Kellerman, N. A. Minor Plant Notes, No. 2. Ohio Nat. **1**: 76. Mr. 1901.

Lemmermann, E. Beiträge zur Kenntniss der Planktonalgen. Ber. deutsche bot. Gesellsch. **19**: 85–95. *pl. 4. f. 1–9.* 25 Mr. 1901.

Lloyd, F. E. The Extra-Nuptial Nectaries in the Common Brake, *Pteridium aquilinum.* Science, II., **12**: 885–890. 7 Je. 1901.

MacDougal, D. T. Propagation of *Lysimachia terrestris* (L.) B.S.P. Bull. N. Y. Bot. Garden, **2**: 82–89. *pl. 13* and *f. 1–7.* 27 My. 1901.

Meissner, R. Ueber das Verhältniss von Stamm- und Nadellänge bei einigen Coniferen. Bot. Zeitung. **59**: 25–60. *pl. 1.* 1901.

Miehe, H. Ueber Wanderungen des pflanzlichen Zellkernes. Flora, **88**: 105–142. *pl. 1.* 1900.

Morkowine, N. Recherches sur l'influence des alcaloides sur la respiration des plantes. Rev. Gen. Bot. **13**: 109–126. 1901.

Němec, B. Ueber die Wahrnehmung des Schwerkraftreizes bei den Pflanzen. Jahrb. wiss. Bot. **36**: 80–178. *f. 36.* 1901.

Osterwalder, A. Eine Bluthe von *Cypripedium spectabile* Sw. mit Rückschlagserscheinungen. Flora, **88**: 244–247. *f. 3.* 1901.

Palladine, W. Influence de la nutrition par diverses substances organiques sur la respiration des plantes. Rev. Gen. Bot. **13**: 18–32, 93–96, 127–136. 1901.

Philibert, H. Un groupe de Brya, parallèle à la section Mucronatum. Rev. Bryol. **28**: 25–37. 1901.

Five new species, *Bryum submuticum*, *B. Williamsi*, *B suborbiculare*, *B. Treleasei* and *B. Agattuense* from Alaska, the Aleutian Islands, and Montana, are described.

Philippi, R. A. Eine Wurzel direct in ein Blatt verwandelt. Ber. deutsche bot. Gesellsch. **19**: 95–97. 26 Mr. 1901. [Illust.]

Piper, C. V. The Flora of Mount Rainier. Mazama, **2**: 93–117.

Includes description of *Vaccinium deliciosum* Piper, sp. nov. and several new combinations in nomenclature.

Piper, C. V. & Beattie, R. K. The Flora of the Palouse Region. 1–208. Pullman, Washington. 14 My. 1901.

Contains descriptions of all vascular plants within thirty-five kilometers of Pullman, Washington.

Richards, H. M. "A simple Dynamometer." Torreya, **1**: 48. 19 Ap. 1901.

Richards, H. M. *Ceramothamnion Codii*, a new Rhodophyceous Alga. Bull. Torr. Club, **28**: 257–265. *pl. 21, 22.* 21 My. 1901.

Robinson, B. L. Further Notes on the Agrimonies. Bull. Torr. Club, **28**: 295–300. 21 My. 1901.

Rusby, H. H. Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1885–1886, XXXI. Bull. Torr. Club, **28**: 301–313. 21 My. 1901.

New species in *Manihot*, *Acalypha* (6), *Alchornea*, *Conceveiba*, *Sapium*, *Pharmacosycea*, *Urera* (3), *Pilea* (4) and *Boehmeria*.

Rydberg, P. A. Studies on the Rocky Mountain Flora—V. Bull. Torr. Club, **28**: 266–284. 21 My. 1901.

New species in *Sporobolus*, *Carex*, *Streptopus*, *Vagnera* (2), *Limnorchis*, *Piperia* (gen. nov.), *Corallorhiza*, *Salix* (4), *Blitum*, *Alsine*, *Arenaria*, *Delphinium* (2), *Erysimum*, *Draba*, *Physaria* (3), *Cardamine*, *Thlaspi* (2), *Sophia* and *Sedum* (2).

Rydberg, P. A. The North American Twinflowers. Torreya, **1**: 52–54. 22 My. 1901.

Rydberg, P. A. The Oaks of the Continental Divide North of Mexico. Bull. N. Y. Bot. Garden, **2**: 187–233. *pl. 25–33.* 27 My. 1901.

Includes *Quercus submollis*, *Q. Vreelandii*, *Q. leptophylla*, *Q. nitescens*, *Q. Eastwoodiae*, *Q. Havardi*, *Q. pauciloba*, *Q. Mohriana*, and *Q. Wilcoxii*, new species.

Sargent, F. L. Amadon Touchwood, Tinder or Spunk; its History and Uses. Sci. Am. Suppl. **51**: 21227, 21228. *f. 1–3.* 18 My. 1901.

Notes on the economic uses of *Polyporus fomentarius*.

Schmid, B. Ueber die Einwirkung von Chloroformdämpfen auf ruhende Samen. Ber. deutsche bot. Gesellsch. **19**: 71–76. 26 Mr. 1901.

Scribner, F. L. American Grasses—II. Bull. U. S. Dept. Agric. (Div. Agrost.), **17**: 1–349. *f. 303–627.* 1901.

A revised edition with numerous changes.

Small, J. K. A Kentucky Cornel. Torreya, **1**: 54, 55. 22 My. 1901.

Cornus Priceae, sp. nov.

Small, J. K. Shrubs and Trees of the Southern States. Bull. Torr. Club, **28**: 290–294. 21 My. 1901.

New species in *Prunus*, *Leucothoë*, *Hypericum* and *Ptelea* (3).

Small, J. K. The Mimosaceae of the Southeastern United States. Bull. N. Y. Bot. Garden, **2**: 89–101. 27 My. 1901.

Siderocarpos and *Havardia* new genera, and *Morongia latidens* new species.

Solms Laubach, H. Graf zu. Cruciferenstudien. Bot. Zeitung, **59**: 61–78. *pl. 1.* 1901.

Sonntag, P. Verholzung und Mechanische Eigenschaften der Zellwände. Ber. deutsche bot. Gesellsch. **19**: 138–149. *pl. 6. f. 1–4.* 24 Ap. 1901.

Stevens, F. L. Die Gametogenese und Befruchtung bei *Albugo.* Ber. deutsche bot. Gesellsch. **19**: 171–176. *pl. 8.* 24 Ap. 1901.

Sudworth, G. B. The White River Plateau and Battlement Mesa Forest Reserves. Ann. Rep. U. S. Geol. Surv. **20**^{5}: 117–243. *pl. 49–75.* 1900.

Sydow, H. & P. Mycologische Mittheilungen. Beiblatt für Hedwigia, **40**: (1)–(3). 21 F. 1901.

New species in *Aecidum, Auerswaldia,* and *Fusarium* from Kansas, Mexico and Brazil. *Tracya* substituted for *Cornuella* Setch.

Toumey, J. W. Our Forest Reservations. Pop. Sci. Monthly, **59**: 115–128. Je. 1901. [Illust.]

Tschermak, E. Weitere Beiträge über Verschiedenwerthigkeit der Merkenale bei Kreuzung von Erbsen und Bohnen. Ber. deutsche bot. Gesellsch. **19**: 35–51. 26 Mr. 1901.

Underwood, L. M. An Enumeration of the Pteridophytes collected by R. S. Williams and J. B. Tarleton [in the Yukon Territory]. Bull. N. Y. Bot. Garden, **2**: 148, 149. 27 My. 1901.

Underwood, L. M. Suggestions for the study of the North American Boletaceae. Contr. Dept. Bot. Columbia Univ. 176: 1–41. My. 1901.

Synopsis of American species described to date and bibliography.

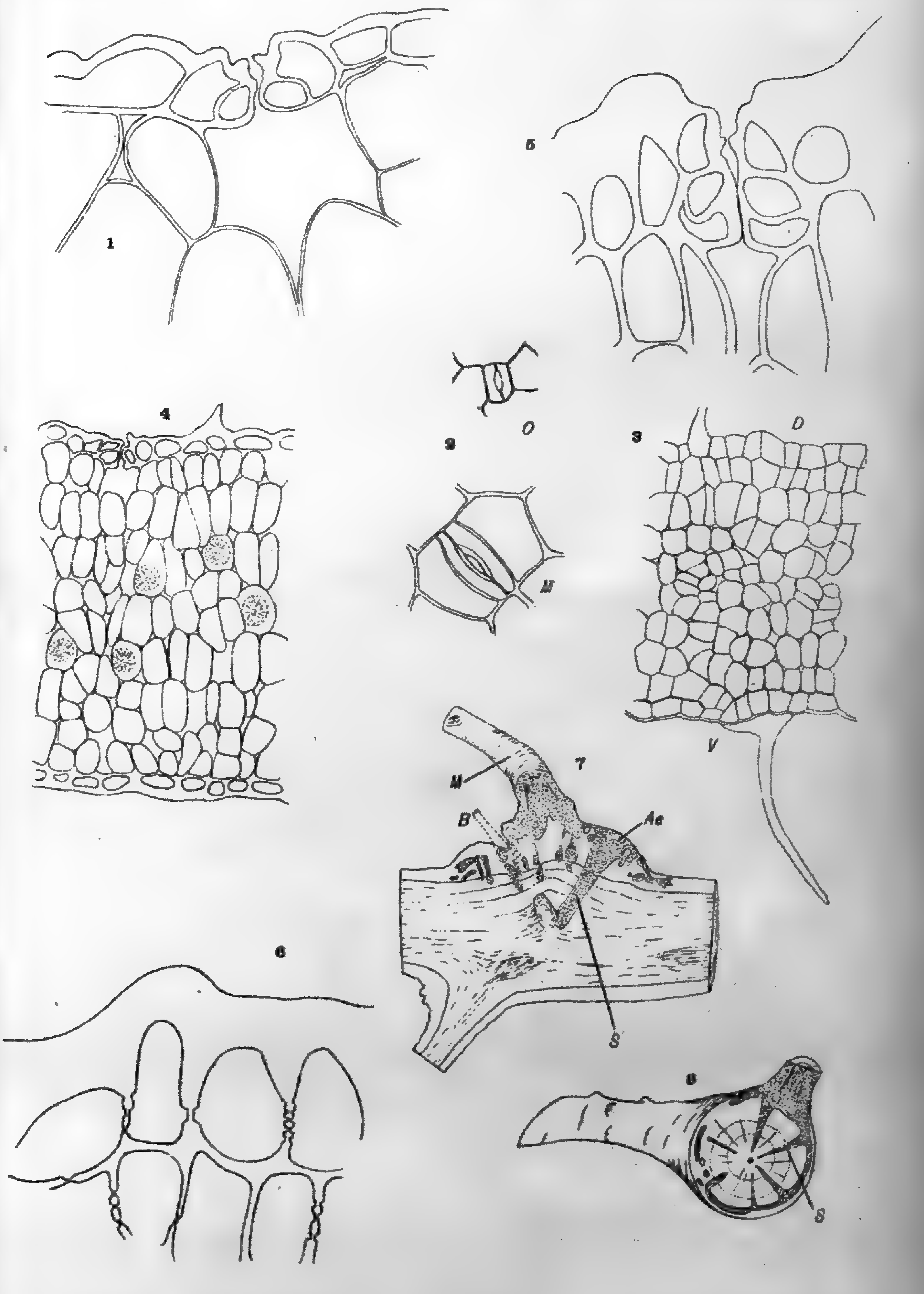
Underwood, L. M. The Names of our Ferns. Bot. Gaz. **31**: 365, 366. 18 My. 1901.

Vries, H. de. Recherches expérimentales sur l' origine des espèces. Rev. Gen. Bot. **13**: 5–17. *f. 10.* 1901.

Wetzstein, A. Additional Note on the *Syndesmon* Involucre. Ohio Nat. **1**: 104. Ap. 1901.

White, P. J. *Sabbatia campestris* in Oklahoma. Plant World, **4**: 96. My. 1901.

Whitford, H. N. The Genetic Development of the Forests of Northern Michigan; A Study in physiographic Ecology. Bot. Gaz. **31**: 289–325. *f. 1–18.* 18 My. 1901.



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Memoirs. (See last page of cover.)

Vol. 28 No. 8

BULLETIN

OF THE

TORREY BOTANICAL CLUB

AUGUST 1901

The Tylostomaceae of North America

By V. S. White

(With Plates 31–40)

The members of this family are puffball-like plants, which form underground in the shape of rounded masses, appearing at first on the mycelium as minute thickenings, and gradually reaching their full development. The ball has a thick outer covering, and an inner, and usually thinner one, commonly known as the peridium proper. The upper and larger portion of the ball is composed of sporogenous tissue, and there is a lower sterile portion which elongates when conditions are most favorable, forcing the upper portion up through the surface of the ground, and consequently rupturing the outer coat which originally enveloped the whole mass. In some genera this outer coat remains at the base as a distinct cup-like volva, the upper portion then being carried up almost intact and falling away or adhering to the peridium; in other cases the outer coat is ruptured irregularly, bearing very slight traces at the base of the stem or even none at all, and in the genus *Tylostoma* this coat adheres more or less to the peridium, nearly always leaving some traces in the form of a collar at its base. The stem is commonly of a firm, almost woody texture, and the plants can be quite satisfactorily preserved in a dry condition. They vary greatly as to size and shape, but are all constructed on the same general plan, having a more or less irregularly globose peridium, and a distinct footstalk, which is usually, though not always, more than twice the length of the peridium in mature forms. The methods of dehiscence are very different in the various genera, some having a definite apical mouth, the peridium withering and collapsing as the spores escape; others rupture irregularly from above downwards, more as in the Sclerodermataceae. *Battarrea* has a regular line of dehiscence where the upper portion of the somewhat hemispheric peridium breaks away, leaving the lower portion at the summit of the long stem.

In the peridial characters, *Tylostoma* is closely allied to the Lycoperdaceae. The relation of this family to the Phallaceae is one of analogy mainly, shown in the elongation of the stem which forces the spore-bearing parts to a higher position for the better scattering of the spores.

In his latest treatment of the family, Fischer* recognizes four genera: *Tylostoma* with forty species, widely distributed; *Queletia* with a single species from France, failing to note that it had also been reported from America; *Battarrea* with eight species; and *Sphaericeps* with one species from Angola. The genus *Chlamydopus*, described by Spegazzini† from Argentina, after Fischer's first draft was prepared, was later too summarily assigned as a synonym of *Tylostoma*,‡ for the differences are so marked that it would be unfortunate to include these two diverse types under one genus.

Within the past year several specimens of a *Chlamydopus* have been found at Mesilla Park, New Mexico, and it was the original purpose of this paper simply to describe and figure these. It soon became necessary to study the members of the allied genus *Tylostoma*, of which extensive suites of specimens were found in the Ellis collection, mainly from the western half of the country, representing some species hitherto undescribed, so that it was finally concluded to prepare a revision of the entire family as represented in North America. Finally some specimens collected by Mr. E. Bethel, of Denver, Colorado, and sent by him to Mr. Ellis, proved to belong to an undescribed genus. This large amount of material, mostly forming a part of the Ellis collection at the New York Botanical Garden has made the preparation of this paper

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* Engler & Prantl, Die nat. Pflanzenfam. 1[1]**: 342. 1900.

† An. Mus. Nac. Buenos Aires, 6: *pl. 4. f. 2, 3.* 189. 1899.

‡ Engler & Prantl, Die nat. Pflanzenfam. 1[1]**: 357. 1900.

possible. Mr. E. Bartholomew has kindly loaned material, for the better description of one species, and Mr. E. S. Salmon has kindly looked up some data at Kew, England.

Special thanks are due to Professor Charles H. Peck, of Albany, for material and suggestions, and more especially to Professor L. M. Underwood, of Columbia University, under whose direction the work has been undertaken and whose private collection has furnished considerable additional material.

The genera of the family Tylostomaceae may be recognized by the following synopsis:

Peridium opening by an apical mouth.
- Peridium with a collar underneath, formed about the cylindrical stem; volva indefinite. I. TYLOSTOMA
- Peridium without a collar; stem much enlarged where it joins the peridium; volva cup-like, flaring. II. CHLAMYDOPUS

Peridium circumscissile.
- Peridium hemispheric or nearly plane below, dehiscing at the margin of the plane of the hemisphere. III. BATTARREA
- Peridium spherical, dehiscing at the equator. SPHAERICEPS (extra-limital).

Peridium opening irregularly.
- Peridium readily separating from the stem; capillitium free. IV. QUELETIA
- Peridium closely attached to the stalk; capillitium embedded in a membranous tissue. V. DICTYOCEPHALOS

I. TYLOSTOMA Pers. Römer, Neues Mag. Bot. 1: 86. 1794

The first reference to a plant certainly belonging to *Tylostoma*, is to be found as early as 1696, in Ray's Synopsis * under the name of *Fungus pulverulentus minimus*. He describes it in a few Latin words, "Pediculo longo, insidens. In agris circa Londinum," and adds in English, "the least dusty mushroom, with a long foot-stalk, collected by D. Tancred Robinson, M.D." The next mention is made in 1700 by Tournefort † who also gives the first figure of a *Tylostoma*; this has the characteristic short tubular mouth of *T. pedunculatum*, a slender, smooth stem, and closely resembles specimens of this plant found in our own country. Micheli ‡ next figured the other variety of *T. pedunculatum* under the name, *squamosum*. This figure is not so easy to identify as that of Tournefort;

* Syn. Meth. Stirp. Brit. 2d ed., 16. 1696.

† Inst. rei Herb. 1: 563. *pl. 331. f. E, F.* 1700.

‡ Nova Plantarum Genera, 218, nos. 10 and 11. *pl. 97. f. 1.* 1729.

none of the European specimens of this variety seen, have such a rough stem, or a peridium of the exact shape as shown in the figure, but it is evident notwithstanding, what it was meant to represent. *T. pedunculatum* being the commonest European species, and widely distributed tends to vary and extreme specimens are found to differ so widely that were it not for the many intermediate stages, the extremes might well be kept distinct, as indeed has been done by several writers.

Linnaeus * refers to this same plant by its first binomial, *Lycoperdon pedunculatum*, and cites the above-mentioned descriptions of Ray and Tournefort. His description is in the following words: "Stipite longo, capitulo globoso glabro; ore cylindrico, integerrimo. Habitat in campestribus." In 1794 Persoon established the genus *Tulostoma.*† He described it—"Peridium stipitatum, ore cylindrico cartilageneo"—and mentions two species *T. brumale* (*L. pedunculatum* L.) and *T. imbricatum* (Micheli Ly. 11); these two species have since been commonly referred to, under the name of *T. mammosum* (Mich.) Fries, but all these specific names are antedated by *pedunculatum* of Linnaeus.

Since the time of Persoon, various species of *Tylostoma* have been described, and De Toni ‡ enumerates thirty-four species from different parts of the world.

Our own species were studied in 1890 by Morgan,§ but evidently from a limited amount of material. In his paper he enumerates five species, of which *T. mammosum* and *T. fimbriatum* are originally European, two were new native species, *T. verrucosum* and *T. campestre*, and the fifth he called *T. Meyenianum* Kl., but it is evident that the original *T. Meyenianum* was not a true *Tylostoma* but a poorly figured species of the genus *Chlamydopus*, and as the material on which Morgan based his determination is not now available, we are uncertain as to what his last species really is. *T. pedunculatum* was first reported from this country in 1818 by Schweinitz|| under the name

---

* Sp. Plant. 1184. 1753.

† Tylostoma from τυλοσ, callous skin, and στομα, a mouth.

‡ Saccardo, Syll. Fung. 7: 60; 9: 268; 11: 159; 14: 258.

§ Jour. Cin. Soc. Nat. Hist. 12: 163; *pl. 16. f. 1–5.* 1890.

|| Syn. Fung. Car. 34. 1818.

of *T. brumale* Pers. from North Carolina, and in 1834* he gives two species, *T. brumale* and *T. squamulosum*,† of which latter he writes "not a variety of the preceding but closely resembling *Rinella* of Rafinesque,‡" but notwithstanding his assertion to the contrary *T. squamosum* is now commonly regarded as a variety of *T. pedunculatum* (*brumale*). In 1837, Montagne§ described *T. exasperatum* from Cuba, collected by Ramon de la Sagra, the well-known Cuban naturalist, and this species has since been reported from India. In 1867 Curtis¶ mentions *T. fimbriatum* and *T. mammosum* as "common in North Carolina," and six years later Berkeley ** reported *T. fimbriatum*, *T. mammosum*, and *T. Meyenianum*, collected by Wright in New Mexico. As late as 1891, Massee †† published Berkeley's description of *T. Wrightii*, also from New Mexico. Other American species have been described since, *T. obesum* C. & E., ‡‡ *T. punctatum* Peck, §§ and *T. semisulcatum* Peck. ¶¶ Much of the western material found in the Ellis collection had been referred to *T. obesum*, although it represents very diverse forms. *T. punctatum* has been reported from several localities, but of *T. semisulcatum* only the type specimens are known, and these are inaccessible at Albany, if indeed they are still in existence. Extensive collections have been made in different parts of the United States in the past few years and we

* Trans. Amer. Phil. Soc. 4: 256. 1834.

† Since writing the above it has been possible to examine Schweinitz' original specimens, which are carefully preserved in the Philadelphia Academy of Natural Sciences. There is a question as to the specimen marked *T. brumale* being *T. pedunculatum*, to which it is usually referred, owing to the color of the peridium, which is a bright terra-cotta red, unlike anything seen before—but this may be due to the color of the clay in which the plant grew or to other causes of unknown origin. The specimen marked *T. squamosum* resembles greatly some of our specimens of *T. fimbriatum* in general habit and spore characters, with the exception of the mouth which is entire, but not tubular and prominent, like the mouth of *T. pedunculatum*—which fact may be owing to the wasting of the cartilaginous tissues occasioned by time—so that it is hardly possible to determine what this plant really was.

‡ Syst. F. Veg. 139.

§ Ann. Sci. Nat. II. 8: 362. 1837.

¶ Geol. and Nat. Hist. Survey North Carolina, 3: 110. 1867.

** Grevillea 2: 49. 1873.

†† Grevillea 19: 95. 1891.

‡‡ Grevillea 6: 82, *pl. 100. f. 24.* 1878.

§§ Bull. Torr. Club, 23: 419. 1896.

¶¶ Bull. Torr. Club, 22: 209. 1895.

find among them several additional species. The indications are that we are only at the beginning of our knowledge of their distribution.

The following table shows the distribution of the hitherto known species of *Tylostoma*:

TYLOSTOMA.	North America.	South America.	Europe.	Asia.	Africa.	Australia.	Mexico and Central America.	Borneo.	Sandwich Islands.
album.						+			
Angolense.				+	+				
Barlae.			+						
Barbeyanum.				+					
Berteroanum.		+							
Bonianum.				+					
Bossieri.					+				
campestre.	+								
caespitosum.				+					
carneum.					+				
Cesatii.				+					
exasperatum.	+			+					
fimbriatum.	+		+			+			
Giovanellae.			+						
granulosum.			+						
Jourdani.					+				
laceratum.					+				
leprosum.						+			
Leveilleanum.									+
mammosum.	+		+	+	+	+	+		
maximum.						+			
Mollerianum.					+				
montanum.					+				
obesum.	+								
pulchellum.					+				
pusillum.		+						+	
Patagonicum.		+							
Schweinfurthi.					+				
squamosum.					+				
tortuosum.					+				
volvulatum.				+					
verrucosum.	+								
Wightii.				+					
Wrightii.	+								

The species of *Tylostoma* are found principally in sandy regions, in dry barren fields, rarely in woods or shaded places. As yet very little is known of their habits, growth and development as no little difficulty attends the study of these strange and interesting plants in their early subterranean stages. It is hoped that students in the districts where these plants are most common will gather material in the earlier stages of growth—digging down where mature forms are found above ground in the hope of finding the young peridia.

As far as can be ascertained, only two papers have appeared treating of the growth of these plants. Schroeter * has published an account of the development of the spores and basidia. Professor Bessey † has a short note on the growth of *T. mammosum* in which he says, "The ball forms underground, and reaches maturity there so far as the spores are concerned. *Tylostoma* agrees with *Lycoperdon* in having the interior of the ball composed of two portions, first a spore-bearing part which occupies most of the interior, and second a sterile base composed of tissue which does not produce spores. In *Tylostoma* a portion of this tissue of the sterile base remains living until the spores ripen. Then this tissue begins a rapid growth and a cylindrical stalk is produced which forces the ball through the overlying earth and carries it up several inches." Massee,‡ speaking of *Tylostoma mammosum* says, "resembling a *Lycoperdon* with an elongated stem, but readily distinguished by the groove between the apex of the stem and the peridium, and by the threads of the capillitium being nodulose at the base of the septa." And writing of the stem, "it is sometimes smooth, and at others broken with small irregular fibrillose squamules which are sometimes arranged more or less in circles."

Synopsis of our Species

Mouth entire, short tubular.
  Spores smooth, or occasionally with a few minute scattered warts.
    1. *T. albicans.*
  Spores uniformly and densely verrucose.
    Peridium smooth; capillitium not much swollen at the joints.
      2. *T. pedunculatum.*
    Peridium warty; capillitium swollen at the joints. 3. *T. verrucosum.*
Mouth lacerate-fimbriate, not tubular.
  Spores smooth or nearly so.
    Mouth plane.
      Stem tapering toward the base; peridium depressed.
        4. *T. gracile.*

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* Cohn's Beitr. Biol. Pflan. **2**: 65. 1877.

† Amer. Nat. **21**: 665. 1887.

‡ Ann. Bot. **4**: 85. 1889.

Stem not tapering; peridium globose.
Capillitium freely septate; stem short (1–1.5 cm.), collar close. 5. *T. minutum.*
Capillitium rarely or never septate; stem longer (1.5–5 cm.), collar distant. 6. *T. Kansense.*
Mouth raised, convex.
Capillitium freely septate; outer peridium long persistent. 7. *T. poculatum.*
Capillitium rarely or never septate; outer peridium soon receding. 8. *T. obesum.*
Spores verrucose or granular.
Mouth plane. 9. *T. campestre.*
Mouth raised, convex.
Spores furnished with long blunt spinules; stem short (0.75 cm.), rough spiny. 10. *T. exasperatum.*
Spores with coarse scattered tubercles; stem longer (3 cm.), even, nearly smooth. 11. *T. tuberculatum.*
Spores finely granulate-verrucose.
Capillitium sparingly septate, not much swollen at the joints.
Stem elongate (6 cm.), with copious persistent mycelial strands. 12. *T. fibrillosum.*
Stem shorter (3.5 cm.), without mycelial strands. 13. *T. subfuscum.*
Capillitium freely septate, swollen at the joints.
Peridium smooth; mouth fimbriate. 14. *T. fimbriatum.*
Peridium pitted; mouth lacerate. 15. *T. punctatum.*

1. **Tylostoma albicans** sp. nov.

Peridium depressed globose, 0.7–1 cm. high, 1–1.5 cm. in diameter: outer peridium scaly, retreating and leaving a smooth whitish surface to the inner membranaceous peridium: mouth short tubular, entire, prominent: collar irregular, 3–5 mm. distant from the stem: stem equal, slightly thickened at the base, the outer coating lacerate scaly, whitish like the peridium, 4–6 cm. long, 0.5 cm. in diameter: capillitium whitish, hyaline, branched, septate, slightly swollen at the joints, 4–6 μ wide, free ends rounded: spores reddish brown, irregularly globose, pedicled, smooth, or if rough only a very few of them so, 4–5 μ in diameter. (Pl. 31, f. 4–7.)

TEXAS: *E. D. Cope.*

2. TYLOSTOMA PEDUNCULATUM (L.) Schroeter; Cohn, Beitr. Biol. Pflan. **2**: 65. 1877

Lycoperdon pedunculatum L. Sp. Pl. 1184. 1753.

Tulostoma brumale Pers. Rōmer Neues Mag. Bot. **1**: 86. 1794.

Tulostoma mammosum Fr. Syst. **3**: 42. 1829.

Lycoperdon II. Mich. Nov. Plant. Gen. 218. 1729.

Tulostoma imbricatum Pers. Römer Neues Mag. Bot. **1**: 86. 1794.

Lycoperdon squamosum Gmel. Syst. Nat. **2**: 1462. 1796.

Tulostoma squamosum Pers. Syn. Meth. Fung. 139. 1801.

Tulostoma mammosum Fr. Syst. **3**: 42. 1829.

Tylostoma mammosum var. *squamosum* De Toni; Saccardo, Syll. Fung. **7**: 61. 1888.

Peridium subglobose, 1–1.5 cm. high, 1–2 cm. in diameter, the brown outer peridium soon retreating, leaving the inner peridium smooth and membranaceous: mouth short tubular, entire, prominent: collar inconspicuous: stem slender, lacerate scaly, or nearly smooth, with a small mycelial bulb, stuffed with loose silky threads, 1–5 cm. long, 2.5 mm. in diameter: capillitium 4–7 μ thick, septate, somewhat swollen at the joints, light colored, hyaline: spores subglobose, 3–5 μ in diameter, minutely verrucose, some short pedicled. (Pl. 31, f. 1–3.)

Exsicc. E. & E. N. A. Fungi 2734 (as *T. mammosum*). Ravenel, Fungi Am. Ex. 137 (as *T. mammosum*).

NEW YORK, *Underwood, Fischer;* NEW JERSEY, *Ellis;* PENNSYLVANIA; MICHIGAN, *McBride;* WISCONSIN, *D. V. B;* NORTH CAROLINA, *Curtis, Wood;* KANSAS, *Kellerman,* 770; INDIANA, *Cook, Underwood;* FLORIDA, *Underwood;* NEBRASKA, *Webber;* TEXAS, *Harris;* COLORADO; IOWA; NEW MEXICO, *Wright, Fendler, Cockerell;* MEXICO, *C. L. Smith.*

3. TYLOSTOMA VERRUCOSUM Morg. Jour. Cin. Soc. Nat. Hist. **12**: 163. *pl. 16. f. 2.* 1890

Peridium depressed globose, 1–1.2 cm. high, 1–1.5 cm. in diameter: outer peridium of scales and warts persistent: inner peridium brownish, becoming smooth with age: mouth entire, raised, prominent, short tubular: collar of delicate lacerate points descending about the top of the stem: stem 4–5 cm. long, .5 cm. in diameter, slender, the surface lacerate scaly, brown, hollow, cylindrical and having a large basal bulb composed of the mycelial strands and adherent earth: capillitium almost white, hyaline, slender, septate, some of the joints rather swollen, 3–6 μ wide: spores subglobose, granular, lightish cinnamon-colored, 4–7 μ in diameter. (Pl. 31, f. 8–10.)

OHIO: *Morgan, C. G. Lloyd.*

Growing on the ground in rich soil in woods. The mycelial bulb is usually larger than the peridium.

4. **Tylostoma gracile** sp. nov.

Peridium depressed globose, 1–1.5 cm. high, 1.5–2 cm. in diameter: outer peridium retreating, leaving but slight traces on the inner peridium which is thin, smooth, whitish and rather shiny: mouth plane, lacerate: collar entire, restricted around the top of the stem: stem slender, 3–5.5 cm. long, 6 mm. in diameter at the top, 3 mm. in diameter at the base which is slightly enlarged, somewhat sulcate, lacerate, whitish within and without, fibrillose stuffed, becoming hollow: capillitium dark ferrugenous, 4–6 μ wide, ends rounded, and having swollen places mostly near the ends, branched, rather thick-walled, many threads flattened, septa very scarce: spores subglobose, 3–5 μ in diameter, smooth, short pediceled. (Pl. 32, f. 1–3.)

NEW MEXICO: Las Cruces, *Wooton.*

5. **Tylostoma minutum** sp. nov.

Peridium globose, 0.7–1 cm. high, 0.7–1.2 cm. in diameter; outer peridium scaly, retreating, leaving smooth, brownish surface to the thin inner peridium, remnants of the outer peridium forming a cup around the base of the inner peridium: mouth plane, fimbriate, small; collar entire, indistinct: stem 1.5–2 cm. long, 3 mm. in diameter at the top, 5 mm. in diameter at the base, slender, slightly enlarged at the base, hollow, fibrillose stuffed: capillitium yellowish, hyaline, sparingly branched, rather thin walled, ends rounded, septa swollen at the joints, 3–5 μ wide: spores irregularly globose, nearly smooth, pediceled, thick-walled, 3–5 μ in diameter. (Pl. 31, f. 11–13.)

COLORADO, *Bethel* (type); KANSAS, *Kellerman.*

6. **Tylostoma Kansense** Peck, sp. nov.

Peridium subglobose, 1–2 cm. broad, 1–1.5 cm. high, thick, firm, glabrous, white, somewhat flattened at the base: mouth slightly lacerate on the margin, plane, sometimes slightly prominent: collar wide, membranaceous, 2.5 mm. distant from the stem: stem equal or slightly narrowed toward the base, 1.5–7 cm. long, 6–8 mm. thick, hollow or stuffed with silky fibrils, somewhat sulcate-striate, white within and without, slightly and abruptly bulbous: capillitium sparingly branched, colored, 7–11 μ wide, hyaline, septa not seen: spores subglobose, 4–5 μ in diameter, brownish ferruginous. (Pl. 32, f. 7–9.)

KANSAS, *Bartholomew.* July. It has rarely two ostiola.

7. **Tylostoma poculatum** sp. nov.

Peridium globose, somewhat depressed, 1–1.5 cm. high, 1–2 cm. in diameter, smooth, fawn-colored, membranaceous: outer peridium scaly, but more persistent than in most species, remaining in the shape of a cup-like involucre round the base of the peridium, mouth slightly raised, fimbriate, mostly large: collar entire, inconspicuous: stem 1–3 cm. long, 3–6 mm. in diameter, cylindrical, firm, slightly bulbose, hollow or stuffed, often with considerable remnants of the outer peridium attached: capillitium lightish yellow, sparingly branched, septate, swollen at joints, 4–7 μ wide, rather thick walled: spores ferruginous, subglobose, smooth, or irregularly ridged in the older specimens, owing to the shrinking of the inner substance, short pediceled, 4–5 μ in diameter. (Pl. 34, f. 4–6.)

NEBRASKA: Lone Pine, *Bates*, 462 (type); ALABAMA: Tuskegee, *Carver;* COLORADO: Boulder, *D. M. Andres.* Plants growing singly or in groups of twos and threes.

8. TYLOSTOMA OBESUM C. & E. Grevillea **6**: 82. *pl. 100. f. 24.* 1878

Peridium globose pyriform, 2.2 cm. high, 2 cm. in diameter, smooth, leathery, whitish, with a kid-like finish: outer peridium scaly, retreating, leaving a narrow ring around the lower part of the peridium: collar entire, descending about the stem: mouth raised, lacerate, rather large: stem 4 cm. long, hard, leathery, somewhat sulcate, slightly tapering at the base, 8 mm. in diameter at the top, 5 mm. in diameter at the base: capillitium dark ferruginous, slender, free ends rounded, branched, septa none or very scarce, 3–6 μ wide: spores globose, smooth, short pediceled, 3–6 μ in diameter. (Pl. 32, f. 4–6.)

COLORADO.

This description and the figure are based on the specimen of this species which Mr. Ellis retained when he sent other specimens to M. C. Cooke for a description. It will be seen that the dimensions and shape here given differ considerably from the one figured in Grevillea. The type is at Kew (2715 Cke.), and through the kindness of Mr. E. S. Salmon, it was possible to compare some of the spores and capillitium which agree in all respects with the original here, but the Kew specimens are apparently not so mature.

9. TYLOSTOMA CAMPESTRE Morg. Jour. Cin. Soc. Nat. Hist. **12**: 163. *pl. 16. f. 4.* 1890

Peridium subglobose, 1–1.5 cm. high, 1–2 cm. in diameter: outer peridium brown, scaly, retreating and leaving an irregular ring around the lower part of the smooth inner peridium: collar irregular, descending about the top of the stem: mouth plane, lacerate, in some specimens being a mere crack or slit: stem rather thick, 3–10 cm. long, 1–1.5 cm. in diameter, darker than the peridium, fibrillose stuffed, becoming hollow, outer brownish coat lacerate, scaly, and having a small thickened mycelial bulb: capillitium yellowish, hyaline, cylindrical, 4–8 μ wide, branched, septate, somewhat swollen at the septa: spores subglobose, warty, some short pedicled, 3–5 μ wide. (Pl. 33, f. 10–12.)

EXSICC: E. & E. N. A. Fungi, 3297 (as *T. granulosum* Sw. ?), 3514.

NEBRASKA: *Webber, Bates;* CALIFORNIA: *Underwood, McClatchie;* COLORADO, *Crandall.* Growing singly and in groups in sandy soil.

10. TYLOSTOMA EXASPERATUM Mont. Ann. Sci. Nat. II. **8**: 362. 1837

Peridium subglobose, 1.2 cm. high, 1.3 cm. in diameter: outer peridium composed of long spinulose scales, somewhat reflexed, which recede from the top downward, leaving the brown inner peridium marked with a series of regular pits: mouth raised, fimbriate lacerate, rather large: collar inconspicuous: stem equal, slightly enlarged at the base, 5–7 mm. in diameter, 3.5 cm. long, covered with reflexed lacerate scales, like those on the outer peridium: dark brown: capillitium whitish-yellow, hyaline, 4–6 μ wide, branched, free ends rounded, sparingly septate, not much swollen at the joints: spores globose, furnished with long blunt spinules, 5–8 μ in diameter. (Pl. 33, f. 1–3.)

CUBA, *Wright.*

11. **Tylostoma tuberculatum** sp. nov.

Peridium depressed globose, 1–1.2 cm. high, 1–1.8 cm. in diameter: outer peridium scaly, retreating, leaving a wide band around the base of the whitish, smooth, and rather thin, inner peridium: mouth raised, fimbriate, roundish: collar close, inconspicuous: stem slender, whitish, hollow or stuffed, slightly enlarged at the base, 2–3 cm. long, 3 mm. in diameter: capillitium light yellow, hyaline, branched, thick-walled, variable as to width, 4–8 μ wide, rather flattened, ends rounded, broad, sparingly septate, swollen at joints: spores subglobose, nearly smooth or with occasional tuber-like warts, thick-walled, 3–5 μ in diameter. (Pl. 33, f. 7–9.)

BRITISH COLUMBIA: *Macoun* (type); COLORADO: Fort Collins, *Baker*, 405.

12. **Tylostoma fibrillosum** sp. nov.

Peridium globose, 1–2 cm. high, 1–2.5 cm. in diameter: outer peridium retreating leaving a smooth whitish surface to the thin, membranaceous inner peridium, and leaving a thick portion round the base of the peridium forming a ring: collar indistinct, close: mouth raised, fimbriate, roundish: stem equal or slightly tapering toward the base, sulcate, firm, white and slimy within and without, somewhat hollow, fibrillose stuffed, and having a small thickened bulb which in some specimens falls off leaving a flat, whitish surface to the base of the stem, 5–7 cm. long, 5 mm. in diameter: capillitium whitish, hyaline, 4–8 μ wide, branched, some threads rather thicked walled, sparingly septate, not much swollen at the joinits, rather flattened: spores subglobose, minutely warted, darker than the capillitium, some short pediceled, 3–5 μ in diameter. (Pl. 33, f. 4–6.)

ONTARIO: *Dearness* (type); MICHIGAN, *Hicks*. Growing on sand dunes.

The stem is much covered usually for upwards of 2 cm. with the mycelial strands, and adhering sand. The specimens from Michigan have rather more swollen septa.

13. **Tylostoma subfuscum** sp. nov.

Peridium globose, 0.8–1.3 cm. high, 1–1.5 cm. in diameter: outer peridium scaly, retreating, leaving a ring around the base of the smooth, brownish inner peridium: mouth raised, fimbriate: collar inconspicuous, close: stem brown, somewhat lacerate scaly, leathery, sulcate, with a small thickened bulb at the base, 2–3 cm. long, 3–5 mm. in diameter; capillitium lightish yellow, hyaline, branched, threads long and slender, 4–6 μ wide, free ends rounded, occasionally septate, somewhat swollen at the joints: spores subglobose, minutely warted, some short pediceled, 3–5 μ in diameter. (Pl. 34, f. 10–12.)

COLORADO, *Bethel*, 21.

14. TYLOSTOMA FIMBRIATUM Fries, Syst. Myc. **3**: 43. 1829

Peridium subglobose, 1–1.5 cm. high, 1–1.5 cm. in diameter: outer peridium retreating, having a smooth, brownish surface to the thin inner peridium: mouth raised, fimbriate, collar irregular, inconspicuous, close: stem white within and fibrillose stuffed, brownish and lacerate scaly outside, with a small mycelial bulb at the base, 1.5–5 cm. long, 5 mm. in diameter: capillitium light-colored, almost white, hyaline, freely septate, swollen at the joints, 4–8 μ wide: spores subglobose, dark ferruginous, verrucose, some short pediceled, 3–6 μ in diameter. (Pl. 34, f. 7–9.)

EXSICC.: Ravenel, Fungi Car. Ex. **5**: 80; Ravenel, Fungi Am. Ex. 724.

NEW YORK, *Peck;* SOUTH CAROLINA, Ravenel; NORTH CAROLINA, *Curtis, Wood;* ALABAMA, *Earle;* TEXAS, *Wright;* WYOMING, *Nelson;* NEW MEXICO, *Wright;* COLORADO, *Cockerell;* KANSAS, *Kellerman.*

15. TYLOSTOMA PUNCTATUM Peck, Bull. Torr. Club, **23**: 419. 1896

Peridium subglobose, 1–1.3 cm. high, 1–1.3 cm. in diameter: outer peridium scaly, retreating, leaving a ring around the base of the peridium: inner peridium thin, whitish, covered with irregular shallow pits: mouth raised, lacerate, irregular, rather large: collar indistinct, close: stem equal, darker than the peridium, lacerate scaly, with a small mycelial bulb, white within, hollow or stuffed, 2–3 cm. long, 3 mm. in diameter: capillitium whitish, hyaline, branched, septate, much swollen at the joints, 4–8 μ wide: spores subglobose, yellowish cinnamon-colored, minutely verrucose, some short pediceled, 3–5 μ in diameter. (Pl. 34, f. 1–3.)

KANSAS, *Bartholomew;* NEBRASKA, *Webber;* WASHINGTON, D. C., *Braendle.* Growing in sandy pasture land.

SPECIES NOT SEEN

16. TYLOSTOMA SEMISULCATUM Peck, Bull. Torr. Club, **22**: 209. 1895

"Peridium subglobose, usually a little longer than broad, 6–8 lines broad, 9 lines long, glabrous above, ferruginous-tomentose on the lower half: osteolum entire: stem equal, about 2 inches long, even and glabrous or but slightly furfuraceous on the upper part, the lower part longitudinally sulcate, whitish: spores ferruginous, globose, .00016 to .0002 in. broad: threads of the capillitium not septate.

"Sandy soil, Nevada. Collected by C. W. Irish, communicated by T. Taylor.

"This species is separated from *T. mammosum* Fr. by its peridium, which is tomentose on the lower half and not depressed, and by its stem which is distinctly furrowed on the lower half."

As this species was not seen the above original description is quoted. The same is the case with the following description of *T. Wrightii*, and the species which Morgan calls "*T. Meyenianum.*" It has been thought best to include these descriptions in order that our present knowledge of the group may be accessible in a single paper.

17. TYLOSTOMA WRIGHTII Berk. Grevillea, **19**: 95. 1891

"Stem 6 cm. high, 4 mm. thick, hollow, equal, ochraceous, even, glabrous; peridium spherico-depressed, 2 cm. broad, minutely umbonate, pale, ochraceous, glabrous, the wall of the umbo disappears at maturity and forms a small circular stoma; mass of spores yellowish brown; threads of capillitium hyaline, thick-walled, aseptate, equal, very long, branched, axis lunate, 5 μ in diameter: spores glabrous, globose, pale yellow brown, minutely warted, 5–6 μ in diameter.

"On the ground. Rio Grande, North * Mexico (Wright). Type in Herb. Berk.

"Distinguished from *Tulostoma Meyenianum* in the entire mouth and the hollow, even and not striated stem."

TYLOSTOMA sp. (Described by Morgan, Jour. Cin. Soc. Nat. Hist. **12**: 163. *pl. 16. f. 5*, as *T. Meyenianum* Kl., but it is clearly distinct from that species, though it might possibly be referred to *T. obesum* C. & E.)

"Peridium depressed, globose; the cortex soon receding, leaving a smooth whitish or yellowish surface to the submembranaceous inner peridium, the apex plane with a lacerate mouth: stipe long, thick, unequal, fusiform or tapering, nearly solid, sulcate: threads of the capillitium long, much thicker than the spores, branched, hyaline: spores subglobose, even, pale brown, 4.5–5.5 mic. in diameter.

"Growing in sandy soil. New Mexico, *Wright;* Colorado, *Webber.* Plant 2–4 inches in height, the peridium ¾–1 inch in diameter, the stipe about ½ of an inch in thickness at the thickest part. Specimens referred to *T. Angolense* W. & C. do not differ otherwise than in having the stipe thickest at the apex and taper-

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* Probably a misprint for *New* as Wright was not known to have collected across the Rio Grande.

ing downward instead of fusiform. *T. obesum* C. & E. appears to be founded on a specimen with the short thick stipe not fully developed."

Morgan's description was made solely from Webber's Colorado specimen which was returned to Mr. Webber who is now unable to find it. The New Mexican reference is merely a quotation from Berkeley who determined Wright's original specimens under this name.

The following tabulation will give more compactly our present knowledge of the distribution of *Tylostoma* in North America:

TYLOSTOMA.	New York.	New Jersey.	Pennsylvania.	N. Carolina.	S. Carolina.	Alabama.	Florida.	Texas.	New Mexico.	Arizona.	California.	Nevada.	Colorado.	Nebraska.	Wyoming.	Michigan.	Iowa.	Wisconsin.	Ohio.	Kansas.	Indiana.	Canada.	Cuba.	Mexico.
albicans.								+																
campestre.											+		+	+										
exasperatum.																							+	
fibrillosum.																+						+		
fimbriatum.	+			+	+	+		+	+				+		+					+				
gracile.									+															
Kansense.																				+				
minutum.													+							+				
obesum.													+											
pedunculatum.	+	+	+	+			+	+	+	+			+	+		+	+	+		+	+			+
poculatum.						+							+	+										
punctatum.														+						+				
semisulcatum.												+												
subfuscum.													+											
tuberculatum.													+									+		
verrucosum.																			+					
Wrightii.									+															

II. CHLAMYDOPUS Speg. An. Mus. Nac. Buenos Aires, 6: 189. *pl.* 4. *f.* 2, 3. 1899

In describing this genus Spegazzini includes two species from Argentina, *C. clavatus*, from which we cannot separate our New Mexican material, and *C. Amblaiensis* with a distinct annulus (?), and up to the present no other species of this genus have been reported. It is evident, however, from the description and figure of *Tylostoma Meyenianum* Kl.* that that species, also, belongs to the genus *Chlamydopus*. While the figure shows no trace of a volva, its tapering stem with its broad attachment to the peridium, together with its general habit would seem to indicate its relationship to

* Nov. Act. Caes. Leop. Carol. Nat. Cur. 19: 243. *pl.* 5. *f.* 4. 1843.

this genus. The volva is of such a friable nature that it would be preserved with difficulty even if the stem had not been detached by the inattentive collector. Quite recently several specimens have been found at Mesilla Park, New Mexico, which belong here. In going over the material referred to *Tylostoma*, in the Ellis collection, two other specimens, from different localities in New Mexico, were found which though destitute of volva, evidently belong to the genus *Chlamydopus* though they may constitute another species. For the present they have been placed with *C. clavatus*.

1. CHLAMYDOPUS CLAVATUS Speg. *loc. cit.*

Peridium depressed globose, 1.5–2 cm. high, 2.2–3.5 cm. in diameter, smooth, leathery, lightish fawn-colored: mouth plane, lacerate, irregular: stem 8–15 cm. long, much enlarged at the top where it joins the peridium, 1.5–3 cm. in diameter at the top, 0.5–1.5 cm. at the base, sulcate, lacerate scaly, firm, solid, of the same color within and without as the peridium: volva friable, cup-like, with flaring sides, 1.5–2.5 cm. high, having remnants of earth and sand adhering to it: capillitium very abundant, interlaced, lightish yellow, hyaline, branched, sparingly septate, not swollen at the joints, the free ends usually rounded, 5–7 μ wide: spores subglobose, dark ferruginous, densely verrucose, 4–6 μ in diameter. (Pl. 35, f. 1–6.)

NEW MEXICO: Mesilla Park, *Cockerell*, Mesa, *Garcia*, Las Cruces, *Wooton*. Sandy soil under mesquite.

Aside from its technical characters this species presents a habit very unlike any species of *Tylostoma* found in this country. Its clean smoothish peridium and stem are quite in contrast with the usual condition found in the species of *Tylostoma*, where the rough outer peridium, and usually the stem also, is frequently covered with fragments of adhering soil. Also in the specimens of this genus, the capillitium threads are not as distinct as those of *Tylostoma* and have considerable white amorphous hyaline tissue intermingled with them.

III. BATTARREA Persoon,* Syn. Meth. Fung. 129. *pl. 3. f. 1–3.* 1801

It has been impossible to trace the history of *Battarrea* to its very beginning as the Acta Anglica, in which Woodward makes

* This genus was named for Antonio Battarra, an early Italian mycologist, and was first erroneously spelled *Batarrea* by Persoon. In 1804 the name was changed by Palisot de Beauvais to *Battarea*, but the correct spelling, *Battarrea*, was not adopted until 1825 by Fries.

first mention and gives the first drawing of this plant, has been inaccessible, but as early as 1785 Dickson * described *Lycoperdon phalloides*—"volvulatum stipilatum, pileo deflexo campanulato; supra pulverulento calyptrato, infra glabro libero"—which unquestionably was the original *Battarrea*. It was collected in September by D. Humphreys and T. Woodward at Norwich, Norfolk and Bungay, Suffolk, England. In 1801, Persoon established the genus, and named and figured one species, *B. phalloides*, which he describes as follows—"volulata stipitata, Pileus deflexus, campanulatus, villosus, pulueris strato obsitus, a volua calyptratus." In 1814 Liboschitz † made the next mention, when he described a plant which he named *Dendromyces Stevenii*, from the river Volga, which Fries in 1839 referred to *Battarrea*. De Toni ‡ gives eight species, and Fischer § mentions seven of these, while quite lately, in 1899, Spegazzini ‖ described two new species from Argentina, making the number of described species ten in all.

The first *Battarrea* reported in this country was *B. phalloides* ** in 1873, said to have been collected by J. Torrey in the vicinity of San Francisco, Cal., but strangely enough, though this is the well-known European species, it has never since been found, to my knowledge, in the United States. Owing to the lack of description of the plant mentioned there is a question as to whether this plant really belongs to the species indicated. The only other species so far known in this country are *B. attenuata* from Nevada, described by Professor C. H. Peck †† in 1895, and *B. Digueti*, described in the following year by M. Patouillard ‡‡ from Lower California. Lastly some material has been sent to Professor L. M. Underwood from New Mexico and Arizona which proves to belong to two undescribed species.

A list of the hitherto known species with their localities is added:

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* Plant. Crypt. Brit. **1**: 24. 1785.

† Beschreibung eines neuendeckten Pilzes. 1814.

‡ Saccardo, Syll. Fung. **7**: 65; **9**: 270; **14**: 260.

§ Engler & Prantl, Die nat. Pflanzenfam. **1**¹**: 344. 1900.

‖ An. Mus. Nac. Buenos Aires **6**: 190, 191. 1899.

** Grevillea **2**: 35. 1873.

†† Bull. Torr. Club, **22**: 208. 1895.

‡‡ Jour. de Bot. **10**: 251. *f.* 2. 1886.

B. PHALLOIDES Pers. England, Italy, North America (?).
B. GAUDICHAUDII Mont. Peru.
B. GUICCIARDINIANA Ces. Italy.
B. TEPPERIANA Ludw. Australia.
B. STEVENII (Libosch.) Fries. Siberia.
B. DIGUETI Pat. & Har. North America.
B. ATTENUATA Peck. North America.
B. MUELLERI Kalchbr. Australia.
B. GUACHIPARUM Speg. Argentina.
B. PATAGONICA Speg. Argentina.

Synopsis of the North American Species

Stem hollow.
- Plants more than 20 cm. high; volva double, the inner layers split into numerous leaves. 1. *B. laciniata.*
- Plants 20 cm. high or less.
  - Spores minutely verrucose; volva simple. 2. *B. Griffithsii.*
  - Spores nearly smooth; volva triple. 3. *B. Digueti.*

Stem solid. 4. *B. attenuata.*

1. **Battarrea laciniata** Underwood, sp. nov.

Peridium 5–6 cm. in diameter, 2–3 cm. high, smooth, membranaceous, the upper portion sometimes having portions of the outer coat of the volva adhering to it: the lower portion after the spores have been shed is a yellowish-white and shows traces of where the capillitium has sprung: stem 25–35 cm. long, woody, hollow, stuffed with silky, thread-like fibers running about half way down the center of the stem, outer coat fibrous, pealing, sometimes merely lacerate, at others shaggy, slightly tapering to the base, about 2.5 cm. at the top and 1.5 cm. at the base: volva complex, composed of a thick outer coating, and an inner set of very numerous thin leaflets arranged more or less in layers about the stem: capillitium whitish, hyaline, indefinite, irregular, somewhat fascicular: cells 30–50 μ long, 5–7 μ wide, with raised annular thickenings or nearly flat spiral markings: spores subglobose, reddish-brown, 5–7 μ in diameter, almost smooth. (Pl. 36, f. 1–6.)

NEW MEXICO: Mesilla Park, *Cockerell.*

This plant resembles *B. Digueti* in some of its characters, but it is distinguishable (1) By its much larger size, (2) By its having no inner woody volva enclosing the lower portion of the stem, (3) In the much larger number of leaflets which compose the inner portion of the volva, and (4) In the different coloring and marking of the cells. The plants vary considerally as to size and roughness of the stem.

2. **Battarrea Griffithsii** Underwood, sp. nov.

Peridium 2–3.5 cm. in diameter, 1–2 cm. high, smooth, membranaceous, lower part flat, showing the line of dehiscence distinctly: stem hollow, equal, 1–1.5 cm. in diameter, 9.5–15 cm. long, sulcate, pealing fibrillose: volva fairly well marked, composed of a few appressed fibrillose blunt squamules: capillitium 4–10 μ wide, whitish, flattened, rather amorphous, branched, and having a large number of cells mixed with it: cells darker than the capillitium, with spiral markings and annular thickenings, 6–8 μ wide, 24–85 μ long: spores subglobose, minutely verrucose, looking smooth except under very high magnification, reddish-cinnamon colored, 4–5 μ in diameter. (Pl. 37, f. 1–6.)

ARIZONA, *David Griffiths*, to whom the species is dedicated.

3. BATTARREA DIGUETI Pat. & Har. Jour. de Bot. **10**: 251. *pl. 2. f. 1–6.* 1896

Peridium depressed globose, membranaceous: stem 15–20 cm. long, 8–10 mm. wide: spores globose, ferruginous, 5–6 μ in diameter: cells 100–150 μ long, 4–7 μ wide, with darker yellow annular markings: volva of three layers, the outer one woody, simple, whitish, the inner woody and simple, and encircling the lower third part of the stem, the third layer between the outer and inner volva is composed of from 10 to 20 thin membranaceous leaflets.

LOWER CALIFORNIA, *Diguet.* In barren rocky soil.

No specimens of this species have been seen, but it has been thought best to quote the above partial translation of M. Patouillard's very full description.

4. BATTARREA ATTENUATA Peck, Bull. Torr. Club, **22**: 208. 1895

"Exoperidium unknown: endoperidium 2 in. or more in breadth, the basal part hard, thick, even and concave beneath, convex above, and somewhat coarsely reticulated by the bounding walls of broad shallow pits: stem 8 to 10 in. long, gradually attenuated toward the base, hard, almost woody, solid, rough except at the top, with rather coarse spreading or reflexed scales, brown externally, rusty brown within: spores globose, ferruginous, .0003 in. broad: threads of the capillitium destitute of spiral thickenings.

"Plant commonly growing in tufts of 3–5 individuals. Dry sandy soil. Nevada. Collected by C. W. Irish; communicated by Dr. Thomas Taylor."

The single specimen of this species known is at Albany and is inaccessible at the present time, so the above original description has been quoted verbatim.

IV. QUELETIA Fries. Öfversigt Kongl. Vetens. Akad. Förhandlingar, Stockholm, 171. *pl. 4.* 1871

This genus was established on a single species, and as yet no others are known. It is very raie, having been reported from very few localities. It was discovered by Dr. L. Quelet, at Herimncourt, France, and has since been reported from the environs of Rouen (Saint-Saens), and Pont de Sochaux, France. It has been found only once in the United States, at Trexlertown, Penn., by Mr. William Herbst, and was reported by Professsor C. H. Peck, in his 46th report of the State Botanist. He is of the opinion that this plant was introduced into this country in some way with tan bark, on which it usually grows.

1. QUELETIA MIRABILIS Fries, *loc. cit.*

Peridium globose, 2.5–3.5 cm. high, 3–4 cm. in diameter, fragile, easily separating from the stem, rupturing irregularly, of a reddish-brown color: collar irregular, of the same substance as the peridium: stem 6.5–8 cm. long, 1.5 cm. wide at the top, 2 cm. at the base, fascicular, reddish-brown, within and without, like the peridium, solid, lacerate, fibrillose, particularly at the base: capillitium very abundant and interwoven, forming with the spores a felt-like mass, reddish-brown, single threads whitish-yellow, thick-walled, hollow as shown by the truncated ends, septa rare or wanting, 5–9 μ wide, branches rather short, free ends rounded and recurved: spores subglobose, coarsely warted, 4–6 μ in diameter, some short-pediceled, inner portion breaking up and issuing from the thin-warted coating which is then hyaline and shrivelled. (Pl. 38, f. 1–5.)

PENNSYLVANIA: Trexlertown, *Herbst.* On spent tan bark. Summer, after rains, forming circles.

V. DICTYOCEPHALOS Underwood, gen. nov.

Plants with the irregularly rupturing peridium closely attached to the solid stem. Volva cup-like, persistent at the base of the stem. Gleba composed of a mesh-like irregular tissue, in which the capillitium threads are embedded.

1. **Dictyocephalos curvatus** Underwood, sp. nov.

Outer peridium of a thick woody texture, bearing a definite cup-like volva at the base of the stem, the upper portion being carried up on the peridium, and either falling off or remaining adherent to it: inner peridium scleroderma-like, rough, dark brown, scaly, rather flattened sideways, rupturing irregularly, 3–6 cm. high, 5–8 cm. in diameter: stem 25–40 cm. long, 3–6 cm. in diameter at the summit, 1.5–4 cm. in diameter at the base, considerably flattened, twisted, solid, dark brown within and without, sulcate, the outer surface very uneven, and peeling: the collar indistinct, formed by the lower portion of the peridium adhering to the top of the stem and becoming torn as the stem elongates: the top of the stem is rounded and projects into the peridium forming a pseudo-columella, of a yellowish-brown color, lighter than the rest of plant, marked with irregular, reticulated pits, from the sides of which the mesh-like tissue springs which forms with the spore mass the main part of the gleba: capillitium 8–10 μ wide, mostly embedded in the mesh-like tissue, bright yellow, cylindric, septate, not much swollen at the joints, branched, the free ends rounded: spores subglobose, warty, 5–7 μ in diameter. (Pl. 39, 40.)

COLORADO: Colorow, *Bethel.*

Plants with a strong odor which in the dry condition much resembles that of the dried bark of *Ulmus fulva.* The spores of these specimens first appeared to be of two kinds—darker warted, larger ones, and smaller, smooth, light colored ones—but it was soon seen that this was owing to the outer coat having been eaten off by the quantities of small insects by which these plants were infested.

These strange plants were found by Mr. E. Bethel at Colorow, Col., in the month of August, 1897. In the notes sent with these specimens to Mr. Ellis, Mr. Bethel says: "These plants are very odd-looking in their native haunts; they grow on a soft alkaline adobe soil. Some of them had lifted themselves entirely out of the ground, while others had the stalk standing in about one inch of soil. They presented a very fantastic appearance, as there was little or no other vegetation about. * * * Some of the specimens were very much bent, approximating a semicircle, others were twisted like a corkscrew, with the portions of the stalk split and bent back. I think the chief factor in lifting the plant out of the ground is this twisting and bending back of the portions of the stem during dessication."

Explanation of Plates

In most cases the drawings have been made twice natural size and reduced one half. The capillitium and spores were drawn with a camera lucida under double the magnification noted.

PLATE 31

FIG. 1. *Tylostoma pedunculatum*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4, 5. *Tylostoma albicans*, nat. size.
FIG. 6. Spores and capillitium, × 170.
FIG. 7. Spores, × 310.
FIG. 8. *Tylostoma verrucosum*, nat. size.
FIG. 9. Spores and capillitium, × 170.
FIG. 10. Spores, × 310.
FIG. 11. *Tylostoma minutum*, nat. size.
FIG. 12. Spores and capillitium, × 170.
FIG. 13. Spores, × 310.

PLATE 32

FIG. 1. *Tylostoma gracile*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. *Tylostoma obesum*, nat. size.
FIG. 5. Spores and capillitium, × 170.
FIG. 6. Spores, × 310.
FIG. 7. *Tylostoma Kansense*, nat. size.
FIG. 8. Spores and capillitium, × 170.
FIG. 9. Spores, × 310.

PLATE 33

FIG. 1. *Tylostoma exasperatum*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. *Tylostoma fibrillosum*, nat. size.
FIG. 5. Spores and capillitium, × 170.
FIG. 6. Spores, × 310.
FIG. 7. *Tylostoma tuberculatum*, nat. size.
FIG. 8. Spores and capillitium, × 170.
FIG. 9. Spores, × 310.
FIG. 10. *Tylostoma campestre*, nat. size.
FIG. 11. Spores and capillitium, × 170.
FIG. 12. Spores, × 310.

PLATE 34

FIG. 1. *Tylostoma punctatum*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. *Tylostoma poculatum*, nat. size.
FIG. 5. Spores and capillitium, × 170.
FIG. 6. Spores, × 310.

FIG. 7. *Tylostoma fimbriatum*, nat. size.
FIG. 8. Spores and capillitium, × 170.
FIG. 9. Spores, × 310.
FIG. 10. *Tylostoma subfuscum*, nat. size.
FIG. 11. Spores and capillitium, × 170.
FIG. 12. Spores, × 310.

PLATE 35

FIG. 1. *Chlamydopus clavatus*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. Single spores, × 450.
FIG. 5. Peridium showing lacerate mouth, and enlarged stem, nat. size.
FIG. 6. Section through peridium and stem.

PLATE 36

FIG. 1. *Battarrea laciniata*, ½ nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. Cells, × 310.
FIG. 5. Cell after desiccation, × 310.
FIG. 6. Peridium, nat. size, showing attachment to the stem.

PLATE 37

FIG. 1. *Battarrea Griffithsii*, nat. size.
FIG. 2. Specimen showing under side of peridium, volva missing, nat. size.
FIG. 3. Peridium showing method of dehiscence, nat. size.
FIG. 4. Spores, capillitium and cells, × 170.
FIG. 5. Spores, × 310.
FIG. 6. Cells, × 310.

PLATE 38

FIG. 1. *Queletia mirabilis*, nat. size.
FIG. 2. Spores and capillitium, × 170.
FIG. 3. Spores, × 310.
FIG. 4. Spores, showing breaking up of inner substance, × 310.
FIG. 5. Section through the peridium, showing detachment of stem, nat. size.

PLATE 39

FIG. 1. *Dictyocephalos curvatus*, ½ nat. size.
FIG. 2. Lower portion of stem, and double volva, ½ nat. size.
FIG. 3. Peridium, ruptured irregularly, with remnants of mesh-like tissue, ½ nat. size.
FIG. 4. Portion of tissue with spores and capillitium embedded in it, × 170.

PLATE 40

FIG. 5. *Dictyocephalos curvatus*, ¾ nat. size.
FIG. 6. Spore, × 465.
FIG. 7. Inner portion of spore issuing from outer coat, × 465.
FIG. 8. Empty, hyaline spore coats, × 465.
FIG. 9. Smooth inner spores after issuing from outer coat, × 465.

Some Points in the Anatomy of Chrysoma pauciflosculosa *

By Francis E. Lloyd

The material upon which these notes are based was collected by the writer on Cat Island, one of the Mississippi Sound series. This region lies in the northern edge of the tropical life zone, and is characterized by the presence of a goodly number of tropical strand plants.† *Chrysoma pauciflosculosa*, may be considered as one of these, indigenous to America, with a northern range extending to South Carolina on the Atlantic Coast. Its habitat according to Chapman ‡ is "sandy banks and shores," and appears to be a halophytic plant, at least in some localities. The plant is a shrub a meter or over in height, having vertical isolateral leaves. These are rigid, with three prominent longitudinal views, and are covered with an aromatic gummy exudate.

Using the floral characters as a basis the plant has been by some authors referred to the genus *Solidago*, from which it was separated first by Nuttall, who has been followed more recently by Greene. The reasons for which this has been done are found in the habit, woody character, and inflorescence of the plant. It is our present purpose to examine more particularly some points in the anatomy of the leaf.

In shape the leaf is narrowly elliptical, tapering into a short petiole. When examined by transmitted light it appears "pellucidly punctate" an appearance which is due to the peculiar arrangement of the internal tissues and not to accumulations of a secretion in cavities, as for example, in the Hypericaceae. Further observation by reflected light shows that each of the polygonal,

* Shortly before her death Dr. Emily L. Gregory, with whom two of her students, Miss Alice M. Isaacs and Miss Marion Satterlee, worked in collaboration, examined this plant. The results of their observations were presented in a paper read before the Torrey Botanical Club on January 14, 1896. Had Dr. Gregory's death not occurred, the paper would undoubtedly have been published. The writer has very kindly been given access to these results by Miss Isaacs, whom he wishes here to thank. The present paper is largely a verification of the observations presented in 1896.

† For a fuller account of this region see Lloyd, F. E., and Tracy, S. M., The Insular Flora of Mississippi and Louisiana Bull. Torr. Club, 28: 61–101. 1901.

‡ Flora of Southern States.

pellucid areas is surrounded by a sulcus. In drying they shrink inwardly, giving rise to the term "pitted" as applied to the leaf surface, which however would better be described as a mosaic. Both sides of the leaf have the same appearance, the reason for which will be better understood by an examination of the internal structure.

The sulci just referred to are caused by the dipping down of the epidermis on both sides of the leaf to a depth equal approxi-

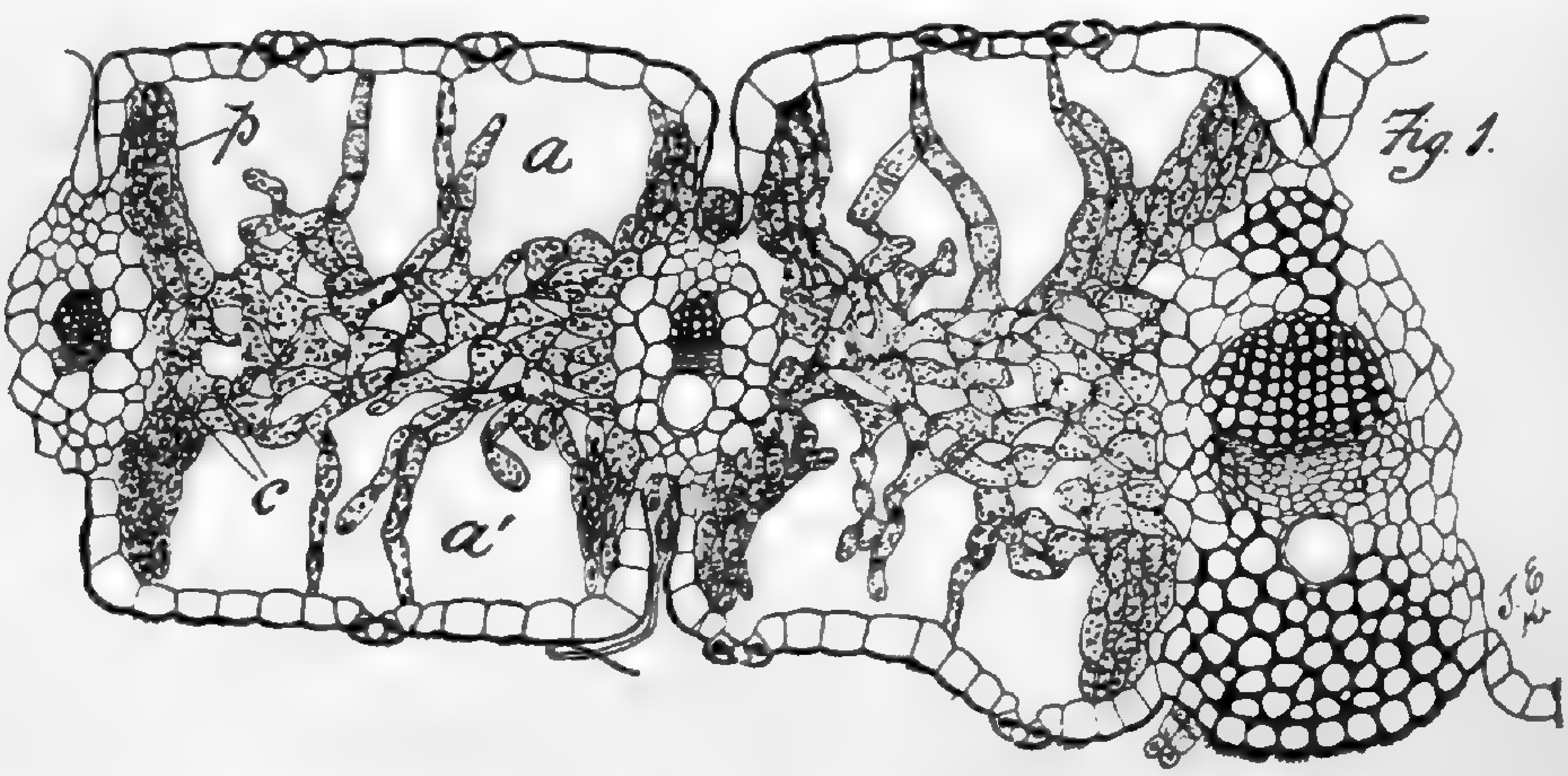

FIG. 1. Transverse section of leaf, through the midrib and two pairs of air chambers.

mately to one third of the thickness of the leaf. (Fig. 1.) The epidermal cells which line the sulcus are of gradually decreasing depth, the deeper they are placed. Between the sulci the epidermis stretehes almost without support. The arrangement of the mesophyll is such that there is thus formed a disposition of

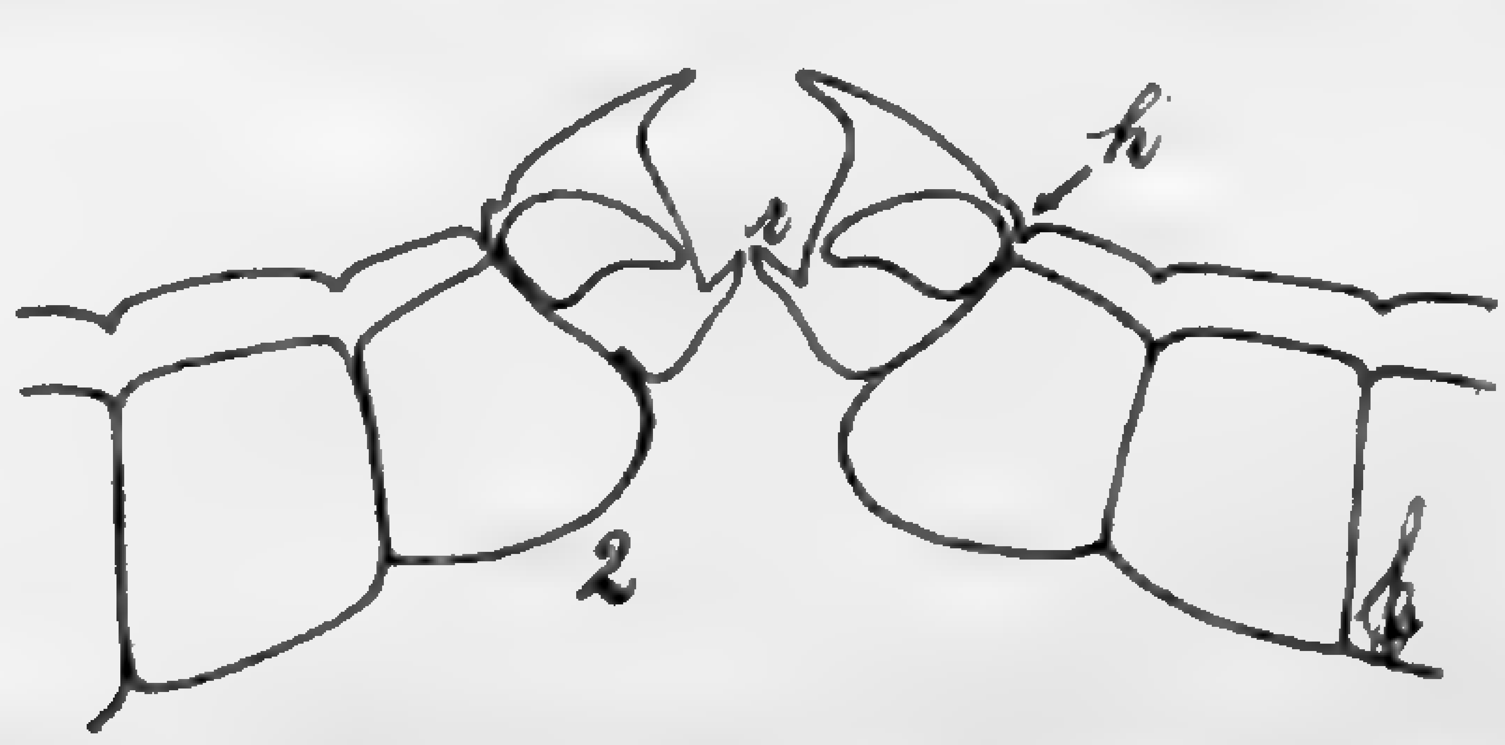

FIG. 2. Transverse section through a stoma.

tissues which suggests at once the well-known air chambers of the liverwort, *Marchantia*. In the roof of epidermal cells, which are cuticularized both within and without, are found the stomata, one of which is shown in detail in Fig. 2, in which are delineated the hinge line (*h*) and an inner guard ridge (*r*) making a sensitive and effective stoma. The effectiveness is heightened by the accessory cells lying adjacent, the presence of which in the Compositae is, so far as known, of rather rare occurrence, according to Benecke.* These cells are not, however, as well differentiated as in *Carlina* (Benecke, *l. c.*), but nevertheless serve to raise the stoma somewhat above the level of the epidermis, and, by the conformation of their walls, to aid in closing the aperture.

The stomata are to be found only in the "pellucid" areas, from the margins of which they are absent. In each area there are, on an average, about 22. They are found also upon the rounded edges of the leaf. The average size of the areas is 0.19 sq. mm. The stomata are therefore relatively numerous in the areas in which they occur.

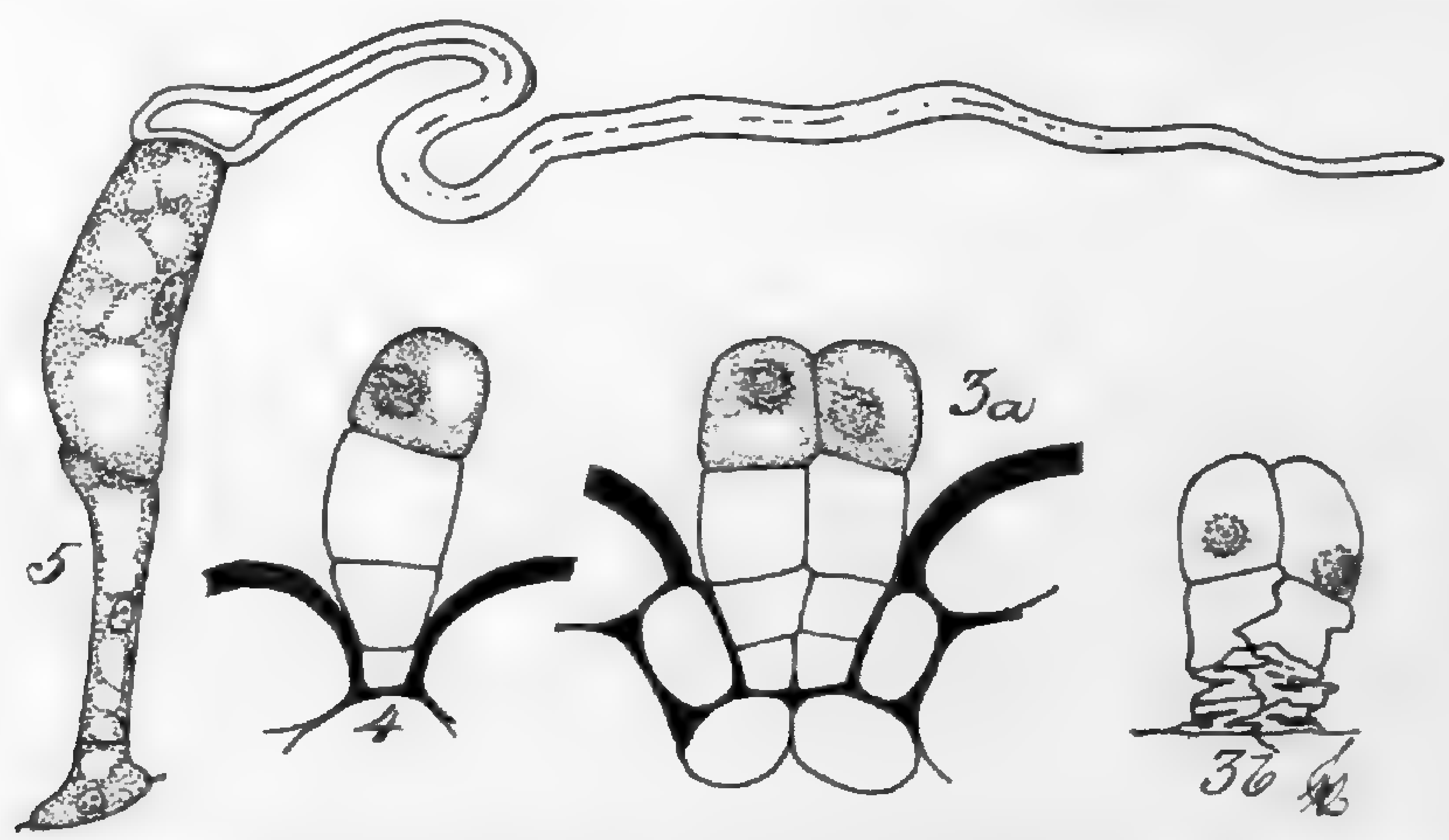

FIG. 3*a*, Double glandular hair; 3*b*, older condition, with collapsed cells; 4, single glandular hair; 5, whip hair.

The exposed surface of the leaf is entirely smooth and free from organs such as hairs. The cuticle is sculptured into irregular ridges, chiefly over the veins, and inconstantly over the rest of the surface. Two kinds of hairs grow in abundance at the bottoms of the sulci. Of these, one sort is glandular, the other, the so-called whip cells.†

The former are composed of two series of four cells each, the basal cells being the smallest (Fig. 3*a*). Their walls are thin and have a delicate cuticularized external layer. In the terminal cell one always finds a rounded mass of calcium oxalate crystals. In the mature leaf the three lower cells appear empty and are collapsed

* Bot. Zeit. 1892.

† Vesque, J., Caractères des * * * gamopetales * * *. Ann. Sci. Nat. Bot. VII., 1: 183. 1885.

while the terminal cell maintains its shape and contents. (Fig. 3*b*.) In type this form of hair agrees with that described by Vesque (*l. c.*) which he found at the base of the heads of *Chrysanthemum coronarium*. The contour differs however. Occasionally one finds such a hair composed of but one row of cells (Fig. 4). In all cases so far observed the two series of cells, when two are present, arise from two neighboring cells of the leaf, a fact which leads to the view that we have before us a case of concrescence. This must however be verified by a study of their development.

The whip hairs (Fig. 5), on the other hand, are quite different in form and function. They are composed of one series of four cells. The basal cell is lenticular, with or without a projecting portion. The second is a slender stalk-like cell ; the third a thicker and somewhat longer cell, supporting at its outer end a long lash cell, four to five times as long as the rest of the hair. At the base of the lash cell is a bulbous enlargement upon which the lash is set obliquely, as occurs in similar hairs in *Carduus lanceolatus* (Vesque, *l. c.*). The lumen of the lash cell is almost obliterated except toward and at the base, and the thickened wall is composed of cellulose, with a very thin layer of cuticle which extends over the whole hair and is continuous with the cuticle of the leaf. The protoplasmic contents are plainly seen in all the cells of the hair except the lash cell, from which they appear to be absent in maturity. The whip cells, the lash of which is somewhat curled, usually protrude out of the sulcus and their slender ends lie upon the exposed leaf surface. They occur in greatest numbers at the juncture of the sulci.

When one asks concerning the function of these hairs the answer is more difficult for the whip cells than for the gland cells. From the latter is exuded the gummy secretion which renders the leaf more effectually protected against the loss of moisture. The activity of secretion is resident chiefly, or probably entirely, in the terminal cell, as is indicated by the accumulation of calcium oxalate. The whip cells occur, in cases so far as known, only as part of a tomentose or arachnoid covering (Vesque, *l. c.*). We may regard them here as useless morphological members, or we may ascribe to them some function, such as leading by capillarity the gummy secretion out upon the leaf surface exposed to the air. That this takes place there is no doubt, though that this is more than an incidental phenomenon may be doubted.

The mesophyll offers some points of very great interest. No palisade tissue may be said to exist in the ordinary acceptance of the term. Dorsiventral differentiation is quite absent. We do find, however, a distinct division into two forms of chlorenchyma. Speaking with reference to a single chamber we may describe these two forms as follows. (1) There is a tightly packed mass of cylindrical cells with their longitudinal axes approximately perpendicular to the leaf surface, and with small intercellular spaces. (*p*, Fig. 1.) This mass lies against the side walls of the chamber, and abuts upon the margin of the roof; here, in the roof, are no stomata. Deep in the leaf, near the middle, the form of the cells changes to that of irregular "collecting" cells (*c*, Fig. 1) which lie against each other, and large parenchymatous elements which receive the products of photosynthesis. (2) A very loose spongy chlorenchyma with large intercellular spaces extends across the floor of the chamber, and separates the two air spaces (*a*, *a′*, Fig. 1) on opposite sides of the leaf. From this loose chlorenchyma extending to either face of the leaf are columns composed of a single series of cells—filaments in effect—which abut upon the epidermal cells and are attached to them. Altogether the chlorenchyma presents a most curious and unique arrangement, in which the palisade may be regarded as really present but, for some secondary reason pushed, so to speak, to the sides of the air chambers. What ecological explanation may be offered? We would suggest that we are dealing here with a very delicate mechanism for controlling the loss of water. It has been remarked that the epidermis is cuticularized on both sides, while the chlorenchyma is free from cuticle. On the assumption that a reduction in turgidity would affect first the chlorenchyma, the rigidity of the columns would thereby be lessened and the epidermal roof would sink in. Such a movement would effect the simultaneous closure of the outer entrances of all the stomata without causing any change in the relative position of the inner guard ridge, within which, the stomata being lifted up somewhat would be the center of oscillation of the guard cells. A very slight movement would suffice for a relatively great change in the total cross section of the outer entrances of the stomata. The writer has sought to determine if a sinking in of the roof actually occurs.

By applying glycerine to thick sections of alcoholic material he has in the majority of cases been able to produce the movement. The results, however, are not convincing, and more exact studies should be carried out upon living material. If this explanation holds good, the position of the palisade cells may be accounted for as contributive to the formation of the diaphragm.

An alternative explanation may be found in the light relations. Vertically placed leaves or their physiological equivalents are commonly supplied with palisade tissue on both faces (isolateral), but hitherto no such peculiar grouping of the chlorenchyma in an isolateral leaf has come to light. Such grouping therefore appears to be secondary and to be accounted for in some other way. The best we can do, therefore, is to admit our ignorance and await experimental evidence.

No further matters in the anatomy of this plant need receive mention at this time beyond the remark that the shrubby character of the plant and its peculiar leaf anatomy clearly separate it from the genus *Solidago*, in which, so far as at present known, no approach to our plant in either regard is to be found, even in halophytic species.

In summarizing we point out the following matters of general interest:

1. The leaf of *Chrysoma pauciflosculosa* is bifacial, isolateral, and of unique structure.

2. Two kinds of hairs are present, which agree with the morphological types found in the Compositae, as defined by Vesque.

3. The stomata correspond closely in structure to those of the majority of halophytes, as described by Warming in his Halofyt Studier, but possess a more specialized inner entrance. They are provided with accessory cells (Nebenzellen), which are not, however, very regularly placed.

4. The arrangement of the mesophyll possibly stands in mechanical relation with the stomata.

5. The perennial shrubby character of the plant and its peculiar leaf anatomy separate it definitely from the genus *Solidago*.

I have to thank Mr. J. E. Kirkwood for the sketch forming Fig. 1.

BONN, March, 1901.

Dasystoma flava and some related Species

By John K. Small

Specimens of *Dasystoma* that have recently accumulated in the herbaria at the New York Botanical Garden indicate a segregation of species in the *Dasystoma flava* group as follows: *

Key to the Species

Upper leaves and bracts with pinnatifid blades. 1. *D. grandiflora.*
Upper leaves and bracts with entire or merely toothed blades.
  Pedicel shorter than the calyx.
    Upper leaves and bracts with toothed blades. 2. *D. serrata.*
    Upper leaves and bracts with entire blades.
      Racemes continuous: flowers approximate: calyx densely pubescent.
        Capsules about 1 cm. long, scarcely beaked. 3. *D. brachycarpa.*
        Capsules about 1.5 cm. long, long-beaked. 4. *D. flava.*
      Racemes much interrupted: flowers remote: calyx glabrate or merely puberulent. 5. *D. dispersa.*
  Pedicel longer than the calyx. 6. *D. patula.*

1. Dasystoma grandiflora (Benth.) Wood

Gerardia grandiflora Benth. Comp. Bot. Mag. **1**: 206. 1835.
Dasystoma grandiflora Wood. Bot. & Flor. 231. 1873.

In open woods, Wisconsin and Minnesota to Tennessee and Texas.

2. **Dasystoma serrata** (Torr.)

Gerardia serrata Torr.; Benth. in DC. Prodr. **10**: 521. 1846.

Perennial, grayish puberulent or finely pubescent. Stems 4–12 dm. tall, often widely branched: leaf-blades pinnatifid on the lower part of the stem and their segments entire, merely serrate and much smaller above: calyx-tube 5–6 mm. broad during anthesis; lobes linear-lanceolate to lanceolate, entire: corollas 2.5–4 cm. long: capsules ovoid or globose-ovoid, 1–1.5 cm. long, short-beaked.

In dry soil, Missouri to Louisiana and Texas.

Louisiana: *Hale*, no. 249.

Missouri: McDonald County, *Bush*, no. 272; Swan, *Bush*, no. 677.

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* Species hitherto undescribed and newly combined binomials are indicated by heavy face type.

3. **Dasystoma brachycarpa**

Perennial, puberulent or finely pubescent. Stems 6–15 dm. tall, usually simple below the inflorescence: leaf-blades leathery, oblong-ovate, oblong-lanceolate or lanceolate, 5–12 cm. long, incised or repand on the lower part of the stem, entire or merely undulate and shorter above: racemes continuous: flowers very short pedicelled: calyx-tube campanulate at maturity; lobes as long as the tube or longer: corollas 2.5–3 cm. long, with widely dilated tubes: capsules globose-ovoid, about 1 cm. long, scarcely beaked.

In dry sandy soil, Stone Mountain, Georgia.

The specimens on which this species are based were collected by the writer on the slopes of Stone Mountain, Georgia, September 6–12, 1894, and are in the herbaria both of Columbia University and the New York Botanical Garden.

4. DASYSTOMA FLAVA (L.) Wood

Perennial, grayish pubescent or sometimes merely puberulent. Stems 3–12 dm. tall, simple, or branched above: leaf-blades lanceolate to oblong, 4–14 cm. long, repand, coarsely toothed or rarely pinnatifid on the lower part of the stem, entire or merely undulate above: racemes continuous, at least during anthesis: calyx-tube turbinate at maturity; lobes as long as the tube or much longer: corollas 3–4 cm. long: capsules ovoid-conic, about 1.5 cm. long, long-beaked.

In open woods and thickets, Ontario and Wisconsin to Massachusetts, Florida and Mississippi.

5. **Dasystoma dispersa**

Perennial, inconspicuously puberulent, blackish in drying. Stems 4–10 dm. tall, simple, or widely but rather sparingly branched: leaf-blades spatulate, oblong, elliptic or oblong-oblanceolate, entire, 2–6 cm. long, or longer and repand near the base of the stem, slender-petioled: racemes conspicuously interrupted, the pairs of flowers quite regularly separated by internodes 2–4 cm. long: calyx-tube 7–8 mm. broad during anthesis, glabrate or merely puberulent; lobes about as long as the tube or usually shorter: corollas 3–3.5 cm.

In pine woods and on hillsides, Alabama, Mississippi and Louisiana.

ALABAMA: no locality, *Gates*.

MISSISSIPPI: Biloxi, *Tracy*, no. 5108.

LOUISIANA: Feliciana, *Carpenter;* type in the herbarium of Columbia University.

6. DASYSTOMA PATULA Chapm.

Dasystoma patula Chapm. Bot. Gaz. **3**: 10. 1878.

On river banks, Tennessee and Georgia.

A local, and very characteristic species thus far found only in the two states cited above.

On a Collection of Plants made in Georgia in the Summer of 1900

By Roland M. Harper

(With Plate 29)

Having made plans to spend the past summer in studying the flora of Georgia, I left New York on the 14th of June, 1900, and arriving in Georgia the next day. While passing through North Carolina on the morning of the 15th, I noted an extension of range of an introduced plant, which might be mentioned here. At Aberdeen, Moore county, I found *Acanthospermum australe* (L.) Kuntze growing beside the track. This station is considerably farther north than the one mentioned in a previous paper,* and is probably the northernmost yet reported. In the same county, among other things of interest, I saw *Sarracenia flava* L. for the first time. It was quite abundant in moist pine-barrens from Lemon Springs to Aberdeen, a distance of about 22 miles.

My first stop in Georgia was at Athens, where I had collected many interesting plants in previous years. Here I spent about three weeks, collecting plants numbered 1 to 161, all in Clarke county. During June my operations were considerably interfered with by unusually frequent rains, and on this account I did not have a chance to visit some of my favorite localities in adjacent counties.

On July 8th I went to Atlanta, where I was joined by Mr. Percy Wilson, of the New York Botanical Garden, who accompanied me during the next four weeks.

During a week spent in Atlanta we made trips to several points of botanical interest in the vicinity. On the afternoon of the 9th we collected along the bank of the Chattahoochee River in Cobb county, and on 10th we spent the day at Stone Mountain, in DeKalb county, which has been made famous by the researches of Porter, Ravenel, Canby, Gray, Small and several other botanists. Fig. 1 is a view of the mountain from the northeast, about a mile distant, showing the precipitous north side.

* Bull. Torr. Club, **27** : 341. 1900.

On the 12th we went to Kennesaw Mountain, in Cobb county, 20 miles northwest of Atlanta, whose summit is the highest point in Georgia south of the 34th parallel (1809 feet). This mountain is well known historically, having been the scene of an important battle on June 27, 1864, but has apparently never been mentioned in botanical literature. Kennesaw is mostly covered with woods, and its flora seems to be richer in species than that of Stone Mountain, which is mostly bare rock. Many species are common to the two mountains, but those on Kennesaw are in general plants of less restricted range.

On the afternoon of the 14th Mr. Wilson made a short trip to De Kalb county, while I went to the northern part of Clayton county, about 10 miles southwest of Atlanta, where I discovered new stations for two or three rare species. While in the vicinity of Atlanta Mr. Wilson collected plants numbered 1 to 61, and I increased my numbers to 241.

We left Atlanta on the morning of July 17th, and went *via* the Southern Railway to Dalton, the county seat of Whitfield county, about 100 miles to the northward. Up to this time we had been collecting in the Archaean or granite region, but on the way to Dalton we passed into the newer terrane of the Palaeozoic.

Between Atlanta and Dalton I made notes on several interesting plants seen from the train, the most important of them being *Pinus palustris*, which has long been known to reach its inland limit in this region, though I know of no botanist who had visited this portion of its range before; and I selected the longer route to Dalton because I knew it would give us an opportunity to observe this species. It was first seen by us in the western part of Paulding county, in the Archaean region, at an altitude of about 1100 feet, and for the next 15 miles along the railroad, in Polk and Floyd counties, some specimens of this pine were nearly always in sight. In Polk county we crossed the boundary of the Palaeozoic region and began to descend rapidly, and in Floyd county, where we left *Pinus palustris* behind, our altitude was only about 600 feet.

We made Dalton our headquarters during a few weeks' exploration of Whitfield and Walker counties, which lie along the northern boundary of the state, adjacent to Tennessee, and are both wholly in the Palaeozoic region. The principal points of interest visited during the remainder of July were the Chattoogata Mountains, a few miles west of Dalton, and Gordon Springs, in the extreme western part of Whitfield county, at the base of Taylor's Ridge. At this delightful rural retreat we spent three days, from the 25th to the 28th, crossing the ridge into Walker county, two or three times. The summits of these higher ridges in Whitfield county, are composed of sandstone rocks, of the Red Mountain (or Rockwood) formation, which represents the upper portion of the Silurian in Georgia. The lower ridges are mostly of the Knox Dolomite and Chickamauga formations (Lower Silurian).

During these trips in the latter part of July I collected my numbers 242–324, and Mr. Wilson his numbers 62–160.

Having decided to explore the still higher mountains of the Lookout plateau to the west of us, we set out on July 31 and walked across Chattoogata, Taylor's, and several smaller ridges, to Lafayette, the county seat of Walker county, about 25 miles west of Dalton. With Lafayette as a base, on the first three days of August we made trips to different portions of Pigeon Mountain, a few miles to the westward, and also collected several plants in the immediate vicinity of Lafayette, which is in a valley of Oostanaula (or Connasauga) shale, a part of the Cambrian formation.

Pigeon Mountain is a spur of Lookout Mountain, and, like Lookout, is a synclinal plateau, capped by coal measures (Carboniferous). The rock of the coal measures here is a sandstone, scarcely distinguishable from the Red Mountain sandstone. Below the coal measures the Mountain (or Bangor) Limestone is exposed over a large area on the lower slopes of the mountain. This is a compact bluish limestone, and many interesting plants are found on it. Below the carboniferous rocks is a stratum of Devonian rocks about 25 feet thick, known as the Chattanooga Black Shale. This outcrops all along the base of the mountain, but is rarely visible, on account of the ease with which it disintegrates where exposed.

The highest point of Pigeon Mountain is 2329 feet above sea level, and about 1400 feet above the adjacent valleys. On the first of August we ascended to this high point, and made the acquaintance of some of the rare plants of this mountain region.

On the following morning we collected in and near Lafayette, and in the afternoon went to the railroad tunnel at the north end of Pigeon Mountain and found a number of interesting plants on the Chattanooga Black Shale and Mountain Limestone in that vicinity.

On the morning of the third we visited Bluebird Gap, on the mountain, about midway between the points visited on the two preceding days. The same afternoon we returned to Dalton by rail, by way of Chattanooga, Tenn.

We would gladly have remained longer in this interesting region, but as we could not bring our driers over the mountains with us, our stay was limited. During our Lafayette trip Mr. Wilson collected numbers 161–210, and I numbers 324–365.

On August 5 Mr. Wilson left me, to return to New York, while I remained in Dalton ten days longer, collecting plants numbered 366 to 401 in the vicinity.

From Dalton I journeyed about 250 miles southward, and the afternoon of the 16th found me at Leslie, a small town of about 200 inhabitants, in the pine barrens of Sumter county, where I spent five weeks at the home of the mayor, an old friend of mine. From Leslie I made three trips to Americus, 12 miles northwest, on August 20, 27–29, and September 15, and two to the Flint River, 9 miles east, on September 3 and 10. The rest of the time I collected within two or three miles of Leslie. Fig. 2 is a typical scene in the pine barrens near Leslie, in which I did most of my collecting in that region.

The geological formations in Sumter county are Lower and Middle Eocene (Tertiary), with several subdivisions, overlaid by two recent formations, the Lafayette and the Columbia. The Lafayette (named for its type-locality, Lafayette county, Mississippi), which is a mixture of sand and clay in varying proportions, averaging many feet in thickness, covers nearly the whole county. In the vicinity of the Flint River this has been removed by erosion and replaced by the Columbia (named for the District of Columbia), a newer and much thinner deposit of almost pure sand. In the southeastern part of the county the Columbia formation extends back from the river about three miles, and seems to overlap the Lafayette slightly, as I have been led to infer from the character of the existing vegetation there. The very important relations between these two superficial formations and the present flora seem to have been almost entirely overlooked by botanists. The Lafayette is briefly mentioned by Dr. Mohr in his "Timber Pines of the Southern States," and by Dr. Gattinger in his "Tennessee Flora" (in the latter under its former name of Orange Sand), but I find no mention of the Columbia in any botanical work published previous to my trip.

While in Sumter county (together with a trip to Dooly county on September 3, when I crossed the Flint River), I collected plants numbered 402 to 657.

A friend in Douglas, the county seat of Coffee county, having invited me to spend a few days with him, I now availed myself of an opportunity to visit a part of the State botanically and geologically unexplored, and on September 19th left Leslie and started for Douglas, by way of Cordele, Tifton and Waycross.

Between Cordele and Tifton a change in the topography and flora of the country I was passing through became apparent. I passed from a comparatively level region, with the water mostly in ponds and swamps occupying shallow basin-like depressions, to a slightly rolling region, with valleys occupied by sluggish streams. Here I saw *Sarracenia flava* in Georgia for the first time, and in considerable abundance. *Pinus heterophylla* began to appear, replacing *P. palustris*, and *Taxodium distichum imbricarium* became common in all the little valleys, instead of only occupying isolated depressions, as in Sumter county. I also saw many plants new to me, which the rapid motion of the train would not permit me to identify.

This change in the topography and flora is probably caused by a double change in the geological formations. Between Cordele and Tifton the Middle Eocene strata are replaced by Upper Eocene, and somewhere near the same place the overlying Lafayette becomes in turn overlaid by the Columbia. The Lafayette is covered in this way throughout most of southeast Georgia. The underlying formations no doubt influence the topography, and thereby indirectly the flora, while the superficial formations have a direct influence on the character of the flora.

At Tifton, which is in the northwestern corner of Berrien county

I had to wait from 3:30 to 5:15 p. m. for another train, and during the short time at my disposal I went out into the pine-barrens to examine the flora, which I found quite different from any to which I had been accustomed. Here I collected twelve species, numbered 658 to 669, two of which are described below as new.

It became dark soon after I left Tifton, so that I did not have much further opportunity to observe the flora that day. I noticed however that *Serenoa serrulata* began to appear a few miles east of Tifton, and the pines seemed to be all *P. heterophylla*. I am not sure that I saw *P. palustris* any more during the remainder of my trip.

In Waycross the next morning I took a short walk into the outskirts of the city before boarding the train for Douglas, and found myself in an almost perfectly level region, in which the underlying formation is probably Miocene. What I saw of the flora there did not differ much from that at Tifton, the superficial formations being no doubt the same. I collected only one species in Waycross, no. 670.

From Waycross to Douglas, a distance of 42 miles, the country is very sparsely settled, and the pine forests are almost unbroken. To my surprise I noticed that nearly every tree bears the marks of the turpentine industry, but otherwise the country is practically in a state of nature. For a distance of 35 miles out from Waycross the topography continues level, and then changes rather abruptly to a rolling country similar to that around Tifton.

This part of Georgia is a most excellent region for studying the distribution of plants, for the destructive influences of civilization have scarcely begun to make themselves felt here, and most of the species are fairly common throughout their respective areas, so that their ranges can be determined with some degree of accuracy. In the case of the more conspicuous plants one can observe many of them to good advantage while traveling by rail, as I found from experience.

Coffee county seems never to have been visited by a botanist before, and I made some interesting discoveries during my short stay there. The topography and flora around Douglas are so similar to those in the vicinity of Tifton that the geological formations are probably very nearly the same, namely, Upper Eocene, overlaid by Lafayette and Columbia. My numbers 671–724 were collected in Coffee county, between September 21 and 26.

On the morning of the 28th I went from Douglas to Savannah. The afternoon of the same day I made a trip to Thunderbolt, a few miles south of Savannah, and collected nos. 725–731 in the salt marshes there; and on the 29th I spent most of the day on Tybee Island, in the same county (Chatham), at the mouth of the Savannah River. This is the easternmost point of Georgia.

Although Tybee is a famous summer resort, and the only island on the Georgia coast reached by railroad, it seems to have been almost entirely overlooked by botanists. The flora of Tybee is such as might be expected anywhere along the Georgia or Carolina coast, and although most of the plants I collected there were new to me, few are of especial interest. The surface of the whole island is covered with the sands of the Columbia formation, and the most conspicuous geological feature is the line of sand dunes along the shore, the largest ones being about twenty feet in height. On these I did most of my collecting, and also photographed a number of characteristic plants which I did not collect, such as *Sabal Palmetto*, *Uniola paniculata*, *Yucca gloriosa*, etc. One Tybee Island I collected plants numbered 732 to 754, and this ended my collecting for the summer.

During 106 days spent in Georgia I collected plants in twelve counties, and made notes on the flora of fifteen others which I passed through. Besides my regular collection of spermatophytes and pteridophytes I collected a few sets of bryophytes and thallophytes, amounting to 86 numbers, which were numbered separately from the rest. I crossed every geological formation recognized in the state (about twenty-five in number), though I did not collect plants on all of them. The observations I made on the relations between geological formations and existing flora promise to yield some interesting results when properly correlated.

The figures on Plate 29 are from photographs made with a hand camera of 4-inch focus, and are reproduced nearly natural size.

It would be impracticable to give here a complete enumeration of the plants collected by Mr. Wilson and myself in Georgia last summer, but in the following notes I will mention some of the new or noteworthy ones. For the sake of brevity I omit the bibliographical citations of most of the species. Descriptions of those whose places of publication are not cited may be found in Chapman's Flora, third edition, or in Britton and Brown's Illustrated Flora.

ASPLENIUM ANGUSTIFOLIUM Mx.

Collected by Mr. Wilson on moist shaded cliffs of Chattanooga Black Shale near the north end of Pigeon Mountain, at an altitude of 1000 ft., August 3 (no. 210). We did not find this fern on any other formation. This station is near its southern limit.

ASPLENIUM BRADLEYI D. C. Eaton

Collected by Mr. Wilson near the summit of Stone Mountain, at 1650 ft. altitude, July 10 (no. 17), and by myself on sandstone cliffs on the east slope of Rocky Face Mountain (a part of the Chattoogata range), in Whitfield county, at 1400 ft., July 21 (no. 279).

CAMPTOSORUS RHIZOPHYLLUS (L.) Link

On August 2 I found this fern for the first time, growing on the upper portions of the Chattanooga Black Shale near Pigeon Mountain Tunnel, at 1000 ft. (no. 358).

EQUISETUM HIEMALE L.

What appears to be this species was collected by Mr. Wilson in wet clay soil just north of Lafayette, Walker county, at an altitude of 925 ft., on August 2 (nos. 192, 195). I find no record of its having been collected in the Southern States east of the Mississippi before.

LYCOPODIUM PINNATUM (Chapm.) Lloyd & Underw. Bull. Torr. Club, **27**: 155. *pl. 3, 4.* 1900

I collected this species in moist pine barrens in Sumter county on September 8 (no. 613), and in a similar locality in Coffee county on the 25 (no. 705). At the former station it was accompanied by *L. alopecuroides*.

SELAGINELLA RUPESTRIS (L.) Spring

Found in abundance on exposed granite rocks on the southwest slope of Kennesaw Mountain, at an altitude of 1220 ft. (no.

215). This is probably the southernmost known station for this species east of the Mississippi, the Florida plants being now referred to another species.

ISOETES ENGELMANNI GEORGIANA Engelm. Trans. St. Louis Acad. Sci. **4**: 384. 1882

On July 26th I discovered a second station for this little-known plant, in cool wet woods at the eastern base of Taylor's Ridge, Whitfield county, at 1100 ft. altitude (no. 310). It grew in wet clayey soil, which is probably never inundated, and was accompanied by *Panicum barbulatum, Isnardia palustris, Lycopus* sp., *Gratiola Virginiana* (no. 311), and a few other plants. Only about 25 specimens were observed, but more could probably have been found by a longer search. This station is about 36 miles north of the original one and 500 ft. higher. I am indebted to Professor Underwood for the determination of this plant.

PINUS PUNGENS Mx. f.

This tree is quite common on the Chattoogata Mountains, Taylor's Ridge, and other outcrops of Red Mountain strata, descending to about 1000 ft. Collected on the Chattoogata Mountains, July 19th (no. 263).

PINUS GLABRA Walt.

I made the acquaintance of this little-known pine on September 3d, while collecting along the Flint River (no. 560). It grows along both banks of the river, in Sumter and Dooly counties, at an altitude of about 200 ft. On the 20th of the same month I saw a few specimens in Coffee county, near Seventeen Mile Creek. It is called "white pine" by some of the natives in that vicinity, who probably consider it identical with *P. Strobus* of the north.

SAGITTARIA MOHRII J. G. Smith; Mohr, Bull. Torr. Club, **24**: 19. *pl. 290.* 1897

Collected in a very wet, slightly sloping bog among the pine barrens of Coffee county, September 25 (no. 718). Previously reported only from the original station, Mobile, Ala., which is 300 miles away.

CHRYSOPOGON SECUNDUS (Ell.) Benth.

Andropogon secundus Ell. Bot. S. C. & Ga. **1**: 580. 1818.
Sorghum secundum Chapm. Fl. S. States, 583. 1860.

Collected in dry pine barrens west of Douglas in Coffee county, Sept. 25 (no. 719). Also seen three days later in Appling, Ware, Pierce, Wayne, Liberty and Chatham counties. This species has not been reported from southeast Georgia before.

Dried specimens give little idea of the elegant appearance of this grass. The stems grow several in a tuft, and are not erect as usually described, but ascending, and slightly curved at the summit; and the graceful one-sided panicles are very handsome with their yellow anthers and long purple awns. It is known as "wild oats" by the natives of southeast Georgia. This species is not mentioned by Scribner and Merrill in their recent paper on Elliott's grasses (Circ. U. S. Dept. Agric., Div. Agrost. 29: F. 1901).

I have just found a good colored figure of it, showing the panicle and upper part of the stem, in Georgia Insects * (*pl. 13*), where it is called *Andropogon nutans*. Mr. Abbot's figure, which is over 20 years older than Elliott's description, is probably the only one ever published of this species, and it illustrates very well some of the characters I have just mentioned.

PANICUM PUBIFOLIUM Nash, Bull. Torr. Club, **26**: 577. 1899

Collected by myself in dry rocky woods in Athens, June 20 and 25 (nos. 15, 40), and by Mr. Wilson in Cobb county, July 12 (no. 27). My specimens were determined by Mr. Nash. This species seems quite distinct from any other *Panicum* I have seen in middle Georgia.

PANICUM GYMNOCARPON Ell.

Grows in considerable abundance on the muddy banks of Muckalee Creek in Americus, where I collected it on August 28 (no. 522). Although the type-locality of this species is in Georgia,

* The Natural History of the rarer Lepidopterous Insects of Georgia. Including * * * the Plants on which they feed. Collected from the observations of Mr. John Abbot, * * * by James Edward Smith, M.D., F.R.S. London, 1797. Folio. 104 plates.

I have seen no other specimens from the state besides my own, the others all being from farther west. It does not seem to be generally known that the stems of this species are often, if not usually, decumbent at the base and root from the lower nodes.

CENCHRUS MACROCEPHALUS (Doell) Scribn. Bull. U. S. Dept. Agric., Div. Agrost. 17: 110. *f. 406.* 1899

I found this species very abundant on the summits of the drifting sand dunes of Tybee Island (no. 744).

CENCHRUS INCERTUS M. A. Curtis

Collected in dry sandy soil on the banks of Gum Creek (near the Flint River) in Dooly county, September 3 (no. 570). All the specimens of this species which I have seen seem to be from the Columbia formation.

ARISTIDA SPICIFORMIS Ell.

Collected in flat pine barrens near Douglas in Coffee county, September 22 (no 686), where it was accompanied by *Polygala nana*, *Kalmia hirsuta* (no. 687), *Afzelia cassioides* (no. 688), and *Gratiola hispida* (no. 689). Also seen in Ware county, September 28. In the living state this grass bears a striking resemblance to *Hordeum jubatum*, on account of its long straight crowded awns.

ARISTIDA PALUSTRIS (Chapm.) Vasey, Contr. U. S. Nat. Herb. **3**: 45. 1892

Collected in a pine-barren pond in Sumter county, September 12 (no. 644), and in wet pine barrens near Douglas, September 22 (no. 690). Previously known only from Florida and near the Gulf coast.

SPOROBOLUS FLORIDANUS Chapm.

Collected in moist pine barrens, Sumter county, August 31 (no. 547) and September 8 (no. 611). Not definitely known outside of Florida before. The leaves of this species are unusually stiff and strong, being of about the same texture as those of *Sabal glabra* or *Serenoa serrulata*. When putting the plants into press I noticed that the leaves did not break like those of other grasses when doubled, and after my return I made some tests of their strength.

A leaf from the first collection (no. 547), 5.5 mm. wide, not twisted, and perfectly dry, sustained a weight of 27 pounds without breaking.

SPOROBOLUS COMPRESSUS (Torr.) Kunth.

Collected in moist pine barrens, Sumter county, with *S. Floridanus*, August 31 (no. 549). Previously reported only from Long Island and New Jersey, so that my discovery extends the known range of this species southwestward about 700 miles. Identified by Prof. Scribner, of the U. S. Dept. of Agriculture. *Rhexia aristosa*, another New Jersey plant, was found a short distance away a few days earlier (see below).

EUSTACHYS FLORIDANA Chapm.

In dry sand near Gum Creek, Dooly county, September 3 (no. 571), with *Cenchrus incertus* and *Paronychia riparia*. The northernmost station previously reported for this species is Bainbridge, which is about 100 miles farther down the Flint River. Like *Cenchrus incertus*, it seems to be confined to the Columbia formation.

CYPERUS SQUARROSUS L.

Abundant in sandy soil along the streets and railroad in Douglas. Collected September 22 (no. 674). This I believe is the first time it has been reported in this country north of Florida.

CYPERUS REFRACTUS Engelm.

Grows in dry rocky woods in Athens, with *C. retrofractus*, which it much resembles. Collected June 20 (no. 17). Not previously reported from Georgia.

KYLLINGA BREVIFOLIA Rottb.

K. monocephala Torr.

Collected in most soil on Tybee Island, September 29 (no. 753). I find no record of any station farther north than this.

KYLLINGA ODORATA Vahl

In muddy places in the northern part of Americus, August 27 (no. 503). Altitude about 350 ft. Not previously reported north of Florida.

Fuirena breviseta Coville

F. squarrosa var. *breviseta* Coville, Bull. Torr. Club, **17**: 6. *pl. 98. f. 6.* 1890

Collected in moist sandy soil, Leslie, August 17 (no. 403). Mr. Coville, who determined my specimens, now regards this without hesitation as a distinct species, and asks me to so publish it for him. In most of my specimens the upper leaves are deflexed, and this seems to be due to the turgidity of a portion of the base of the blade. This turgid portion is rather conspicuous on account of its whitish color.

SCIRPUS ATROVIRENS Muhl.

Collected in a marshy place south of Kennesaw Mountain in Cobb county, at an altitude of 995 ft., July 12 (no. 207). (Not previously known from middle Georgia.) Also in a wet meadow just west of Taylor's Ridge in Walker county, at 950 ft., July 31 (no. 325). The latter station is on the Chickamauga formation.

SCIRPUS POLYPHYLLUS Vahl

Found with *S. atrovirens* in both the above-mentioned localities (nos. 209, 326), also in wet woods, DeKalb county, at 950 ft. altitude, July 10 (no. 196). The station last mentioned seems to be the southernmost known for this species. It was also observed at two or three points in Whitfield county, mostly on Chickamauga strata.

SCIRPUS GEORGIANUS Harper, Bull. Torr. Club, **27**: 331. *pl. 22.* 1900

On June 18th I revisited the type-locality of this species, in Clarke county, and after some search succeeded in finding a good specimen (no. 6). On July 4th I found it in some abundance about three miles farther down the Middle Oconee River (no. 156), and on the 12th I was agreeably surprised by discovering another station for it, 62 miles west of the original, in Cobb county at 995 ft. altitude (no. 212). The specimens from this locality are in every way similar to those from the type-locality. At the Cobb county station both *S. atrovirens* and *S. polyphyllus* were collected also within a few yards, thus affording an exceptional opportunity for comparing the three species. With the better material of *S. Georgianus* now at hand I can add somewhat to the original description. The stem is usually a meter tall, and bears as many as eight or ten leaves. The character of the sheaths of the leaves seems to be variable and of little value. Its affinities seem to be rather more with *S. atrovirens* than with *S. polyphyllus*.

SCIRPUS SYLVATICUS L.

A few large specimens of this species were collected in a small brook at the northern base of Stone Mountain, at about 950 ft. altitude, July 10 (no. 205), accompanied by *Polygonum setaceum* Baldw. (no. 206). This is its southern limit, as far as known. The locality is so near the perpendicular face of the mountain that it is probably shaded most of the time, and its temperature must be considerably lower than the average of the surrounding country. (See Fig. 1.)

ELEOCHARIS BALDWINII (Torr.) Chapm.

This rare species was collected in flat pine barrens in Waycross, at an altitude of 140 ft., September 20th (no. 670), and in Douglas, September 22 (no. 685).

STENOPHYLLUS FLORIDANUS Britton; Nash, Bull. Torr. Club, **22**: 161. 1895

I collected this species in a sandy cornfield in the southeastern part of Sumter county, about two miles from the Flint River, September 10 (no. 622), and in similar situations in Douglas, September 22 (no. 691). It has been known hitherto only from the original station, Eustis, Fla., where Mr. Nash discovered it in 1894. It is a common weed in Douglas, and has long been known to the inhabitants there by the name of "water-grass." On asking the origin of this curious name I was told that it is derived from the fact that the plant is especially abundant after a wet summer.

STENOPHYLLUS CILIATIFOLIUS (Ell.) Mohr, Bull. Torr. Club, **24**: 22. 1897

What is probably this species was collected in dry pine barrens, Dooly county, September 3 (no. 575), and on dry sand hills near Seventeen Mile Creek in Coffee county, September 24 (no. 696). Both localities are on the Columbia formation, where I have never seen *S. capillaris.* I have been unable to distinguish satisfactorily between *S. ciliatifolius* and *S. coarctatus* (*Scirpus coarctatus* Ell.), but to whichever my plants belong, they are certainly distinct from *S. capillaris.*

RHYNCHOSPORA ALBA MACRA Clarke; Britton. Trans. N. Y. Acad. Sci. **11**: 88. 1892

Collected in a wet sloping bog in Coffee county, September 25 (no. 716), with *Sagittaria Mohrii.* Not previously known from Georgia.

Rhynchospora solitaria sp. nov.

Probably annual. Stems solitary, 5–6 dm. tall, very slender, flattened: basal leaves few, about half the length of the stem and 3 mm. wide, flat or nearly so, weak; upper stem-leaves 2 or sometimes 1: when 2 (as in most of my specimens) the uppermost is short, setaceous, inserted 4–6 cm. below the inflorescence, the other about 20 cm. below the inflorescence, 4–6 cm. long, and as wide as the basal leaves (when only one stem-leaf is present it is intermediate in character and position between the two just described); spikelets lanceolate in outline, 1-flowered, 5–6 mm. long, aggregated in a single dense terminal compound capitate corymb 12–15 mm. broad, with filiform bracts slightly exceeding the inflorescence: achene oblong, compressed, faintly pitted, 1.5 mm. long, capped with a triangular tubercle about a third its length: style exceeding the spikelet, 2-cleft less than half its length, its branches recurved: bristles about 6, very fragile, equalling the achene, very minutely hispid upward.

A species apparently without close affinity to any other of which I have any knowledge. Readily distinguished by its solitary slender culms, flat basal leaves, short upper leaves, terminal inflorescence, and narrow spikelets. Resembles most in general appearance *R. pallida* M. A. Curtis, but that is a stouter cespitose plant with the very different achene and bristles.

Collected in moist pine barrens, Tifton, Berrien county, on Sept. 19 (no. 668), altitude about 340 ft. An inconspicuous plant, growing scattered among the grass, with *Burmannia capitata* and *Sarracenia psittacina.*

The specific name used has a double significance, applying to both the solitary culms and the solitary inflorescence.

ARISAEMA QUINATUM (Nutt.) Schott

A. polymorphum (Buckl.) Chapm.

In rich shady woods (Knox Dolomite formation) in Whitfield county, at 750 ft. altitude, July 18 (no. 253).

HETERANTHERA RENIFORMIS R. & P.

Collected in a wet meadow in Lafayette, at 925 ft., August 2 (no. 345), and in a similar locality along Bear Creek, Whitfield county, at 725 ft., August 7 (no. 376), the latter specimens in flower.

JUNCUS SETACEUS Rostk.

Found in June in two or three localities in Clarke county (nos. 2, 28), and on July 21 on dripping sandstone (Red Mountain) cliffs on the east slope of Rocky Face Mountain in Whitfield county at an altitude of 1400 ft. (no. 280). The latter station is rather remarkable, as the usual habitat of this species is said to be near the coast.

JUNCUS GEORGIANUS Coville; Small, Bull. Torr. Club, **22**: 44. 1895

On July 10 I collected this species near its type locality, at the northwestern base of Stone Mountain, at about 1100 ft. altitude (nos. 170, 171), and four days later I discovered a second station in Clayton county, 21 miles away, where it grows on flat granite rocks with *Diamorpha pusilla* as at the original station, at an altitude of 950 ft.

JUNCUS DIFFUSSISIMUS Buckley

Collected in muddy places along a road in the western part of Whitfield county, at 975 ft. altitude, July 27 (no. 313). This station is within a few rods of the divide between the Tennessee and Alabama Rivers. This is a western species, and has not been previously reported from Georgia. I am indebted to Mr. Coville for determining my specimens, which are a little smaller than the average.

TRILLIUM UNDERWOODII Small, Bull. Torr. Club, **24**: 172. 1897

Collected by Mr. Wilson in rich shady woods, Whitfield county at 750 ft. altitude, July 18 (no. 69).

BURMANNIA BIFLORA L.

In moist pine barrens, Sumter county, with *Lycopodium alopecuroides* and *L. pinnatum*, September 8 (no. 615). Not previously reported so far inland.

BURMANNIA CAPITATA (Walt.) Mart.

Collected in moist pine barrens, Tifton, September 19 (no. 669), and seen in similar situations in Coffee county, September 21st. Tifton is probably considerably higher than any other known station for this species (340 ft.). The only specimens I have seen besides my own are from Florida and southern Mississippi.

PONTHIEVA GLANDULOSA (Sims) R. Br.

A few specimens of this rare orchid, without flowers, were collected in rich damp woods in the southeastern part of Sumter county, August 25th (no. 489). Not previously reported from Georgia.

HEXALECTRIS APHYLLUS (Nutt.) Raf.

Collected by myself on the southwest slope of Kennesaw Mountain, at 1400 ft., July 12 (no. 225), and by Mr. Wilson at the base of Mt. Rachel (Chickamauga formation) in Whitfield county, at 800 ft. altitude, July 23 (no. 109).

BATIS MARITIMA L.

A few specimens observed on the south shore of Tybee Island, September 29. This seems to be the northernmost known station for this species on the Atlantic coast. Dr. Feay reported it * from Ossabaw Island, which is in Bryan county.

ARISTOLOCHIA CONVOLVULACEA Small, Bull. Torr. Club, **24**: 335. 1897

A single sterile specimen of this species was collected in rich damp woods at the eastern base of Taylor's Ridge in Whitfield county, at 1100 ft. altitude, July 26 (no. 309). This seems to be the first specimen collected since the original ones of Dr. Boykin's.

* Oglethorpe Medical and Surgical Journal (Savannah), **3**: 173. 1860. The title of this journal is incorrectly given as "Atlanta Medical Journal" in Dr. Britton's List of Local Floras, and was so copied by me in Bull. Torr. Club, **27**: 323. 1900.

ARISTOLOCHIA NASHII Kearney, Bull. Torr. Club, **21**: 485. 1894

Collected in rich woods along Chokee Creek, Sumter county, August 25 (no. 499). The range of this little-known species is thus extended northward about 30 miles, Dr. Small having collected it near Albany. This and the last-mentioned species were identified for me by Dr. Small.

ASARUM SHUTTLEWORTHII Britten & Baker, Jour. Bot. **36**: 98. 1898

Collected by Mr. Wilson in rich damp woods, DeKalb county, at 950 ft. altitude, July 10 (no. 22).

HEPATICA ACUTA (Pursh) Britton

The known range of this species was extended into Georgia by Mr. Wilson, who collected it in a ravine near Gordon Springs, in Whitfield county, at 975 ft. altitude, July 26 (no. 119), and on the eastern slope of Pigeon Mountain, August 1 (no 166).

DELPHINIUM AJACIS L. Sp. Pl. 531. 1753

This species is quite common as an escape in pastures and along roadsides in Athens, although it has not yet been recognized in any of the floras covering this region.

HYDRANGEA CINEREA Small, Bull. Torr. Club, **25**: 148. 1898

Collected in rich woods on the south side of Bear Creek, Whitfield county, July 18 (no. 243). With the typical form were collected some specimens with leaves glabrous beneath, which are apparently indistinguishable from *H. arborescens.*

PHILADELPHUS HIRSUTUS Nutt.

Collected among sandstone rocks along the summit of the Chattoogata Mountains, at 1350–1450 ft. altitude, July 19 and 21 (nos. 267 and 274). Not previously reported from Georgia.

AMORPHA VIRGATA Small, Bull. Torr. Club, **21**: 17. *pl. 171.* 1894

I collected this species at its type-locality on Stone Mountain, July 10 (no. 179), and in a similar locality on Kennesaw Mountain, at 1450 ft. altitude, two days later (no. 226).

GLOTTIDIUM FLORIDANUM (Willd.) DC.

In a previous paper * I mentioned the remarkable woodiness of the stem of this annual plant. On August 28, while in Americus, I collected some specimens of it (no. 525), including some of the largest stems which I could find. A portion of one of these was recently tested in the engineering laboratories of Columbia University, and found to have a tensile strength of 4,135 pounds per square inch. I afterward determined the specific gravity of the wood, exclusive of pith, to be .358. So this is, perhaps, the strongest and heaviest annual wood known. The specimens I collected were in full bloom, and the wood of older plants would probably be still stronger. A radial section of the stem shows numerous medullary rays, and the microscopic structure of the wood is doubtless interesting. It may be of interest to note that this species was much more abundant in Americus last summer than it was in 1897, and it now forms dense thickets along Muckalee Creek many square rods in extent.

I find that this species was first described, with an excellent colored plate, by N. J. Jacquin, under the name of *Robinia vesicaria* (Ic. Plant. Rar. **1** : 15. *pl. 148.* 1781–6; Collectanea, **1** : 105. 1786). The specific name *Floridanum* originated with Willdenow (Sp. Pl. **3** : 1252) in 1803. The name of the species should then be **Glottidium vesicarium.** A variety (*atro-rubrum* Nash) has been described,† but to rename it would be beyond the scope of this paper. Several other synonyms for the species may be found in Watson's Bibliographical Index.

DOLICHOLUS SIMPLICIFOLIUS (Walt.) Vail, Bull. Torr. Club, **26**: 114. 1899

Specimens of this species were collected in Leslie, September 5 (no. 584). Intermingled with the normal simple-leaved form were many specimens with the upper leaves trifoliolate, these being apparently identical with *D. intermedius* (T. & G.) Vail, as described by Miss Vail (*l. c.*, 115). From the manner in which the two forms occur together and vary into each other they can only be regarded as mere forms of the same species. But I

* Bull. Torr. Club, **27** : 429. 1900.

† Bull. Torr. Club, **23** : 101. 1896.

notice that the original description * of the latter calls for "leaves all trifoliolate."

PHASEOLUS SINUATUS Nutt.

Collected in sandy soil near Leslie, August 31 and September 5 (nos. 555 and 592). Not previously reported north of Florida.

XANTHOXYLUM AMERICANUM Mill.

Two or three sterile specimens of this species were collected on the northern slope of Kennesaw Mountain, at 1750 ft. altitude, July 12 (no. 229). It has not to my knowledge been reported from the Southern States before, but I find in the Columbia University Herbarium a specimen similar to mine, collected on Stone Mountain by Dr. Small.

POLYGALA CURTISSII Gray

Collected by myself on a flat granite rock in Athens, June 25 (no. 54), with *Stenophyllus capillaris, Talinum teretifolium, Arenaria brevifolia, Crotonopsis linearis, Ilysanthes refracta*, etc., also by Mr. Wilson on Stone Mountain, July 10 (no. 10), in Whitfield county, July 26 (no. 135), and on the summit of Pigeon Mountain, at 2329 ft. altitude, August 1 (no. 177).

It seems therefore that I was mistaken in supposing † that the genus *Polygala* was not represented in middle Georgia; for besides the species just mentioned, I collected *P. verticillata* in DeKalb county (no. 189), and Mr. Wilson *P. polygama* in Cobb county (no. 5).

CROTON MONANTHOGYNUS Michx.

This is a common weed in the Palaeozoic region, but was not observed by us in other parts of the state. I collected it along the road over Bluebird Gap on Pigeon Mountain, at about 1300 ft., August 3 (no. 362), and in the streets of Dalton, August 9 (no. 387).

CROTON ELLIOTTII Chapm.

Grows in dry pine barrens and dry sandy soil near Leslie. Collected September 5 (no. 593). This species seems to be quite rare. The only specimen I have seen besides my own (and the

* T. & G. Fl. N. A. 1: 285. 1838.

† Bull. Torr. Club, 27: 330. 1900.

only one cited by Mr. A. M. Ferguson in his recent revision of the genus *) is in the herbarium of Columbia University, and was collected at Quincy, Fla., by Dr. Chapman.

STILLINGIA AQUATICA Chapm.

Having noticed the extreme lightness of the wood of this species, I made a determination of its specific gravity. The specimen experimented with was a part of my no. 460, collected in a pine-barren pond near Leslie, Sumter county, August 23. A stem about 2 cm. in diameter, showing five or six annual rings, was dried with the bark on in an ordinary room for about six months. A piece of it was then shaped into a rectangular prism, placed in a drying oven at a temperature of 90° C. for about four hours, and then carefully weighed and measured. Its specific gravity was found to be .2101. Of all known woods, apparently only that of *Leitneria Floridana*, with a specific gravity of .207 (see Trelease in Rep. Mo. Bot. Gard. **6**: 65–90. *pl. 30–44.* 1895) surpasses it in lightness, and that by a very small margin. More careful tests might perhaps even show *Stillingia* to be the lighter of the two.

Stillingia aquatica presents many other interesting peculiarities besides the lightness of its wood. Unlike *Leitneria*, it has a considerable development of heart-wood, and no pith. It is rather short-lived, the specimens at my locality seeming to die at the age of seven or eight years. It has a remarkably small root-system, resembling very much that of an annual plant, and is very easily pulled up from the mud in which it grows.

BERCHEMIA SCANDENS (Hill.) Trel.

Collected on dry partly shaded limestone rocks, at about 1050 ft. altitude, on the eastern slope of Pigeon Mountain, August 3 (no. 360). The finding of this species in such a place was rather unexpected, as its usual habitat is in alluvial swamps of the coastal plain. All my specimens were sterile. *Bumelia lycioides*, a plant of similar distribution, was found by Mr. Wilson a little higher up the mountain, in similar situations (no. 206).

* Rep. Mo. Bot. Gard. **12**: 57. 16 F. 1901.

HYPERICUM DOLABRIFORME Vent.

The known range of this species was extended southward into Georgia by my discovery of it on flat exposed limestone rocks at the eastern base of Pigeon Mountain, August 3 (no. 359), about 50 feet lower than the *Berchemia* just mentioned. Previously known only from Kentucky and Tennessee.

The prevailing tree in the vicinity of my locality was *Juniperus Virginiana*, which I never saw in such abundance elsewhere in the state; so this may be an extension of the "cedar-glades" of Tennessee, in which Dr. Gattinger finds several other interesting species of *Hypericum*. Mr. T. H. Kearney, Jr., who has collected *H. dolabriforme* in Tennessee, informs me that he has always found it in these cedar-glades.

Viola denticulosa Pollard, sp. nov.*

Acaulescent, 1–2 dm. in height at the flowering season, becoming 3–4 dm. tall in late summer, producing filiform stolons often fully this length: leaves ligulate-lanceolate, the blades equalling or surpassing the petiole, strongly decurrent, acute at apex, the margin from evenly and finely denticulate to subentire, the upper surface sparsely hirsute with slender bristly hairs: scapes mostly shorter than the foliage: flowers white, nearly or quite 2 cm. in diameter, the keel petal alone veined with dark purple or black: sepals lanceolate, scarious-margined, distinctly auriculate at base, about half the length of the petals: capsules angled or prismatic: cleistogamous flowers borne on erect scapes.

The plant is a southern ally of *V. lanceolata*, bearing somewhat the same relation to that species as *V. primulaefolia australis* does to *V. primulaefolia*. The unusual stature of the plant, its peculiar pubescence, denticulate leaves, which are most noticeable in the older specimens, and the comparatively large sepals and petals are the most distinctive diagnostic characters.

For the above description I am indebted to Mr. Charles Louis Pollard, of the U. S. National Herbarium. The specimens on which the description is based are deposited in the National Herbarium.

This species grows in wet woods among the pine barrens in and near Douglas, Coffee county, where I collected the autumnal stoloniferous and fruiting specimens on September 26 (no. 724).

* Published by permission of the Secretary of the Smithsonian Institution.

As it seemed to differ considerably from any known species, I wrote in April to my friend, Prof. J. W. Hendricks, of the Southern Normal Institute at Douglas, directing him to one of my localities and asking him to collect some flowering specimens for me. He very kindly did so the same month, securing abundant material with flowers and young fruit. He informs me that the best specimens grew in shallow water or very near it. At the time I collected my specimens the ground, although not covered with water, was very moist.

The plant is very abundant in its particular localities, and all of the numerous individuals which I saw seemed to maintain their characters perfectly. To Mr. Pollard's description I can add a character which is not apparent in herbarium specimens, viz: in the living plant (at least in September) the leaves are usually recurved until their tips touch the ground, somewhat after the manner of *Camptosorus*, as might be expected from their great length and thin texture. Some of the leaves of my largest specimens were fully 5 dm. long when fresh.

Some of the specimens collected by Professor Hendricks showed the long dead petioles of last year's leaves, from which the outer tissue had partly fallen off, exposing a strong whitish central vascular bundle. This peculiarity I have never noticed in any other species of the genus.

OPUNTIA VULGARIS Mill.

On July 12 we found this species on the summit of Kennesaw Mountain, at 1809 ft., which is probably the highest station known for it. Stone Mountain, which has hitherto held the record, is 123 ft. lower. It grows also on the Chattoogata Mountains, which are about 75 miles farther inland, but not quite so high.

RHEXIA ARISTOSA Britton

I collected this little-known species in wet pine barrens in Sumter county on August 23 (no. 466), thus extending its known range southwestward about 250 miles, the only previously known station in the Southern States being Sumter, S. C. My specimens are probably the largest of this species ever collected, showing that it reaches its greatest development in Georgia. It grows about 6 dm. tall, and branches copiously; and with its shining dark-green leaves and numerous large pink-purple flowers it may be considered the handsomest species of the genus.

SANICULA GREGARIA Bicknell, Bull. Torr. Club, **22**: 354. *pl. 242.* 1895

In rich woods on the south side of Bear Creek, Whitfield county, July 18 (no. 256). Not previously reported from Georgia.

SANICULA SMALLII Bicknell, Bull. Torr. Club, **24**: 578. 1897

Collected in rich woods on the south side of Bobbin Mill Creek, Clarke county, July 4 (no. 143).

ERYNGIUM INTEGRIFOLIUM LUDOVICIANUM (Morong) C. & R. Contr. U. S. Nat. Herb. **7**: 48. 31 D. 1900

Collected in moist places among the pine barrens, Sumter county, August 17 (nos. 415, 422), and in a similar locality in Coffee county, September 25 (no. 709). Also observed on September 19 at Tifton, which is within 20 miles of the two stations cited by Coulter and Rose. Six stations in Georgia for this plant are now known (the other one being mentioned in the third edition of Chapman's Flora).

CICUTA CURTISSII C. & R. Contr. U. S. Nat. Herb. **7**: 97. 31 D. 1900

Collected in the edge of a swamp near the Oconee River in the northern part of Athens, July 2 (no. 121). Also seen in Clayton, Paulding and Walker counties.

STEIRONEMA TONSUM (Wood) Bicknell

Collected in dry soil south of Kennesaw Mountain, at 1000 ft. altitude, July 12 (no. 208). This is probably the southernmost known station for it.

STEIRONEMA TONSUM SIMPLEX Kearney, Bull. Torr. Club, **24**: 571. 1897

Two or three specimens were collected on the summit of

Rocky Face Mountain, Whitfield county, at an altitude of 1600 ft., July 21 (no. 284). Known hitherto only from the original collection (Kearney's no. 831) from Wolf Creek, Tennessee. My specimens have been compared with type-material in the herbarium of the New York Botanical Garden, and also examined by Mr. Kearney himself.

LYSIMACHIA FRASERI Duby

This rare species was collected by Mr. Wilson near the summit of Pigeon Mountain, at about 2050 ft. altitude, on August 1 (no. 185).

LIMONIUM NASHII Small, Bull. Torr. Club, **24**: 491. 1897

Collected on the south shore of Tybee Island, September 29 (no. 748). Hitherto reported only from Florida.

SABBATIA BOYKINII Gray

This handsome and little-known species was collected by Mr. Wilson at several points in the northwestern part of the state, at altitudes ranging from 1000 ft. near Gordon Springs to 1950 ft. on Pigeon Mountain. (Nos. 134, 142, 172.) We also saw it at about 800 ft. in Dalton, and at various altitudes in the Chattoogata Mountains. Messrs. Pollard and Maxon found it about the same time in the adjacent portions of Alabama. It seems to have been collected only a few times before.

VERBENA ANGUSTIFOLIA Michx.

This is another common weed in northwest Georgia which seems to be absent from other parts of the state. It is represented in our collections by Mr. Wilson's no. 161, from the west side of Taylor's Ridge in Walker county, July 31, and by my no. 385, from Dalton, August 9.

CLINOPODIUM NEPETA (L.) Kuntze

The foregoing remarks will apply to this species also. Collected in Dalton, August 9 (no. 384).

Dicerandra odoratissima sp. nov.

Annual. Base of stem enlarged, and, like the larger roots, covered with sinuous longitudinal ridges : stem 2–4 dm. tall, fastigiately branched from the base : leaves opposite, linear, 2–3 cm. long, with a few smaller ones fascicled in their axils : flowers odorous, very short-pedicelled, in 3–5-flowered sessile axillary cymes, becoming crowded toward the summits of the branches, the uppermost opening first : calyx ascending or erect, about 8 mm. long, 13-nerved, somewhat bilabiate, the upper lip rounded and entire or nearly so, the lower of two slender incurved teeth, exceeding the upper ; limb of the calyx white, the remainder green : corolla about twice the length of the calyx, white, sprinkled with numerous minute purple spots ; tube straight, included in the calyx ; upper lip arched, the lower spreading or deflexed, and 3-lobed : stamens 4, the anterior pair longest, but not exceeding the corolla ; anthers purple, 2-celled, with short purple horns : style bifid, slightly exceeding the corolla.

A beautifully distinct species, differing from its two congeners (*D. linearifolia* (Ell.) Benth. and *D. densiflora* Benth.) more than they do from each other, so much so that the generic characters will have to be somewhat modified. Among the characters by which it differs from both are the nearly sessile flowers, white-limbed calyx, white corolla, and included stamens. The odor of the flowers of *D. odoratissima* is peculiar, suggesting that of the insect *Cimex lectularius*, but not unpleasant. I do not remember noticing any such odor connected with *D. linearifolia* when I collected that species a few years ago.

D. odoratissima differs further from *D. linearifolia* in its dense inflorescence and purple anther-horns (yellow in *D. linearifolia*, and perhaps in *D. densiflora* also), and from *D. densiflora* in its linear leaves. Some specimens of *D. densiflora* which I have examined have an enlarged stem-base approaching in size that of *D. odoratissima*, but I have not observed this character in *D. linearifolia*.

Dicerandra odoratissima grows in abundance in dry sunny places on sand-hills (Columbia formation) along the Satilla River and its tributaries in southeastern Georgia, and was observed in full bloom Sept. 20–28, in Coffee, Ware and Pierce counties. My specimens were collected near Seventeen Mile Creek, in Coffee county, on the morning of Sept. 24th (no. 695). At the time I suspected it to be an undescribed species, and photographed a patch of it. This photograph is reproduced in Fig. 3.

At the type locality *D. odoratissima* is accompanied by such plants as *Stenophyllus ciliatifolius* (no. 696), *Smilax pumila*, *Eriogonum tomentosum*, *Siphonychia Americana* (no. 700), *Chrysobalanus oblongifolius* (no. 698), *Euphorbia cordifolia*, *Trichostema lineare*, *Solidago odora* (no. 699), and *Actinospermum angustifolium* (no. 697). The altitude of the type-locality is unknown, but the altitude of the locality in Pierce county where I last saw the plant is about 100 feet. This species grows in large patches, and its characteristic odor was very noticeable from a moving train as I passed through several of these patches the day I left Douglas.

On examining the material representing the genus *Dicerandra* in the Columbia University Herbarium, I found a fragmentary specimen of what is evidently *D. odoratissima*, collected in Georgia by Capt. LeConte, in 1831. On the same sheet (which bears the stamp of the Torrey Herbarium), was a plant collected in Florida by Dr. Baltzell in 1839, which turns out to be *Conradina puberula* Small,* a recently described species. Both were labeled "*Ceranthera linearifolia* Ell.," apparently in Dr. Torrey's handwriting, Capt. LeConte's specimen doubtless came from somewhere in the same region as mine, as he had a plantation in Liberty county, and most of his Georgia plants were probably collected in that vicinity.

YEATESIA LAETEVIRENS (Buckl.) Small, Bull. Torr. Club, **23**: 410. 1896

Collected in low woods near the Flint River, in Dooly and Sumter counties, September 3 and 10 (nos. 582 and 630). This rare species has been hitherto known in Georgia only from the collections of Dr. Small, who found it near Albany, about 30 miles down the river.

HOUSTONIA ROTUNDIFOLIA Michx.

Collected in dry pine-barrens, Sumter county, August 23 (no. 454), and in dry sand near the Flint River, in Dooly county, September 3 (no. 573). This species has probably not been found farther inland. My Sumter county specimens are the only ones I have seen from the Lafayette formation, all the others in the herbaria which I have examined being from the Columbia.

* Bull. Torr. Club, **25**: 469. 1898.

LONICERA FLAVA Sims.

This rare species was found by Mr. Wilson and myself in several localities in the northern part of the state. I collected it on Stone Mountain (no. 178), Kennesaw Mountain (no. 216), and Pigeon Mountain (no. 330); and Mr. Wilson collected it on the Chattoogata Mountains (no. 75). The altitudes of all these stations are between 1250 and 1400 ft.

VERNONIA FLACCIDIFOLIA Small, Bull. Torr. Club, **25**: 144. 1898

We found this species quite frequent in Whitfield and Walker counties, adjoining Catoosa, in where Dr. Small discovered it in 1895. Mr. Wilson collected it near Dalton (no. 86) and on Pigeon Mountain (no. 174). It grows on various formations, ranging from Chickamauga (Lower Silurian) to Coal Measures (Carboniferous), and ascends to 2000 ft. altitude on Pigeon Mountain.

LACINARIA BOYKINII (T. & G.) Kuntze

This species was collected, apparently for the first time since it was described, by me on the high sandy bank of the Flint River in Sumter county, September 10 (no. 635). The original specimens were collected by Dr. Boykin in the vicinity of Columbus in the early part of the nineteenth century.

The circumstances under which I found it lead me to suspect that it is a hybrid between *L. elegans* and *L. tenuifolia*, both of which grew in abundance in intimate association with it. Although these two species are not very similar, yet *L. Boykinii* appears intermediate between them in all its characters, such as position of leaves, length of peduncles, size and color of involucral bracts, plumosity of pappus, and color of corollas (white in *elegans* and purple in *tenuifolia*). The specimens of *L. Boykinii* were much less abundant than those of either of the other species, and I did not find it at any distance from them. My first impression that it was an undescribed hybrid was so strong that it was a surprise to me to find after my return that my specimens were referable to a described species. They have been compared with the type of *Boykinii* in the Torrey Herbarium. I have no means of knowing whether *L. Boykinii* is associated with the same two species elsewhere, as I know of no other living botanist who has collected it ; but it is not at all improbable that these two species might have accompanied it at the original locality, which is about 80 miles from mine.

ANTENNARIA SOLITARIA Rydb. Bull. Torr. Club, **24**: 304. 1897

A. plantaginifolia var. *monocephala* T. & G.

Collected in rich shady woods at two localities in Clarke county, between 600 and 700 ft. altitude (nos. 37 and 142), also in a ravine at the eastern base of Taylor's Ridge, near Gordon Springs, July 27 (no. 321); also seen in the Chattoogata Mountains. No trace of an inflorescence was observed at either locality, but this species is strikingly distinct, by its leaves and stolons alone, from *A. plantaginifolia*, which grows near it in Clarke county, but in warmer and drier places.

ANTENNARIA CALOPHYLLA Greene, Pittonia, **3**: 347. 1898

Fine large specimens, which seem to belong here, with leafy flowering stems and withered involucres still persistent, were collected in dry rocky places north of Stone Mountain, at 875 ft. altitude, July 10 (no. 202), accompanied by *Arenaria lanuginosa* (Michx.) Rohrb. Some leaves which doubtless belong to the same species were collected up on the northwest slope of the mountain, at 1300 ft. (no. 177). Determined by Mr. Elias Nelson.

POLYMNIA CANADENSIS RADIATA Gray

This showy plant was collected, apparently for the first time in Georgia, on the summits of limestone boulders (Mountain Limestone) in rich woods on the eastern slope of Pigeon Mountain, at 1300 ft. altitude, August 3 (no. 361). It is probably a good species. The rays in my specimens were pure white and fully 2 cm. long.

POLYMNIA LAEVIGATA Beadle, Bot. Gaz. **25**: 278. 1898

A second station for this species was discovered by Mr. Wilson on the east slope of Pigeon Mountain, among sandstone rocks (Coal Measures) at 1500–1550 ft. altitude, August 1 (no. 170). Known hitherto only from the original station, Cowan, Tennessee, which is about 45 miles away.

Baldwinia atropurpurea sp. nov.

Stem furrowed, erect, 6–8 dm. tall, simple or with one or two erect branches: leaves alternate, ascending, linear-spatulate, gradually diminishing in size toward the summit of the stem; the lowest 10–12 cm. long by 3–4 mm. wide: heads 1–3, terminal: ligules of the rays spatulate, 3–4 cm. long, 3–4 mm. wide, 2–3-toothed at the apex, pale yellow: disk-corollas dark purple: pappus, achenes and involucre nearly as in *B. uniflora.*

This species is distinguished at once from *B. uniflora*, its only near relative, by its dark-purple disk, longer and narrower leaves, and usually longer and fewer rays. Its aspect in the field is so different from that of *B. uniflora* that I was not certain of the genus until I examined the achenes several weeks after collecting the specimens. In the living plant the rays are decidedly paler than those of *B. uniflora*, but this character is scarcely apparent in dried specimens.

Collected in moist pine barrens, Tifton, Berrien county, at 340 ft. altitude, about 4:15 p. m. on September 19th (no. 662). Accompanied by such species as *Woodwardia Virginica*, *Eriocaulon decangulare*, *Sarracenia flava* (no. 663), *S. psittacina* (no. 660), *Aeschynomene Virginica*, *Eryngium integrifolium Ludovicianum*, *Oxypolis filiformis* (no. 659), *O. ternata* (no. 666), *Mesosphaerum rugosum*, *Viburnum nudum*, *Coreopsis angustifolia* (no. 661), and *Mesadenia lanceolata* (no. 664), which is rather a different association from that in which I have found *B. uniflora.*

I find no specimens similar to mine in the U. S. National Herbarium or the herbaria of Columbia University and the New York Botanical Garden; but it is possible that this species has been collected before. Dr. Chapman, in his Flora, under the head of *B. uniflora*, says: "Dr. Curtis finds a form with the disk flowers dark purple," and this would seem to indicate the occurrence of this species in North Carolina. It should be looked for in the coastal plain of that state, as well as in South Carolina.

Rafinesque has described a *Baldwinia bicolor*,* "found by Le Conte in Florida or Georgia," which I thought at first from his specific name might be my plant; but certain clauses in his description, such as "with white rays and yellow disk" and "stem pedal, leaves uncial," would seem to exclude my *B. atropurpurea*,

*New Fl. N. A. 4: 73. 1836.

so that unless a specimen of Rafinesque's plant is found, it must continue to be classed among his numerous unidentified species.

The nomenclature of this genus is in a somewhat unsettled condition (see Barnhart in Bull. Torr. Club, **24**: 411), but I have used the generic name which will be best understood until a suitable substitute is found. I would hardly regard *Baldwinia* as congeneric with *Actinospermum*, as has been done by some authors.

ACTINOSPERMUM ANGUSTIFOLIUM (Pursh) Torr.

Collected on dry sand-hills near Seventeen Mile Creek, Coffee county, September 24 (no. 697), and observed in similar situations near the Satilla River in Ware county, September 28. Accompanied by *Dicerandra odoratissima* at both stations.

HELENIUM TENUIFOLIUM Nutt.

The spread of this weed in northwest Georgia during the past few years has been remarkable. While in Dalton I was asked by many people if I had noticed how it had taken the place of the dog-fennel (*Anthemis Cotula*), which was as abundant when I lived there, ten or twelve years ago, as *Helenium* is now. Some thought that the *Anthemis* had all changed into *Helenium* by some sort of metamorphosis. *Anthemis* has now almost disappeared from the vicinity of Dalton, while *Helenium* is everywhere in vacant lots and along roadsides. The latter is represented in our collection by Mr. Wilson's no. 88, from Dalton, July 20th. I do not recall another case of an American weed driving out a European one.

Helenium is also common in middle and south Georgia, but does not seem to have perceptibly increased in those sections since 1895, when I first became acquainted with it.

LACTUCA SCARIOLA L.

This weed seems to be obtaining a foothold in Georgia. I collected it in Athens July 2 (no. 122), and afterward saw it in Floyd and Whitfield counties. So far I have seen it only along railroad tracks.

Besides the species here mentioned, there are several others in my collection of 1900 which appear to be undescribed, but as they seem to present more difficulties than those herein described, they are reserved for further study.

COLUMBIA UNIVERSITY.

Studies in the Asclepiadaceae.—V. A New Species of Vincetoxicum from Chihuahua

By Anna Murray Vail

(With Plate 30)

Vincetoxicum Wootonii

(*Gonolobus* A. Gray, non Michaux)

A low branching perennial herb with small axillary sub-umbellate clusters of dull greenish-purple flowers : stems angled, puberulent with short, apparently twisted hairs : leaves opposite, on petioles 3–5 mm. long ; blades 7 mm.–1 cm. long, pale grayish-green, round-ovate, obtuse at the apex, cordate, the basal lobes rounded, obtuse, thick and coriaceous, glabrous above, puberulent on the veins beneath, ciliate : peduncles 5–12 or 15 mm. long, 3–6- or 7-flowered, puberulent : pedicels very slender, 4–6 mm. long, puberulent, bracteolate at base : calyx-segments ovate-lanceolate, less than 2 mm. long, acute, puberulent, purplish, eglandulose at the base within : corolla-segments rotately spreading, dull yellowish-green, thickish, less than 4 mm. long, oblong-ovate, obtuse, glabrous, vertically reticulated, subglobose? in bud : corona saucer-shaped, 5-lobed, somewhat higher than the anthers, fleshy ; lobes broadly rounded, thickened at the center on the inner side, appendaged with 5 ligulate *Asclepias*-like incurved horns which adhere to the lobe to near the middle : stigma flat, barely 5-angled : pollinia obliquely semi-orbicular ; caudicles broadly winged, very slender at the attachment to the narrowly oblong corpuscle.

Nearly related to *Vincetoxicum biflorum* (Raf.) Heller and remarkable for the small leaves and *Asclepias*-like horns.

Mexico: State of Chihuahua, Colonia Garcia, Sierra Madre, altitude about 7200 ft., collected by Elmer O. Wooton, no. 13, June, 1899.

Explanation of Plate 30

Fig. 1. *Vincetoxicum Wootonii*, slightly reduced.
Fig. 2. Flower diagrammatically enlarged, × 5.
Fig. 3. Flower enlarged, × 2½.
Fig. 4. Corona diagrammatically enlarged.
Fig. 5. Pollinia enlarged, × 50.

Proceedings of the Club

TUESDAY, MAY 14, 1901

The meeting was held at the museum of the New York Botanical Garden, with Dr. Rusby in the chair. Twenty-seven persons were present.

Two new members were elected: Miss Heloise F. Esterly, Inwood, New York City; Dr. Wm. A. Murrill, 232 W. 114th Street.

Five resignations were accepted, of Mr. Wm. L. Fisher, 4670 Lake Avenue, Chicago; Miss Mary Appleton, Riverdale; Miss Beatrix Jones, 21 E. 11th Street; Dr. Clarence C. Howard, 57 W. 51st Street; Mr. A. Emil Schmidt, 448 E. 59th Street.

On vote of the Club the Treasurer was requested to furnish at the next meeting a list of all members delinquent in dues and of the amounts due.

Dr. Britton announced the next meeting of the Horticultural Society on the 11th of June at the Botanical Garden, at 2 P. M., to be devoted particularly to a rose, paeonia and spiraea exhibit. He also extended the invitation of that Society to members of the Torrey Club to be present at that and any subsequent meetings.

Dr. Schoeney, of the Committee on Field Meetings, spoke in favor of making out and printing field programs for the entire summer at one time. Voted to authorize committee to take this course at their discretion.

A letter was read from Mrs. Josephine D. Lowe, of Noroton, Connecticut, inviting the Club to make one of its field excursions to Noroton and vicinity. The invitation was accepted for the second Saturday in June.

The scientific program was as follows:

Professor Underwood spoke on "The Genus *Pteridium*," the type of which is the widely distributed and well-known *Pteris aquilina* of Linnaeus. It was separated from the genus *Pteris* by Gleditsch in 1751, followed by Scopoli in 1760. The principal generic character distinguishing it from *Pteris* is the presence of a double indusium. Specimens of various species, varieties and forms were shown, including extremely large specimens of *Pteridium aquilinum* collected by the speaker in southern France.

Three species may be recognized in North America. The first of these is the common and variable *Pteridium aquilinum*, of which the recently described variety *pseudocaudatum* Clute is more or less common from New Jersey southward.

The second species is *P. caudatum* found in the extreme tropical portion of Florida. The third, which occurs in the West Indies, seems to be identical with a species originally described from Brazil, though it has been confused with *Pteris esculenta*, a species originally described from the Society Islands. Species from South Africa, India and the Hawaiian Islands were also mentioned.

Dr. D. T. MacDougal gave an account of "Carpotropic Movements of Flowers," taking his illustrations from plants in bloom at the time. The two classes of movements of flowers are the induced or protective and the developmental or automatic. Of the former, the wild carrot furnishes a good example, its umbels being erect during the day and pendent or inverted at night. The segments of the perianth of the tulip also furnish a good illustration of movements induced by changing conditions of temperature.

Developmental movements, *i. e.*, those due to forces which originate within the plant, are well shown in the inflorescence of *Allium Neapolitanum*. The inflorescence here is nodding when in the bud, but the development of the flowers sends a stimulus to the curved portion of the peduncle, causing it to straighten. In addition, the plant is provided against accident by the fact that each pedicel will bend so as to erect the flower if the peduncle is prevented from straightening. Under normal conditions the pedicels take positions separating the flowers equally. In *Claytonia Virginica*, the buds are nodding, the flowers erect. After fertilization, there is another curvature, more abrupt and nearer the base of the pedicel. In *Streptocarpus*, the flower-stalk is curved and somewhat coiled in the bud, while the open flower is horizontal, bending the stalk at a right angle, and after fertilization, the maturing fruit becomes erect. The movements of the fruit, in many cases at least, are for the better dissemination of the seeds, and the movements of the flower are commonly connected with methods of fertilization. Dr. MacDougal referred also to the curious development of the cotyledons in *Streptocarpus*. One of the cotyledons ceases to grow after a time, while the other elongates very much. In one species, this cotyledon remains the only foliage of the plant.

Dr. N. L. Britton gave an account of "An undescribed species of *Stachys*," remarking that many North American species were until a few years ago referred to the *Stachys palustris* of Europe, but have more recently been recognized as distinct. A plant which grows on the sand hills along the beach near New Dorp, Staten Island, is really very different from the European *S. palustris*, and may safely be considered a new species. It has been collected in Michigan by Mr. Farwell and a specimen from Illinois is in the Chapman Herbarium. The species is apparently confined to sandy shores.

E. L. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Ashe, W. W. Suggestions for the Study of the Hawthorns. Plant World, **4**: 104–106. Je. 1901.

Bessey, C. E., Pound, R. & Clements, F. E. Additions to the reported Flora of the State. Bot. Surv. Nebraska, **5**: 12–27. 30 Mr. 1901.

Blodgett, F. H. A Tulip with a Runner. Torreya, **1**: 78, 79. Jl. 1901. [Illust.]

Britton, E. G. Mosses in the Catskill Mountains, N. Y. Torreya, **1**: 84. Jl. 1901.

Britton, N. L. Judge Daly's Sunflower. Jour. N. Y. Bot. Garden, **2**: 87–90. Je. 1901.

Helianthus Dalyi, new species.

Britton, N. L. *Nocca* and *Cracca*. Torreya, **1**: 83. Jl. 1901.

Burnham, S. H. Heterophylly in *Hepatica acuta*. Torreya, **1**: 65, 66. Je. 1901. [Illust.]

Burt, E. A. Key to the Genera of Basidiomycetes of Vermont. (Revised edition.) 1–24. Cambridge, Mass. 1901.

Clark, J. F. On the toxic Value of Mercuric Chloride and its double Salts. Jour. Phys. Chemistry, **5**: 289–316. My. 1901.

Studies largely based on mould fungi.

Clements, F. E. New Species of Fungi. Bot. Surv. Nebraska, **5**: 5–11. 30 Mr. 1901.

New species in *Septonema*, *Scaphidium* (gen. nov.), *Graphyllium* (gen. nov.), *Peziza* (2), *Humaria*, *Peiodiscus* (gen. nov.) (2), *Sepultaria*, *Ascophanus*, *Volvaria* (2), *Pluteolus*, *Naucoria*, and *Cortinarius*.

Clute, W. N. A new Form of *Cystopteris*. Fern Bull. **9**: 64, 65. *f. 1–3*. Jl. 1901.

Cockerell, T. D. A. Varietal and Specific Names. Torreya, **1**: 79, 80. Jl. 1901.

Curtis, C. C. The work performed in Transpiration and the Resistance of Stems. Bull. Torr. Club, **28**: 335–348. 19 Je. 1901.

Dietel, P. Bemerkungen über einige Melampsoreen. Hedwigia, **40**: Beiblatt (32)–(35). 20 Ap. 1901.

Holm, T. Some new Canadian Gentians. Ottawa Nat. **15**: 110, 111. Jl. 1901.

G. Macounii, G. procera and *G. nesophila.*

Kellerman, W. A. Twelve Plants additional to the Ohio List. Ohio Nat. **1**: 121, 122. Je. 1901.

Knowlton, F. H. Fossil Sequoias in North America. Plant World, **4**: 111. Je. 1901.

Lloyd, C. G. Mycological Notes. No. 6. 49–64. My. 1901.

MacDougal, D. T. Carpotropic Movements of Flowers. Jour. N. Y. Bot. Garden, **2**: 90–93. *f. 8.* Je. 1901.

Maxon, W. R. Notes on American Ferns: IV. Fern Bull. **9**: 59, 60. Jl. 1901.

Meehan, T. *Phlox maculata.* Meehan's Monthly, **11**: 97, 98. *pl. 7.* Jl. 1901.

Miller, E. S. *Amsonia Amsonia* in New Jersey. Torreya, **1**: 75, 76. Jl. 1901.

Morris, E. L. Botanizing in and around a Lake. Plant World, **4**: 109, 110. Je. 1901.

Müller, C. (Halle). Symbolae ad Bryologiam Brasiliae et regionum vicinarum. Hedwigia, **39**: 235–272. 30 O. 1900; **40**: 55–80. 21 F. 1901; 81–99. 20 Ap. 1901.

New species in *Cladastomum, Ephemerum, Monkemeyera, Fissidens, Conomitrum, Entosthodon, Physcomitrium, Mnium, Dicranum* (2), *Calymperes, Syrrhopodon, Weisia, Daltonia, Distichophyllum, Lepidopilum, Hookeria, Prionodon* (5), *Entodon* (2), *Plagiothecium* (10), *Vesicularia* (10), *Taxicaulis* (10), *Sigmatella* (4), *Cupressina* (6), *Trismegisria* (2), *Pungentella, Brachythecium* (7), *Cryphaea* (3), *Dusenia, Neckera* (5), *Rigodium* (4), *Haplocladium* (3), *Rhynchostegium, Ligulina, Pilotrichella* (2), *Orthostichella* (8), *Papillaria* (19), *Meteorium* (4), *Polytrichum*, and *Porotrichum*, in part also from Costa Rica and the West Indies.

Palmer, W. Cuban Uses of the Royal Palm. Plant World, **4**: 107, 108. Je. 1901.

Pammel, L. H. & Hodson, E. R. The Asparagus Rust in Iowa. Bull. Iowa Exper. Sta. 53: 60–67. *f. 1–4.* N. 1900.

Pammel, L. H., Weems, J. B. & Scribner, F. L. Grasses of Iowa Part I. Bull. Iowa Exper. Sta. 54: 71–344. *f. 1–137.* Ja. 1901.

Account of economic species and their fungus parasites.

Rydberg, P. A. "When in Rome do as the Romans do." Torreya, **1**: 61–65. Je. 1901.

A plea for correct Latin in botanical names.

Schrenk, H. von. Factors which cause the Decay of Wood. Jour. Western Soc. Engineers,—(1–15). *pl. 1–3.* My. 1901.

Sellards, E. H. A new Genus of Ferns from the Permian of Kansas. Bull. Univ. Kansas, 1: 179–189. *pl. 37–42.* Jl. 1900.

Glenopteris gen. nov.

Small, J. K. An Alleghanian *Rudbeckia.* Torreya, 1: 67, 68. Je. 1901.

R. monticola, new species.

Small, J. K. *Juncoides* in the Southeastern States. Torreya, 1: 73–75. Jl. 1901.

J. echinatum and *J. bulbosum*, new species.

Small, J. K. Shrubs and Trees of the Southern States. IV. Bull. Torr. Club, **28**: 356–361. 19 Je. 1901.

New species in *Brayodendron* (gen. nov.), *Quercus* (4), *Aesculus, Hypericum, Azalea*, and *Dendrium.*

Smith, A. L. On some Fungi from the West Indies. Jour. Linn. Soc. **35**: 1–19. *pl. 1–3.* Ap. 1901.

New species in *Radulum, Cyphella* (2), *Acrostalagmus, Coniosporium, Zygodesmus, Stilbum, Heydenia, Arthrobotryium, Solenopeziza, Belonidium* (2), *Ombrophila, Calloria, Rhynchostoma, Xyloceras* (gen. nov.), *Ceriospora, Hypomyces, Calonectria*, and *Hypocrella.*

Thornber, J. J. The Prairie-grass Formation in Region I. Bot. Surv. Nebraska, **5**: 29–143. 30 Mr. 1901.

Underwood, L. M. A changed Conception of Species. Fern Bull. **9**: 49–53. Jl. 1901.

Warnstorf, C. Ueber Rhizoideninitialen in den Ventralschuppen der Marchantiaceen. Hedwigia, **40**: 132–135. 20 Ap. 1901. [Illust.]

White, D. The Canadian Species of the Genus *Whittlesaya* and their systematic Relations. Ottawa Nat. **15**: 98–110. *pl. 7.* Jl. 1901.

Includes three new species.

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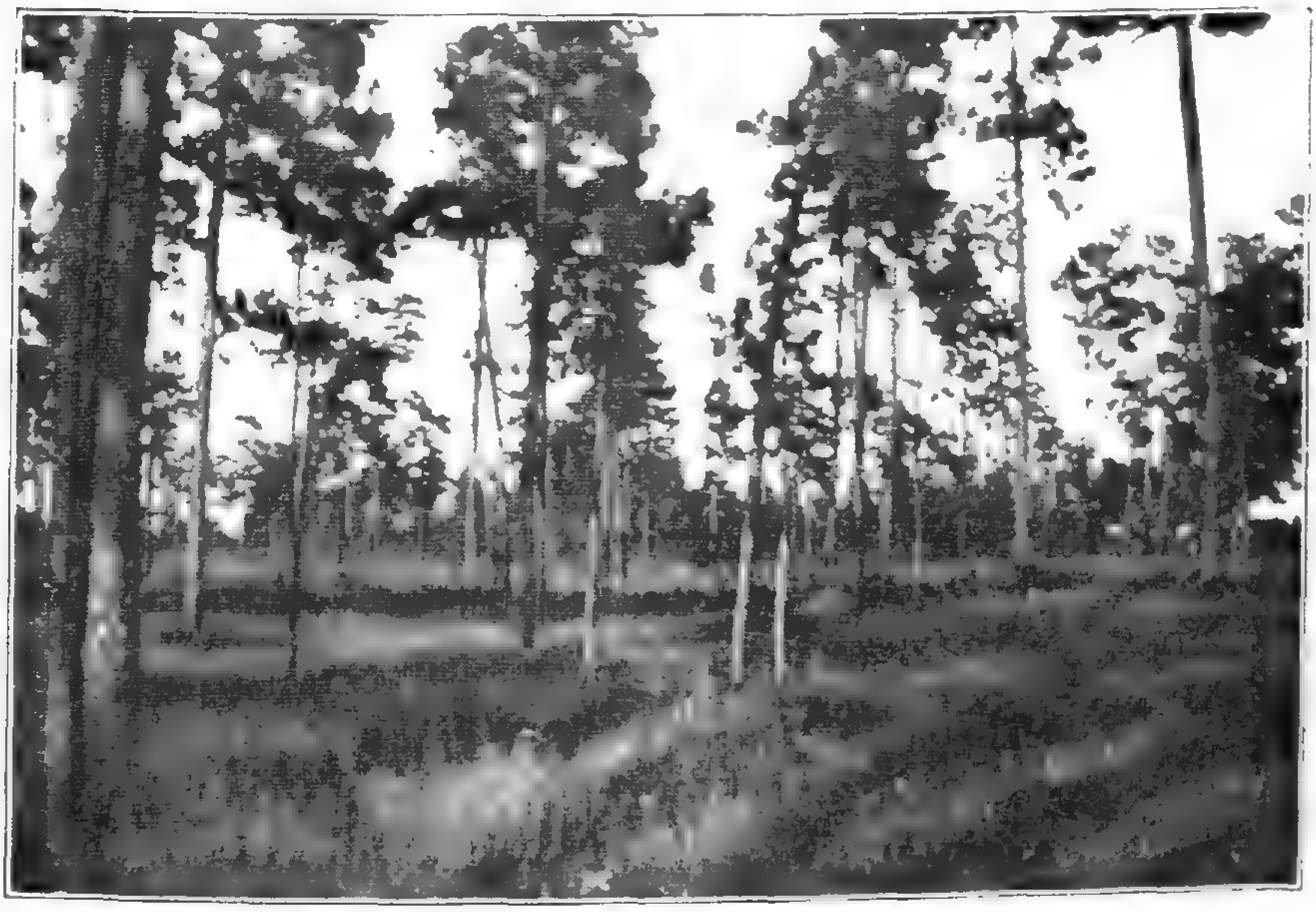

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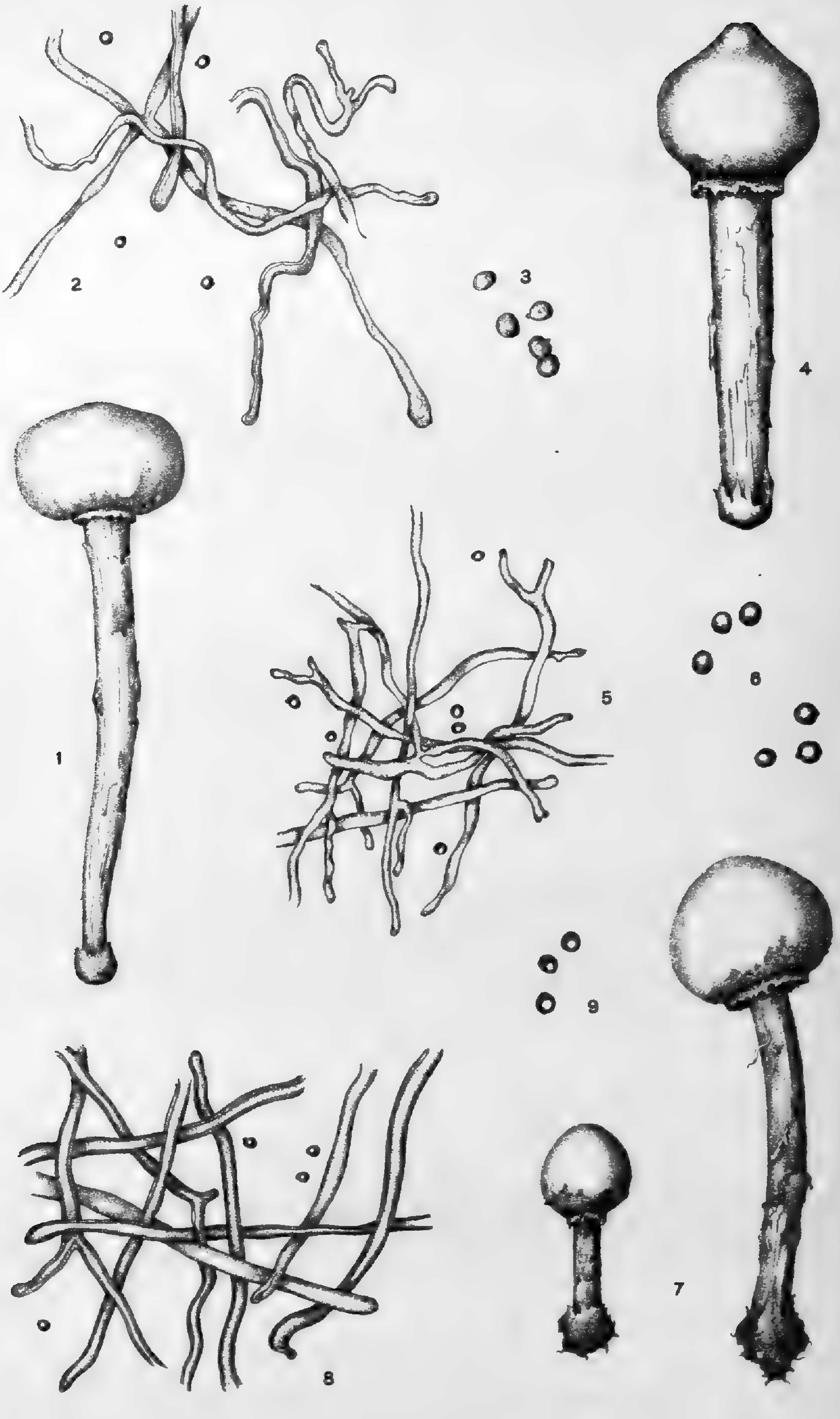

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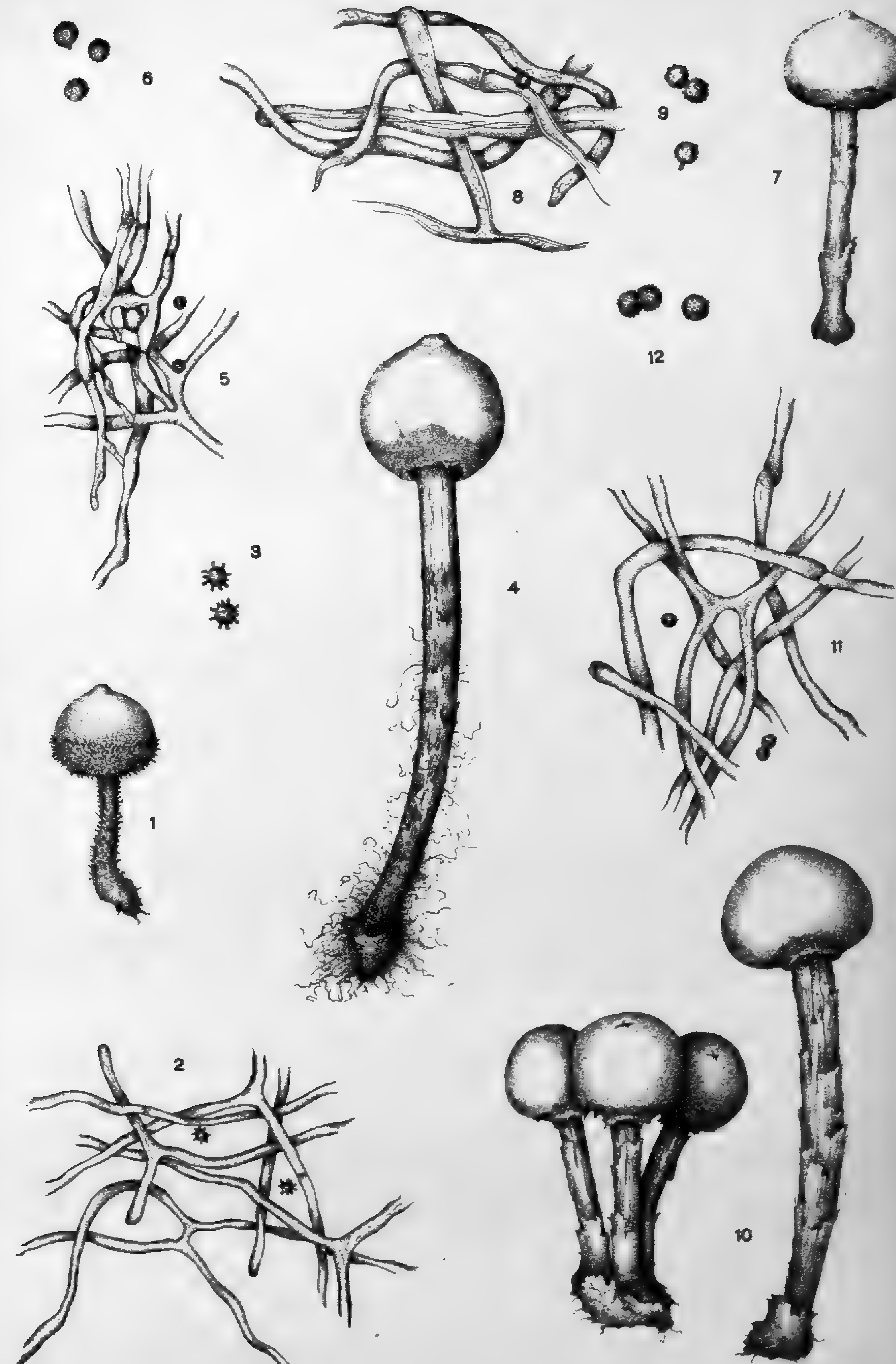

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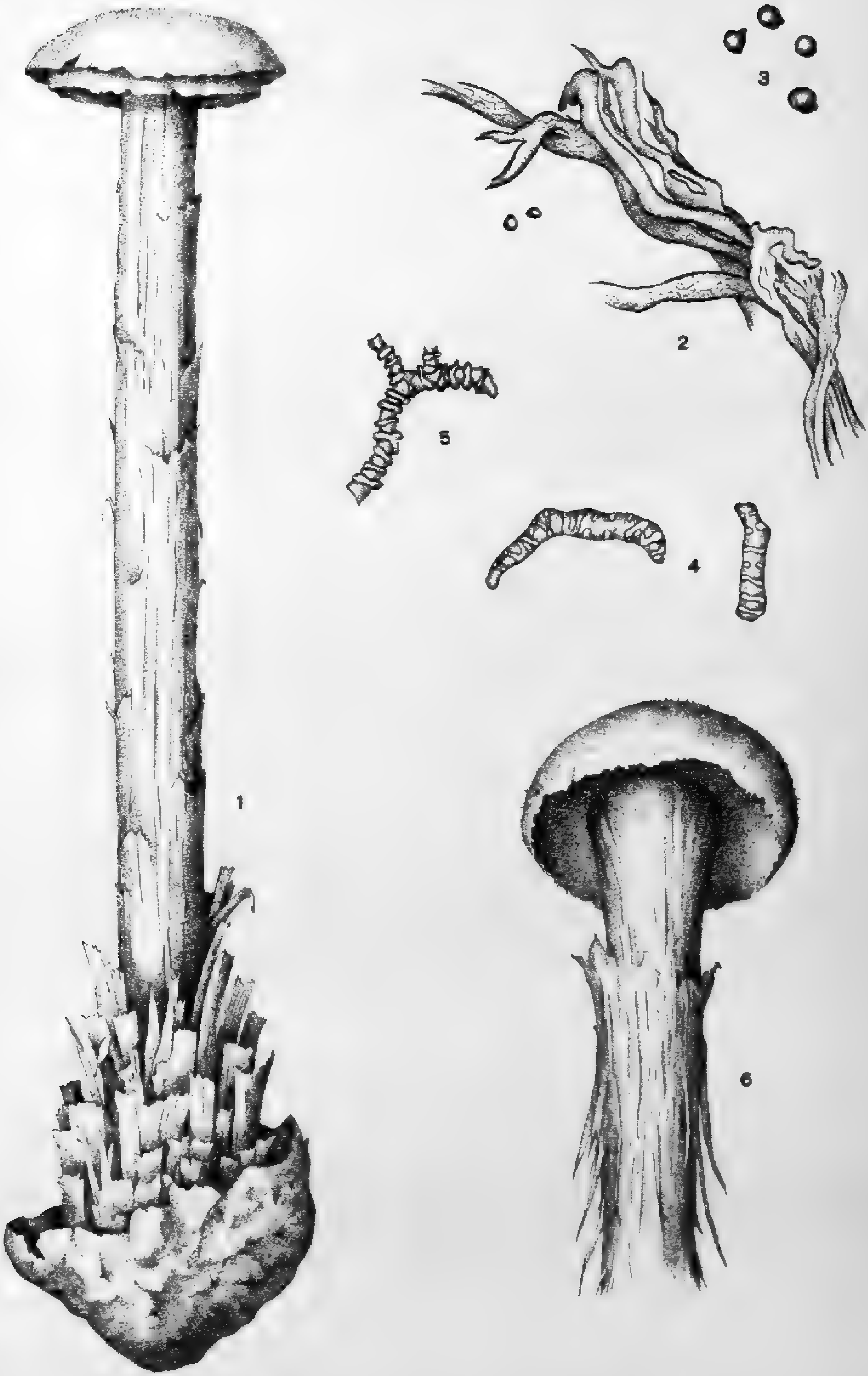

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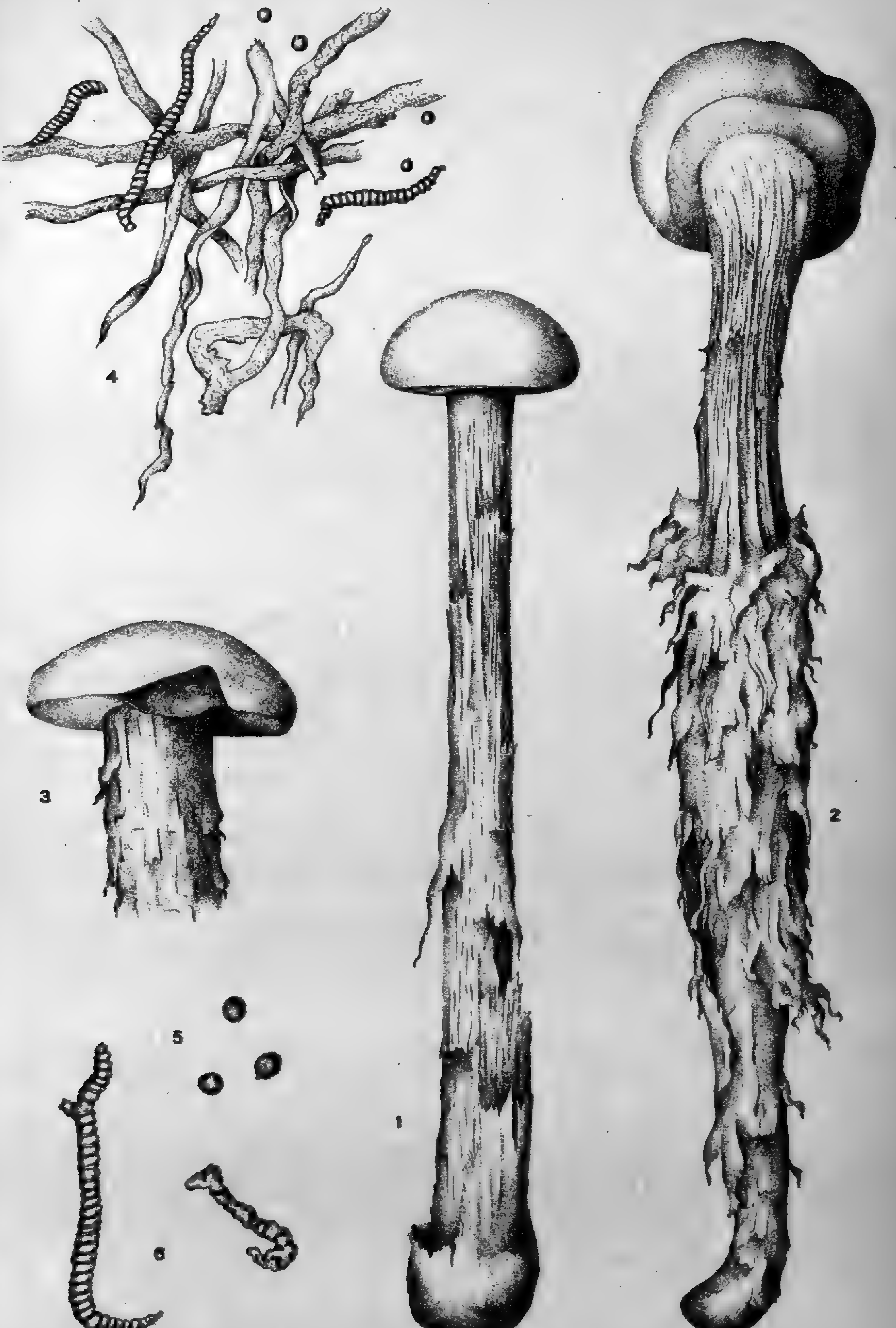

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OF THE

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CONTENTS

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Memoirs. (See last page of cover.)

Vol. 28 No. 9

BULLETIN

OF THE

TORREY BOTANICAL CLUB

SEPTEMBER 1901

The Origin of Stipules in Liriodendron

By Edward W. Berry

(With Plates 41, 42)

In 1894 Dr. Arthur Hollick described * a species of *Liriodendron* from the Laramie formation at Walsenberg, Colorado, under the name of *Liriodendron alatum*, a manuscript name given the specimen by the late Professor J. S. Newberry. It was a large leaf, oblong in outline, with a deeply emarginate apex, and had conspicuously winged petioles. In the same paper a form of *Liriophyllum populoides* Lesq. was described from the Dakota formation, with similarly winged petioles; and Dr. Hollick was led to suggest from these two instances that the large fugacious stipules of our living tulip-tree might represent former leaf-lobes, which, becoming separated, formed basilar lobes, then winged petioles, and finally the modern stipules.

In a subsequent paper † he describes two specimens of leaves of *Liriodendron Tulipifera* Linn., which serve, in a measure, to substantiate this view although it was sharply assailed by Theo. Holm in the Botanical Gazette.‡

Somewhat similar petiolar appendages in the genus *Platanus* have been ably discussed by Professor Lester F. Ward in several papers,§ and his conclusion that the large foliar stipules of the

* Bull. Torr. Club, **21**: 467–471. *pl. 220, 221.* 1894.

† Ibid., **23**: 249, 250. *pl. 269, 270.* 1896.

‡ Bot. Gazette, **20**: 312. 1895.

§ Palaeontologic Hist. of the Genus *Platanus*, Proc. U. S. Nat. Mus. **11**: 39–42. *pl. 17–22.* 1888. Origin of Plane Trees, Am. Nat. **24**: 797–810. *pl. 28.* 1890.

modern tree represent the final stage in development from the basilar leaf-lobes of the Cretaceous species, is amply proven, although questioned in some quarters.* Still another instance where stipules are mentioned as developing from leaf-lobes is implied in the following footnote on page 420 of The Smilaceae of North and Central America. In speaking of those species which climb by means of tendrils growing from the stipular wings on each side of the petiole, Dr. Morong says: "De Candolle regards this appendage as more in the nature of a modified leaf segment or leaflet than a stipule, but it seems to me that a stipule is nothing else than a leaflet at the base of the petiole." † The only other mention of winged petioles in *Liriodendron* so far as I am aware, is a short communication to Meehan's Monthly for August, 1896 (p. 145), from Mrs. W. A. Kellerman recording her observation of several forms with adnate stipules.

The writer has been fortunate in securing a large series of specimens of *Liriodendron Tulipifera* Linn. with winged petioles and adnate stipules in all stages of development, all of which strikingly confirm Dr. Hollick's theory of their origin. We have noted them briefly in the following pages in what seem to be the natural stages of their development as exhibited by our material.

We are greatly indebted to Mrs. W. A. Kellerman, of Columbus, Ohio, for many fine specimens. The first suggestion of basilar lobes is found in an obtusely lobed leaf of the normal size from a sapling. The leaf-blade is extended on each side at the base to form more or less well-defined lobes nearly the size of an ordinary stipule, and strikingly like them in venation, attracting attention at a glance; this is particularly true of the right-hand lobe which is entirely stipular in venation, quite different from the usual venation of the basilar portion of ordinary leaves. These lobes are well shown in Plate 41, Fig. 1. This form undoubtedly represents the first stage the ancestral leaf, or at least its basal portion, assumed in the course of stipular development. We find what we consider analogous basilar lobes or ears in two

* Ward's conclusions are rejected by A. G. Nathorst, Rev. of Types of Laramei Flora by L. F. Ward, in Neues Jahrbuch für Mineralogie, 2: 219–222. 1893.

† Morong, Bull. Torr. Club, 21: 420, footnote. 1894.

existing species of *Magnolia* from our Southern States, *Magnolia Fraseri* Walt. and *Magnolia macrophylla* Michx. and among ancient species they occur in *Magnolia auriculata* Newb., which is a rather common species in the Amboy Clays of New Jersey and which exhibits almost every stage from leaves with a truncate base to those with an extremely lobed base. We find these forms of especial interest because of the close relationship between *Magnolia* and *Liriodendron*. The leaf figured on Plate 41, Fig. 9 represents the second stage of the series five-eighths natural size. It is a very remarkable specimen, both in shape and venation. Nearly triangular in outline, with an acute base, it bears upon the petiole immediately below the base of the blade, but entirely separated from it, a pair of appendages * shaped like flasks with crooked necks (irregularly umbonate). The upper portion of the appendages overlaps the basilar portion of the leaf, and like it they are very coriaceous, thus differing widely from the thin parenchyma of ordinary stipules. The length of the petiole below the appendages is one and seven-eighths inches, showing that they are true leaf segments and not of stipular origin.

On Plate 42, Fig. 1, is pictured a leaf which was borne on a shoot from an old stump; it is an inverted triangle in rough outline with a truncate apex four and three-quarter inches in width, and tapers to a narrow base: the petiole is short and broadly winged: these wings are continuous with the blade, there being simply a contraction on one side, while on the other side there is a sharp sinus which extends to within one-sixteenth of an inch of the petiole, leaving room however for a plainly marked vein which passes from one to the other: the wings are exactly similar to the blade proper in texture and extend to the base of the petiole, encircling the stem as do true stipules; the right hand wing is the larger of the two and bears a mucronate point at its apex exactly like a true stipule. While the latter might possibly be considered by some as an adnate stipule, the left-hand wing can hardly be considered other than as a winged margin of the petiole in the act of becoming stipular, and rather closely resembles *Liriodendron alatum* Newb. from the Laramie.

* The left hand one is broken off in the specimen, but the scar where it was attached is plainly shown.

In the specimen figured on Plate 41, Fig. 2, we have a much smaller leaf, somewhat suggestive of a *Liriophyllum* in outline; the blade is two-lobed at the top, with an emarginate apex, and is constricted at its middle to form two large petiolar wings which encircle the stem and coalesce at the point marked *A*, forming a loose tube. These wings are very large, nearly equalling the leaf-blade proper in size, and the nervation of each extends into the other, as is well shown on Plate 42, Fig. 6, which represents the tube slit open and spread out flat; it will be noticed that one of the primary veins takes its origin in the right-hand wing, a significant fact, showing that if we are to consider these wings as stipular, then we are obliged to consider the leaf-blade proper in this case as an appendage of these stipules which is manifestly not the case, the only alternative being to consider the wings as separated segments of the leaf-blade.

On Plate 41, Fig. 5, we have a larger leaf in a slightly more advanced stage of stipular evolution; the blade proper has a retuse apex, and strongly resembles certain leaves referred to *Liriodendron primaevum* Newb. from the Dakota formation and to *Liriodendron simplex* Newb. from the Amboy Clays. A wide, rounded sinus separates the blade proper from the wings of the petiole, which latter nearly equal the blade proper in size and are continuous with it by means of a narrow margin on each side of the petiole.

Plate 41, Fig. 10, shows a small oblong-cuneate leaf in about the same stage of stipular development as the preceding. The general shape is that of *Liriophyllum obcordatum* Lesq. and the petiole is narrowly winged throughout its whole length; the left-hand margin expands suddenly at a point about half way to the base of the petiole to form a stipule-like wing, while the right-hand margin enlarges gradually until at its base it is about three times as wide as it is at its narrowest part.

Plate 42, Fig. 2, of a much larger leaf, shows us the next step in the chain, with somewhat reduced wings which have become entirely separated from the blade by an interval of petiole which is one-half of an inch long on the right side and five-eighths of an inch long on the left side; the finer venation of the wings is somewhat transverse in its general direction, rather than longitudinal, the usual manner; the union of the wings with the petiole forms an angle of about 90°.

On Plate 42, Fig. 9, we have a slightly more advanced stage than that shown on Plate 42, Fig. 2; the leaf shows traces of lobation and the wings are more like stipules both in shape and venation, and are more separated from the petiole, the angle formed by the union with the latter being about 45°.

In the form shown on Plate 41, Fig. 6, we have the closely succeeding stage in the series. The wings are very broad, being fully as wide as the blade proper. This form resembles Plate 41, Fig. 5, in the outline of its blade, while the wings are but slightly removed from the preceding, being a trifle freer from the petiole.

We place as the next stage in the series Fig. 5 on plate 42, for although the petiole is much lengthened and the wings are considerably reduced, still they are attached to the petiole for over half of their length. Fig. 8, plate 41, closely follows the preceding. While the leaf-blade is of a different shape, the petiole is of similar length and its appendages are similar in size and form; the only difference being that they are free for more than half their length, approaching the next stage in their degree of attachment.

On plate 41, Fig. 7, we have a somewhat more advanced stage; the blade proper is orbicular in general outline with a slightly emarginate apex, exactly similar to dozens of leaves which may be found on young shoots; the distance from the blade to the wings is comparatively great (one and one-quarter inches), almost the same as the length of the blade; wings are attached to the petiole by their bases only and are widely divergent; they are somewhat larger than in the preceding form. From this to the regular modern stipulate form, it is but a step, which interval we bridge over with the form shown on Plate 41, Fig. 3. At first glance the stipules appear entirely free, but closer examination shows that they still retain their connection with the petiole by means of a small triangle of connective tissue (shown enlarged at Fig. 4, Plate 41).

The modern form of stipules is shown in Figs. 3, and 8, on Plate 42, Fig. 3 being the small form the leaf assumes on young shoots and saplings, and Fig. 8 that of the normal modern form of leaf.

In the growth of young and vigorous shoots in the spring time, where there is excessive, or at least a full supply of nourishment, and where the necessity of protecting the unfolding leaflets is more imperative, comparatively immense stipules usually occur; one of these (nat. size) is figured on Plate 42, Fig. 4, in order to show its venation.

Still another form sometimes assumed by stipules is shown in Fig. 7, on Plate 42, reminding one of the curious stipular appendages on some of our magnolias. All degrees of coalescence occur from forms barely united to those united for about half their length like the one figured; we have specimens one-third larger than this.

Figs. 10 and 11 on Plate 42, show the curious stipular forms which occur on *Magnolia obovata* Thunb. and *Magnolia conspicua* Salisb. the only two species which I have had an opportunity of observing. They form large bud scales, affording effective protection for the tender unfolding leaves. In the youngest shown (Fig. 10), they are many times the size of the tiny leaflet they bear, while Fig. 11 shows a larger leaflet.

On comparing this form with those forms of adnate *Liriodendron* stipules shown on Plate 42, Fig. 7, it will be seen that the addition of a petiole with a small leaflet at its summit would make them identical with the magnolia specimen, the venation too is almost identical, that in *Magnolia* being somewhat finer and more reticulate; as the *Magnolia* leaves become older the wings separate along the petiole and fall off. These stipular wings become particularly significant when we consider that *Magnolia* is so closely related to *Liriodendron,* and has several species with basilar lobed leaves. *Magnolia,* as we should naturally expect, is found in older strata than *Liriodendron* and there is no doubt of their community of descent from the same primitive form. It does not seem to me to be necessary to make any further comments on the foregoing; the figures tell the story, and no more perfect series of forms, each slightly removed from its predecessor, could be desired: in fact we are surprised to find the evolution of stipules in this genus which must have occurred in the Cretaceous period, so well portrayed and epitomized after so long an interval of time.

PASSAIC, N. J.

Studies on the Rocky Mountain Flora.—VI

By P. A. Rydberg

Salix padophylla n. n.

S. padifolia Rydb. Bull. Torr. Club, **28**: 272. 1901. Not Anderson.

In the May number of the Bulletin appeared a new species of willow under the name *S. padifolia*. The name should have been *S. padophylla*, as *S. padifolia* is preoccupied by one of Anderson's species. Besides, *padus* is originally a Greek word, *παδος*.

Trifolium stenolobum sp. nov.

A densely cespitose and scapose perennial. Branches of the caudex covered by the large stipules which are 2 cm. long; petioles 5–10 cm. long, finely strigose; leaflets 3, narrowly lanceolate or oblanceolate, 1.5–4 cm. long, finely strigose, very acute or acuminate: scape 1–1.5 dm. long: heads many-flowered; bracts minute; flowers reflexed in fruit: calyx-tube silky-strigose, 4–5 mm. long; teeth almost filiform, 7–9 mm. long: banner about 18 mm. long, obtuse, mucronate.

This is related to *T. dasyphyllum* but is easily distinguished by the minute bracts, the long slender calyx-teeth and the larger corolla. It grows at an altitude of 3600 m.

Colorado: La Plata Mountain, 1896, *F. Tweedy, 457* (type in U. S. Nat. Herb.).

Trifolium subcaulescens A. Gray, Ives, Rep. Colo. Riv. Bot. 10. 1860

Trifolium nemorale Greene, Pittonia, **4**: 136. 1900.

Dr. Watson referred this species to *T. gymnocarpum*, to which it is nearest related, but it differs in the larger size and the many-flowered head. The specimen of C. F. Baker's no. 446 in the herbarium of the New York Botanical Garden matches perfectly Newberry's specimen in the Columbia University herbarium. The former is the type number of *T. nemorale* Greene, and the latter that of *T. subcaulescens* A. Gray. Unless the type sheets represent different species from those represented in our herbaria, Prof. Greene's name has to pass into synonymy.

Trifolium bracteolatum

Trifolium lilacinum Rydb. Bull. Torr. Club, **28**: 37. 1901. Not Greene. 1896.

Vicia producta sp. nov.

A very slender, sparingly hairy cespitose perennial. Stems decumbent or ascending, 2–3 dm. long, much branched and leafy, striate and somewhat angled: stipules narrow, semi-hastate, entire, 3–5 mm. long; leaflets 3–5 pairs, oblong to linear, 5–15 mm. long, obtuse, mucronate; tendrils 3-cleft: peduncles 2–4 cm. long, usually 2-flowered, produced beyond the upper flower: calyx-tube about 2 mm. long, strigose, teeth about 1 mm. long, lanceolate-subulate: corolla about 8 mm. long, yellowish-white, tipped and tinged with purple.

This species is probably closest related to *V. humilis* H. B. K., but is characterized by having the peduncle produced beyond the two flowers and by different calyx-lobes. The type was growing among rocks on the south side of a butte, at an altitude of about 2400 m.

COLORADO: Butte, 5 miles southwest of La Veta, 1900, *Rydberg & Vreeland, 6006.*

Primula Americana sp. nov.

Primula farinosa A. Gray, Syn. Fl. **2**[1]: 58, in part. 1878. Not L. 1753.

Perennial with a short rootstock and fleshy-fibrous roots. Basal leaves oblong or oblong-oblanceolate or spatulate, 2–8 cm. long, obtuse, gradually contracted at the base, usually with short winged petioles, sinuate dentate above the middle or subentire, thin, more or less mealy, especially on the lower surface: scape 1–2 dm. high, mealy when young: bracts 6–10 mm. long, linear-lanceolate, usually acute: pedicels in flower little if any exceeding the bracts, in fruit sometimes 2 cm. long, erect from the beginning: calyx more or less mealy, 6–8 mm. long, lobes oblong-obtuse: corolla lilac; tube 8–9 mm. long, only slightly exceeding the calyx; lobes of the corolla obcordate, 2–3 mm. long.

This species has been confused with *P. farinosa*, but I think it distinct. All specimens from the Rocky Mountain region under that name differ from the European and especially the Scandinavian *P. farinosa* in the longer bracts, in the longer calyx and in the short corolla lobes. The specimens of northeastern America seem to be like the European plant. In the latter the bracts are only 4–6 mm. long, acuminate, the calyx less than three fourths the length of the tube of the corolla and the lobes of the latter 4–5 mm. long. *P. Americana* grows in swamps and wet meadows of the Rocky Mountain region at an altitude of 1200–2500 m.

MONTANA: Deer Lodge, 1895, *P. A. Rydberg, 2746* (type).

WYOMING: Little Laramie River, 1896, *Aven Nelson, 1961*; Hams Fork and La Barge, 1900, *C. C. Curtis.*

ALBERTA: Devil's Head Lake, Banff, 1899, *W. C. McCalla, 2422.*

COLORADO: North Park, 1896, *Geo. E. Osterhout.*

Cuscuta gracilis sp. nov.

Stem filiform, about .25 mm. in diameter. Flowers in dense globular clusters: calyx gamosepalous but cleft to near the base, lobes ovate: corolla urceolate, less than 2 mm. high, lobes ovate, widely spreading, acute, delicate, about 1 mm. long; scales ovate, crenate, not divided, almost half as long as the corolla-tube: filaments subulate, about twice as long as the anthers: styles distinct, equal, about as long as and somewhat thicker than the red filiform curved stigmas: capsule about 2 mm. high, acute-globose, circumscissile near the base: seeds about 1 mm. long.

This species is nearest related to *C. epilinum*, which, however, has shorter and broader corolla-lobes, shorter filaments, scarcely longer than the anthers and short emarginate and crenate scales. *C. gracilis* grows parasitic on species of *Erigeron*, *Chrysothamnus* and *Solanum.*

WYOMING: Rolling plains between Sheridan and Buffalo, 1900, *F. Tweedy, 3292* (type); Laramie, 1894, *Aven Nelson, 1139.*

Cuscuta megalocarpa sp. nov.

Stem stout, usually over 1 mm. in diameter. Flowers in dense globular clusters: pedicels very short, at most 2 mm. long: calyx gamosepalous, lobes rounded, scarcely 1 mm. long: corolla about 3 mm. high and broad, lobes broadly triangular, acutish, about 1 mm. long, with incurved tip; fringed scales attached near the bottom, equalling about half the corolla-tube, deeply 2-lobed, and fringed only in the open sinuses: stamens about as long as the lobes of the corolla, filaments subulate, about twice as long as the rounded anther: styles distinct, short, stigmas capitate: capsule 5–6 mm. in diameter, acute-globose, about 4-seeded: seeds about 2.5 mm. long and 2 mm. broad, finely muricate.

A plant parasitic on willows and other shrubs, at an altitude of about 2000 m.

COLORADO: Cucharas Creek, near La Veta, 1900, *F. K. Vreeland, 670.*

WYOMING: Dayton, Sheridan Co., 1899, *F. Tweedy, 2278.*

Monarda comata sp. nov.

Perennial with a horizontal, slender rootstock. Stem obtusely 4-angled, 4–6 dm. high, simple, sparingly silky-villous, especially below the nodes and on the upper portion: lower leaves with more or less hairy petioles, which are about 1 cm. long, the upper subsessile; blades ovate or lance-ovate, more or less cordate at the base, acute or acuminate, serrate with small teeth which are directed forward, 4–6 cm. long, sparingly silky-strigose on both sides: bracts green or tinged with purplish, ovate, 1–2 cm. long: calyx about 1 cm. long, minutely puberulent, with a ring of hairs at the base of the teeth, which are subulate, .7 mm. long: corolla red-purple, almost wine-color, densely villose-puberulent, the exserted portion about 2 cm. long.

This is nearest related to *M. stricta* Wooton, but differs in the long pubescence of the stem, leaves and bracts, shorter calyx-teeth and darker flowers. It grows in meadows among bushes, at an altitude of 2000–2500 m.

COLORADO: Wahatoya Creek, 1900, *Rydberg & Vreeland, 5673* (type); Ruxton, 1900, *Fred Clements.*

Castilleja Wyomingensis sp. nov.

A more or less cespitose perennial with a short woody caudex. Stems 3–4 dm. high, striate, sparingly puberulent and the upper portion viscid-pubescent: leaves linear, 4–5 cm. long, 4–7 mm. wide, minutely puberulent, more or less distinctly 3-nerved, entire, or the upper 3-lobed: bracts lanceolate to ovate, puberulent and ciliate on the margin and veins tinged with sulphur-yellow, 3-lobed at the apex or the lower entire, middle lobe oblong and rounded at the apex, the lateral ones lanceolate or linear, acute: calyx villose, nearly 2 cm. long and almost equalling the corolla, sulphur-yellow, cleft about half way down, slightly deeper on the lower than on the upper side, lateral cleft 3–4 mm. deep: corolla greenish, tinged and bordered with sulphur-yellow, galea about 6 mm. long, lip about 2 mm.: capsule ovoid, 12–13 mm. long.

The species is nearest related to *C. sulphurea*, from which it differs in the narrow leaves and in being more puberulent. It grows in northern Wyoming at an altitude of 2200–2700 m.

WYOMING: Big Horn Mountains, Sheridan Co., 1899, *F. Tweedy, 2341* (type) and *2342*; Headwaters of Clear Creek and Crazy Woman River, 1900, *Tweedy, 3400.*

Pentstemon suffrutescens sp. nov.

Pentstemon caespitosus var. *suffruticosus* A. Gray, Syn. Fl. **2**[1]: 270. 1878. Not *P. suffruticosus* Dougl. 1846.

Excellent specimens of what I take to be Gray's variety cited above, which was described from imperfect material, have been collected by Mr. Tweedy, and these show that the plant is nearer related to *P. pumilus* than to *P. caespitosus*, but the calyx lobes are broader, shorter and blunter than in that species, the corolla slightly smaller and the leaves glabrous.

COLORADO: Ridgway, 1895, *F. Tweedy, 170.*

Sambucus microbotrys sp. nov.

A low shrub, 5–20 dm. high, glabrous throughout and with pale green foliage. Leaflets ovate or rarely ovate-lanceolate, acute or short-acuminate, 3–9 cm. long, mostly rounded and oblique at the base, coarsely serrate: cyme thyrsoid-paniculate, small, about as long as broad, about 3 cm. in diameter and of the same height; flowers whitish: fruit bright red, 4–5 mm. in diameter: seeds finely punctate-rugose.

This species is nearest related to *S. pubens* and perhaps all specimens from the southern Rockies referred to that species belong here. The main distinctions from *S. pubens* are the total absence of pubescence and the smaller inflorescence. It grows at an altitude of 1500–2700 m.

COLORADO: Bottomless Pit, and below Halfway House, Pike's Peak, 1896, *E. A. Bessey* (type); Gray's Peak, 1895, *P. A. Rydberg*; East Indian Creek, 1900, *Rydberg & Bessey, 5582*; Little Veta Mountain, *5583.*

Chrysothamnus filifolius sp. nov.

A small shrub, about 3 dm. high, very bushy. Bark of the stems and larger branches gray and somewhat fissured, that of the young branches white and shining: leaves very narrow, linear-filiform, 1–2 cm. long, less than 1 mm. wide, dark green and glabrous except the minutely scabrous-ciliolate margins: cyme large, flat-topped: heads very numerous, 5–6 mm. high, 2 mm. in diameter, turbinate; bracts in 5 vertical rows with usually 3 in each row, lanceolate-acuminate, the outer with green tips, the inner wholly chartaceous.

In habit and leaves, this species resembles *C. stenophyllus*, but the leaves are still narrower and in that species the bracts are obtuse or merely acute.

COLORADO: Granite, 1896, *Fred. Clements, 390.*

Chrysothamnus scoparius sp. nov.

Perennial with a woody caudex and deep tap-root. Stems 1–2 dm. high, glabrous and shining, with a white bark: leaves narrowly linear, light bluish-green, glabrous, 2–3 cm. long, a little over 1 mm. wide, more or less twisted: cyme flat-topped: heads numerous, 6–8 mm. high, 2–3 mm. wide; bracts chartaceous, lanceolate, acuminate.

This species is still more like *C. stenophyllus* in habit, but the bracts are different, being acuminate instead of obtuse or acute and more keeled. The perennial portion is also much shorter and the general color of the plant is much lighter.

COLORADO: Mesas, La Veta, 1900, *F. K. Vreeland, 698.*

Aster crassulus sp. nov.

Aster multiflorus A. Gray, Pl. Wr. **2**: 75. In part. 1853.

Aster incano-pilosus Rydb. Mem. N. Y. Bot. Gard. **1**: 393. In part. 1900.

Perennial with a horizontal, stoloniferous rootstock. Stems erect or ascending or rarely decumbent, usually simple below, branched above, 4–7 dm. high, terete, brownish, densely hirsute with short divaricate hairs: stem-leaves linear, or oblong-linear, 3–6 cm. long, 2–3 mm. wide, rather firm, hirsute with short spreading hairs, sessile and slightly clasping, in age usually reflexed, acute with a short spinulose tip; those of the branches smaller; those of the branchlets only 3–5 mm. long and merging into the bracts of the involucres: heads numerous, borne at the end of leafy branchlets which are 1–2 cm. long; involucre turbinate, 5–8 mm. high, 8–10 mm. broad; bracts in 3–4 series, the outer successively shorter, broadly spatulate, minutely spinulose-mucronate, very thick, hirsute especially on the margin, chartaceous at the base with a broadly oval herbaceous tip: rays numerous, white, 5–7 mm. long and fully 1 mm. wide: achenes strigose.

This is a member of the *A. multiflorus* group and has been confused with *A. commutatus* (T. & G.) Gray or *A. incano-pilosus* Sheldon. In *A. commutatus*, the stem is strigose-pubescent, the branchlets more elongated and the outer bracts longer than in *A. crassulus* and often equalling or surpassing the inner bracts. It may be the same as described by Lindley in Hooker's Flora and DeCandolle's Prodromus as "*A. ramulosus* β, incano-pilosus"; but here it is to be noticed that the word "incano-pilosus" is printed in the same type as all the descriptions and not the special type used for names. Hence "incano-pilosus" was a descriptive term for the *A. ramulosus* β, and not the name. If, however, it should be taken as a name, which Mr. Sheldon did, it is a *nomen nudum*, as no further description is given, and then should be disregarded. As Sheldon's *Aster incano-pilosus*, which is amply distinct, has as a synonym, the older *A. commutatus* (T. & G.) Gray it must be dropped and *A. commutatus* substituted.

A. crassulus grows on dry plains and table-land at an altitude of 1200 m.

COLORADO: Mesas, La Veta, 1900, *F. K. Vreeland, 690a* (type) and *690*; Denver, 1871, *Dr. Geo. Smith, 83*; Ridgway, 1894, *F. Tweedy, 306*; Pagosa Spring, 1899, *C. F. Baker, 637*.

NEW MEXICO: 1851, *C. Wright, 1155*; Rio Dolores, *Newberry*.

CALIFORNIA: Valley, near San Filipe, 1858, *S. Hayes*.

WYOMING: Bear Lodge Mountains, 1898, *L. W. Carter*; Moorcroft, 1897, *L. W. Carter*; Dayton, 1899, *F. Tweedy, 2031*.

NORTH DAKOTA: Minot, 1891, *Wright*; Custer, 1892, *Rydberg, 773*.

MONTANA: Park Co., 1887, *F. Tweedy, 359*; Colgate, *Sandberg, MacDougal & Heller, 1021*; Montana Valley, Madison Co., 1899, *Aven & Elias Nelson, 6839*.

Aster exiguus (Fernald)

Aster ciliatus Muhl.; Willd. Sp. Pl. **3**: 2027. 1804. Not Walt. 1788.

Aster hebecladus A. Gray, Syn. Fl. **2**[1]: 185, under *A. multiflorus*. Not DC.

Aster multiflorus var. *exiguus* Fernald, Rhodora, **1**: 187. 1899.

I think that *Aster ciliatus* Muhl. is distinct from *A. multiflorus*;

but unfortunately it is antedated by *A. ciliatus* Walt. In *A. multiflorus* the pubescence is mostly appressed and the bracts are narrow-oblanceolate and rather thin. In *A. exiguus* the pubescence is much denser and divaricate and the bracts are thick, broadly spatulate or obovate. In fact *A. exiguus* differs from the preceding only in the smaller, more crowded heads and the shorter rays; the former are less than 5 mm. high and the rays are only 5–6 mm. long. The New Mexican form which Gray regarded as *A. hebecladus* DC. and for which Dr. Greene has revived the name belongs here, but is evidently not *A. hebecladus* DC. for this is described as having glabrous stem and linear bracts.

A. exiguus grows on prairies and plains along roads, etc., and westward is much more common than *A. multiflorus*. It ranges from Vermont and Pennsylvania to Washington and south to Texas and Arizona.

Machaeranthera rubricaulis sp. nov.

Biennial or perhaps perennial. Stem erect or nearly so, simple below, branched above, 4–6 dm. high, terete, striate, usually tinged with red or purple, finely strigose-puberulent, not viscid: leaves linear or linear-oblanceolate, sessile, acute, entire or sparingly dentate, scabrous-ciliolate on the margins; the largest 8 cm. long, and 8 mm. wide: heads corymbose-cymose, numerous: involucre 10–12 mm. high, 12–15 mm. in diameter: bracts numerous, linear-lanceolate with attenuate, almost terete squarrose tips, viscid-puberulent: rays numerous, dark blue, about 12 mm. long and 1 mm. wide: pappus sordid: achenes flat, sparingly and minutely strigose.

The species grows in dry soil at an altitude of 2000–2700 m.

COLORADO: Mesas, La Veta, 1900, *F. K. Vreeland, 681* (type); Telluride, 1894, *F. Tweedy, 304* and *305*.

Erigeron laetevirens sp. nov.

Perennial with a woody tap-root. Stems several, 1.5–2 dm. high, slender, erect or ascending, striate, silky strigose: basal leaves very narrowly linear-oblanceolate, acute, 5–10 cm. long, 1–3 mm. wide, sparingly strigose; stem-leaves narrowly linear, 2–6 cm. long, scarcely over 1 mm. wide: heads solitary: involucre 12–15 mm. in diameter, grayish villous-hirsute: bracts in 2–3 series, subequal, linear-lanceolate, long-acuminate: rays numerous, blue or purple, 7–8 mm. long, 1–1.5 mm. wide.

This species is nearest related to *E. Montanensis*, from which it differs in the narrower, blue or purple rays and longer and less pubescent leaves. It grows at an altitude of 2000–2700 m.

WYOMING: Little Goose Creek, 1899, *F. Tweedy, 2005* (type); Headwaters of Clear Creek and Crazy Woman River, 1900, *3010*.

Carduus Centaureae sp. nov.

(?) *Cnicus carlinoides* var. *Americanus* A. Gray, Proc. Am. Acad. **10**: 48. 1874. Not *Cirsium acaule* var. *Americanus* A. Gray. 1863.

(?) *Cnicus Americanus* A. Gray, Proc. Am. Acad. **19**: 56.

Biennial or perennial. Stem rather slender, 6–10 cm. high, striate, often tinged with red, slightly floccose when young: basal leaves about 2 dm. long, thin-petioled, deeply pinnatifid to near the midrib, above light green, sparingly floccose when young, glabrate in age, beneath more or less permanently grayish-tomentose; lobes lanceolate or triangular, 2–4 cm. long, more or less toothed and tipped with weak spines, 1–3 mm. long; lower stem-leaves similar but petiole more winged, dilated at the base and short decurrent; the upper sessile and clasping with an auricled base; the uppermost lanceolate and undivided: heads 2–2.5 cm. high and 1.5–2 cm. in diameter: outer bracts narrowly lanceolate, yellowish, often with darker center, fimbriate on the margin and tipped with a flat weak spine 1–2 mm. long: the inner with dilated deltoid scarious fimbriate tips which are merely acuminate: flowers ochroleucous.

This species may be the *Cnicus Americanus* A. Gray or *Carduus Americanus* Greene, but the name *Americanus* is preoccupied. The species is, however, not nearest related to *C. Parryi*, where Dr. Gray placed it; but to *C. leiocephalus* and *C. canovirens*, from which it differs in the less spinose, more dilated and fimbriate bracts. A seedling of apparently this species was collected by Cowen and it has long oblanceolate 3–4 dm. long, undivided leaves. It grows at an altitude of 2200–2600 m.

COLORADO: Laramie County, 1895, *J. H. Cowen* (type); 4-mile Hill, Routt County, 1896, *C. F. Baker;* Penn's Gulch, 1865, *Letterman, 78*.

Carduus erosus sp. nov.

Biennial. Stem stout, about 7 dm. high, angled and striate, often red, loosely floccose when young: lower leaves about 2 dm. long, rather thin, green and slightly floccose above when young:

grayish-tomentose beneath, deeply pinnatifid to about one fourth from the midrib: lobes about 2 cm. long, lanceolate, few toothed or lobed and tipped with moderately strong spines 4–10 mm. long: heads hemispherical, 2.5–3 cm. high and 2.5–3.5 cm. broad: outer bracts ovate, slightly floccose when young, entire, with a narrow dorsal line, tipped with weak spines 1–2 mm. long, the inner with dilated deltoid erose scarious acuminate tips: flowers ochroleucous.

A species closely related to the preceding, differing in the larger heads, longer spines, broader bracts and with erose instead of fimbriate tips. It grows in moist meadows at an altitude of about 2200 m.

COLORADO: Durango, 1896, *Frank Tweedy, 517* (type in U. S. Nat. Herb.).

Carduus Americanus (A. Gray).

Cirsium acule var. *Americanus* A. Gray, Proc. Acad. Phila. 1863: 68.

Cnicus Drummondii acaulescens A. Gray, Proc. Am. Acad. **10**: 40, in part.

Dr. Gray's *Cirsium acaule* var. *Americanum* is amply distinct from *C. Drummondii* not only by the acaulescent habit, but also by the narrower bracts and their long stout spines which are 1–2 cm. long while in *C. Drummondii* they are only a few mm. in length and very weak. It is an alpine species growing at an altitude of 2800–3500 m. To this belong the following specimens.

COLORADO: Silver Plume, 1895, *P. A. Rydberg;* Como, South Park, 1895, *C. S. Crandall;* South Park, 1884, *Letterman.*

Carduus acaulescens (A. Gray)

Cnicus Drummondii var. *acaulescens* A. Gray, Proc. Am. Acad. **10**: 40, in part.

Gray's variety *acaulescens* was based on two previously published things, viz., *Cirsium acaule* var. *Americanus* A. Gray, given above, and *Cirsium Drummondii*, "acaulescent form" D. C. Eaton in King's Report. As the first already has a valid name, I here adopt the name *acaulescens* for the other part on which the variety was founded. *C. acaulescens* resembles closely *C. Americanus* in habit, but the spines of the outer and middle bracts are shorter and weaker, seldom over 5 mm. long, and the inner are acuminate, wholly unarmed. The true *C. Drummondii*, even in its subacaulescent state, has very broadly ovate outer bracts and the spine is so fine that it is better called a bristle. The inner bracts have a long acuminate very crisp tip. In *C. acaulescens* it is scarcely crisped. The following specimens belong to *C. acaulescens:*

UTAH: Bear River Valley, 1869, *S. Watson, 690.*

WYOMING: Woods Creek, 1897, *Aven Nelson, 3483.*

COLORADO: Grizzly Creek, 1896, *C. F. Baker.*

Carduus oreophilus sp. nov.

Cirsium Drummondii, D. C. Eaton, King's Rep. **5**: 195. 1871. Not T. and G.

Biennial stem 4–8 dm. high stout, angled and striate, slightly arachnoid-hairy when young, leafy: basal leaves about 2 dm. long, thin, short-petioled, green and glabrate above, more or less grayish-tomentose beneath, pinnately lobed a little more than half way to the midrib; lobes triangular, usually 2–3-lobed, with rather slender spines 3–10 mm. long: heads hemispherical, 2–2.5 cm. high, 2.5 cm. broad: outer and middle bracts narrowly lanceolate, slightly arachnoid, tipped with flat spines 3–6 mm. long, the inner with a long attenuate soft tip: flowers red.

This species has been included in *C. Drummondii* but is taller with smaller head, narrower bracts, the outer with longer spines, and the tips of the inner scarcely crisp. It grows at an altitude of 1500–3000 m.

COLORADO: Georgetown, 1895, *P. A. Rydberg* (type); Pagosa Springs, 1899, *C. F. Baker, 644.*

NEVADA: Run Valley, 1868, *S. Watson, 689.*

Caduus griseus sp. nov.

Biennial. Stem stout, sparingly floccose when young, angled and striate: basal leaves oblanceolate in outline, thin, glabrate above, grayish-tomentose beneath, deeply pinnately divided; segments 3–4 cm. long, deeply 2–3-lobed and toothed, tipped and margined with rather slender spines 3–5 mm. long; the upper similar but less deeply divided, sessile and half clasping by the dilated rounded shortly decurrent base: heads about 3 cm. high and broad: bracts subequal, without dorsal glandular ridge, the outer narrowly lanceolate, with a long-attenuate tip gradually changing into a flat spine, and somewhat laciniate or spinulose-dentate on the margin; the inner bracts less rigid, their tips not spinose but long-attenuate, scarious and somewhat crisp: flowers ochroleucous.

This species is probably nearest related to *C. leiocephalus* (D. C. Eaton) Heller but differs in the less divided, less spinose leaves and the bracts which are lacking the long yellow spines on the margins. *C. leiocephalus* has red flowers. *Carduus griseus* grows at an altitude of 3400 m.

COLORADO: Telluride, 1894, *F. Tweedy, 321* (type in U. S. Nat. Herb.).

Carduus pulcherrimus sp. nov.

Biennial. Stem about 4 dm. high, very leafy, grayish-tomentose, especially when young, angled: lower leaves 1–1.5 dm. long, oblanceolate in outline, short-petioled, pinnately divided, bright green and glabrate above, densely white-tomentose beneath; segments lanceolate or triangular, lobed and toothed with slender spines 3–5 mm. long; the upper leaves similar, sessile and half clasping: heads 2.5–3 cm. high, 2.5–4 cm. broad: outer bracts lanceolate with a narrow glandular ridge, slightly floccose, tipped with yellow spines about 5–7 mm long; the innermost narrowly lanceolate and with long-attenuate tips: flowers rose-colored.

In habit this species resembles most *S. undulatus* and *S. ochrocentrus*, but has smaller heads, narrower bracts and narrower glandular ridge. It is perhaps intermediate between those species and *C. canovirens*, from which latter it is easily distinguished by the dense tomentum on the lower surface of the leaves. It grows in open woods, etc., at an altitude of about 2500 m.

WYOMING: Headwaters of Clear Creek and Crazy Woman River, 1900, *F. Tweedy, 3048* (type); Medicine Bow, 1898, *Elias Nelson, 4396*.

Carduus oblanceolatus sp. nov.

Apparently perennial. Stem rather slender, 3–6 dm. high, almost terete, densely white-tomentose: lower leaves about 1 dm. long, oblanceolate, thick, short-petioled, merely spinulose-dentate or rarely with a few triangular lobes, loosely floccose above, densely white-tomentose beneath, spines slender, 2–5 mm. long; upper leaves lanceolate, sessile and half clasping: heads 1–3, campanulate, 3–3.5 cm. high, 1.5–2.5 cm. broad: bracts slightly floccose at first, with a narrow glandular dorsal ridge, the outer ovate-lanceolate, the middle lanceolate, with a slender divergent spine, 3–5 mm. long, the innermost long-attenuate, unarmed: flowers rose-colored.

This species is nearest related to *C. Flodmanii*, differing in the more simple habit, the smaller, thicker, not pinnatifid leaves and shorter and weaker spines. From *C. altissimus* it differs in the denser tomentum, the simple habit, the narrower and fewer bracts and their narrower dorsal ridges.

COLORADO: Twin Lakes, 1896, *Fred. Clements, 385* (type).

Agoseris arachnoidea sp. nov.

Perennial with a tap-root, more or less floccose throughout. Leaves 1.5–2 dm. long, more or less runcinate-lobed, oblanceolate in outline, long-attenuate at the apex, densely floccose when young, more glabrate in age: scape 1.5–4 dm. high, densely woolly above, less so below: head 2–2.5 cm. high, 1.5–2 cm. broad: bracts in about 3 series, linear-lanceolate, long-attenuate, the inner one-third longer than the outer: flowers at least in age rose-purple: beak of the achenes fully as long as the body.

Perhaps nearest related to *A. aurantiaca* but differing in the larger heads, the dense pubescence and the lighter flowers. It grows in meadows at an altitude of 2000–2800 m.

COLORADO: Gray-Back Mining Camp, 1900, *Rydberg & Vreeland, 5553* (type); La Veta, 1896, *Fred. Clements, 167*.

Agoseris pubescens sp. nov.

Perennial with a tap-root and short branching caudex. Leaves narrowly oblanceolate, about 1 dm. long, .5–1 cm. wide, acuminate, slightly glaucous but even in age villous-pubescent: scape 1.5–2 dm. high, sparingly villous: involucre about 2 cm. high and 1.5 cm. wide, villous and somewhat viscid: bracts with a dark median line and sometimes tinged with purple, the outer ones ovate-lanceolate, about ⅔ the length of the linear-lanceolate long-acuminate inner ones: flowers lemon-yellow, the outer striate or tinged with purple: beaks of the achenes short and striate throughout.

This species is nearest related to *A. glauca* and *A. scorzoneraefolia* but differs in being very pubescent. It grows in moist meadows at an altitude of 2000–2500 m.

WYOMING: Big Horn Mountains, Sheridan County, 1899, *F. Tweedy, 2055* (type); Buffalo Fork, 1897, *578*; Amethyst Creek, 1899, *Aven & Elias Nelson, 5769* (in part).

Taraxacum Alaskanum sp. nov.

A low delicate plant with perennial root: leaves linear-oblanceolate in outline, 3–5 cm. long, deeply runcinate-pinnatifid with triangular retrorse lobes: scape 4–5 cm. high: involucre campanuate, 10–12 mm. high, 6–8 mm. broad: bracts fuscous, not corniculate; the inner linear-lanceolate, long-acuminate; the outer scarcely half as long, lanceolate, spreading or somewhat reflexed: achenes brownish, spinulose-muricate above, fusiform, 4 mm. long.

This in size and habit most resembles *T. scopulorum*, but is easily distinguished by its triangular acute lobes. It was found "on steep side bank facing the ocean."

ALASKA: Pt. Barrow, 1898, *McIlhenny*.

Crepis glaucella sp. nov.

Perennial with a slender tap-root. Stem slender, about 3 dm. high, glabrous and shining: basal leaves glabrous and shining, somewhat glaucous, thin, 5–10 cm. long; blades oblanceolate, acute at the apex, tapering downward into a more or less winged petiole, remotely sinuate-dentate with divaricate or retrorse short teeth or entire; stem-leaves 1–2, much reduced, 1–2 cm. long, linear or nearly so: heads 1–4, on slender branches: involucre turbinate, about 1 cm. high and 6–8 mm. wide, sparingly hirsute; bracts linear-lanceolate, acuminate: achenes brown, 10-striate, glabrous: pappus white.

This species is nearest related to *C. glauca* but differs in the smaller, narrower, longer-petioled leaves and hirsute involucre.

WYOMING: Pacific Creek, 1897, *F. Tweedy, 603*.

HIERACIUM MACRANTHUM Nutt. Trans. Am. Phil. Soc. II. **7**: 446. 1840

Hieracium umbellatum Hook. Fl. Bor. Am. **1**: 300, in part; Rydb. Mem. N. Y. Bot. Garden **1**: 463, mainly. Not L.

The plant of the Rocky Mountain region which has been referred to *H. umbellatum* and sometimes to *H. Canadense* is quite distinct from both. The leaves are usually broader than in the first but narrower than in the second and the heads are usually fewer than in either. The best character by which to distinguish it is, however, the pubescence. The leaves are densely puberulent and decidedly scabrous-ciliolate on the margins. The upper portion of the stem and the branches of the inflorescence are also scabrous-puberulent.

H. macranthum ranges from Wyoming and Washington northward to subarctic America. It apparently also extends eastward to the upper Mississippi River (Nicollet's specimens seem to belong here) and therefore may be Schweinitz' *H. scaberrimum*, which has been referred to *H. umbellatum* and *H. Canadense*. I have not seen Schweinitz' original description and can not venture an opinion. Nuttall's name belongs to the plant without any doubt.

Hieracium Columbianum sp. nov.

Perennial. Stem about 6 dm. high, terete, more or less tinged with purple, more or less white- or yellowish-hirsute below, glabrous or puberulent above: lower leaves oblanceolate, 8–10 cm. long, light green and somewhat glaucous beneath, usually more or less silky-hirsute, sinuately dentate, acute; the middle leaves lanceolate or ovate-lanceolate with rounded or obtuse base, sessile, more glabrate; the uppermost much reduced and bract-like: inflorescence corymbose-cymose, small and contracted: heads 2–6, 12–15 mm. high: bracts lanceolate, unequal and more or less imbricated, dark, puberulent when young, glabrous in age: pappus very light brownish.

This species is nearly related to *H. Canadense* and *H. umbellatum*, but differs from both in the long hairs of the lower part of the plant. The leaves are thin as in *H. Canadense* but narrower and the heads are fewer. It grows in low ground at an altitude of about 600 m.

IDAHO: Priest River Valley, 1900, *D. T. MacDougal, 109* (type); cañons near Farmington Landing, 1892, *Sandberg, MacDougal & Heller, 573*.

Still further Notes on the Agrimonies

By Eugene P. Bicknell

It so happens that only now, some months after its publication, have I read in this journal Dr. Robinson's defense of his expressed views as to the names which should be used in our group of agrimonies. Lest silence should be taken as giving assent, some further words may here be said touching the nomenclatorial disturbance which has developed around these modest plants. Let not the time-honored name of their genus bear any such irreverent modification as one of our British friends has ventured to suggest (James Britten, Journal of Botany, **39**: 152). It is not easy to discern any important reason why the discussion should be modeled too sharply after a salient character of the plants themselves which, after all, are provided with hooked prickles only in the beneficent way of nature. The third paper of the discussion is stripped of all such armament and the reply it must elicit here gladly follows its graceful lead. Nevertheless, a wide divergence of view on the points at issue must still be expressed.

Happily, the number of propositions at first in dispute are already reduced since he has frankly admitted that the names newly adopted for two of our species were incorrectly taken up.* But it should not be left unsaid that the names since adopted for these mistakenly substituted ones are equally ineligible for current use inasmuch as they cannot justly be made to supplant the names by which the plants in question were earlier distinguished.

The matters remaining in dispute are primarily these: (1) The right application of the name *Agrimonia striata* Michx. (2) The identity of *A. Brittoniana* with *A. pilosa* Ledeb. (3) The identity of *A. hirsuta* Muhl. (4) The status of distinctive names of species first used in a varietal sense.

1. Dr. Robinson argues that the *A. striata* Michx. is the same as my *A. Brittoniana*, basing his contention on the orig-

* *Agrimonia platycarpa* Wallr. for *A. mollis* Britton, and *A. microcarpa* Wallr. for *A. striata* Michx. (*A. glabra* Muhl.).

inal description of the plant and on one of the specimens on the existing sheet of *A. striata* in the Michaux herbarium. Of the original description it may at once be said that it applies better to *A. Brittoniana* than to any other one of our species. A moment's thought, however, will show that this essential agreement is in itself quite inconclusive. If there were no such plant as *A. Brittoniana* the description would unquestionably be held to apply with sufficient exactness to several of our species and, as a matter of fact, was so held during the long period within which *A. Brittoniana* remained undistinguished. The description is, in fact, almost generic, and specimens of *A. hirsuta* (Muhl.), *A. glabra* (Muhl.) and *A. mollis* Britton may be compared character by character with the description and be found to come sufficiently within it. It cannot be claimed therefore that Michaux's description is in itself so thorough-going as to exclude all but a single one of several critically similar species. But even assuming that it was principally derived from a specimen of the plant now known as *A. Brittoniana*, Michaux's name would still be unavailable.

The existing sheet of *A. striata* in the Michaux herbarium at Paris shows that the species as originally put forth was a composite one. Upon the sheet are two distinct plants both labeled *A. striata*, one being *A. Brittoniana*, the other *A. glabra* (Muhl.). It is, of course, well-established practice that the first critical student of a mixed species has the privilege of restricting the original name and applying it definitively to either of the two or more component plants. In this case of the composite *A. striata* Michx. this was long ago done, and in no uncertain way, by Dr. Gray. The name *A. striata* was thus carefully limited by him to that part of the original *A. striata* later distinguished by Muhlenberg as *A. Eupatoria glabra*. I cannot see how this long-standing disposition of the matter can now be reversed, even though the balance of probabilities—certainties in this case are now quite beyond our reach—should favor the view that, possibly with better reason, Dr. Gray might have restricted the name *A. striata* to that one of the component specimens other than the one he chose. For his own reasons which may well have been, and doubtless were, better than we can now know, he did so limit the name, at his right was, and in unmistakable terms. Other material of which we now know nothing may well have been available to him at that time to influence his determination, at any rate any amount of argument as to what might, could, would or should have been done can be of no avail as against what actually was done, and on matters of that kind we may well hesitate to attack the wisdom of Dr. Gray.

In attempting to correlate an actual specimen of a plant with a written description there is always a very natural tendency to read into the words of the description the particular characters of the specimen seeking determination. Descriptive terms must necessarily be more or less elastic owing to the great variability in the characters of organic beings and it is well, therefore, always to guard against a too formal understanding of such terms or to attach to them an adequacy which nature itself is certain to repudiate. It follows that a very brief description of a plant which may be quite sufficient in the case of a monotypic species is very apt to be found to be little more than generic if the species finally proves to be only one of a closely related group. The description of *A. striata* Michx. is, as already shown, a case in point. Contrariwise, in the case of the plant *A. glabra* (Muhl.) which forms part of the type of *A. striata* Michx., it will not do to insist too strongly on the character of "globular fruit," a term which wholly fails to cover the great variability in the fruit of this species. At full maturity its fruit is often perfectly graduated to the base—fairly turbinate on a not too narrow understanding of that term—which may on may not be somewhat curved, the very character from which Wallroth derived the specific name *rostellata*. So, too, the fruit becomes definitely reflexed, if less conspicuously so than in *A. Brittoniana*, and in some of its variations may well be described as sulcate and crowned by the bristles just as is called for by Michaux's description. It may be said further that *A. Brittoniana* is by no means always so sharply distinguished in its characters as to be readily separable from specimens of *A. hirsuta* or *A. mollis*, and specimens occur which need careful discrimination in order to be confidently distinguished.

In discussing *A. Brittoniana* Dr. Robinson has more than once referred to the "first mentioned type," a phrase absolutely without meaning when applied to a species of which an exclusive type has been set apart. It so happens that the plant thus referred to was somewhat ambiguous and took first place in the list of specimens examined only for the purpose of showing continuity in the range indicated.

2. It is, of course, quite possible that Dr. Robinson may be right in his contention that my *A. Brittoniana* is identical with the *A. pilosa* Ledeb. of Continental Europe, but his later reference to the matter seems to imply some recession from his earlier confidence in his position, and to my own mind the balance of probabilities is quite against this view. It is clear that the question must remain an open one subject to final settlement only by further critical study.

3. I have already given in detail the reasons which establish conclusively the identity of Muhlenberg's *A. Eupatoria hirsuta.* These reasons are made to appear all the more cogent from Dr. Robinson's later support of his dissenting view which finally rests alone on the purely fanciful supposition that the plant may have been a more hairy form of his *A. Eupatoria glabra.* The latter species does indeed, in rare cases, become somewhat hairy, but to suppose that this unusual state of the plant was regarded by Muhlenberg as its primary type is wholly untenable. Moreover *A. glabra* never approaches in hairiness the true *A. Eupatoria* of which Muhlenberg's *hirsuta* is made a variety. It is absurdly beyond reason to contend that so astute a botanist as Muhlenberg would make a variety *hirsuta* of a plant far less hairy than its parent type.

The essential thing in regard to Muhlenberg's *A. Eupatoria hirsuta* is that it recognizes the capital fact that the common American plant, by Muhlenberg so considered, was distinct from the European. For the purpose of the present use of Muhlenberg's name it matters not at all whether its original use was for a particular one of several species, as we have since learned to understand them, or was more general in its application. The name was given to confer a merited distinction on a common American plant, whether exclusively or only in part to the particular species to which I have restricted it, is not of the least present consequence.

The position that a distinctive name for a new species, because first used as a varietal designation, should be denied any future recognition, involves a disregard of the simplest principles of justice that, in the nature of the case, can never receive any right following. That a moral principle should fall because of inconvenience in applying it, is a proposition hopelessly shut out from any justification. The moral flaw would instantly appear if in to-day's practice a plant described by one author as a variety should be by a promptly succeeding author claimed as a species under a different name. Even on the most irresponsible utilitarian grounds it may be seriously doubted whether the advantages claimed for the practice advocated would not be far outweighed by its subversion of much accepted nomenclature.

In conclusion it may be reiterated that, in the course of this discussion, nothing has been brought forward which at all justifies the displacement of any of the names adopted in my review of the American species of this troublesome genus.

Dacryopsis Ellisiana Massee

By George Massee

In Mr. Durand's interesting researches on the genus *Holwaya* Sacc., which appeared in the June number of this journal, the author has clearly proved that *Holwaya gigantea* Durand has a conidial form. This conidial form Durand calls *Coryne Ellisii* Berk.

Some years ago I gave a full diagnosis * of *Coryne Ellisii* Berk., drawn up from the type specimen, and discovering that it was a Basidiomycete, named it *Dacryopsis Ellisiana*.

Arguing from the material Durand supposed to be *Coryne Ellisii* Berk., this author remarks as follows: "The matter was further greatly complicated when Massee, in 1894, described the type of *Coryne Ellisii*, making it one of the types of a new genus of the Basidiomycetes, called *Dacryopsis*."

I have again examined Berkeley's type and find that my previous description is correct. The plant resembles a little stout-handled drumstick. The head for some time consists of very slender conidiophores bearing very minute conidia; at a later stage bifurcate basidia also appear in the head.

The explanation is quite simple. The *Coryne Ellisii* of Durand is not the *Coryne Ellisii* of Berkeley. Why Durand has made such a mistake I am not able to say. The type specimen of *Coryne Ellisii* Berk. is in excellent condition, and I have sent a fragment of it to Mr. Durand.

I observe that the specimen in Ellis, N. Amer. Fung. 1383, called "*Coryne Ellisii* Berk. (=*Stilbum giganteum* Pk.)," although superficially resembling *Coryne Ellisii* Berk., is in reality a very different fungus, and probably illustrates what Durand has been dealing with and who, like Burt in his paper, "Is there a Basidiomycetous stage in the life history of some Ascomycetes," had been misled by accepting the specimen in the exsiccati quoted above as representing the species described by Berkeley.

The above account illustrates the value of a type-specimen, *i. e.*, the actual specimen on which the species was founded, and not another specimen supposed to represent the same species. It urther illustrates the advisability of being quite certain about your species before venturing to indicate mistakes made by others.

* Jour. Myc. **6**: 181, *pl. 7. f. 19–21.* 1891.

Index to recent Literature relating to American Botany

Allen, C. E. On the Origin and Nature of the Middle Lamella. Bot. Gaz. **32**: 1–34. 24 Jl. 1901.

Arthur, J. C. Damping off of Beets in the Field. Ann. Rep. Indiana Agric. Exper. Sta. **13**: 15, 16. F. 1901.

Arthur, J. C. Formalin and Hot Water as Preventives of Loose Smut of Wheat. Ann. Rep. Indiana Agric. Exper. Sta. **13**: 17–24. F. 1901.

Arthur, J. C. The Asparagus Rust. Ann. Rep. Indiana Agric. Exper. Sta. **13**: 10–14. F. 1901.

Arthur, J. C. & Holway, E. W. D. Descriptions of American Uredineae, III. Bull. Lab. Nat. Hist. State Univ. Iowa, **5**: 171–193. *pl. 1–4. & f. 1–5.* My. 1901.

Arthur, J. C. & Holway E. W. D. Violet Rusts of North America. Minn. Bot. Stud. **2**: 631–642. *pl. 47.* 20 Jl. 1901.

Ashe, W. W. New North American Plants—Some new Species of *Crataegus*. Bull. N. C. Agric. Exper. Sta. 175: 109–114. Au. 1900.

Includes twenty-one species from eastern America.

Ashe, W. W. Notes on some dichotomous Panicums. Bull. N. C. Agric. Exper. Sta. 175: 115, 116. Au. 1900.

Includes eight species from eastern America.

Bennett, A. Notes on *Potamogeton*. Jour. Bot. **39**: 198–201. Je. 1901.

Britten, J. Bibliographical Notes. XXVIII.—Periodical Publications. Jour. Bot. **39**: Jl. 1901.

Britton, N. L. Thomas Conrad Porter. Bull. Torr. Club, **28**: 369–373. *Portrait.* Jl. 1901.

Bolley, H. L. & Waldron, L. R. A preliminary List of the Spermaphyta, seed-bearing Plants of North Dakota. Bull. N. D. Agric. Exper. Sta. **46**: 591–681. D. 1900.

Bryhn, N. *Scapania Evansii* n. sp. Bryologist, **4**: 45, 46. Jl. 1901.

Butters, F. K. A preliminary List of the Minnesota Xylariaceae. Minn. Bot. Stud. **2**: 563–568. 20 Jl. 1901.

Campbell, R. Additional Notes on the Flora of Cap-à-l'Aigle. Can. Rec. Sci. **8**: 281–295. Ja. 1901.

Cannon, W. A. The Anatomy of *Phoradendron villosum* Nutt. Bull. Torr. Club, **28**: 374–390. *pl. 27, 28.* Jl. 1901.

Chamberlain, C. J. Methods in Plant Histology; 8vo. 1–159. *f. 1–74.* Chicago, 1901.

Clute, W. N. Use of Fern Names. Bot. Gaz. **31**: 446, 447. 20 Je. 1901.

Cockerell, T. D. A. *Potamogeton polygonifolius* in Newfoundland. Bot. Gaz. **32**: 58–60. 24 Jl. 1901.

Copeland, E. B. Studies on the Geotropism of Stems. Bot. Gaz. **31**: 410–422. *f. 1–3.* 20 Je. 1901.

Fairchild, D. G. Notes of Travel, VI. The Botanical Institute of Netherlands India. Bot. Gaz. **31**: 423–425. 20 Je. 1901.

Fanning, M. G. Observations on the Algae of the St. Paul City Water. Minn. Bot. Stud. **2**: 609–618. *pl. 44–46.* 20 Jl. 1901.

Fischer, A. Die Bakterienkrankheiten der Pflanzen. Antwort an Hernn Dr. Erwin F. Smith. Centralbl. Bakteriologie, Parasitenkunde und Infektionskrankheiten, **5**: 279–287. 1899.

Flahault, C. A Project for Phytogeographic Nomenclature. Bull. Torr. Club, **28**: 391–409. Jl. 1901.

Translation of a paper read at the International Botanical Congress, Paris, October, 1900.

Freeman, E. M. A preliminary List of Minnesota Uredineae. Minn. Bot. Stud. **2**: 537–560. *pl. 32.* 20 Jl. 1901.

Ganong, W. F. A laboratory Course in Plant Physiology. 8vo. 1–147. *f. 1–35.* New York, 1901.

Ganong, W. F. The Cardinal Principles of Morphology. Bot. Gaz. **31**: 426–434. 20 Je. 1901.

Grout, A. J. *Climacium* Web. & Mohr, Iter. Suec. 96. 1804. Bryologist, **4**. 52–55. Jl. 1901. [Illust.]

Grout, A. J. Two new varieties of *Brachythecium.* Bryologist, **4**: 48. Jl. 1901. [Illust.]

Brachythecium rivulare laxum and *B. collinum Holzingeri* Grout.

Hall, H. M. Studies on California Plants, I. Bot. Gaz. **31**: 388–393. *pl. 10.* 20 Je. 1901.

Two new species in *Frasera* and *Gilia.*

Harris, C. W. Lichens—*Cetraria.* Bryologist, **4**: 41–45. Jl. 1901. [Illust.]

Heller, A. A. Thomas Conrad Porter. Plant World, **4**: 130, 131. *pl. 8.* Jl. 1901.

Holzinger, J. M. A green *Trillium.* Plant World, **4**: 132. *pl. 9.* Jl. 1901.

Humphrey, H. B. Observations on *Gigartina exasperata* Harv. Minn. Bot. Stud. **2**: 601–608. *pl. 42.* 20 Jl. 1901.

Irish, H. C. Garden Beans cultivated as Esculents. Rep. Mo. Bot. Garden, **12**: 81–165. *pl. 38–47.* 1901.

Lange, D. The Revegetation of Trestle Island. Minn. Bot. Stud. **2**: 621–630. 20 Jl. 1901.

Life, A. C. The Tuber-like Rootlets of *Cycas revoluta.* Bot. Gaz. **31**: 265–271. *f. 1–10.* 15 Ap. 1901.

Lyon, H. L. Observations on the Embryogeny of *Nelumbo.* Minn. Bot. Stud. **2**: 643–655. *pl. 48–50.* 20 Jl. 1901.

MacMillan, C. The Growth Periodicity of the Potato Tuber. Bull. Minn. Acad. Nat. Sci. **3**: 355–362. 1901.

Macoun, J. M. Contributions to Canadian Botany. XIV. Ottawa Nat. **15**: 71–79. 1 Je. 1901.

Maxon, W. R. *Polypodium hesperium,* A new Fern from Western North America. Proc. Biol. Soc. Washington, **13**: 199, 200. 21 D. 1900.

Meehan, T. *Apios tuberosa.* Meehan's Monthly, **11**: 81, 82. *pl. 6.* Je. 1901.

Mohr, C. Plant Life of Alabama. An Account of the Distribution, Modes of Association, and Adaptations of the Flora of Alabama, together with a systematic Catalogue of the Plants growing in the State. Contr. U. S. Nat. Herb. **6**: 1–921. *pl. 1–13.* 31 Jl. 1901.

Includes several new species.

Nelson, A. Contributions from the Rocky Mountain Herbarium. II. Bot. Gaz. **31**: 394–409. 20 Je. 1901.

New species in *Parosela, Petalostemon, Gentiana, Polemonium, Oonopsis, Eupatorium, Coleosanthus, Kuhnia* (4), *Lacinaria* (2) and *Arnica* (4).

Niedenzu, F. De Genere Brysonima. Arbeit aus dem. bot. Inst. kgl. Lyceum Hosianum, in Braunsberg, Ostpreussen. 1–47. 4to. Braunsberg. 20 Je. 1901.

Pierce, N. B. Walnut bacteriosis. Bot. Gaz. **31**: 272, 273. 15 Ap. 1901.

Pseudomonas juglandis, new species.

Pollard, C. L. The Rochester Code Bot. Gaz. **31**: 285, 286. 15 Ap. 1901.

Preston, C. E. Structural Studies on Southwestern Cactaceae. Bot. Gaz. **32**: 35–55. *f. 1–9.* 24 Jl. 1901.

Rehder, A. Note on *Basilima* and *Schizonotus* of Rafinesque. Bot. Gaz. **32**: 56–58. 24 Jl. 1901.

Rendle, A. B. A new *Philodendron.* Journ. Bot. **39**. Au. 1901.
Philodendron crassum Rendle, a plant cultivated in England, supposed to have been brought from Brazil.

Rolfs, P. H. Florida Lichens. Trans. St. Louis Acad. Sci. **11**: 25–39. 16 Mr. 1901.
List of 176 species.

Sargent, C. S. New or little-known North American Trees. III. Bot. Gaz. **31**: 217–240. 15 Ap. 1901.
New species in *Crataegus* (12), *Betula* and *Cupressus.*

Saunders, D. A. A new species of *Alaria.* Minn. Bot. Stud. **2**: 561–562. *pl. 33.* 20 Jl. 1901.
A. curtipes from California.

Schaffner, J. H. A Contribution to the Life History and Cytology of *Erythronium.* Bot. Gaz. **31**: 369–387. *pl. 4–9.* 20 Je. 1901.

Shear, C. L. Our Puffballs.—IV. Plant World, **4**: 124–127. *f. 1.* Jl. 1901.
Compiled descriptions of *Tylostoma* and *Geaster.*

Sheldon, E. P. Preliminary notes on the Epinasty and Hyponasty of *Rhaphanus* Cotyledons. Bull. Minn. Acad. Nat. Sci. **3**: 362–369. 1901.

Sherborn, C. D., & Woodward, B. B. The Dates of Humboldt and Bonpland's "Voyage." Jour. Bot. **39**: 202–205. Je. 1901.

Shimek, B. Addenda to the Flora of Lyon County (Iowa). Bull. Lab. Nat. Hist. State Univ. Iowa, **5**: 215, 216. My. 1901.

Smith, E. F. Are there Bacterial Diseases of Plants? A Consideration of some Statements in Dr. Alfred Fischer's Vorlesungen uber Bakterien. Centralbl. Bakteriologie, Parasitenkunde und Infections-krankheiten, **5**: 271–278. 1899.

Smith, E. F. Dr. Alfred Fischer in the Rôle of Pathologist. Centralbl. Bakteriologie, Parasitenkunde und Infektionskrankheiten, **5**: 810–817. 1899.

Smith, E. F. Entgegnung auf Alfred Fischer's "Antwort" in Betreff der Existenz von durch Bakterien verursachten Pflanzenkrankheiten. Centralbl. Bakteriologie, Parasitenkunde und Infektionskrankheiten, **7**: 88–199. *pl. 1–11.* 1901.

Thaxter, R. Preliminary Diagnoses of New Species of Laboulbeniaceae.—IV. Proc. Amer. Acad. Arts and Sci. **37**: 21–45. Je. 1901.

New species in *Eumonoicomyces* (gen. nov.) (2), *Monoicomyces* (3), *Euhaplomyces* (gen. nov.), *Eucanthomyces*, *Dichomyces* (5), *Peyritschiella*, *Chitonomyces* (5), *Dioicomyces* (gen. nov.) (3), *Teratomyces* (3), *Acompsomyces* (gen. nov.), *Stichomyces* (gen. nov.), *Rhachomyces* (3), *Sphaleromyces* (3), *Corethromyces* (2), *Ceratomyces* (5), and *Kainomyces* (gen. nov.).

Townsend, C. O. The Effect of Hydrocyanic Acid Gas upon Grains and other Seeds. Bot. Gaz. **31**: 241–264. *f. 1–6.* 15 Ap. 1901.

Trelease, W. A Pacific Slope Palmetto. Rep. Mo. Bot. Garden, **12**: 79, 80. *pl. 35–37.* 16 Ap. 1901.

S. Uresana from Sonora.

Wheeler, W. A. A Contribution to the Knowledge of the Flora of the Red River Valley in Minnesota. Minn. Bot. Stud. **2**: 569–600. *pl. 34–41.* 20 Jl. 1901.

Wheeler, W. A. Notes on some Plants of Isle Royale. Minn. Bot. Stud. **2**: 619, 620. 20 Jl. 1901.

White, D. Some Palaeobotanical Aspects of the Upper Palaeozoic in Nova Scotia. Can. Rec. Sci. **8**: 271–280. Ja. 1901.

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Memoirs. (See last page of cover.)

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BULLETIN

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TORREY BOTANICAL CLUB

OCTOBER 1901

A Synopsis of the Palms of Puerto Rico

By O. F. Cook

(With Plates 43-48)

The following systematic notes have been accumulated in connection with economic studies of Puerto Rico* palms, and although the list is doubtless still incomplete, the printing of it may be justified as a means of securing at least provisional names needed for reference purposes in connection with other publications of a non-systematic character.

The palms may well be considered a very refractory group when handled by the conventional methods of systematic botany. Difficult at once to collect or to study from dried material, they are commonly neglected both in the field and in the herbarium, with the result that literature is scanty and unsatisfactory. A very large proportion of the descriptions are entirely inadequate for the identification of species, and there has been much lawlessness and diversity in the application of generic names, as will appear from some of the instances discussed below. Difficulties of description and classification have also been multiplied by the fact that the palms are such peculiar plants that analogies and criteria borrowed from other families are often inapplicable and misleading. Moreover, the terminology of parts and characters has not been developed to the point where the expression of observed differences is easy, and available language often fails completely to suggest the significance of the characters used. Thus the fibers into which parts of the leaf-bases of many palms are resolved afford many

* This spelling and the adjective use of the name in this form are editorial corrections.

[Issued 26 October]

diagnostic characters, for which we have no parallels in other groups of plants.

A compensating advantage may be drawn, however, from the definite and often very limited geographical distribution of the species of palms. Thus, although Puerto Rico is a relatively small island, several of the indigenous palms have apparently ranged in nature over but a small part of it, and a locality definitely indicated would often go further toward establishing the identity of a species than much of the descriptive matter prepared for this purpose. For the present, at least, the geographical idea should be kept uppermost in systematic studies of the palms, since it is generally much easier and far more logical to extend the limits of supposed distribution and unite supposed species, than to cope with the confusion caused by the miscellaneous reporting of species far outside their natural ranges.

From the popular standpoint another serious inconvenience of the systematic literature of palms arises from the fact that it is based so largely on floral characters that even the botanical traveler might need to wait months for the blossoms and then climb the trees or cut them down before being able to secure a clue to botanical names or relationships. But however necessary refinements of formal characters may be in presenting classifications or monographs of large groups, more obvious differences may still be adequate for distinguishing between the species, genera and families represented in a limited flora like that of Puerto Rico. In the present paper use is made therefore of obvious external differences, not only because of the greater convenience and utility of such facts in field study but also in the belief that with the palms, at least, the vegetative, habital and ecological features are often quite as important for diagnostic purposes as the more technical and conventionalized characters to which botanists are accustomed in dealing with other natural orders.

As will be apparent from some of the following systematic notes, the generic nomenclature of the palms is in a condition closely comparable to that now known to obtain among the myxomycetes, fungi, hepaticae and ferns. Possibly the palms have suffered more from neglect and carelessness than other groups of flowering plants, but it can no longer be maintained that the practical defects of former taxonomic methods do not exist in the phanerogams as well as in the cryptogams, and it becomes obvious that the enactment of different nomenclatorial legislation for these two subdivisions of the vegetable kingdom would be unreasonable and inconsistent.

The present list records twenty palms from Puerto Rico, of which three are introduced and seventeen are supposed to be native species. As may also be inferred from many other groups of plants Puerto Rico appears to be a rather remote corner of the Antillean region, which many types present in Cuba and Jamaica did not reach, whether by reason of greater distance from the continent or because of an earlier interruption of land communication. The native palms of Puerto Rico may thus be said to represent a distinctly Antillean or Caribbean series, only *Acrocomia* and *Bactris* being known to have a wider distribution.

The list of introduced palms, consisting of the date, the cocoanut, and the betel, might have been somewhat increased by canvassing ornamental gardens, but it does not appear that any other introduced species has been put to any useful purpose or has escaped into general culture, certainly a remarkable fact when we consider the number and importance of the economic palms of other tropical countries.

Finally, it may be well to note here that several palms have been reported from Puerto Rico which probably do not exist in the island; at least their occurrence is not supported by adequate evidence. Thus Mr. R. T. Hill, of the United States Geological Survey, mentions (Bull. U. S. Dept. Agric., Division of Forestry, 25: 1899) as occurring in Puerto Rico seven palms, as follows: *Cocos Mauritia*, *Oreodoxa oleracea*, *Cocos nucifera*, *Martinezia caryotaefolia*, *Mauritia flexuosa*, *Oreodoxa regia*, and *Caryota* sp., of which list only *Cocos nucifera* and *Oreodoxa regia* appear to have been justified.

The reference to *Oreodoxa oleracea* is supported by the botanical authority of Professor Drude, but the specimens identified by him as *Oreodoxa oleracea* (Sintenis collection, no. 1525) and sent from the Berlin Botanical Garden to the National Herbarium and to the New York Botanical Garden are not *Oreodoxa oleracea*, but belong to the new genus *Acrista* described below, while a specimen collected by Sintenis (no. 5749) at Aguadilla and sent out from Berlin as an *Attalea* or related genus is not even a cocoid palm but *Areca catechu*, the betel nut of the Malay region.

The existence of numerous tubercles on the roots of a young specimen of the royal palm of Puerto Rico is a fact of biological interest and possible economic importance. It was, however, noted so nearly at the end of our last visit that further studies were not practicable, but barring possible nematodes or other pathological causes for the tubercles it appears that we must add palms to the Leguminosae, *Podocarpus*, *Alnus*, and *Cycas* as plants which have, as it were, domesticated nitrogen-collecting soil organisms.

The field notes, specimens and a considerable series of illustrations for publications of the Department of Agriculture were secured during two visits to Puerto Rico, the first in November and December, 1899, the second in June and July, 1901. The photographs are the work of Mr. G. N. Collins.

Key to the Families

Leaves fan-shaped; branches of inflorescence subtended by spathes.
Family SABALACEAE, p. 529.

Leaves feather-shaped; spathes few, not subtending the branches of the inflorescence.

- Leaf-divisions v-shaped in section, concave above; trunk rough with leaf-bases or prominent diamond-shaped scars. Family PHOENICACEAE, p. 528.
- Leaf-divisions inverted v-shaped in section, convex above; trunk smooth or the leaf-scars ring-like and not prominent.
  - Leaf-bases long-sheathing, green and fleshy, finally split down the side opposite the midrib permitting the leaf to fall; fruits with fleshy, fibrous or woody endocarps. Family ARECACEAE, p. 546.
  - Leaf-bases sheathing only while young, with maturity separating, except at the midrib, into a dry fibrous network which must tear or decay before the leaves fall; fruits with a stony endocarp perforated by three foramina. Family COCACEAE, p. 558.

Family PHOENICACEAE

This family contains a single genus of old-world palms usually associated with the fan-leaved series, and differing from all other feather-palms by having the concave side of the leaf segments turned upward.

PHOENIX DACTYLIFERA Linn. Sp. Pl. 1188. 1753

The date palm was probably introduced into Puerto Rico in the early part of the Spanish occupation of the island, and isolated trees are to be found in many localities especially in the vicinity of the larger towns. The climate is, however, too cool and too moist to permit the fruit to ripen properly, and there is apparently no inducement for planting in large quantities.

Family SABALACEAE

Although forming no conspicuous part of the palm vegetation of the island the fan-leaved species seem to be more numerous than those of any other family. It is certain also that further species remain to be discovered, since in addition to the species listed below, young inflorescences supposed to belong to a *Copernicia* were collected by Sintenis (no. 6512) near Utuado, and he also collected two other *Thrinax*-like palms of doubtful identity, one near Cabo Rojo and one at Fajardo.

Key to the Genera of Sabalaceae

Leaves depressed in the middle, with a distinct decurved midrib; a slender fiber rising from each of the notches which separate the leaf segments. INODES.

Leaves flat, midrib rudimentary; segment without alternating fibers.

- Leaves chartaceous, naked on both sides when mature, the veinules unequal; fruits nearly sessile; seeds smooth, albumen solid except for a deep basal cavity. THRINAX.
- Leaves tough and coriaceous, the lower surface silvery with a persistent, closely appressed pubescence; veinules equal; fruits distinctly pedicellate; seeds deeply grooved or furrowed.
  - Trunk tapering upward, tall and slender; pedicels short, bracteate at base; seeds subspherical, ruminate with deep narrow grooves; surface with a dull membranous cuticle. THRINCOMA.
  - Trunk columnar, of equal diameter or enlarged upward; pedicels long, bracteate above the base; seed naked, smooth and shining, cerebriform, the surface irregular with broad furrows and convolutions. THRINGIS.

Inodes gen. nov.

In this genus, of which the hat palm of Puerto Rico may be considered the type, it is proposed to accommodate the dendroid palms commonly referred to *Sabal*, the type of which is *S. Adansonii* Guersent. The most conspicuous difference between *Inodes* and *Sabal* is, of course, the fact that the former produces an upright trunk while the latter has only what might be called an underground rootstock, although such a distinction is quite artificial, both groups of species beginning life with a creeping axis which becomes erect in one and remains horizontal in the other. A much more important difference is to be found in the leaves which in *Inodes* have secured strength by the development of a midrib, a tendency early abandoned by *Sabal* in which the midrib is rudimentary and the middle of the leaf is the weakest part. The leaves of *Sabal* are adapted for standing erect and avoid resistance to the wind by being split down the middle. The leaves of *Inodes* which are held horizontal from an erect axis have attained the unique adaptation of a decurved midrib which braces the sloping sides of the leaf and effectively prevents the breaking above the ligule common in some of the species of *Thrinax*. It is true that leaves of young specimens of *Inodes* stand erect like those of *Sabal* and do not have the curved midrib, but even at this stage the midrib is relatively well developed and the blade opens out to an almost circular form instead of occupying an arc of 180 degrees or less as in the more strictly flabellate leaves of *Sabal*.

Further differential characters might be enumerated, such as the short ligule and the flat petiole of *Sabal*. The inflorescence and seeds also afford differences, but these points are unnecessary for diagnosis, and their proper expression will require careful comparative study of the species of both genera, since *Sabal* is not monotypic but includes at least two species from the Southern States and perhaps *S. Mexicana* Martius. Guersent's *S. Adansonii*, the first binomial species to which the name *Sabal* was applied, is, to judge from the figure, the smaller of our species, while Jacquin's *Corypha minor* may be the larger. Both species were described from hothouse specimens and the plates give no details really adequate for identification, but if there are but two species to be considered there can be little doubt that Jacquin's drawing represents the larger of the two forms commonly referred to *Sabal Adansonii*, since the leaves are nearly four feet long with the mesial divisions united somewhat less than half way up. The basal segments are represented, however, as diverging horizontally and not obliquely as is usual in the living plants in the greenhouses of the Department of Agriculture.

Guersent maintained that he was dealing with the *Sabal* which Adanson had in mind in naming the genus, and made his specific name in accordance with that fact, treating *Corypha minor* Jacquin, *Corypha pumila* Walter and *Chamaerops acaulis* Michaux as synonyms. The relative merits of these names and of *Chamaerops* *glabra* Miller, which Dr. Sargent (Silva, **10**: 38) has resurrected, are not likely to be easy of determination, but since the last was based on plants grown from seeds which came from Jamaica, it seems unwise to use it for United States species to which the description is inapplicable. Miller's name may, however, replace *Sabal taurina* Loddiges which was also founded on a stemless *Sabal* supposed to come from Jamaica.

The species of *Inodes* are in a similar or even worse state of disorder. There is little use, for example, in transferring to the new genus the traditional name *umbraculifera* which was based by Martius on the *Corypha umbraculifera* of Jacquin, but not on Linnaeus' species of the same name, which is a native of Ceylon. Present taxonomic methods forbid such generic transfers of misapplied names, so that the name **Inodes Blackburniana** (*Sabal Blackburniana* Glazebrook, Gardener's Mag. **5**: 52. 1829) should be used instead of the traditional *Sabal umbraculifera* of the conservatories, though the identity and origin of the species still remain in doubt.

Inodes causiarum sp. nov.

Trunk 45–75 cm. thick at base, 5–15 m. tall, columnar or slightly tapering upward; surface narrowly rimose or nearly smooth, light gray or nearly white. Leaf-bases splitting into rather brittle fibers, partly remaining compacted into long ribbons 5–8 cm. wide. Leaves about 4 m. long, the petiole subequal to the blade, considerably exceeded in length by the inflorescence. Petiole 3.8 cm. wide, distinctly carinate above near the end; ligule 4.2 cm. in diameter. Fruit grayish, 9–10 mm. in diameter; seed chestnut-brown, finely rugose or nearly smooth, 7–8 mm. in diameter; embryo oblique, at an angle of somewhat less than 45 degrees from the horizontal. Type specimen from Joyua (no. 154).

The palm-leaf hats manufactured in large quantities in Puerto Rico are made from the present species. The center of the hat industry is at Joyua, a small village on the western coast of the island some miles southwest of Mayaguez and west of Cabo Rojo. Here many hundreds of the palms are growing along the shore in a narrow belt of coral sand.

From the two species of *Sabal* recognized by Grisebach *Inodes causiarum* differs from *umbraculifera* in having the inflorescence much longer then the leaves, while the trunk and leaves are much shorter and thicker than in *Sabal mauritiiformis* a native of Trinidad and Venezuela which appears from Karsten's figure, reproduced in the Natürlichen Pflanzenfamilien, to have neither the leaves nor the habit of an *Inodes* though there is no other genus to which it can be referred with greater propriety. The diameter of the trunk of the Trinidad palm described as *S. mauritiiformis* is given as from 12 to 15 inches, while *I. causiarum* is often two feet or more thick.

From the Florida palmetto, **Inodes Palmetto** (*Corypha Palmetto* Walter, Fl. Carol. 119. 1788) the Puerto Rico species differs most conspicuously in not retaining the old leaf-bases which give the trunk of the Florida palm so rough an appearance. The cause of this difference is doubtless to be found in the fact that as with most other palms the trunk of *I. Palmetto* grows to full size while the surrounding leaf-bases are still alive, but in the West Indian species the trunk tapers greatly, especially in young trees, and the leaf-bases are torn away by its gradual enlargement to full diameter. The existence in southern Florida of an *Inodes* having this last characteristic is a fact of much interest recently brought to my attention by Mr. E. A. Schwarz, of the U. S. Department of Agriculture. The specific distinctness of this palm was impressed upon Mr. Schwarz, not only by its naked trunk, different habit, and smaller size (5 m., instead of 10 to 20 m.), but also by the possession of a distinctly tropical insect fauna, quite different from that of the more northern palmetto with which he had previously been familiar.*

This new Florida species it gives me pleasure to name **Inodes Schwarzii** in honor of its discoverer, in whose opinion of its distinctness I have great confidence, although he makes no claims to botanical skill. It is confined, as far as observed by Mr. Schwarz, to the coral reef formation of southern Florida, the most accessible station visited being about one mile south of Co-

* Of numerous insects distinctive of the more southern palmetto the most conspicuous is a longicorn beetle, *Agallissus chamaeropis* Horn, the larvae of which bore in the leaf-bases. The more common *Inodes* is inhabited by the allied genus *Zagymnus*, though another species of *Agallissus* is reported from Texas, where the native *Inodes* is of the smooth-trunked type.

coanut Grove on the coral reef of the mainland side of Biscayne Bay. In the vicinity of Snapper Creek, *Inodes Schwarzii* extends to the Everglades where it is met by *I. Palmetto.* It was also seen on the Perrine Grant about six miles from Cocoanut Grove; it seemed not to occur about Miami but reappeared with the appropriate formation and attendant fauna at New River, thouhg again absent at Lake Worth. A photograph secured by Mr. H. J. Webber (negative 164) on Taby Island near Long Key shows an *Inodes* with a naked trunk and a smaller crown of straighter leaves than are normal for *I. palmetto.* Messrs. Swingle and Webber had also remarked the distinctness of the smooth-trunked palmetto of South Florida.

A third robust species of *Inodes* is growing in the conservatory of the Department of Agriculture labeled *Sabal umbraculifera.* It differs conspicuously from *I. causiarum* by the very large leaves and by the great development of fine brown fibers which fill all the interstices between the leaf bases, and suggest the name **Inodes vestita.*** Photographs of both the species have been prepared for the illustration of comparative detailed descriptions.

Sabal Mexicana has been reported from Cuba, and as it is described in Sargent's Silva (**10**: 43) as having a trunk "often 2½ feet in diameter," a robustness equalled only by the Puerto Rico trees, the question of its identity was examined. It appears that the original of *S. Mexicana* came from southern Mexico and is a trunkless or very slender, rather than a robust species, being only about 10 cm. in diameter. The berry and the seed are de-

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* **Inodes vestita** sp. nov. Trunk about 45 cm. thick at base, columnar or tapering upward; surface rimose, the chinks commonly 5 mm. wide and 20 mm. apart. Leaf-bases torn into very numerous, fine, hair-like, light reddish-brown fibers, a few much coarser than the others and measuring from .6 to 1 mm. in diameter. The epidermis separates into delicate membranous shreds, the surface of which is delicately pitted and sparsely beset with brownish hairy-margined peltate scales. Petiole 10 cm. or upward in width below near where it begins to split, 4.5 cm. wide at base of ligule; 3 m. long, concave above; blade 2.13 m. long, 2.50 m. wide, composed of about 60 segments, the apical united more than two-thirds their length, the basal for less than one-third; apical segments 4.5 cm. wide, deeply divided above, a long fiber terminating both the longer and the shorter ribs.

As shown by the rimose bark this species affords a rather extreme instance of the gradual enlargement of the trunk at a distance from the growing point. Numerous leaf-bases remain attached to the trunk in the greenhouse as they would not do in nature, since they are torn loose except for a few fibers at the extreme sides.

scribed as closely similar to those of *Sabal Adansoni.* Sargent's *S. Mexicana* from southern Texas, in addition to the seven times greater thickness of the trunk, has a seed nearly 1.25 cm. broad with a strongly prominent micropyle. There can be little doubt that it is another new species, quite distinct from that of Puerto Rico, similar only in the unusual diameter of the trunk, which is furthermore described as bright reddish brown instead of white or very light grayish as *Inodes causiarum.* In the view of the apparently localized distribution of the species of this genus the name **Inodes Texana** would be appropriate for that described and figured by Sargent as noted above.

In addition to the recently described **Inodes Uresana** (*Sabal Uresana* Trelease, Rep. Mo. Bot. Gard. **12**: 79), there is another large-seeded *Inodes* on the western slope of Mexico, a specimen of which was collected at Acaponeta, State of Tepic (no. 1528) by Dr. J. N. Rose,* for whom this species may be named **Inodes Rosei.** The seeds are of the same size and shape as those of *I. Uresana*, but have the surface much more finely rugose, or nearly smooth, with the embryo directly lateral, not subdorsal. The branches of the inflorescence are slender and but little over 1 mm. in diameter instead of fusiform and thickened in the middle to nearly 3 mm. as shown in Professor Trelease's photographic illustration.

THRINAX Linn. f.; Swartz, Prod. Veg. Ind. Occ. 51. 1788

In the genus *Thrinax* were formerly placed all the West Indian fan-palms with smooth stems and no midribs, but the gradual dis-

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* Dr. Rose also kindly permits the use of the following field notes and measurements showing that *Inodes Rosei* is also a taller and more slender tree than *I. Uresana.*

"Trees 6–12 or sometimes even 18 meters high, the long slender naked trunk 15–20 cm. in diameter, crowned with a large cluster of leaves; petioles 60 cm. or more long, flat on the face, pubescent, but becoming glabrate; blade pale green, 8 cm. or more in width, strongly keeled, more or less clothed beneath with brown scales on the large veins; segments cleft to below the middle, 25 mm. or less wide; inflorescence in large branching panicles 60 cm. or more long; fruit spherical, 18 mm. in diameter, blackish or dark blue when mature."

"A very common tree east of Rosario towards Mazatlan, also extending all the way from Rosario to Acaponeta; especially common on the low hills, and east of Rosario toward the mountains. This species is of considerable economic importance, the trunks being used in building fences, corrals and huts, while the leaves appear as thatch on a majority of the houses of this region."

covery of numerous and diverse species has resulted in propositions for subdivision and segregation on the part of several botanists. As usual these new groups have been characterized very inadequately, and that mostly from the flowers and seeds, and with no attempt at establishing correlations of habit or other vegetative features without which the classification is likely to remain formal and artificial, as well as useless for popular and field study. Possibly no ecological differences exist among the *Thrinax*-like palms of other regions, but in Puerto Rico there are, as shown in the discussion of the following genus, two well-defined types, one of which varies the ordinary short columnar habit by the possession of a tall slender and flexible trunk which doubtless enables it to compete in a measure with the rapid growth of the surrounding vegetation, and which is also obviously adapted for withstanding the force of the strong winds encountered in the exposed places apparently preferred by palms of this species.

The type of the genus *Thrinax* is the Jamaican *T. parviflora*, a tree 3 to 6 metres high with the trunk swollen at base. The leaves are said to be 30–60 cm. long with rigid lanceolate divisions; the stipes longer than the leaves, terete-compressed. The spadix is said to be terminal, nearly erect and 60–90 cm. long. The tree grows in dry maritime situations in Jamaica and Santo Domingo. It does not appear that the original specimens of this species have been examined by Sargent or other recent writers, but it seems reasonable to use the name for the group of short species with uniform albumen and a basal cavity instead of a complete perforation. Swartz's statement regarding the seed "*intus albus, medio ruber,*" in connection with its context "*nauco osseo fragile tectus*" might possibly be rendered "white inside, red between" and might refer to the red coat of the seed rather than to a red center as commonly inferred. Of course Swartz might have cut his seed transversely, but if so he would doubtless have discovered and noted the perforation had one existed. Patrick Brown's account of the Jamaica species, cited by Swartz, evidently refers to a palm with the habits of *T. Ponceana*. On the other hand the "very slender" palm referred to under this name in the Jamaica Bulletin (1: 196. 1894) shows greater similarity with *Thrincoma.*

Thrinax praeceps sp. nov.

Trunk 8–12 cm. in diameter at base, columnar or slightly enlarged upward, seldom attaining over 3 or 4 meters in height. The leaf-bases split in the middle of the midrib and long remain adherent to the trunk. When they finally fall away on older trees a rather rough grayish and longitudinally chinked rimose surface is exposed.

The stalks of large leaves measure 75–80 cm. in length and 1.2–1.5 cm. in width. The middle divisions of the leaf are 55 cm. and under in length and attain a width of 4.8 cm., and in the middle of large leaves are united for more than half their length. Cross-veinules numerous, distinct in both surfaces but especially the upper. The white pubescence or tomentum which clothes the young leaves and is especially abundant on the ligule soon disappears, leaving the under side glaucous or slightly pruinose.

This species is described at some length a little later in a comparison of generic characters under *Thrincoma alta*. The type specimen (no. 850) was collected on the precipitous mountain-side which overhangs the road between Utuado and Arecibo, a short distance to the northward from the station where *Thrincoma alta* was obtained.

What is believed to be the same species was collected in a similar situation on the side of a mountain overlooking the town and valley of Lares.

Thrinax Ponceana sp. nov. Plate 43

Trunk 5–8 cm. or more in diameter, columnar, or slightly tapering or enlarged upward, 1–4 m. high; surface coarsely and irregularly rimose longitudinally. Leaf-bases separating into abundant rather loose light grayish or brownish fibers. Leaves numerous, large, drooping or pendant; petioles 65 mm. long, 1.5–2 cm. wide; segments attaining 75 cm. in length and 3.5 cm. in width, united for half their length. Seed smooth, mahogany-brown, 5 mm. in diameter. Type specimen no. 1005.

This species apparently exists in much larger quantities than any other yet known from Puerto Rico, being the predominant plant on several square miles of territory along the range of dry limestone hills which skirt the southern coast of the island, to the west of Ponce. Many of the palms are scattered among the taller shrubs and trees wherever there is sufficient soil and water to permit these to grow and yet not enough to give them exclusive possession, but on many of the drier and more sterile higher slopes the advantage is with the palms.

This abundance of living material deserves more careful study than could be given during a very brief visit to this almost uninhabited part of the island, but one note of systematic interest was made. Several species of *Thrinax*, of which *T. Morrisii* Wendland may serve as an example, have been described chiefly with reference to the relative size of the leaf segments and the extent of their separation. If the palms under observation near Ponce belonged, as was believed, all to one species, it is not only true that the individual *Thrinax* passes all the stages from the narrow and grass-like, almost completely separated segments of the very young plant, to the more than half united leaf of the large tree, but it also appears to be true that under unfavorable conditions a *Thrinax* may not be able to attain to full maturity of size and form but may at the same time produce flowers and seeds. In the narrow chinks and crevices of the bare rocks were very small, stunted trees, obviously of great age, while but a few feet distant a deeper fissure might hold vegetable débris and moisture sufficient to nourish vigorous specimens several times the size of their less fortunate companions. The stunted trees retain in proportion to their size, but apparently with little reference to their age, the small deeply divided leaves of young plants and have short few-branched inflorescences, another difference of supposed systematic importance.

In *Thrinax Ponceana* the leaves of well grown trees have the middle divisions united to about the middle; the smaller the leaves, the more deeply they are divided. A further correlation with size is that of the "fullness" of the leaf. The basal sinus is not closed by the overlapping of the lateral divisions as in some species, but the area is too great for a plane circle and there are one or more folds, more numerous and deeper in large leaves. The lateral divisions do not lie in the plane of the others but project upward or backward nearly at right angles with the plane of the middle divisions.

The middle divisions of large leaves may measure 75 cm. in length by 3.5 and sometimes nearly 4 cm. in width, while the narrowly grass-like lateral segment is only .8 cm. wide and about 30 cm. long. The lowest segment is not divided at the tip but is produced into a slender hair-like seta, 6 or 8 cm. long, making it nearly as long or longer than the next segment above.

The normal segments are split at the apex to the distance of from 2 to 8 cm. and the tips are usually markedly divaricate, owing to the fact that the young leaves of this species suffer two impressions from the bases of older leaves, one near the middle the other near the end. The pressure causes the curvature of the unopened leaves, which in turn causes them to split apart when the leaf expands.

Old leaves are smooth and glaucous on the lower side, but in the younger state more or less remains of the delicate appressed hairiness present on the lower surfaces of the newly opened leaves. The lower surface is distinctly grayish and glaucous, but under a lens it can be seen that this appearance is due to the presence of numerous whitish points (stomata?) among which are scattering brownish spots of larger size, the nature of which remains a question.

The free stalks of the largest leaves attain 65 cm. in length and are 2 cm. wide near the base, 1.5 cm. near the apex. The cross section is lenticular above, but the upper surface becomes flat toward the base.

Young unopened leaves are covered near the base, both above and below, with a scurfy white tomentum and the margin of the ligule has a long white fringe.

To avoid possible error it seems best to make separate entry of the following notes on specimens which might be considered quite distinct from the larger and normally mature form of *Ponceana*, but which represent, it is believed, merely a somewhat depauperate condition of that species, although leaves exactly comparable were not brought home by our party. The specimens in question were collected by Sintenis (no. 3500) on the south coast of the island near Guanica and distributed from Berlin as "*Thrinax* n. sp."

The leaves are characterized by the narrow straight-sided segments which retain the same width (15 mm. or less) for about 11 cm.; they are united in the middle of the leaf for about 8 cm. and the apical tapering part is about the same length. Other species, so far as known, have the segments much broader, both absolutely and relatively, and the width is held for a very much smaller proportion of the length.

In addition the midrib is unusually weak, inconspicuous and only slightly prominent on the lower side. The small fibro-vascular bundles which compose it are sometimes spread apart so that there is scarcely an indication of a rib while in other segments of the same leaf, and especially at the base, the conditions are more normal. The midrib is sufficiently distinct above, though very small and fine in comparison with other species.

Lower surface of leaf glabrous or somewhat glaucous, very slightly puberulous on the depressed veins near the base. Veinlets inconspicuous, mostly subequal, though 4 or 5 are sometimes a little larger than the others. Transverse veinlets indistinct below.

Petiole slender, 4 mm. wide, lenticular in cross section; about 2 mm. thick. Ligule small and weak, short, with a small apical mucro.

Fruits 5 mm. in diameter, olive brown, irregularly rugose-coriaceous on the outside as though dried from a pulpy condition; exocarp with a slightly sweetish taste. Seed bright mahogany-brown, darker below, depressed-globose, with a sublateral raphe; embryo ascending but more nearly lateral than vertical; conical basal cavity extending somewhat above the center, nearly filled with a deep red material.

At the time of our visit in July no ripe fruits of *T. Ponceana* were found on the trees, but a few picked up from the ground are apparently indistinguishable from those of Sintenis' specimen.

Thrincoma gen. nov.

Trunk slender, tapering, flexible; wood firm, covered by a smooth hard brittle outer shell or bark.

Leaf bases long-sheathing, expanded by the separation of the fibers of the side opposite the midrib; petiole strongly flattened above the base, prominently angled above and below; ligule large and firm, produced laterally to support the outer divisions.

Leaf-divisions narrow, separated below the middle and below the point of greatest width; texture firm and coriaceous; veinules subequal, close together, cross-veinules obsolete. Lower surface clothed with persistent closely appressed hairs, the upper coated with wax when young.

Seeds with few longitudinal grooves, the surface not polished, grayish; embryo subapical.

The generic name alludes to the preference of this palm for the summits of crags and the brows of perpendicular cliffs which abound in the limestone region of the north side of Puerto Rico.

The tall, slender trunk and other differences between this genus and *Thrinax* are probably to be interpreted as ecological adaptations necessary to enable the present palm to compete with the vegetation which often surrounds its base, and to withstand the winds to which it is commonly exposed. The species of *Thrinax* and other allied genera, as far as known, have the trunk rigid and columnar, or even enlarged from the base upwards. When growing solitary and exposed they seldom, if ever, attain half the height of *Thrincoma.* Usually, however, they are protected by other vegetation or by growing gregariously in thickets.

Thrincoma might be described as a *Thrinax* which has adopted habits of the arecoid genus *Aeria* which grows in similar situations in a neighboring part of the island. In addition to the smooth, slender, and flexible trunk *Thrincoma* makes further provision against the wind in having fewer, less ample, tougher and more deeply divided leaves and like the arecoid palms it also drops the old leaves as soon as their usefulness is past, instead of retaining, like *Thrinax*, a large pendant cluster of them. The details of these differences are given below in a comparative note on fresh material of *Thrincoma alta* and *Thrinax praeceps* collected but a short distance apart in the lower part of the Arecibo valley along the Utuado-Arecibo road. In this region of jagged mountains, *Thrinax* seeks shelter against the walls of perpendicular precipices, while *Thrincoma* challenges the wind and the admiration of the traveller by its evident preference for the crags and pinnacles.

Thrincoma alta sp. nov.

With but one species known with certainty to belong to the present genus the separation of generic and specific characters would have little purpose. Data for a specific description are, however, contained in the following notes which are retained in their original comparative form as better illustrating the generic differentiation of *Thrincoma* and *Thrinax*, as represented by *Thrinax praeceps.*

The trunk of *Thrincoma* differs in three adaptive particulars from that of *Thrinax praeceps, Ponceana* and similar species which are merely columnar with very short internodes and an irregularly rimose surface, not smooth and hardened.

1. There are distinct internodes from 3.5 to 5 cm. in length. These indicate rapid growth and would increase the chances of survival in the face of competition of quick-growing tropical vegetation.

2. The trunk tapers gradually from a diameter of 9 cm. near the base to 3.5 at the top, and thus possesses considerable flexibility in view of its great length, 11 meters, *Thrinax praeceps* and other related types not exceeding 4 or 5 meters.

3. In order to support the weight and strain of this greater height, the texture of the wood is extremely hard and firm, especially near the base of the trunk. Externally it is covered by a smooth shell or bark of very hard, brittle, dark colored material. The fibers of the interior which in *Thrinax* are merely imbedded in a soft pith like those of a corn-stalk are here thickened and cemented together, as in tall palms of other groups, into a dense hard wood. In the specimen cut by us all but a small area of the middle of the trunk was thus hardened, rendering it extremely heavy. The wood-fibers of *Thrincoma* are much coarser than those of *Thrinax*, and there appear to be none of the obliquely radial threads which are abundant in the wood of *Thrinax Ponceana*.

With reference to methods of leaf-attachment four differences may be noted:

1. In *Thrinax praeceps* the leaf-bases split below in the median line and remain long attached to the trunk. This adaptation is not confined to the old leaves but appears while the leaves are still very young, or as soon as they begin to be expanded by the pressure of those above them. In the tall species such pressure separates the fibers of the opposite side of the cylinder. The short species has the outside of the leaf-bases densely tomentose, and the tomentum is especially abundant along the edges of the split midrib of the young leaf.

2. The ligule of *Thrincoma* is notably larger than that of *Thrinax* and continues to lie in the same plane as the blade, and

becomes brown with maturity. In old leaves of *Thrinax* the ligule stands nearly at a right angle to the blade and remains green.

3. For leaves of the same size the petioles, not including the sheathing base, are longer (75–80 cm.) in the short than in the tall species (60–65 cm.).

The petiole of the short species is of nearly the same width (1.2–1.5 cm.) throughout, while in the other it is distinctly broader at both ends than in the middle. The enlargement at the ligule is abrupt. The base widens gradually to about 2 cm. but is much thinner than in the short species. In the upper part of the petiole the reverse is true, the cross section of the leaf-stalk of the *Thrincoma* being almost diamond-shape, while that of *Thrinax* is merely lenticular.

4. These differences of proportion of ligule and stalk are obviously correlated with the different habits of the two species. The shorter and more robust trunk of the one enables it to withstand the strain of the relatively limited exposure to the wind. There is also a greater flexibility in the leaf itself, due to its thinner texture and to the smaller development of the ligule and adjacent thickened area, so that the leaves are often split to near the center. The narrow petiole of the tall species affords greater flexibility in the lateral plane while strength has been secured by the greater thickness. On the other hand the thinness of the base of the petiole of *Thrincoma* reduces resistance by permitting the petiole to be twisted when the leaf is opposed to the wind or blown laterally, thus avoiding the strain which would come upon the more rigid base of the petiole in *Thrinax*.

The more salient differences between the leaf-blades of the two species may be enumerated as follows:

1. Although the length of the middle segments of the leaves of *Thrincoma* are longer (62 cm.) than those of the other (55 cm.) the apparent size of the latter is much greater because they are fully expanded while those of *Thrincoma* remain more or less fan-shaped, generally opening less than a semicircle. This decreases the lateral expansion, since the shortest divisions are brought to the sides, and gives no projection below the ligule where in *Thrinax* more than one third of the foliar expanse is located.

2. The leaf segments are much narrower (3.6 cm.) in the tall than in the short species (4.8 cm.).

3. Practically the difference in width is still greater because the segments of *Thrincoma* are never fully expanded but remain deeply channelled, thus decreasing the area of exposure to the wind and increasing the rigidity of the leaf.

4. Resistance to the wind is also reduced in the tall species by the separation of all the segments to more than two-thirds their length, while in *Thrinax praeceps* the median segments are united more than half way up. In the latter, as in the other members of the group, the separation begins at the point of greatest width of the segment, but as if to show that the deeply divided leaves of *Thrincoma* are an adaptation, the greatest width is located near the longitudinal middle of the segments, 10 cm. or more above the bottom of the cleft.

5. The texture of the leaf of *Thrincoma* is thicker and firmer so that the segments generally remain straight to the tips while in *Thrinax* they often droop after the leaves have become fully expanded.

6. The color of the leaves of the tall palm is a very dark green while those of *Thrinax praeceps* are uniformly of a much lighter, fresher tint.

7. The veinules of the firm leaves of *Thrincoma* are more numerous and closer together than those of *Thrinax.*

8. The veinules are also subequal in size, giving an appearance of uniform pattern, while in *Thrinax praeceps* from 3 to 5 of the veinules of each side of the midrib are distinctly larger than the others, the larger veinlets being separated by from 3 to 10 smaller ones.

9. In *Thrincoma* the cross-veinules are scarcely visible to the naked eye; under a lens they are still obscure, never equalling in size the smaller of the longitudinal veinules, which they seldom appear to cross. In *Thrinax praeceps,* on the contrary, the cross-veinules are as large as the finer longitudinal ones; they are obvious without a lens and give the fabric of the leaf a peculiar marbled effect on account of the fact that they are generally oblique or wavy and commonly appear to cross several of the longitudinal veinules.

10. The margins of the segments are thickened in both species, and on the upper side there is a groove inside the mar-

ginal rib. In the short species the margin is flat belowand does not become decurved in drying. In the other the thin edge is closely folded under, and on drying the sides of the segments uniformly roll under, giving the dried leaves of the two species an appearance even more dissimilar than in the fresh state.

11. The lower surface of the leaf of *Thrincoma* has a silvery white layer of fine closely appressed hairs, all lying parallel to the veins and forming a continuous covering. The fibers seem not to be attached merely at one end, but along the side. They are firmly adherent and are to be removed only by scraping or rubbing; the surface underneath is deep green like the upper side, but the fibers remain in the grooves between the veins. In *Thrinax praeceps* the lower surface of mature leaves is smooth and glaucous, a comparatively very slight hairy covering present in young leaves being evanescent, though traces of it are usually to be found in the deeper basal grooves. The glaucous appearance is due to the presence of numerous white or hyaline points arranged in rows (stomata?). The hairiness of one leaf and the glaucous character of the other are probably to be looked upon as different adaptations for the same purpose—the reduction of transpiration.

12. The upper surface and the ligule of young leaves of *Thrincoma* are covered with a layer of wax in the form of small plates or scales not present in *Thrinax*.

Thringis gen. nov.

Trunk columnar, rimose; wood pithy. Leaves coriaceous with equal veinules, silvery below with closely appressed whitish pubescence. Fruits distinctly pedicellate, the pedicel with a bract above the base. Seed cerebriform, irregular, with wide furrows and convolutions; surface smooth and shining. Embryo subapical.

The characters of this genus are imperfectly known, none of the specimens being complete. Supposing however, that the association is a natural one, we have a genus with leaves and pedicellate fruits much more similar to those of *Thrincoma* than to those of *Thrinax*, and at the same time a columnar, rimose and pithy trunk like that of *Thrinax* and *Coccothrinax*. The seeds appear to differ from those of all related genera in the possession of large irregular convolutions. The coriaceous leaves, small fruits, subapical embryo, and other differences separate this genus from *Coccothrinax*.

Thringis laxa sp. nov.

The trunk is columnar or somewhat enlarged upward, about 3.6 m. high and 12 cm. in diameter. Surrounding its base was a dense turf of fine upright rootlets. The bark was rough and rimose.

The leaves are similar to those of *T. latifrons*, but smaller, the segments being about 70 cm. long by 33 mm. wide. The size of leaves is thus about the same as those of *Thrincoma alta*, but the texture is thin and flexible, the veinules being slender and not prominent on either side. The pubescence is much thinner than that of *T. alta* and of a silvery-gray color.

A palm collected in December, 1899, at Vega Baja, but without fruit (no. 1041). The habit and trunk are not those of *Thrincoma*, but the form and texture of the leaves and ligule associate the species with *Thrincoma alta* rather than with the palms here placed in *Thrinax*.

The columnar habit and protected habitat are reflected in the small ligule, 18 mm. across, and the relatively broad petiole, 13 mm. wide. It appears from the dried specimens of this species and *T. latifrons* that the leaves may have been "full," or irregularly folded, instead of strictly and equally expanded as in *Thrincoma alta*, and the greater width of the segments is a further indication of this possibility. The rigidity of the leaf of *Thrincoma alta* can be maintained because the segments are narrow and do not open widely.

The soft texture of the leaves of this palm is recognized by the natives who use it for making hats and call it "yaray" the same name which is applied in this part of the island to *Inodes causiarum*.

Thringis latifrons sp. nov.

The leaves, inflorescence and young plants of a palm collected by Sintenis (no. 3278) on Monte Calabaza near Coamo are much larger and coarser than those of *Thrincoma alta*. The total length of the middle segments of the leaf would be over a meter, and the width of the larger divisions is over 5 cm. The thickness of the petiole at the base of the ligule is over 10 mm. The form of the ligule is much like that of *Thrincoma alta*, though scarcely as large in proportion to the size of the leaf.

The lower surface is clothed with a satiny, appressed grayish pubescence somewhat less pronounced than that of *Thrincoma alta*. As in that species the veinules are of equal size, but they are more widely separated, and the wavy and usually somewhat oblique transverse veinules are easily distinguishable on both sides of the dried leaf. There are also slight traces of wax on the ligule and in the grooves of the upper surface. The median divisions are united for distinctly more than one-third their length.

The spathes and spadix are distinctly larger than those of *Thrincoma alta*, but the fruits are, unfortunately, quite immature and contain only shriveled seeds. The pedicels of the fruits are 2–4 mm. long and bear, usually near the middle, a very slender bract 1–2 mm. long.

This species is apparently distinct from *Thringis laxa* in the larger size and firmer texture of the leaves. It differs in the longer pedicels of the fruits, with their longer and more slender bracts, from a specimen belonging to the New York Botanical Garden and supposed to have been collected by Mr. A. A. Heller, though the number (3278) indicates that it may belong to the Sintenis series.

This consists of a single, short, once-branched inflorescence arising from two fibrous spathes. The fruits are about 4 mm. in diameter, nearly spherical, distinctly apiculate, deep reddish brown in color and borne on pedicels 2–3 mm. long, with a bract 1 mm. long or less at or below the middle. The seeds are 2–2.5 mm. in diameter; the surface is smooth and shining and light brown in color; general shape spherical but with deep folds and convolutions.

No leaves are known in connection with this specimen, and the exact locality is also in doubt. Mr. Heller believes, however, that the inflorescence came from a small *Thrinax*-like palm growing in the limestone hills a few miles to the east of San Juan.

Family ARECACEAE

A large family, with abundant genera in the tropics of America and Asia, but absent from tropical Africa. The Puerto Rico representatives may be recognized very easily by the fact that the leaf crown is supported upon a column of the sheathing bases, a character of which the royal palm furnishes a conspicuous and ever-present example. Of the remaining genera, one, the betel palm of the East Indies is sparingly introduced about towns in the western part of the island and may be recognized at a glance by reason of the extremely dark green of its foliage. The other two genera are native palms confined to uncultivated areas and thus seldom seen at close range from traveled roads. The mountain palm, *Acrista*, covers the summits of many of the mountains of the island, but *Aeria* seems to be confined to the range of high limestone crags which skirt the northern coast of the island between Bayamon and Arecibo.

Key to the Genera of Arecaceae

Trunk tall and slender, tapering from a swollen base; spathes numerous (7); inflorescence appearing in the axis of the rather persistent lower leaves, long and slender; staminate flowers arranged in rows. AERIA.

Trunk robust or of uniform diameter; spathes 1 or 2; inflorescence short and brush-like, not exposed until the enclosing leaf below it falls away; flowers not set in rows.

- Spathe single, the fruits 2.5 cm. long; leaf-divisions upright, very dark green. ARECA.
- Spathes 2, fruits less than 1.25 cm. long; leaf-divisions horizontal or oblique.
  - Trunk robust, thickened near the middle; leaf-divisions inserted by twos and standing at different angles; inflorescence twice or thrice branched, standing close to the leaf-bases. ROYSTONEA.
  - Trunk slender, of uniform diameter; leaf-divisions at equal distances, horizontal; inflorescence once-branched, at maturity 15 cm. or more below the leaf-bases. ACRISTA.

Aeria gen. nov.

A tall slender palm evidently related to *Gaussia*, but the embryo lateral instead of basal, and the pinnae without basal cushions.

Among palms in Puerto Rico *Aeria* resembles only *Acrista*, from which it is readily distinguishable by the very slender habit, the swollen base of the trunk, the much-branched slender interfoliar inflorescence, the shorter sheathing bases of the leaves, and the numerous spathes.

The embryo of *Aeria* is located near the longitudinal middle of the seed on the side opposite the rudiment of the style, which is here located at the base of the fruit instead of on the side as in *Acrista*. The albumen is also uniform, except for a small central cavity and the outer covering is fleshy rather than fibrous.

The position of the embryo is, perhaps, the most obvious difference between this genus and *Gaussia*, but there are several other significant discrepancies. Thus the flowers are arranged 3 or 4 in a row, very seldom 5 or 6. Three fruits develop from one flower only exceptionally. The trunk is of more than medium height, and the inflorescence is in reality infrafoliar, for although the dead leaf-bases and midribs of the leaves are persistent and support the long inflorescence, this condition is not comparable to that of the cocoid and other really interfoliar inflorescences.

Aeria attenuata sp. nov. Plate 45

The tallest of Puerto Rico palms, probably attaining 30 metres and upward. The trunk is supported on a mass of coarse roots with spine-like projecting rootlets arranged in whorls. The surface of the trunk is smooth with very faint annular impressions. Near the ground the diameter is 12 to 15 cm. and increases upward to about 25 cm. at about 3 m. above the base. Above this swelling the trunk tapers very gradually and in tall specimens is less than 7 cm. in diameter at the top.

The sheathing leaf-base is only 20 cm. long. The leaves remain attached long after the rupture of the open side, but no fibers are formed, the edges of the split side being fringed only with brown membranous shreds. The petiole is rather short, round and rigid and the rachis is prominently angled above.

Segments of a rather firm texture and standing in different planes, but all more or less upright or oblique to the rachis, segments from middle of leaf 2.3 cm. wide near the base, 3.8 cm. long. The segments are set very closely together, especially the proximal, and overlap each other in a succubous manner. Fresh fruits deep orange in color and of an unsymmetrical oval in shape, 16 mm. by 12 mm., with a firm, fleshy outer covering 1.6 mm. thick, adherent to the seed, the three persistent styles remain of the same size and are located at the base of the fruit.

The seed is flattened oval, 11 mm. by 9 mm., with a prominent basal tubercle (hilum). The surface is brownish with a few shallow impressed lines, but the albumen is white and uniform. Flowers and ripe fruit were obtained at Vega Baja in December, 1899; type specimen no. 1040.

The so-called llume palm is a most striking ornament of the rugged limestone hills from Vega Baja to Manati and Arecibo. At a sufficient distance the slender trunk is no longer visible and the crown of leaves appears as if suspended in mid-air, while at closer range it does not seem possible that so slender a shaft can maintain itself. This very slenderness with the attending flexibility is however, an element of strength since it permits the trees to bend before the wind while the leaves diminish the resistance by straightening out as in the cocoanut. The hurricane of August, 1899, seemed to have done little damage to these tallest of Puerto Rico palms, many of which project for more than half their height above everything standing about them. As the trees of the rather sparse forest growth of these hills are commonly from 12 to 18 metres tall, the llume palms must often attain upwards of 30 metres.

ARECA CATECHU Linn. Sp. Pl. 1189. 1753

In the western end of the island the betel palm of the Malay region has been sparingly introduced, though the fact does not seem to have been reported hitherto. A few were seen in gardens about Mayaguez and others in and near San Sebastian. So far as we were able to learn, the people do not know the name or nature of this introduced species which is apparently planted only as an ornament or a curiosity. The form is not unpleasing, but the extremely deep, sombre green of the foliage seems almost unnatural and imparts a suggestion of artificiality.

Only photographs and fruits of *Areca* were secured at San Sebastian, but Puerto Rico specimens collected by Sintenis (no 5749) at Aguadilla have already been distributed from the Berlin Botanical Garden with the label "Palma Spec. Subtrib. Attaleae."

ROYSTONEA Cook, Science, II. **12**: 479. 1900

Oreodoxa Martius and more recent authors, not Willdenow.

The history of the generic name *Oreodoxa* shows that botanical writers of the last few decades have been in error in removing the two original species and applying it to another series of similar but not closely related forms. To avoid further confusion with reference to a name which by reason of the conspicuous character of the trees has wide use in popular literature it seems desirable to add the following notes on the genus *Oreodoxa* as originally established by Willdenow in the Memoires de l'Academie Royale, Berlin, 1804, a publication which seems to have been consulted very seldom, even by writers on palms.

Spathe universal, univalvate; spadix ramose, perianth monophyllous, tripartite below, the divisions ovate, acute, concave; petals ovate, acuminate, concave. Filaments six, of the length of the corolla; anthers oblong, acute. Style tripartite, shorter than the filaments, stigma acute. Ovule, drupe, and seed globose; drupe succulent, but slightly fibrous; seed single, cartilaginous, nearly smooth, marked with a longitudinal sulcus. In the discussion subsequent to the statement of the above characters, *Oreodoxa* is said to be distinct from *Bactris* in the tripartite style and in the absence of the "ordinary three impressions"; it is distinguished from *Areca*, then supposed to include *Euterpe* and species now generally placed in *Oreodoxa*, in the single spathe, the triple style and the hermaphrodite flowers.

The first species is *Oreodoxa acuminata*, referred by recent authors to *Euterpe* but probably constituting a distinct genus. The trunk is erect, cylindrical, very smooth, and attains a height of from 15 to 18 metres; the "root" throws out suckers at the base of the trunk. The fronds are pinnate, with opposite or alternate, very long, ensiform, acuminate pinnae, replicate at base. The strongly convolute young leaves form a green apex for the trunk, five feet high. Spathes cinereous, folded in at the base of the leaf-sheaths at the top of the trunk, univalvate, deciduous; spadix erect, much branched, having the appearance of a broom.

The heart of the bundle of leaf-bases, about two feet long and three inches thick is eaten as a salad, with oil and vinegar. It is also stated that the deciduous boat-shaped spathes serve as reservoirs of rain-water which is long retained in the cool shade cast by the trees. Birds and beasts, and human natives as well, are said to be dependent at times upon the liquid thus stored, since in the regions where the palm grows there are at times no other means of procuring water. The forests of the high mountain chain of Buena Vista in the province of Caracas are the native home of the species. It thus appears that in addition to the structural differences *Oreodoxa acuminata* occupies quite a different place in nature from that of the more thoroughly tropical species commonly referred to that genus, and the stoloniferous habit also indicates a different ecology.

The second of the original species of *Oreodoxa* is now referred to the genus *Catoblastus.* It is a somewhat smaller tree from 12 to 15 metres high, with a generally similar habit, and is also stoloniferous, but the pinnae are broad, cuneiform and praemorse, or irregularly truncate as in the species generally referred to *Martinezia.* The drupaceous fruit is grayish and the pulp is only slightly succulent; seed the size of a pigeon's egg, its exterior brown, marbled with numerous veins. In the characters of the spathe the arrangement of the fruit and the edible quality of the heart of the leaf-cluster, as well as in the formation of lateral off-shoot this species is said to be similar to the first.

Botanists are not yet agreed upon the methods of dealing with complications like the present in regard to the names of plants, but it appears certain that those who do not recognize *Oreodoxa* as a genus distinct from those admitted in the more recent works on palms must associate it either with *Euterpe* or *Catoblastus.* The latter mame it would in that case replace, being much older. Moreover, unless we are prepared to disregard Willdenow's statements concerning the stoloniferous trunk, the simple spathe and the hermaphrodite flowers, to say nothing of many minor points of circumstantial evidence, there is no scientific warrant for applying the name *Oreodoxa* to the noble Antillean species with which it has been universally associated.

The dried specimens which Willdenow studied were supplemented by notes of field observation by a court gardener, who was evidently also a botanist of some experience, to whom Willdenow refers as his "friend." The living colors are described with considerable detail throughout the entire paper, which renders noteworthy the fact that the spathes are stated to be cinereous. This is in agreement with species of *Euterpe* which have membranous spathes, but indicates a wide difference from the West Indian trees where the spathes are thick and fleshy and remain vivid green until they open and fall away.

The name *Roystonea* has been given to this ornament of the

Puerto Rico landscape as a respectful compliment to General Roy Stone, the American engineer officer who secured the admiration of the people of Puerto Rico by his fearlessness and conspicuous energy in the Adjuntas road-building campaign which flanked the line of Spanish defenses, and whose subsequent interest in the improvement of the island will undoubtedly affect its future history.

Roystonea Borinquena sp. nov. Plate *45. f. 2.*

Trunk normally fusiform, 30–60 cm. thick, 12–18 m. high. Leaf-segments 4–4.4 cm. in width. Inflorescence robust, compact, twice-branched, the branches numerous and coarse, ferruginous, pubescent. Fruits long-oval, yellowish brown at maturity. Seeds 8 mm. by 6.3 mm., flattened about the hilum, rounded below; wall of endocarp smooth, adherent over a small area.

The royal palm of Puerto Rico differs from that of Cuba in having the trunk generally shorter, more robust and more distinctly fusiform. The inflorescence is twice branched, with the branches more densely clustered, coarser and darker colored than those of the Cuban royal palm, *Roystonea regia.* They are also covered with a slightly hispid brown pubescence while Cuban specimens are much smoother and more pallid. The difference of habit, to judge from photographs of the Cuban species, is most apparent when the trees have grown in the open, as when planted in avenues or along roadsides. In Puerto Rico, trees which are obliged to compete with other vegetation are often tall, slender and unsymmetrical. The typical form is shown in our photograph (no. 250) taken in the plaza of Juana Diaz.

Martius gives the width of the pinnae of the Cuban royal palm as from 8 to 12 lines. Cuban specimens show as much as one inch and a quarter, while others from Porto Rico are half an inch wider (44 mm.) of somewhat coarser texture and with more widely separated secondary veins. The fruits of the Puerto Rico palm are a deep yellowish brown when ripe, while those of the Cuban are said to become violet or bluish black. According to Martius, the fruits of the Cuban species are 6 lines by 4, but dried specimens show no such discrepancy of proportions and measure only about 8.5 mm. by 7.5 mm.

In Puerto Rico the fresh fruits are also much longer than broad, perhaps even more slender than the figures given for the Cuban;

when dry they still appear somewhat longer and larger than the latter.

The seeds of *Roystonea Borinquena* differ in several particulars from those of the Cuban species. In shape they are longer and less spherical, measuring 8 by 6.3 by 5.5 mm. instead of 7.8 by 7 by 6 mm.; the side bearing the hilum is much flattened and even slightly concave; the fibers radiating from the hilum are longer, and the corner between the hilum and the micropyle is evenly rounded, not sharply squared and prominent as in *R. regia.* On the back of the seed the smooth inner wall of the endocarp is closely adherent over a small area, while in Cuban seeds this wall remains attached over nearly the whole side and is furthermore distinctly rugose-coriaceous on the surface, and has a distinct sulcus in the median line.

The royal palm is not only the more conspicuous and characteristic natural object in most parts of Puerto Rico, but it probably exceeds the cocoanut in total economic importance. The most useful part is the *yagua* or sheathing base of the leaf, with which a large proportion of the houses of the poorer classes are thatched or sided, or both.

The royal palm is one of the wild species which has been distinctly advantaged by human interference in natural conditions. It is a general fact that outside the climbing species palms are not successful in competing with tropical forest vegetation. Originally the royal palm and the corozo were probably confined to the more rugged slopes of the lower limestone hills where they both still retain a foothold in places where the natural growth seems never to have been cleared away. But the vast majority of royal palms now in existence in Puerto Rico stand on land which has been cultivated at one time or another, and where the palms were able to secure a foothold before the competition of other plants became too strong.

The discovery of root tubercles on a young plant of this species has been noted in the introductory statement. These tubercles though small in size are very numerous upon the smaller roots. In shape they are mostly oval and symmetrical. The larger are about 2 mm. in length though our natural-size photograph shows several fusiform or clavate bodies from 5 to 10 mm. long and as much as 2 mm. thick. The color of the roots and tubercles is white.

The royal palm of Florida is commonly referred to *Oreodoxa regia*, though with very doubtful propriety. Apparently on account of its great size, Cooper (Smithsonian Report 1860: 440. 1861) was inclined to identify it with *Oreodoxa oleracea* which had also been reported from the Bahamas. The inflorescence and seeds collected by Curtis on the western borders of the everglades (no. 2676) are, however, obviously not those of *R. oleracea* but are much more similar to those of *R. regia*. The branches of the inflorescence are much longer and more lax than those of the species of Cuba and Puerto Rico, from which they also differ in the frequent development of tertiary branches, in this respect resembling *Roystonea oleracea*. The fruits do not resemble those of *R. oleracea* but are closely similar to those of the other species though somewhat smaller and more nearly spherical. Several reliable witnesses are on record to the effect that the trees are from 28 to 35 metres high and as much as 45 metres has been claimed, while among the royal palms of Cuba and Puerto Rico 18 metres is the commonly recognized limit of size. Mr. C. T. Simpson, of the U. S. National Museum, states that the palms of southwestern Florida lack the conspicuous bulge so characteristic in the trunks of the Puerto Ricon trees, and that they grow almost in reach of tide-water, while the natural habitat of the Puerto Rico species is evidently the limestone hills. In view of these differences it seems preferable to treat the Florida royal palm as a distinct species, for which the name **Roystonea Floridana** is proposed.

Mr. Simpson also informs me that the royal palms seen on the islands off the coast of Honduras had the size and habit of those of Florida and not the relatively stunted appearance of those seen by him in Hayti and Jamaica. This fact is suggestive in connection with the popular idea that the palms of Florida are to be looked upon as recent arrivals from Cuba. Instead it seems more reasonable to believe that the royal palm of Puerto Rico, like the species of *Thrinax* of that island, is a remnant of the flora of the time when the limestone hills were keys and hammocks like those of southern Florida, and relatively poor in vegetation able to crowd out the palms.

Acrista gen. nov.

Trunk slender, of uniform diameter. Pinnae horizontal, appendiculate. Inflorescences distinctly infrafoliar; spathes two, the outer short, the inner long and slender. Spadix once-branched, the branches coarse, tapering. Fruits with stigma lateral, seed deeply ruminate, embryo basal.

Related to *Roystonea*, but differing in the more slender habit, the once-branched inflorescence, the basal embryo, and in having the leaflets in one plane. The color of the foliage is also considerably lighter than that of the royal palm so that from a distance the general appearance suggests the cocoanut rather than the royal palm.

There is also some resemblance between the foliage of *Acrista* and *Cocops*, but the absence of sheathing leaf-bases in the latter genus will enable even young specimens to be separated. Moreover the leaf-divisions of *Cocops* are much narrower and those at the end of the leaf are not so much shortened as in *Acrista*.

Further differences from *Roystonea* are to be found, such as the much smaller size and the larger roots, which are tuberculate and inclined to become superficial like those of the llume palm. The sheathing leaf-bases are not as long proportionately as in *Roystonea*, and there is a distinct formation of fibers, although the texture is flimsy. The outer sheaths do not split off and fall away as promptly as in *Roystonea* but several dead ones sometimes hang from about the base of the crown. Although the sheath is longer than in *Aeria* the fibers are much better developed, there being but a few membranous shreds in *Aeria*, and no distinct fibers at all.

Among the mountains between Cayey and Guayama many summits are covered with the *palma de sierra*, probably in places which have never been cleared. A few of the palms follow down the steeper uncultivated ravines. From a distance the crowns suggest royal palms but a closer view renders the difference apparent. There is also no suggestion of the bulging trunk of *Roystonea*. In height the *palma de sierra* probably does not exceed the royal palm.

The tips of leaflets of young leaves are connected by two brittle red strands both of which lie on the mesial face, one along the edge, the other near the middle. The tips of the leaflets are of the same material and are sometimes persistent as long corneous appendices like those of the cultivated *Howea*.

The generic name *Euterpe* Gaertner, which is commonly applied to a considerable series of American palms related to the present, was in reality established for the Malayan genus for which the name *Calyptrocalyx* Blume is now in use, *Pinanga silvestris globosa* Rumphius being cited by both Gaertner and Blume as the original, in the one case, of *Euterpe globosa*, and in the other of *Calyptrocalyx spicatus*. The origin and identity of the seed described and figured by Gaertner have not been established, and seem likely to remain in doubt; but in describing *Calyptrocalyx*, Blume argued that the generic name should remain with the seeds studied by Gaertner and declared that these did not belong to any Malayan species but to some of the arecoid palms of the Mascarene Islands. This suggestion seems not to have been disposed of by Martius or others, but the fact that Gaertner's fruits showed an apical stigma seems to exclude them from the American group with which the generic name has been associated.

In making use of the name *Euterpe* for Brazilian palms Martius cites Gaertner as author of the genus and states that it is of world-wide distribution in the tropics. Gaertner's *E. globosa* is placed as a synonym of *E. oleracea* * Martius, and Jacquin's older name *Areca oleracea* stands in the same relation to *Euterpe edulis* Martius, thus rendering *Euterpe oleracea* Martius a specific homonym. Subsequently Martius claims the genus *Euterpe* for himself and expresses doubt whether it is the same as that named by Gaertner, while Drude in Engler and Prantl's Natürlichen Pflanzenfamilien says "*Euterpe* Mart. (nicht Gaertn.)." Martius also admits that the West Indian *Areca oleracea* Jacquin is distinct from the Brazilian species of *Euterpe*, and redescribes it under the name *Oreodoxa oleracea*.

A further complication connected with *Acrista* was brought to light by finding that specimens collected by Sintenis (no. 1525) in the Luquillo Mountains in northeastern Puerto Rico and distributed from the Berlin Botanical Garden as *Oreodoxa oleracea* belong to the present genus, together with others collected in Martinique by Hahn (no. 805) and identified at Paris. With the last, the local

* Hist. Nat. Palmarum 2: 29.

name *choux palmiste* is given, the same which Jacquin noted in the original description of his *Areca oleracea* (Stirp. Am. 278. 1763). Moreover, it can scarcely be determined from Jacquin's description whether he was dealing with a *Roystonea* or an *Acrista* or with both, though his claim that his was the tallest palm of the Antilles might hold the name for the *Roystonea*.

It might then be argued by some that Miller's species, *Palma altissima* constituted a segregate from Jacquin's *oleracea* and that the latter name is available for the *Acrista* of Martinique, whether identical or not with that of Puerto Rico. But with a possible doubt between the *Acrista* and the *Roystonea* there can scarcely be a justification for the use of the same name for a third South American species or a fourth West Indian.

As a means of decreasing the confusion it may be suggested that as neither the generic nor the specific name of the Brazilian palm which Martius called *Euterpe oleracea* (Hist. Nat. Palm. **2**: 29) is available, the name **Catis Martiana** may be proposed, the generic designation having reference to the drooping pinnae characteristic of the present species and several of its South American relatives.

Acrista monticola sp. nov. Plate 44

Trunk smooth, 10 to 15 m. high, perhaps taller, from 12 to 15 cm. in diameter, with distinct ring-like leaf scars and internodes, light brownish or appearing grayish with bark lichens.

Leaves about 2 m. long, the pinnae lanceolate, equally spaced and lying nearly horizontal, 55 cm. long and 4 cm. broad; the surface light green on both sides, with very close parallel longitudinal veinlets, but no visible cross veins. The sheathing bases are considerably shorter and generally appear somewhat more robust than in *Roystonea*. In protected situations the leaf-bases persist and the margins shrivel up and expose a flimsy network of fibers. Inflorescences appearing several close together; by the falling of the leaves above them they are left several inches below the leaf-bases before maturity is attained. Spathes fusiform, long, more slender and pointed than in *Roystonea*. Spadix once-branched, 1 m. long, 6 cm. in diameter at base, tapering gradually to the apex. Branches 23 cm. long and less, the proximal branches longest; at first appressed to the rachis, the branches are opened out and held stiffly erect by a fleshy turgid cushion on the upper (distal) side of the base of each. The branches of the rachis may thus be said to be hinged, and with maturity the supporting cushion dries away and allows them to resume a direction nearly parallel to that of the rachis.

The dried fruits of *Acrista* are grayish brown in color and nearly smooth or somewhat coriaceous in external texture; they measure 11 or 12 mm. in length and are nearly as wide, being slightly oboval in shape. The outer wall is thin and brittle and covers a more or less distinct thin layer of amorphous brownish material probably representing the pulp of the fresh fruit; in the dry state this may adhere either to the outer wall or to the fibers next inside. Near the base these fibers are simple, pointed and vertical; about half way up they divide and anastomose and are, as it were, felted and cemented together to form an oval sac open below and closed above. The outer fibers are much coarser than the inner and there are sometimes suggestions of three layers separated by a dark-brown friable material. A few of the delicate inner fibers are adnate to the surface of the seed which is otherwise free from its fibrous covering.

Seed 8.5 mm. by 8 mm., slightly lighter in color than the outside of the fruit. Surface slightly uneven with obscure veinlike ridges and impressions of the fibers of the outer covering. The kernel is white, hard and bony, and deeply ruminate, though this is not apparent from the outside. The channels are very narrow and often radial and straight; they penetrate 3 mm. or less. Embryo directly basal; hilum lateral, somewhat below the level of the stigma; a short raphe extends about half way to the embryo.

Family COCACEAE

The cocoid palms are a distinctly American group, the African oil-palm, *Elacis Guineensis* and the cocoanut being the only outliers of the family which have been supposed to be indigenous in the Old World. South America is the center of distribution and is the home of a large proportion of the two hundred or more species. Only five genera reach Puerto Rico, and one of these, *Cocos*, was probably not a native of the island.

Key to the Subfamilies of Cocaceae

Trunks, stems, and midribs beset with sharp spines; seeds foraminate at or above the middle. Subfamily BACTRIDINAE.

Trunks and other parts unarmed; seeds foraminate at base. Subfamily COCINAE.

Subfamily BACTRIDINAE

Some of the numerous South American representatives of this group are nearly smooth, but the three genera known from Puerto Rico have the trunks, leaf-bases, midribs and inflorescences beset with sharp black spines, and are thus readily recognizable.

Key to the Genera of Bactridinae

Trunk small, cespitose; leaves separated by long internodes; foramina of seeds apical. BACTRIS.

Trunk medium or large, solitary; leaves crowded together at the summit; foramina peripheral.

- Trunk slender; leaf-divisions broad, praemorse-truncate; pistillate and staminate flowers intermixed on the inflorescence; exocarp fleshy. CURIMA.
- Trunk robust; leaf-divisions narrow, sharp-pointed; pistillate flowers below and separate from the staminate; exocarp fibrous. ACROCOMIA.

BACTRIS Jacquin, Stirp. Am. 279. *pl. 271.* 1763

The type of this genus, *Bactris minor* Jacquin, described from the vicinity of Carthagena, Colombia, is a small spiny palm with creeping rootstocks. The upright trunks are about an inch thick and twelve feet high, with long spiny internodes. The fruits are fleshy, purple, and about the size of a cherry. Several species of *Bactris* are known from the West Indies though the generic name has doubtless been applied rather loosely to all the small spiny cocoid palms.

The two following species of *Bactris* from Puerto Rico described by Martius several decades ago seem not to have been secured by recent collectors unless it be true, as suggested below, that one of them, the simple-leaved *B. acanthophylla* applies to a young *Curima.* Of *B. Pavoniana* the narrowly grass-like leaf-divisions would be sufficiently characteristic to separate it at once from all other palms known from Puerto Rico.

BACTRIS ACANTHOPHYLLA Martius, Palm. Orbign. 67

"Trunk low, spiny; frond simple, the petiole spiny; blade lanceolate in young plants, oblong in the adult, cuneate at the base and bifid at apex, the margin unequally erose, unarmed; rachis and primary veins spiny on both sides; spines bristle-like, narrowed at base, those of the petiole black, those of the blades fuscous."

"In the western part of the island of Puerto Rico, near the village of Yrurena, in swampy places on the margins of aboriginal forests at an altitude of 400 feet; collected by Wylder, 1827." (Martius Hist. Palm. **3**: 281.)

A specimen to which the above diagnosis would not be inapplicable was collected by Sintenis in the mountain forests near Maricao (no. 484). It was distributed from Berlin as a *Martinezia*, together with two other very young plants and a seed to which one of these was attached.

The seed evidently did not come from a cocoid palm but together with the young seedlings may belong to *Acrista*. The large spiny plant is probably a young specimen of *Curima*, and should these suggestions prove to be correct the specific name *acanthophylla* must be transferred to this genus though whether it will replace *colophylla* or not is not to be determined until it can be ascertained that the Maricao species is the same as that here described from Bayamon.

BACTRIS PAVONIANA Martius, Palm. Orbign. 70

"Frond pinnate, rachis with rather long spines and black bristles: linear acuminate, about equally distant, the terminal united, setose-ciliate, glaucous below and with a sparse whitish down."

"Puerto Rico; Pavon." (Martius, Hist. Pal. **3**: 282.)

Grisebach has reported this species from Antigua and has redescribed it as follows, presumably from the Antigua specimens.

"'Trunk low'; *leaves pinnatisect: segments numerous, grass-like, linear-acuminate* or the uppermost broader by cohesion, glaucous and minutely puberulous or glabrescent beneath, approximate, subequidistant, reduplicate at the base: *rachis armed with very long black prickles* and rare bristles, keeled above.—Flowers unknown; leaf-segments (in our specimens, which are cut off, perhaps about the middle of the rachis) more than 30-jugal, 3‴–6‴ distant, 12″–8″ long, 4‴–2‴ broad, superior gradually shorter, the uppermost cohering ones sometimes 6‴–8‴ broad: prickles scattered or clustered, slender, the greatest 2″ long. HAB. Antigua: *Wullschl.*, Blubber valley; [Portorico]." (Grisebach, Fl. Brit. W. I., 520. 1864.)

Curima gen. nov.

Trunk rather slender, internodes armed with scattered slender spines. Leaves and inflorescence also spiny, especially on the proximal parts. Pinnae numerous, strap-shaped, praemorse-truncate, imperfectly separated near the ends of the leaves. Inflorescence rather slender, once-branched; pistillate flowers mostly located near the bases of the branches. Fruit drupaceous, exocarp fleshy, not fibrous; foramina peripheral.

A palm related to *Acrocomia* and to the genera commonly grouped under the name *Martinezia*, to which *Aiphanes* and *Marara* are generally referred as synonyms. Reasons why none of these names appears available for the Puerto Rico species are given below. The characters of the fruit, with foramina near the middle, seem to indicate that *Curima* is not remotely related to *Acrocomia*, from which it differs superficially in the more slender habit, the truncate or praemorse leaves and the very long and lax inflorescence.

Curima colophylla sp. nov. Plate 46

The solitary trunk rises from a mass of spiny roots somewhat smaller than those of the llume palm (*Aeria*). Diameter of trunk from 1–1.5 cm., often slightly thinner near the ground, though showing no such tendency to bulge as appears in *Roystonea*, *Aeria* and *Acrocomia*. The surface of the internodes is rather sparingly provided with needle-like spines smaller and more slender than those of *Acrocomia*. On old trunks the spines are often more or less completely absent.

Leaves 2.13–2.5 m. long, with from 30 to 40 pairs of strap-shaped praemorse-truncate divisions shorter and broader as the end of the leaf is approached, and with a terminal undivided area several inches wide. There is no apparent tendency toward the arrangement of the leaf-divisions in clusters as in *Martinezia caryotaefolia* and other allied species.

The base, rachis, midribs and even the surfaces of the pinnae are beset with coarse black or deep red spines which are closely appressed when young and become erect as soon as the surfaces are exposed, all the parts except the spines and the upper surfaces of the leaf-division being covered at first with a light grayish or brownish scurfy coating which gradually disappears.

The inner spathe is narrowly fusiform and about 1 m. long. It splits to the level of the outer spathe revealing the spadix and its extremely spiny peduncle. The flowers are greenish cream colored in mass, paler and not so yellow as in *Acrocomia.* The pistillate flowers are relatively very few and located near the base of the simple branches.

The cherry-like fruits are dull orange or brick red with rather dry fleshy or oily exocarp having a rather mealy though distinctly acid flavor, but no really unpleasant taste. This fleshy covering is only very slightly fibrous, and that near the base; the seeds fall off very easily sometimes leaving the base of the exocarp attached to the fruiting branch. The nut is about 12 mm. in greatest or transverse diameter and about 10 mm. high, while the fresh fruit is 14–16 mm. through and 12 or 13 mm. thick. The surface is deeply and irregularly pitted and marked with three radially fibrous striate foveolae.

It is perhaps too soon to assert that there is only one species of the present genus in Puerto Rico. The trees certainly differ considerably in size though not more than the cocoanut and others. There is also a noticeable difference in the abundance of spines. Such apparent variability may, however, be due to age, the older trees tending to become less densely beset with the brittle black spines which are often conspicuous on young specimens.

The specimens (no. 878) and photographs on which this genus and species were based were secured on the limestone hills near the wagon road between Bayamon and Toa Baja where the present palm is not uncommon.

Curima appeared to be especially abundant about Bayamon but is probably rather generally distributed in the limestone hills of the island, perhaps also on other soils. A few trees were seen along the road between Utuado and Lares, and numerous others between Isolina and Manati. Sintenis collected specimens of what is apparently the same species near Juncos and Hato Grande, and at Maricao young specimens discussed under *Bactris acanthophylla.*

As far as Puerto Rico is concerned, this palm is very easily recognized by means of the curiously truncate leaf-divisions, the outer margins of which appear as though accidentally injured or eaten away by caterpillars. This feature is, however, shared with numerous other West Indian and South American palms, though apparently only one, the so-called *grigri* palm of Martinique can be referred to the present genus with confidence. For this the name **Curima corallina** (*Martinezia corallina* Martius, Hist. Nat. Palm. 3: 284) appears to be correct, although Martius places Gaertner's much older *Bactris minima* as a synonym for his species. Gaertner, however, was making a second attempt at renaming Jacquin's *Bactris minor*, having previously misplaced that name in connection with a West Indian *Acrocomia*, probably the same to which Jacquin had already supplied the name *Cocos aculeatus*. Thus it is possible to treat *Bactris minima* Gaertner as a synonym of *Bactris minor* Jacquin and the restoration of Gaertner's inappropriate name for the *Curima* is thus avoided.

With this preliminary description we may return to the consideration of the generic names *Martinezia*, *Aiphanes* and *Marara* which other writers have applied to relatives of the present palm or treated as synonyms. *Martinezia* was described by Ruiz and Pavon (Prodr. Flor. Per. et Chil. 148. 1794) for five Peruvian palms, but it was amended by Martius (Hist. Nat. Palm. **3**: 283) by the removal of all the original species and the substitution of a new set. Of the original species studied by Ruiz and Pavon only two, *M. ciliata* and *M. abrupta* were mentioned in connection with the original description of the genus, and this because they offered exceptions to the generic characters. If these were to be excluded for this reason from those among which the type is to be sought the name *Martinezia* must go with the subsequently published *M. ensiformis*, now referred to *Euterpe* * or with *M. lanceolata* and *M. linearis*, now placed in *Chamaedorea*. If we hold to the first species, *M. ciliata*, *Martinezia* is probably a synonym of *Bactris*. The second species, *M. abrupta*, has escaped Martius and the Index Kewensis, in which a sixth name *M. interrupta* is the only one by Ruiz and Pavon now credited as being a genuine *Martinezia*. Thus by the method of elimination *Martinezia* would according to current classification replace *Chamaedorea* while by the method of types it would stand as a synonym of *Bactris*.

The genus *Aiphanes* was established by Willdenow on *Aiphanes*

* Roemer and Schultes treated *Martinezia* as a synonym of *Oreodoxa*.

aculeata, a spiny palm from the mountains about Caracas. The trunk is said to be erect, ten meters high, subcylindrical and very spiny. The leaves are about 1.6 m. long, with four pairs of remote, broad, cuneate, praemorse pinnae, strongly whitish pubescent on the under side; the petiole is also beset with spines. Spathe acuminate at both ends, aculeate on the outside, smooth within, opening longitudinally; spadix 4.5 dm. long, composed of cylindrical spikes placed opposite. Flowers hermaphrodite; calyx trifid, the divisions acute; petals acuminate; filaments 6, subulate, anthers rounded, style as long as the stamens, stigma trifid; drupe globose, the fleshy farinaceous pulp rather tasteless, though edible; nut hard, of the size of a musket ball, unilocular, black, furrowed with a large number of grayish grooves, of which three are always much larger than the others. The kernel is white, very sweet, and very good to eat. *Aiphanes* grows in the ravines and forests of the high mountains of the district of Caucagua, province of Caracas, Venezuela and requires a fertile, somewhat moist soil. It flowers and fruits in July.

From the above it appears that *Aiphanes* is a genus quite different from *Curima*, approaching some of the South American species of *Bactris* much more closely than it resembles the Puerto Rico tree.

The genus *Marara* was based by Karsten (Linnaea, **28**: 389) on *M. bicuspidata* from Colombia, a cespitose palm having a trunk 7 meters high and 10 cm. in diameter, clothed with black spines 6 to 8 mm. long. The leaves are 125 cm. long with from 60 to 80 pairs of cuneate pinnules which measure 3 dm. in length and 15 cm. in width, and are clustered in sixes or eights. This appears to be a very extreme development of the leaf-arrangement seen in the cultivated palm commonly called *Martinezia caryotaefolia* where the leaflets are distinctly clustered, but by no means so crowded as must be the case when on the side of a leaf 125 cm. long are leaflets with an aggregate width of 10–13 m.

The palm commonly cultivated in conservatories as *Martinezia caryotaefolia* is obviously allied to *Curima*, perhaps more closely than to either *Aiphanes* or *Marara*, but in addition to the clustered pinnules it has a more slender habit, especially apparent in the long internodes and the more lax inflorescence. This difference in habit is also evidently correlated with the fact that the leaf-bases do not become deeply gibbous and obliquely inclined from the trunk as in *Curima* but remain closely sheathing. Moreover, the upper side of the leaf-stalk which in the Puerto Rico palm is deeply channeled and has lateral corners sharp or torn into fibers nearly to the insertion of the lowest pinnae is in the conservatory species nearly cylindrical for a long distance below the pinnae, and has long spines on the upper side as well as on the lower. It is as though the ligule were located in *Curima* near the insertion of the lowest pinnae while in the other form it remains close to the trunk, with a cylindrical section intercalated to reach to where the pinnae begin. Apparently we are dealing with still another generic group for which the name **Tilmia** would not be inappropriate in allusion to the shorn and disheveled appearance which it shares with *Curima*. The species studied are **Tilmia caryotaefolia** (*Martinezia caryotaefolia* H.B.K. Nov. Gen. et Sp. **1**: 305. *pl. 699*) in the National Botanic Garden and **T. disticha** (*Martinezia disticha* Linden, Cat. 32. 1875).

The seeds of *Tilma caryotaefolia* are like those of *Curima*, but considerably larger, rounder, and much smoother. The foramina are peripheral, but are much smaller and more shallow, those of *Curima* being surrounded, as it were, by a prominent rim which adds somewhat to the apparent width of the seed. In both genera the nuts are unsymmetrical, the side which has the largest foramen being distinctly larger than the others and in *Curima* the irregularly pitted sculpture is coarser.

ACROCOMIA Martius, Hist. Nat. Palm. **2**: 66

A genus of palms distributed through tropical America from Mexico to Cuba and Paraguay. All the species are of stocky, compact growth, with a dense crown of numerous leaves. The trunk and the leaf-stalks are usually armed with strong, sharp spines, sometimes several inches long.

Although totally different on close inspection this genus has in Puerto Rico a superficial resemblance to the royal palm, which often deceives travelers. The similarity lies mostly in the two facts that both the royal and corozo palms are more robust and stiffly erect than the cocoanut, and that the leaf-divisions instead of lying horizontal and in one plane are tilted at different angles to the midrib, thus giving the foliage seen in the mass a somewhat unkempt appearance in comparison with the cocoanut.

In distinguishing the corozo palm from the royal palm when seen at a distance so great that the spines of the one and the columnar green leaf-sheaths of the other can not be seen, recourse may be had to the following facts. The leaf-crown of the corozo palm is much rounder, thicker and more compact than that of the royal palm, since it contains many more leaves, and these persist much longer. The royal palm can also be known by the unopened leaves which project straight upward like flag-poles or lightning-rods, while in *Acrocomia* the leaves open as they are pushed out and seldom offer a suggestion of the spire-like effect.

Acrocomia media sp. nov.

Trunk 20–30 cm. in diameter near the base, thickened above to 50 cm. or less; height commonly about 6–8 m. rarely exceeding 10 m. Surface of trunk with slight annular impressions. Internodes armed with slender black spines, the larger 10–15 cm. long, mostly confined to the lower half of the internodes. Fruit green, becoming yellowish, the husk firmly fibrous, inedible; about 35 mm. in diameter, nearly spherical in shape, with a distinct apical papilla. Kernel 25 mm. wide by 22 mm. long; width of the cavity 18 mm. The type specimen was collected near Ponce (photograph no. 255).

The *Acrocomia* of Puerto Rico seems to differ from *A. aculeata* (Jacquin) in its robust habit and somewhat bulging trunk, while it is less stout and less swollen than *A. fusiformis* (Swartz). The name *Acrocomia lasiospatha*, although used by Martius and Grisebach has no warrant for supplanting *fusiformis* of Swartz, which must be preferred for the Jamaica species with the thick, swollen trunk.

In Jamaica there seem to be at least two species of *Acrocomia*, the larger of which is called the "great macaw" palm, and is described as having a fusiform trunk as thick as a man's body. What is presumably the same species occurs in Cuba as shown by a photograph from the vicinity of La Gloria on the north coast. The greatest diameter of the trunk is three or four times the thickness near the base. In Puerto Rico no trees approximating these proportions were observed, the greatest amount of swelling probably not reaching twice the diameter below. According to Maza

Acrocomia lasiospatha grows wild in Cuba and is known under the name "coroja de Jamaica." Swartz described his *Cocos fusiformis* on the supposition that it was distinct from the *Cocos aculeatus* of Jacquin, from Martinique, by reason of the fusiform trunk. The species was, nevertheless, reduced by Martius to his South American *Acrocomia sclerocarpa*, perhaps because the spathe is said to be spiny, a character probably subject to great variation.

Jacquin's name *Acrocomia aculeata* (1763) must, it seems, be used for the West Indian palm placed by Martius under his *A. sclerocarpa*, which is to be maintained, if at all, as a South American species. Jacquin declares that the habit of his tree is similar to that of *Cocos nucifera* and *Cocos amara* (*Syagrus*), and his figure shows a tall straight trunk tapering slightly upward, with no tendency to bulge. The spines of the trunk are few and the midribs are aculeate on both sides. The drawing of the fruit is 37 mm. long by 41 mm. wide and has a broad conic papilla at apex. As indicated above, such a tree was not noticed in Puerto Rico where all the corozo palms are distinctly, though slightly, thicker some distance above the base, though apparently never equaling *A. fusiformis* in this respect.

Subfamily COCINAE

Key to the Genera of Cocinae

Trunk distinctly ringed, rising from an inclined swollen base; leaves numerous, many of the lower drooping or pendant, the divisions many and narrow; fruits very large, borne continuously. COCOS.

Trunk nearly smooth, straight and columnar; leaves fewer, not becoming pendant, divisions less numerous and broader; fruits small, borne at one time and ripening together. COCOPS.

COCOS NUCIFERA Linn. Sp. Pl. 1188. 1753

The cocoa-palm is largely confined to the neighborhood of the coast, but is occasionally planted in small numbers in the interior districts, though it generally does not thrive in such situations especially on the north side of the island. On the drier southern slope of Puerto Rico, which is avoided by the royal palm, the cocoanut seems to thrive better, when it has once become established. Cocoanuts are mostly gathered while still green, for the sake of the milk or, as it is there called, the water (*coco de agua*) a popular beverage wherever obtainable. Although the local consumption of nuts for this purpose is considerable it is largely confined to the towns of the coast region. Thus it may be said that in Puerto Rico the cocoa palm affords a luxury rather than a necessity, and that it is exceeded in economic importance by the royal palm.

Cocops gen. nov.

In a valley on the road between Lares and San Sebastian several young palms were noticed with leaves similar to the cocoanut, but smaller and finer. Finally one mature specimen was found, with both trunk and leaves strongly suggesting the cocoanut, but much smaller. The leaves are light green, the leaflets in one plane, and the fibers separating from the narrow base of the leaf. The fibers are few and flimsy, but like those of the cocoanut and other South American species of *Cocos*. The palm stood within a few feet of a small permanent brook, down which the seeds had evidently been carried and there were several young palms along the bank. The native living in an adjacent house could give us no name except *palmilla*, and seemed to think that none was necessary since the tree does not yield *yagua* or anything else of use. Its early extermination is therefore not unlikely.

In the absence of flowers and fruit * the relationships of the present genus cannot be ascertained nor its validity satisfactorily established. There seems, however, to be no reason for including the species in any of the genera known from Puerto Rico or other parts of the West Indies, and to associate it with Central and South American types would be a still less warrantable procedure.

It is also believed that under the present circumstances the application of a name is justified by convenience of reference and that this will also assist in securing the attention of botanical collectors better than a mere allusion to "an unknown palm which may be new."

Cocops rivalis sp. nov.

In diameter the trunk appeared to be about midway between the palma de sierra (*Acrista*) and the cocoanut, and had the short internodes of the latter. The leaves, however, probably remain

* That the fruits are small and are ripened at one season, as stated in the key, was apparent from the size of the seedlings and from other circumstances which accorded with the testimony of the man whose house stood within a few rods of the largest tree.

somewhat smaller than those of *Acrista* to which they might also be said to have a general similarity, except at the base where their cocoid proclivities become obvious. At a little distance *Cocops* might be overlooked as *Acrista*, while at shorter range it might be mistaken for a very depauperate cocoanut. No species of *Cocos* is, however, known to be native in the West Indies except the doubtful *Cocos crispus* H.B.K., from Cuba.

As a species *Cocops rivalis* may prove to be similar to *Syagrus amara* (Jacquin), which is reported as far north as Jamaica, but it seems to have no true generic affinity with *Syagrus cocoides* Martius, the South American palm which is the type of its genus. According to Martius *S. amara* is 30 cm. in diameter, as large or larger than *Cocos nucifera* and attains the height of from 20 to 35 meters; *Syagrus cocoides*, on the other hand, is a small slender palm with a trunk 2.5–3 m. high and 5–7.5 cm. in diameter, and with foliage and habit resembling the slender and diffuse South American species referred by Martius to *Cocos*, but very different from *Cocos nucifera* or from *Cocops*.

A leaf collected by Sintenis (no. 6061) near Camuy and coming from Berlin labeled *Oreodoxa*, obviously did not originate with an arecoid palm, but probably belongs with the present species. The region of Camuy is but a few miles from Lares, but there is much extremely rough and unoccupied country between, so that the danger of extermination appears to be somewhat diminished.

Explanation of Plates

PLATE 43. *Thrincoma alta*, top of type specimen (no. 848).

PLATE 44. *Thrincoma alta*, part of leaf and seeds, natural size.

PLATE 45. *Thrinax Ponceana*, type (no. 1005).

PLATE 46. *Acrista monticola*, type (no. 761) collected near Adjuntas.

PLATE 47. Fig. 1, *Aeria attenuata*. Fig. 2, *Cocops rivalis* (left) and *Roystonea Borinquena* (right).

PLATE 48. *Curima colophylla*, apex of flower-cluster and terminal leaf-division, natural size. From type specimen (no. 878).

Studies in Sisyrinchium—IX: The Species of Texas and the Southwest

By Eugene P. Bicknell

The present paper has to do primarily with the blue-eyed grasses of Texas but, for convenience, it is made to embrace as well the species known from the adjoining states and territories including also Arizona. In all some twenty-five species are recognized from this general southwestern region seventeen of which are proposed as new. It may safely be said, however, that this enumeration is far from complete, for the lack of any specimens from many sections of the region, as well as the evidence afforded by fragmentary material here passed over, allows little doubt that the number of species actually occurring is materially greater than yet appears. Very few specimens have come to hand from Arizona and New Mexico, and still fewer from the extreme western and southern boundaries of Texas. From the latter state seventeen species can be recorded, and there is little doubt that at least three other known species occur, these being *S. demissum* Greene, to be expected in the extreme northwestern part of the state, *S. albidum* Raf., in the northeastern part, and *S. campestre* in the northwestern and northern section.

The Texan species taken as a group present several noteworthy features of botanico-geographical interest. Not only do none of the distinctly Texan species, as far as appears, extend for any distance beyond the borders of the state to the north or east, but, conversely, very few of the more northern or eastern forms cross the Texan border, and not one of them for any great distance.

Between the Texan and Mexican species a similar mutual exclusion appears to obtain, and in some considerable collections of Mexican species which have passed under notice not a single species known from Texas has been encountered. It is scarcely to be expected, however, that there is not some interchange of species along the border. It may also be noted that no species occurring in Texas appears to be generally distributed throughout the state.

Owing to the present insufficiency of material perhaps no one of the species here described can be held to be well understood. Nevertheless I entertain not the least doubt that, with one or two possible exceptions, all the species here recognized are perfectly distinct. Indeed there is much reason to believe that several of them will be found to include more than one species. Until both flowers and fruit of all can be studied comparatively, many questions of this kind must remain unanswered. On account of the present insufficiency of material, also, the appended "key" must be regarded as wholly tentative. It is, in fact, extremely unsatisfactory, and is offered more as a help to the determination of those species which announce themselves by unmistakable characters rather than as a certain index to all.

The noteworthy *Sisyrinchium Arizonicum* Rothrock * is not included in this treatment for the reason that it deviates so widely from true *Sisyrinchium* as understood in this series of papers that I am obliged to regard it as the type of a distinct genus. For this species, therefore, as well as for the allied *S. platyphyllum* Watson † of Mexico a new genus may be proposed to be called **Oreolirion.**

Key to the Sisyrinchia of Texas and the Southwest

Stem normally simple and scapose, with terminal spathe or spathes.
  Filaments distinct at top of stamen-tube; both bracts of spathe foliaceous. 1. *S. exile.*
  Filaments completely united; inner bract of spathe not foliaceous.
    Scapes straight, more or less distinctly flattened and winged or margined.
      Spathes solitary.
        Plant pale and glaucous; inner scales half the length of bracts or less. 2. *S. campestre.*
        Plant not glaucous, drying dark; inner scales equalling the shorter bract or nearly so. 3. *S. sagittiferum.*
      Spathes two together.
        Plant not glaucous, drying dark; inner scales equalling the second bract or nearly so. 3. *S. sagittiferum.*
        Plant more or less glaucous, not drying dark; inner scales much shorter than second bract. 4. *S. albidum.*
    Scapes wiry, flexuous and subterete, narrowly margined (sometimes branched); spathes subterete below. 5. *S. biforme.*
Stem normally branched or bearing terminal peduncles.
  Plants erect or erectly ascending.

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* *Sisyrinchium Arizonicum* Rothrock, Bot. Gaz. **2**: 125. 1877.

† *Sisyrinchium platyphyllum* S. Watson, Proc. Amer. Acad. **26**: 155. 1891.

Leaves less than half the height of the scape; roots much thickened.
6. *S. radicatum.*

Leaves equalling the scapes or nearly so; roots fibrous, never greatly thickened.

Capsules large, 6–7 mm. long.

Leaves mostly smooth-edged; peduncles stout and stiff.
7. *S. macrocarpon.*

Leaves sharp-serrulate; peduncles very long and slender.
8. *S. longipedunculatum.*

Capsules smaller, 3–5 mm. long.

Sides of leaves and stem scabrellous; pedicels slenderly flexuous.
9. *S. pruinosum.*

Sides of leaves and stem smooth (sometimes roughened in Nos. 10, 18 and 20); pedicels not widely flexuous.

Bracts of spathe becoming thickened and strongly rather few-nerved, the mature spathe rather broad and turgid.
10. *S. Texanum.*

Bracts of spathe closely many-nerved.

Plants very pale green and glaucous, mostly stiff.

Edges of leaves and stem normal rough or serrulate; values of capsule with lateral nerves.
11. *S. ensigerum.*

Edges of leaves and stem normally smooth; valves of capsule without lateral nerves.

Leaves mostly 2–4 mm. wide; perianth 12–15 mm. long, column 6–8 mm. long.
12. *S. amethystinum.*

Leaves mostly 1–2 mm. wide; perianth 7–10 mm. long, column about 5 mm. high.
13. *S. demissum.*

Plants not very pale and glaucous or usually turning dark or discoloring when dry.

Leaves mostly over 2 mm. wide; plants 15–30 mm. high.

Glaucous to glaucescent; scape narrowly firm-winged; perianth light blue; pedicels exserted.
14. *S. varians.*

Green to glaucescent; scapes narrowly firm-winged; parianth deep blue-purple; pedicels scarcely exserted. 15. *S. amoenum.*

Green; scape broadly thin-winged; pedicels slenderly exserted and spreading.
16. *S. graminoides.*

Leaves mostly under 2 mm. wide; plants 5–20 cm. high.

Plants green to glaucescent, becoming more or less dark when dry.

Scapes rigid, somewhat curved; perianth bright blue; ovary glabrous.
17. *S. Brayi.*

Scapes straight, not rigid; ovary puberulent.
Leaves shorter than the scapes; flowers deep purple-blue; column half the length of perianth or less. 18. *S. furcatum.*
Leaves equalling the scapes or longer; flowers pale blue; column half the length of perianth or more. 19. *S. Langloisii.*
Plants pale or glaucescent, discoloring little when dry; small closely tufted species.
Leaves 1–2 mm. wide; flowers pale blue; column 4–6 mm. high; ovary puberulent to glabrate. 20. *S. Bushii.*
Leaves about 0.5 mm. wide; flowers deep blue; column 3 mm. long; ovary glabrous. 21. *S. Canbyi.*
Plants in finally depressed, spreading or weakly diffuse tufts.
Perianth over 8 mm. long; capsule subglobose.
Leaves 5–7 mm. wide; scape broadly thin-winged. 22. *S. colubriferum.*
Leaves 0.5–3 mm. wide; scapes narrowly margined.
Rather stiffly spreading or ascending; inner bract mostly the longer; ovary puberulent. 23. *S. Helleri.*
Diffuse to weakly erect; outer bract usually the longer; ovary glabrous. 24. *S. flaccidum.*
Perianth less than 6 mm. long; capsule oblong; plants branched and leafy-bracted from the base. 25. *S. minus.*

1. **Sisyrinchium exile** sp. nov.

From 3–8 cm. high in diminutive tufts of one to few erect stems within a cluster of ascending leaves; dull pale green and glaucescent, discoloring somewhat when dry; roots pale and exceedingly delicate, more or less fibrillate. Larger leaves equalling or surpassing the stems, 0.75–1.5 mm. wide, narrowed to the obtusely-pointed or acute apex, firm, but rather thin and weakly few-nerved, the edges smooth or nearly so or sometimes minutely ciliolate towards the tip, their bases membranously broadened and with conspicuouly white-hyaline edges; stems simple with terminal spathe, 1.5–6.5 cm. high, less than 1 mm. wide, very narrowly firm-margined, smooth-edged; spathes erect and narrow, sometimes longer than the supporting stem, both bracts foliaceous and prolonged, the outer one 20–28 mm. long, much surpassing the more attenuate inner one, narrowly white-hyaline below and connate for about 3 mm. at base; inner scales silvery-white, less than half the length of the shorter bract: flowers few on hair-like pedicels, much shorter than the bracts and early recurved from midway in the spathe; perianth very small and delicate, about 5 mm. long, rather broadly seated on the ovary around the point of attachment, appearing pale yellowish but bluish towards the ends of the segments or becoming so, the obscurely nerved segments aristulate; stamineal column 1.5–2 mm. high, the filaments free at the tip for about 0.5 mm. and slightly diverging; anthers less than 0.5 mm. long, short and broad; base of column dilated and puberulent; immature capsule trigonous-subglobose, 2 mm. high, sparsely puberulent to glabrate.

Sandy sea shores at Galveston, Feb. 25, 1890, J. E. Bodin, herb. Univ. of Minn. and U. S. Nat. herb.

A remarkable little plant, strictly speaking not a true *Sisyrinchium*, appearing to represent a transition to the genus *Hydastylus*.

3. Sisyrinchium sagittiferum Bicknell, Bull. Torr. Club, **26**: 230. 1899

Firmly erect in scant tufts 10–30 cm. high, slightly or densely short-fibrillose at base, dull green, sometimes slightly glaucescent, drying dark; roots clustered, simple, at first slender but becoming almost tuberous-thickened on vigorous plants. Leaves often equalling the stems, rather thin but firm, 0.5–3 mm. wide, tapering-acute or aculeate with finally indurated tip, closely fine-striate, the edges smooth to fine-serrulate, the margins of the conduplicate base noticeably white-hyaline: stem scapose and leafless, varying from setaceously slender to 1.5 mm. or even 2 mm. wide, the fine-striate wing margins smooth to aculeately-denticulate, perceptibly widened into the base of the spathe; spathes single, or on vigorous plants two together within a subtending leafly bract, sessile or the outer one sometimes stipitate, often purplish, flat, sometimes bent backward, the stiff bracts rather strongly few-nerved, the outer one slenderly attenuate, varying from 1.5–3 cm. long in single spathes to 7 cm. when subtending geminate spathes, the narrowly white-hyaline margins separated quite to the base; inner bract 10–17 mm. long, broadened and often abruptly emerging from the base of the outer one, broadly white-hyaline, the apex mostly scarious obtuse, or truncate or even emarginate with excurrent mid-vein; inner scales brownish-tinged, mostly ¾ the length of the shorter bract; flowers rather small on hair-like, more or less flexuously exerted pedicels; perianth thinly membranous and finely nerved, violet or sometimes white, 8–10 mm. long, the segments mostly emarginate, slenderly aristulate; column 4–5 mm. high; anthers relatively large, 1.5–2 mm. long; ovary sparsely puberulent; capsules on more or less spreading or recurved pedicels, subglobose, 3–6 mm. high, developing obscure lateral nerves.

Texas and Louisiana in woodlands or dry pine woods; flowering from early March to April.

TEXAS: May 1, 1839, Dr. Riddell.

LOUISIANA: Hale, Gray herb.; Lake Charles, March 24, 1900, B. F. Bush; Central, March 14, 1900, Biltmore herb.

Specimens of this species received since the type was described show that the latter represents a small form of the species which, in its fullest development, takes on a notably different appearance. Plants essentially like the type, but even smaller and more narrow leaved and having white flowers, were collected by Mr. B. F. Bush at Lake Charles, Louisiana, March 4, 1900. On April 4th the same year, at Central, Louisiana, the species was collected for the Biltmore Herbarium which has submitted to me a beautiful sheet of specimens. These differ remarkably from the smaller plants referred to in much greater size, more fibrous base, clustered subtuberous roots, almost uniformly twin spathes with greatly elongated subtending bract and violet flowers. The numerous specimens, however, exhibit much variation, and I find among them nothing inconsistent with the view that they represent a robust state of the species hitherto known only from the diminutive type specimen.

The species appears to fall into a group with *S. albidum* and *S. scabrellum*.

5. **Sisyrinchium biforme** sp. nov.

Growing in scant, erect tufts 20–40 cm. high, from stout simple roots; pale green and glaucescent. Leaves slender and very acute, less or more than half the height of the stem, narrow, 1–1.5 mm. wide, prominently close-nerved, the edges smooth or nearly so; stem either scapose, with terminal spathe, or with one to three terminal peduncles, slender but stiff, sinuously erect or straight, 1–1.5 mm. wide, smooth and subterete, the margins sometimes almost obsolete; bracteal leaf slender and erect, shorter than the peduncles; peduncles usually slightly curved, 5–7 cm. long, two-edged; spathes narrow, especially the subterete base, variable in length, from 13 mm. to over 30 mm. long, the stiff bracts strongly close-nerved and cuspidate-acute, the inner one mostly surpassing the outer and flattened-navicular with incurved apex, the outer one tapering above, tubular-clasping for 5–9 mm. at base; inner scales crowded, brownish-tinged, but little shorter than the bracts: capsules on erect pedicels 15–25 mm. long, usually a little exceeding the bracts, brown, large, 5–7 mm. long, broadly oblong, many-seeded; seeds 1–1.25 mm. in diameter, globose or obovoid, coarsely and prominently pitted, distinctly umbilicate.

Based on a single collection by Drummond from San Felipe, Texas, now in the Gray herbarium.

A marked species apparently needing no comparison with any other.

6. **Sisyrinchium radicatum** sp. nov.

Erect, rather stout and rigid, pale and glaucous, from 30–45 cm. or more high; roots in a dense cluster from short woody rootstocks, soft and thick, giving off slender fibrils. Basal leaves mostly distinctly equitant in a short stiff cluster, a few longer ones sometimes half the height of the stem, 2–3 mm. wide, somewhat membranously broadened and hyaline-margined at base, stongly close-nerved, acute with hardened tip, the edges smooth; stem stiff, 2–4 mm. wide, very narrowly firm-margined, the edges smooth or obscurely roughened near the nodes; nodes mostly two, developing stiff bracteal leaves, shorter than the 1–4 peduncles; peduncles 5–10 cm. long, more or less divergent and unequal, smooth-edged and obscurely denticulate; bracts of spathe subequal, acute, 17–22 mm. long, somewhat membranous, distinctly fine-nerved, white-hyaline nearly to the tip, the outer one united below for about 5 mm.; inner scales three-quarters the length of the bracts or more; flowers violet-blue, on slender, slightly exserted pedicels, perianth about 10 mm. long, the segments short-aristulate; stamineal column 5 mm. high, anthers about 1.5 mm. long; ovary and young capsule densely glandular-puberulent.

Southwestern Utah, St. George, Washington county, 1877. Dr. Edward Palmer, no. 456 in herb. College of Pharmacy, N. Y., and herb. Gray. More nearly related to some of the California species than to any of the Texas group.

7. **Sisyrinchium macrocarpon** sp. nov.

Similar to stouter forms of *S. ensigerum*, but stouter, stiffer and less branched, with larger spathes, smaller flowers and larger capsules.

Very glaucous and pale, not changing color when dry, erect, from 20–30 cm. high; leaves over half the height of the stem, 2.5–4 mm. wide, thick and very firm and stiff, strongly close-nerved, very acute with hardened tip, the edges smooth or obscurely denticulate-roughened; stems 3 mm. or less wide, narrowly margined, the edges finely cartilaginous-ciliolate; node one, bearing two rigid, suberect peduncles 6–8 cm. long, and a stiff subtending leaf of about equal length, strongly nerved and ancipital at base; peduncles about 1.5 mm. wide, ciliolate; bracts of the spathe unequal, carinate and ciliolate, the outer one herbaceously prolonged and very acute, 2.5–4 cm. long, united for 5–8 mm. at base, rather broadly white hyaline below the middle; inner bract 2–2.5 cm. long. the tip acute and somewhat incurved; scales about three-quarters the length of inner bract; flowers few, 2–5, about 8 mm. long, the segments rather narrow, short-aristulate, non-emarginate; staminal column 4–5 mm. high, anthers 1 mm. or more long; ovary and capsule puberulent, the latter on rather stout, erect pedicels, pale brown, broadly oblong or subglobose, 5–7 mm. high, the thickish valves sparsely venose.

ARIZONA: Willow Spring, June 10–20, 1890, Dr. Edward Palmer, no. 490a, U. S. Nat. herb.

The flowering time is rather earlier than that of *S. demissum* Greene and much earlier than that of *S. amethystinum*, both of which occur in the same region.

8. **Sisyrinchium longipedunculatum** sp. nov.

Pale green and glaucescent, erect, about 50 cm high, the simple roots rather few and coarse. Leaves dry and stiff, erect, more than half the height of the plant, 2–4 mm. wide, firmly close-nerved, slenderly attenuate and very acute, the rather sharp edges upwardly close-serrulate: stems solitary or few, 2.5 mm. wide, stiff and somewhat flexuously curved, the wing margins sharp-serrulate; bracted leaf much shorter than the two very long slender peduncles; peduncles sometimes 18 cm. long, about .75 mm. wide, subterete, the very narrow margins smooth or obscurely serrulate; spathes very narrow, almost subterete and but 1.5 mm. wide towards the base, the stiff, obscurely nerved bracts, tapering to the apex, almost cuspidate-acute; inner bract 2.6 cm. long, a little surpassing the outer one which is very narrowly hyaline on the margins below and united-clasping for nearly 7 mm. at base; scales silvery white, but little shorter than the bracts: capsules pale brown on nearly erect pedicels about 30 mm. long, obovoid-oblong, large, becoming 7.5 mm. high, the valves sparsely venose; seeds 2–5 in each cell, large, 1.5–2 mm. in longer diameter, irregularly obovoid or obovoid-oblong and angled, some of them compressed and narrowly umbilicate, black, at first finely rugulose, at length smooth and somewhat shining.

Described from a single specimen in U. S. Nat. herb., collected by Dr. Valery Havard, on top of Guadaloupe Mountains, Texas, October, 1881.

A peculiar species differing markedly from any other known to me. In size of fully developed capsules and seeds and length of peduncles it appears to exceed any other North American species.

9. **Sisyrinchium pruinosum** sp. nov.

Loosely erect or ascending, 15–25 cm. high, rather bright green and glaucescent, but little duller when dry, roots simple and slender. Leaves about three-quarters the height of the plant, 1–3.5 mm. wide, the stem-leaves often the broadest, usually perceptibly constricted above the conduplicate base, rather thin and lax, the edges smooth, the sides with those of the stem, peduncles and bracts more or less closely fine-roughened with minute white points, under a lens appearing as if covered with hoar-frost; stems 1–2.5 mm. wide, narrowly margined to rather broadly thin-winged; nodes 1–2, the first one usually low on the stem; peduncles 2–3, erectly ascending, straight and slender, 5–12 cm. in length, often longer than the proper stem; spathes narrow, the bracts slenderly sharp-attenuate, the usually longer outer one 15–30 mm. long, delicately many-nerved, the white-hyaline margins united for 3–5 mm. at base; scales silvery-white and brownish-tinged, equalling the inner bract or shorter; flowers on hair-like slenderly much-exserted and flexuously-recurved pedicels; perianth violet-blue with a broad pale-yellow center; segments 10 mm. or more long, short-aristulate; column 5 mm. high; anthers about 1.5 mm. long; ovary glabrous.

Dallas, Texas, April 13, 1900. B. F. Bush, no. 561, "common in woods"; no. 709, much more slender, "common on prairie."

10. **Sisyrinchium Texanum** sp. nov.

Erect or ascending, 12–25 cm. high, dull green and glaucescent showing more or less discoloration when dry, the bracts and nodes mostly purplish tinged, tufts thinly loose-fibrillose at base, the numerous roots simple and slender. Leaves equalling the height of the plant or nearly so, somewhat withering-persistent, 1–2.5 mm. wide, tapering-acute or aculeate, the extreme tip becoming indurated, firmly close-striate, the edges smooth to obscurely denticulate; stems from less than 1 mm. to 2 mm. wide, the narrow margins either smooth or strongly denticulate; node mostly one supporting a slender erect leaf mostly longer than the two or three subequal or unequal erectly diverging peduncles; peduncles 5–11 cm. long, slender, smooth to denticulate, the margins broadened into the base of the spathe ; spathes rather short and broad, usually broadest near the base, becoming pale and somewhat turgid and obscurely nerved on the sides, the edges keeled ; bracts stiff, strongly but rather distantly nerved or becoming so, the outer one varying from stiffly attenuate and longer than the inner to subequal with it and merely acute, united-clasping for about 2 mm. at base ; inner bract usually very obtuse and scarious at the apex, about 15 mm. long ; inner scales equalling the shorter bract or nearly so, brownish-tinged ; flowers on erect slightly exserted pedicels ; perianth light violet-blue, 10–15 mm. long ; column 4–5 mm. high ; anthers about 1.5 mm. long ; ovary obscurely puberulent to glabrate ; capsules thick-walled, dark brown, 3–5 mm. high, broadly oblong to subglobose the often apiculate valves bearing a pair of submarginal veins ; seeds rather numerous in each cell, not seen when fully mature, less than 1 mm. in diameter, close-pitted.

Eastern Texas to Louisiana flowering in March and April.

A variable plant perhaps including more than one species. In reduced examples some of the stems may be simple with terminal spathe ; a few stout specimens show the base of the bracteal leaf distinctly roughened with minute points along the nerves.

A specimen in the Gray herbarium, mounted on a sheet of Elihu Hall's collection forming the type, has every appearance of being distinct and is only provisionally referred here, not being included in the description. The larger leaves which equal the height of the plant are over 35 cm. high and nearly 5 mm. wide ; the stems bear a short outcurved branch above with a cluster of rather short peduncles ; the spathes are peculiarly thick and blunt, with the inner bract broadly obtuse, in some cases surpassing the obtuse or apiculate outer one.

TEXAS : Houston, Elihu Hall, no. 636, April 12, 1872 ; type in herb. N. Y. Bot. Gard., N. Y. College of Pharmacy, Mo. Bot. Gard., U. S. Nat. Mus. ; Houston, Lindheimer, 1840, 1812, Mo. Bot. Gard. ; Lindheimer, 1842, herb. Gray ; Pierce Junction, March 16, 1876, J. J. Good, herb. Mo. Bot. Gard. ; April 2, 1899, B. F. Bush, no. 32, "Common on prairies" ; Virginia Point, opposite Galveston, April 20, 1899, Prof. W. L. Bray ; Hockley, J. W. Thurow, 1893, herb. U. S. Nat. Mus. ; April, 1839, Lindheimer, herb. Mo. Bot. Gard.

LOUISIANA : Dr. Hale, herb. Torrey.

11. **Sisyrinchium ensigerum** sp. nov.

Stiff, and very pale glaucous-green, mostly remaining pale when dry, 15–30 cm. or becoming 40 cm. high, the slender roots simple and wiry. Stems few, rigid, erect or divergently outcurved, mostly longer than the peduncles, when outcurved usually geniculate midway at the node, when erect often developing two approximate branches, 1.5–3.5 mm. wide, the firm wing-margins striate and rough-serrulate or even cartilaginous ciliolate; peduncles 2–4, approximate or diverging, 5–13 cm. long, mostly 1–2 mm. wide, the wing-margins erose-denticulate to serrulate; basal leaves usually over half the height of the plant, stiff and more or less ensiform and outcurved to straight and erect, 1.5–4 mm. wide, firmly close-nerved, the edges usually fine-serrulate, at least towards the very acute apex; stem-leaves firm and erect, more or less ensiform, tapering-acute, longer or shorter than the peduncles, the united base prominently strong-nerved and oppositely bicarinate; spathes mostly 2–2.5 cm. long, sometimes larger and stouter, broadly flattened or narrow, the stiff thickish bracts strongly nerved, mostly stiffly attenuate and acute, the slender tips often outcurved, the keels serrulate, subequal or the outer one longer, the latter usually widened below and connate for 2–4 mm. at base, narrowly white-margined; scales silvery-white, about three-quarters the length of the bracts: flowers on slender pedicels equaling or longer than the bracts, erect or slightly spreading above; perianth rather pale violet-blue, 10–15 mm. long, the rather broad segments rounded or slightly retuse at the apex and short aristulate; stamineal column 4.5–5.5 mm. high; anthers small and pale, 1–1.5 mm. long; ovary glandular-puberulent; capsules, when not fully mature, 2.5–5 mm. long, obovoid-subglobose, pale and rather thick-walled, the valves developing lateral veins.

From south-central to northeastern Texas, flowering in March and April.

Bexar county, San Antonio, G. Jermy, type in Biltmore herb.; V. Havard, April, 1884, herb. Gray; Gillespie county, G. Jermy, herb. Mo. Bot. Gard.; Hamilton county, J. Reverchon, 1885, herb. Gray; Travis county, Austin, April 2, 1898, W. L. Bray; April 18, 1898, A. A. Heller, no. 114; McLennan county, Waco, Sara A. Trimble, 1887, herb. Columbia Univ.; Shackleford county, Holstein, April 10, 1883, herb. Acad. Nat. Sci. Phila.; Young county, Belknap, March, 1858, Sutton Hayes, herb. N. Y. Bot. Gard.; Tom Green county, San Angelo, May 19, 1899, W. L. Bray; G. C. Neally, 1892, no. 103.

The type is stout, stiff and glaucous, with ensiform attenuate leaves and rather large pale flowers, the node borne about midway in the height of the plant, the outer stems somewhat outcurved and geniculate. Other forms, several of which came from the vicinity of Austin, are taller, more slender and erect, the node much above the middle, and with weaker stems and leaves, narrower spathes and smaller flowers. A specimen collected by Heller on bluffs along the Colorado at Austin is tall and slender-branched and bears numerous slender peduncles and narrow spathes; the leaves vary from very narrow to over 5 mm. wide.

Apparently also to be referred here is a single specimen collected by Prof. W. L. Bray at San Angeles "on dry soil among extreme xerophytes" which is low, with narrow, rigid leaves and small spathes, the bracts mostly scarious-obtuse, the inner one mostly the longer, and small flowers.

✓12. **Sisyrinchium amethystinum** sp. nov.

From 15–45 cm. high, pale green or glaucescent, scarcely discoloring when dry, roots slender, becoming slightly thickened, more or less fibrillate, leaves often numerous, the longer ones sometimes three-quarters the height of the stem, erect, stiffish, many-nerved, smooth-edged, or, when young, ciliolate-serrulate above, 1.5–4 mm. wide, acute, the extreme tip becoming cartilaginous: stem 1–2.5 mm. wide, the narrowly keeled edges smooth or with distant membranous serrulations, node mostly only one, bearing 1–3 long and slender, erectly diverging, mostly unequal peduncles much surpassing the nodal leaves; peduncles 6–18 cm. long, sometimes as long as the stem, mostly 1 mm. or less wide, smooth or slightly serrulate; bracts subequal or the outer one sometimes herbaceously prolonged; inner bract narrowed above, acuminate to scarious obtuse, 15–23 mm. long, outer bract rather broadly white hyaline on the edges below, united-clasping for 5–8 mm., the keels often ciliolate-serrulate, acute or attenuate; scales over half the length of the inner bract; flowers purplish-violet on the herbarium sheet, large; perianth 12–15 mm. long, the segments very abruptly short aristulate or emarginate, column 6–8 mm. high; anthers about 1.5 mm. long; pedicels slender, erect, distinctly exserted, becoming 17–25 mm. long; ovary and young capsule puberulent; capsules pale, subglobose or obovoid, 4–5 mm. high; the valves without lateral nerves; seeds not fully mature but evidently becoming rather large, 1–2 mm. in longer diameter, rugulose.

Arizona, occurring perhaps exclusively at high elevations on the mountains, and ascending to at least 7,500 ft.; flowering from early July to after the middle of August.

ARIZONA: Rincon Mts., 7,500 alt. 1891, G. C. Neally, no, 153; type, U. S. Nat. Mus.; San Francisco Mtn., August 18, 1889, J. H. Knowlton, no. 32; Harts Little Spring, July 8, 1892, J. W. Toumey, no. 430*c*; E. O. Wooton, July 15, 1892; Flagstaff, July, 1891, Dr. D. T. MacDougal, July 2, 1892, J. W. Toumey, no. 420*b*; Mormon Lake, July 17, 1892, J. W. Toumey, no. 430*a*; Bill William's Mtn., alt. 7,000 ft., July 22, 1898, Dr. D. T. MacDougal, no. 321.

This is mostly a taller and stouter plant than *S. demissum*, the broader leaves and stem less discolored in drying, and with much larger flowers on more exserted pedicels, larger seeds and more slender roots. The flowering period is about one month later.

Some specimens bear a close resemblance to specimens of *S. ensigerum*. The two plants are, however, perfectly distinct, the present species differing among other characters in more narrowly margined stem, longer peduncles, decidedly longer stamineal column, and larger capsules, the valves showing no traces of lateral nerves.

13. SISYRINCHIUM DEMISSUM Greene

Growing in narrow erect tufts 15–30 cm. or more high, varying from very pale and glaucous to merely glaucescent, pale yellow or brownish green when dry; roots simple, becoming elongated and somewhat thickened, leaves about half the height of the tufts, sometimes longer, narrow, 1–2.5 mm. wide, mostly attenuate, the acute tip becoming cartilaginous, strongly close nerved or striate, the edges smooth or, toward the tip, cartilaginous-ciliolate: stems slender, often twisted and flexuously curved, narrowly margined, the edges smooth to denticulate or, near the node, cartilaginous-ciliolate; nodes often swollen, mostly only one, when two the lowest one remote and bearing an erect leaf and peduncle; terminal peduncles usually two, very slender, subequal or very unequal, erectly diverging, mostly 4–9 cm. long, usually much surpassing the bracteal leaf; spathes narrow, the bracts stiff and closely striate-nerved, attenuate and often slenderly acute, frequently ciliolate above, subequal, or either one the longer, 13–25 mm. long; outer bract closely united-clasping for 3–9 mm., the lower edges rather broadly firm-hyaline; interior scales silvery white, from half to three-quarters the length of the bracts;

flowers small, pale violet-blue; segments 7–10 mm. long, the midvein often prominent, tapering-aristulate or slightly retuse; column about 3 mm. high; ovary slightly puberulent; capsule subglobose to broadly oblong, pale, corrugate, 4–5 mm. high on stiff erect pedicels shorter than or a little surpassing the bracts; seeds small, 1–1.25 mm. in diameter, obovoid, not umbilicate, finely rugulose to nearly smooth.

New Mexico and Arizona, extending east to western Kansas; ascending to at least 6,500 feet and flowering from early June to the end of July.

14. **Sisyrinchium varians** sp. nov.

Growing in thin or rather scant erect or loosely ascending tufts 15–30 cm. high, light rather dull green and glaucescent, not usually discoloring much when dry; roots simple and slender. Basal leaves usually over three-quarters the height of the plant, erect, but rather thin and soft or becoming firmer, 1.5–4 mm. wide, tapering acute, the rather pronounced nerves at first close but becoming well separated, the edges smooth; stem leaves erect and foliaceous, that from the lower node often surpassing the upper which frequently exceeds the peduncles: stems erect or ascending, mostly longer than the peduncles, 1.5–3 mm. wide, narrowly wing-margined, the edges smooth to denticulate; nodes 1–2, rarely 3, the internode usually closely erect with its leaf and peduncles or peduncle bearing branch; peduncles 2–3, the outer one often slightly outcurved; spathes flattish, rather narrow or sometimes broader and more sharply keeled; outer bract finely many-nerved, straight and narrowly acute or more foliaceous above and somewhat incurved, rarely obtuse, 2–3 cm. long or prolonged to a length of 4 cm. the narrowly white-hyaline edges uniting 2–5 mm. above the base; inner bract 15–25 mm. long, straight and narrowly acute, broader and slightly incurved; scales ¾ the length of the inner bract, brownish-tinged; flowers violet-blue on slender slightly exserted erect or somewhat spreading pedicels; perianth 8–13 mm. long, the segments rounded or slightly emarginate at apex, short-aristulate; column 4–5 mm. high, mostly less than half the length of the corolla; anthers about 1.5 mm. high; ovary glabrous.

An extremely variable plant if not including more than one species. Scarcely any two specimens of my series are closely alike.

Eastern Texas, flowering in March and April. Dallas, April 15, 1900, B. F. Bush, on prairie and in woods; Columbia, March 25, 1900, Wm M. Canby; McLennan county, April, 1888, S. P.

Wright, herb. Columbia Univ. and herb. Gray; Austin, March, 1870, J. E. Bodin, type in U. S. Nat. herb.; A. A. Heller, March 25, 1898, herb. N. Y. Bot. Gard.

INDIAN TERRITORY: Sapulpa, April 28, 1895, B. F. Bush, herb. Columbia Univ., herb. Mo. Bot. Gard.

15. **Sisyrinchium amoenum** sp. nov.

Rather firmly erect and in closely many-stemmed tufts becoming 30 cm. or more high, somewhat yellowish-green and glaucescent, showing much brownish discoloration when dry; roots numerous very slender and elongated. Leaves long and strictly erect but not at all rigid, the longer ones equalling the tufts or nearly so, tapering-acute, 1–3 mm. wide, not very closely fine-nerved, the edges smooth; stems stiff and narrowly firm-winged, 1–2 mm. wide, the edges very smooth to obscurely roughened, usually 2-branched from about the middle, the branches erect or the outer one diverging, each bearing 2–4 mostly shorter peduncles; some stems may bear but one node much above the middle; stem-leaves erect, that from the lower node elongated; peduncles from the upper node relatively short, mostly unequal and somewhat curved, approximate or diverging; spathes mostly 15–18 mm. long, often tinged with reddish-purple, narrowed to the base, the subequal bracts mostly short-attenuate and very acute, very finely close-nerved, the outer with the narrowly white- or purplish-hyaline edges united for about 3 mm. at base; inner scales brownish-tinged, but little shorter than the bracts; flowers on slender erect pedicels subequal with the bracts, rather large, deep purple-blue, the delicately short-aristulate segments becoming 12 mm. long; column 5 mm. or more high; anther orange-yellow, about 2 mm. long; ovary glabrous.

Columbia, Texas, April 1, 1900, B. F. Bush, no. 472.

Proposed as distinct from *S. flaccidum* not without considerable reservation. Nevertheless it seems scarcely possible to reconcile its greater size and strictly erect habit with the diffuse and sub-spreading character of *S. flaccidum*. It is also relatively much longer-stemmed and more glaucescent, with thicker, more firmly and closely nerved leaves and bracts, shorter, stiffer peduncles, and larger flowers on less exserted pedicels.

It should be noted also that this plant and *S. flaccidum* were collected for distinct species by Mr. Bush, who especially noted its conspicuously larger size and larger flowers. Doubtless the mature fruit of each would settle finally the question of relationship.

17. **Sisyrinchium Brayi** sp. nov.

Growing in stiff tufts of many erectly-ascending stems about 15 cm. high, dull green and glaucescent much darkened when dry; roots simple, becoming stiff and wiry. Basal leaves rather few, the longer ones nearly equalling the tufts, firmly erect or ascending, often somewhat curved, 1–2 mm. wide, narrowly very acute, the edges smooth or minutely denticulate especially towards the apex; stem leaves mostly broader, often incurved, equalling the peduncles or nearly so: stems stiff and narrow especially towards the base, often outcurved below, 1–1.5 mm. wide, narrowly margined, the edges cartilaginous and finely erect-denticulate; nodes 1–2, the lower one mostly below the middle and bearing 1–2 erect peduncles, the internodes often forming a stiff double curve with the lower stem and peduncles; peduncles from the upper node 2–4, usually unequal and diverging or curved, 3–8 cm. long, stiff, and slender, denticulate-roughened or smooth; spathes narrowly oblong, about 1.5 cm. long; bracts mostly subequal, very acute, firmly membranous and finely many-nerved, the keels mostly denticulate-roughened; margins of outer bract conspicuously white-hyaline, united about 3 mm. at base, those of the inner bract broadly white-hyaline nearly to the apex; scales silvery-brownish, but little shorter than the bracts; flowers on erect pedicles subequal with the bracts, violet-blue; perianth about 10 mm. long, the oblong segments delicately firm-nerved, almost subspinulose, short-aristulate, not emarginate; column 3–4 mm. high; anthers nearly 2 mm. long; ovary glabrous; capsules apparently very small and trilobulate, subglobose, the valves definitely trinervate.

Virginia Point, opposite Galveston, Texas, April 20, 1899, Prof. W. L. Bray, "flat coast prairie, making blue patches for many acres."

Apparently between *S. Helleri* and *S. colubriferum*, differing from the former in non-spreading habit, stiffer, less branched stems, shorter pedicels, glabrous ovary and much smaller trinervate capsule. Though most like this species in general appearance the plant seems to be in much closer affinity with the much more diverse appearing *S. colubriferum*. From the latter it differs in lesser size, stiffer, less branched habit, darker color when dry, much narrower and less leafy stems, much narrower and firmer leaves and rather smaller flowers with narrower more firmly nerved and non-emarginate perianth segments.

Named for the collector, Prof. W. L. Bray, who has supplied me with specimens of several of the species here described.

18. SISYRINCHIUM FURCATUM Bicknell, Bull. Torr. Club, **26**: 229. 1899

Firmly erect or erectly ascending in close many-stemmed tufts, 10–20 cm. high, rather bright yellowish-green, turning duller or brownish-green when dry, usually not even glaucescent, purplish about the nodes and bracts in most specimens, becoming slightly fibrillose at base, the roots numerous and slender; leaves numerous, the basal usually over half the height of the stem or longer, 0.5–2 mm. wide, closely and finely striate-nerved, slenderly acute, the edges smooth or sometimes obscurely denticulate-roughened, the sides below sometimes incrustate-roughened with minute harsh points; stem-leaf firmly erect, subequal with the peduncles, the narrow base prominently fine-striate; stems 0.5–1.5 mm. wide, narrowly thin-winged or merely margined, the edges smooth or denticulate-serrulate, the sides smooth or roughened with minute whitish points; peduncles 2–3, slender, mostly 4–6 cm. long, approximate or diverging, smooth or roughened and denticulate; spathes broadest at the middle, 2–3 mm. wide in the pressed plant, mostly 1.5–2 cm. long, the bracts at first thinly membranous and semi-transparent, delicately nerved, acute or acuminate, equal or the outer one slightly the longer, rarely 3 cm. in length, its margin narrowly white or purplish hyaline, united-clasping for 2–5 mm. at base; inner scales brownish tinged, about half the length of the bracts; flowers on erect pedicels little if any longer than the bracts; perianth bright purplish-blue, the segments 8–12 mm. long, emarginate or rounded, aristulate; stamineal column 4–5 mm. high, usually less than one-half the length of the perianth; anthers orange-yellow, 1.5–2 mm. long; ovary closely glandular-puberulent or tomentulose.

Additional material which has come to hand since the description of the single specimen on which the species was based permits the above more comprehensive description and extension of range from Louisiana to Mississippi, Arkansas and Texas. The mature fruit has not yet been seen.

MISSISSIPPI: Jackson, April 3, 1900; Wm. M. Canby.

LOUISIANA: Hammond, April 4, 1889; Lewena Gallup, "Pine lands;" type in the U. S. Nat. herb.; Opelousas, April 3, 1900; Washington, April, 8, 1900, dry soil; Biltmore herb.

ARKANSAS: Prescott, April 8, 1900; B. F. Bush, "common on prairie."

INDIAN TERRITORY: Muscogee, April, 1891, M. A. Carleton.

19. SISYRINCHIUM LANGLOISII Greene

Suberect or ascending in loose tufts, 6 10 cm. high from a cluster of delicate fibrous roots, slightly fibrillate at base, dull green, turning dark when dry; leaves firm, almost capillary, mostly .25–.5 mm. wide, the broadest becoming 1 mm. wide, equalling or shorter than the stems, slenderly tapering to a somewhat indurated point, closely striate-nerved, the edges smooth; stem-leaves subequal with the peduncles; stems equally slender with the leaves, the firm narrow margins smooth to denticulate; node often low down or subbasal, usually bearing 2–3 very slender, suberect, smooth or denticulate peduncles 4–9 cm. long; spathes about 1.5 cm. long, 1.5–2 mm. wide, the bracts rather stiff and firmly close-nerved, narrowly attenuate, subequal or the outer one slightly longer, sometimes becoming 2 cm. long, its margins narrowly hyaline and connate for 4–5 mm. at base; inner scales brownish-tinged, about half the length of the bracts; flowers pale blue, on hair-like slenderly exserted pedicels; perianth less than 10 mm. long, the segments contracted or slightly emarginate at apex, mucronulate-aristulate; stamineal-column 4–5 mm. high, usually more than half the length of the perianth; anthers pale yellow, about 1 mm. long; ovary sparsely puberulent.

The above description is based on type specimens received from Professor Greene. Fruiting specimens from Texas referred here are taller, more erect and broader-leaved, becoming 24 cm. high, with the larger leaves 1.5 mm. wide; the capsules are globose to broadly oblong and 2–4 mm. high on flexuously spreading pedicels, their walls rather thin and transversely corrugate without lateral nerves; the seeds are .75 mm. in diameter, black, globose and rather deeply close-pitted.

Related to *S. furcatum* but smaller and more slender throughout, the leaves and bracts firmer and more attenuate and closely nerved, the pedicels more slender and exserted, the flowers smaller and paler, the stamineal-column relatively longer, anthers smaller.

LOUISIANA: St. Martin county, April 11, 1892, in full flower, Rev. A. B. Langlois, type in Herb. Prof. E. L. Greene; Texas, ex herb. George Thurber in herb. Gray; Drummond in herb. Columbia Univ., and Acad. Nat. Sci. Philadelphia.

✓20. **Sisyrinchium Bushii** sp. nov.

Growing in small, more or less spreading or suberect tufts, 6–15 cm. high, rather pale dull-green, darkening somewhat when dry, sometimes minutely scabrous, base of young tufts often chaffy with the remains of dead leaves or finally loosely fibrillose; roots simple. Basal leaves shorter than or nearly equalling the tufts, erect or ascending, firmly close-nerved, mostly 1.5–2 mm. wide, acute with finally hardened tip, the edges smooth or cartilaginous-denticulate; stems erect or ascending or the outer ones spreading and geniculate at the node, 1–2 mm. wide, the firm, narrow margins cartilaginous-denticulate or ciliolate; nodes 1–2, the lower one mostly near the base of the stem; stem-leaves firmly erect, the lower one relatively elongated, the upper subequal with the 2–4 approximate peduncles; spathes 12–20 mm. long, the bracts equal or the outer one often, the inner sometimes, slightly the longer, mostly denticulate on the keels, closely many-nerved, acute, sometimes narrowly prolonged, the edges rather broadly white-hyaline, especially on the inner bract which may be scarious-obtuse at the apex; outer bract connate for 3–5 mm. at base; the bracts, leaves and stem sometimes obscurely roughened with minute points; inner scales equalling the bracts or nearly so, brownish-tinged; flowers rather pale violet-blue on mostly well exserted erect or recurved pedicels; perianth 8–12 mm. long, the segments short-aristulate, contracted at the apex or slightly emarginate; column 4–6 mm. high, one-half or more the length of the corolla; anthers nearly or quite 2 mm. long; ovary puberulent to glabrate; capsules apparently globose or suberect on much recurved pedicels.

A small, tufted, subspreading species near *S. varians* but, besides difference in size and habit, firmer and more glaucous, the leaves more strongly close-nerved, the first node much lower on the stem, the stamineal-column relatively longer with larger anthers; the ovary mostly puberulent.

Named for Mr. B. F. Bush, the collector of the type specimens as well as of several other Texas species here first described.

INDIAN TERRITORY: Sapulpa, April 29, 1895, B. F. Bush, no. 971, herb. Columbia Univ., herb. Biltmore, herb. Mo. Bot. Gard. Dr. Edward Palmer, 1868, no. 336, U. S. Nat. herb. and herb. Torrey.

TEXAS: Herb. Torrey; Austin, April 30, 1898, Prof. W. L. Bray; Leonard, Collin county, May 1, 1886; J. H. Merrill, herb. Columbia Univ., Dallas, April 15, 1900, B. F. Bush.

21. **Sisyrinchium Canbyi** sp. nov.

Growing in very small tufts of several stiffly ascending stems 4–6 cm. high, dull glaucescent green. Leaves extremely narrow, mostly

0.5 mm. wide, stiff, prominently fine-nerved, the edges, as are those of the stem and peduncles, finely cartilaginous-denticulate, the tips somewhat obtuse; stems not broader than the leaves, narrowly two-edged, sometimes simple, but mostly branched about the middle into two erectly-ascending, often slightly curved peduncles 1.5–2.5 cm. long, the subtending leaf not surpassing the peduncles; spathes narrowly oblong, narrowed to each end, the acute or obtuse bracts 10–12 mm. long, or the outer one becoming linear-attenuate and 15 mm. long, rather prominently and closely fine-nerved, the keels denticulate, the inner margins of outer bract rather broadly white-hyaline below; silvery and brownish-tinged, nearly equalling the bracts; flowers small, on distinctly exserted pedicels, bright purplish-blue, the segments rather narrow and close-nerved, sharp-mucronulate, 6–8 mm. long; stamineal-column 3–4 mm. high; anthers about 1 mm. long; ovary glabrous or glabrate.

Columbia, Texas, March 25, 1900, Wm. M. Canby.

A curious little plant, the smallest of our species except *S. exile*, based on a single specimen sent me by Mr. Canby in a sheet with reduced examples of *S. flaccidum*, a very different plant. It suggests a depauperate state of *S. Bushii*, but differs in much narrower, more definitely fine-denticulate leaves and stiffly subspreading habit, smaller, deeper colored flowers, with very short stamineal-column, and much smaller anthers.

22. **Sisyrinchium colubriferum** sp. nov.

Suberect or spreading in leafy tufts 20 cm. or more high, sparsely loose-fibrillose at base, dull green, turning brownish-green, mostly purplish at the nodes, roots simple, stiff and slender. Leaves broad and thin, perceptibly narrowed towards the base, sometimes surpassing the peduncles, 2–7 mm. wide, not very closely many-nerved, acutely pointed, the edges mostly smooth; stems numerous, branched from near the outcurved or suberect base, the internodes and often compound branches more or less stiffly sinuous, broadly thin-winged, 2–5 mm. wide, the edges finely denticulate-serrulate; peduncles in clusters of 3–4, numerous by reason of the compound stems, mostly curved, 5–10 cm. long, .75–1.5 mm. wide, approximate or somewhat diverging, denticulate; spathes narrowed to each end, the bracts acuminate, thin, closely many-nerved, the outer one a little longer than the inner, its margins white-hyaline below, connate for 2–3 mm. at base; scales brownish, three-quarters the length of the inner bract or longer; flowers on slender more or less exserted or slightly spreading pedicels;

perianth light violet-blue, the obovate or obovate-oblong segments about 10 mm. long, mostly retuse, mucronate; stamineal-column short, 4 mm. high; anthers 1.5 mm. long; ovary glabrous; capsules on more or less spreading pedicels, 4 mm. or more high, the valves more or less distinctly trinervate.

TEXAS: Columbia, Brazoria county, April 9, 1899, "common on prairie," B. F. Bush, no. 66.

A well-characterized species of very distinct habit by reason of its widely sinuous and compound, broadly-leaved stems and branches and numerous interclustered peduncles.

23. **Sisyrinchium Helleri** sp. nov.

Spreading or suberect in loosely many-stemmed tufts, dull green or glaucescent, turning dark when dry, roots long and slender. Basal leaves about half the length of the stems, 1–2 mm. wide, thin, rather openly weak-nerved when full grown, narrowly acute, mostly smooth-edged; stems mostly shorter than the peduncles, usually spreading or ascending, and geniculate at the one or two nodes, 8–20 cm. long over all, 1–1.5 mm. wide, narrowly firm margined, the edges smooth to erect-denticulate; peduncles 2–4, more or less unequal and diverging, 3–9 cm. long, sometimes twice the length of the stem, mostly 1 mm. or less wide, smooth-edged or nearly so; stem-leaves usually much shorter than the peduncles, rather abruptly broadened and loosely clasping below, the lower margins conspicuously white-hyaline; spathes mostly deflected, broadest about the middle and somewhat lenticular in outline, mostly 15–18 mm. long and 3–5 mm. wide, the bracts closely fine-striate with broadly white-hyaline margins, sharply acuminate or sometimes obtuse-pointed, the more convex boat-shaped inner one usually a little surpassing the outer which is connate for 2–4 mm. at base; scales brownish, equalling the bracts or nearly so: flowers on erect pedicels 15–25 mm. long, equalling or much surpassing the bracts; perianth rather deep, bright blue, 10 mm. or more long, the segments obovate or narrower, scarcely or not emarginate, mucronate-aristulate; stamineal-column 4–5 mm. high; anthers small, about 1 mm. long; capsules on more or less spreading or recurved pedicels, rather large, subglobose and 4–6 mm. high or becoming obovoid-oblong and 7 mm. high, the dark-brown valves without nerves; seeds not fully mature, rather large, 2–5 in each cell.

TEXAS: Nueces county, along Corpus Christi Bay, April 9–12, 1894, A. A. Heller. Type, "Plants of Southern Texas, no. 1552."

Especially characterized by spreading habit, numerous narrow stems and narrow leaves, relatively broad spathes with longer inner bract, large capsules.

24. **Sisyrinchium flaccidum** sp. nov.

Forming small many-stemmed usually somewhat diffuse or spreading tufts, or sometimes erect, 10–20 cm. high, rather deep green and scarcely if at all glaucescent, turning dark when dry, roots very slender. Basal leaves numerous, frequently equalling the height of the plant, thin and lax with delicate well-separated nerves, 1–3 mm. wide, tapering-acute, the edges smooth; stem-leaves elongated but not usually surpassing the terminal peduncles; stems weak, very slender, .5–1.5 mm. wide, two-edged or narrowly thin-winged, the edges smooth or sometimes partially denticulate-roughened, some of them usually outcurved or spreading at least below and geniculate at the nodes; nodes mostly two the lower one often subbasal, but sometimes high up; peduncles very straight and slender, often appearing filiform, usually only one from the lower node and two or three from the upper one, erect or nearly so, 4–9 cm. long, spathes narrow, somewhat tapering to the base, straight or deflected; bracts membranous, delicately many-nerved, acute to narrowly acuminate, subequal or the outer one slightly prolonged, 13–20 mm. rarely 25 mm. long, the outer one narrowly white-hyaline on the edges, united at base for 3–5 mm.; inner scales ½–¾ the length of the bracts, silvery and brownish tinged; flowers bright purplish-blue, the segments 8–10 mm. long, mucronate-aristulate, mostly not emarginate; stamineal-column 5 mm. high, the anthers 1.5 mm. long; ovary strictly glabrous.

Eastern Texas in rich woods and on prairies, beginning to flower before the end of March. Common about Columbia, the only locality from which I have received it.

Columbia, Brazoria county, April 6–7, 1899, March 26–28, 1900, no. 466 type, B. F. Bush; March 25, 1900, Wm. M. Canby.

A small, thin-leaved species of lax habit apparently nearest to *S. furcatum* but differing in weaker stems, thinner longer leaves, almost perfect smoothness, duller green color and glabrous ovary.

25. SISYRINCHIUM MINUS Engelm. & Gray, Bost. Journ. Nat. Hist. **5**: 263. 1845

Diffusely spreading or ascending in loose tufts, green or slightly glaucescent, usually turning very dark when dry; roots weak and slender, pale and fibrillate. Stems from 5–25 cm. long, branched and leafy from near the base, more or less flexuose and geniculate from node to node as are the longer branches, the nodes 2–6, the branches and peduncles more or less outcurved or diverging. Leaves very thin, semi-transparent, delicately nerved, the main nerves rather distant, the faint alternating series often in groups of two or three and with scattered cross-reticulations, 2–7 cm. long, 1–4 mm. wide, the edges denticulate-roughened to serrulate, acuminate; stem-leaves often incurved-subfalcate; basal leaves few and early withering: stem merely margined or narrowly winged, sometimes almost subterete at base, the edges denticulate-roughened to smooth; peduncles short, 2–6 cm. long, the ultimate ones a diverging pair or solitary; spathes flattened, the bracts very unequal, somewhat abruptly acute or obtusely pointed, the outer one leaf-like, 13–35 mm. long, the edges white-hyaline below, connate for 3–5 mm. at base; inner bract 10–20 mm. long, less foliaceous than the outer one; scales short, commonly less than half the length of the shorter bract, brownish-tinged; flowers 2–6 on hair-like, slightly exserted peduncles, mostly flexuously spreading above; perianth very small, 5–6 mm. long, said to be reddish-purple or yellowish-white, usually colorless in dried specimens, the segments not usually emarginate, slenderly acuminate and aristulate, delicately 3–5-nerved; stamineal-column 2.5–3 mm. high; anthers .05 mm. long: ovary thinly puberulent; capsules light brown, corrugate from the narrow rows of 4–6 seeds, oblong, 3–5 mm. long, 2–3 mm. wide; seeds very small, black, subglobose to ellipsoid, 5.0–.75 mm. in diameter, strongly pitted, umbilicate.

Eastern and central Texas to Louisiana, in damp soil and low prairies, flowering in March and April. Apparently the commonest species of Texas.

TEXAS: Bexar county, San Antonio, V. Havard, 1884; Gillespie county, G. Jermy; Brazoria county, Columbia, B. F. Bush, 1899; Wm. M. Canby, 1900; Chenango, Bush, 1899; Fort Bend county, Richmond, W. F. Bray, 1899; Harris county, Houston, Elihu Hall, 1892, no. 637; Harris county, Harrisburg, I. F. Ivor, 1875; Hockley, T. W. Thurow, 1893; M. A. Carleton, 1891; Dallas county, Dallas, J. Reverchon, Curtiss, North Am. Plants, no. 2860; J. Reverchon, 1874, 1880; also Lindheimer, 1844, no. 313; Drummond, no. 408; Mex. Boundary Survey, no. 1445.

LOUISIANA: Baton Rouge, 1874, G. F. Good.

Index to recent Literature relating to American Botany

Arthur, J. C. Generic Nomenclature of Cedar Apples. Proc. Indiana Acad. Sci. 1900: 131–136. Je. 1901.

Replaces the name *Gymnosporangium* by *Tremella* in accord with the method of generic types.

Berry, E. W. The Origin of Stipules in *Liriodendron*. Bull. Torr. Club, **28**: 493–498. *pl. 41, 42.* 30 S. 1901.

Bicknell, E. P. Still further Notes on the Agrimonies. Bull. Torr. Club, **28**: 514–518. 30 S. 1901.

Blackman, F. F. The primitive Algae and the Flagellata; an Account of modern Work bearing on the Evolution of the Algae. Ann. Bot. **14**: 647–688. D. 1900.

Blankinship, J. W. Weeds of Montana. Bull. Montana Agric. Ex. Sta. 30: 1–70. *f. 1–21.* 10 S. 1901.

Buller, A. H. R. Contributions to our Knowledge of the Physiology of the Spermatozoa of Ferns. Ann. Bot. **14**: 543–582. D. 1900.

Chamot, E. M. & Thiry, G. Studies on Chromogenic Bacteria. Bot. Gaz. **30**: 378–393. 20 D. 1900.

Dietel, P. Bemerkungen über einige Melampsoreen.—II. Hedwigia, **40**: Beiblatt (61)–(62). 20 Je. 1901.

Doherty, M. W. New Species of *Trimmatostroma*. Bot. Gaz. **30**: 400–403. 20 D. 1900. [Illust.]

Driggs, A. W. Notes on the Flora of Connecticut. Conn. School Document, No. 16: 1–23. 1901.

Duggar, B. M. Physiological Studies with Reference to the Germination of certain Fungus Spores. Bot. Gaz. **31**: 38–66. 21 Ja. 1901.

Geheeb, A. Révision des Mousses récoltées au Brésil dans la province de San-Paulo par M. Juan J. Puiggari pendant les années, 1877–1882. III. Espèces du genre *Fissidens*. Rev. Bryol. **28**: 61–65. 1901.

Includes preliminary diagnoses of six new species of *Fissidens*.

Gifford, J. The dwarf Mistletoe, *Razoumofskya pusilla*. Plant World, **4**: 149, 150. Au. 1901.

Greene, E. L. New Species of *Laciniaria*. Pittonia, **4**: 315–318. 30 S. 1901.

L. vittata, *L. serotina*, *L. Earlei*, *L. elegantula*, *L. nervata*, *L. scabra*, and *L. aspera*, new species.

Greene, E. L. New or noteworthy Species.—XXIX. Pittonia, **4**: 318–320. 30 S. 1901.

New species in *Pentstemon*, *Erigeron*, and *Eriogonum* (2).

Greene, E. L. Some neglected Violets. Pittonia, **4**: 285–297. 30 S. 1901.

V. fulcrata, *V. petrophila*, *V. compacta*, *V. Andersonii*, *V. oreocallis*, *V. Albertina*, *V. filipes*, *V. cardminefolia*, *V. retroscabra*, *V. unguiculata*, *V. desertorum*, *V. bellidifolia*, *V. Illinoensis*, *V. subviscosa*, *V. crenulata*, *V. Fletcheri*, and *V. nodosa*, new species.

Greene, E. L. New Species of *Cerastium*. Pittonia, **4**: 297. 30 S. 1901.

C. oreophilum, *C. effusum*, *C. scopulorum*, *C. occidentale*, *C. angustatum*, *C. campestre*, *C. vestitum*, *C. confertum*, *C. patulum*, *C. Sonnei*, *C. adsurgens*, and *C. fastigiatum*, new species.

Greene, E. L. Five new Species of *Rumex*. Pittonia, **4**: 304–306. 30 S. 1901.

R. gracilipes, *R. polyrrhizus*, *R. procerus*, *R. confinis*, and *R. fenestratus*.

Greene, E. L. Corrections in Nomenclature.—IV. Pittonia, **4**: 307. 30 S. 1901.

Greene, E. L. Studies in the Cruciferae.—IV. Pittonia, **4**: 307–315. 30 S. 1901.

New species in *Lesquerella* (8), *Thysanocarpus*, *Lepidium*, *Draba* (3), and *Thelypodium* (2).

Grout, A. J. Mosses with a Hand-Lens. Pp. i–ix, 1–73. New York. 1900.

An introduction to the study of mosses.

Hämmerle, J. Ueber die Periodizität des Wurzelwachstums bei *Acer Pseudoplatanus*. Beitr. wiss. Bot. **4**: 149–165. 1901.

Harper, R. M. On a Collection of Plants made in Georgia in the Summer of 1900. Bull. Torr. Club, **28**: 454–484. *pl. 29*. 27 Au. 1901.

New species in *Fuirena*, *Rhynchospora*, *Glottidium*, *Viola* (by Pollard), *Dicerandra*, and *Baldwinia*.

Hay, G. U. A Wilderness Journey in New Brunswick. Bull. Nat. Hist. Soc. New Brunswick, **17**: 153–169. 1899.

Hemsley, W. B., & Pearson, H. H. W. On a small Collection of dried Plants obtained by Sir Martin Conway in the Bolivian Andes. Jour. Linn. Soc. **35**: 78–90. 15 Jl. 1901.

Holm, P. *Eriocaulon decangulare* L.; An anatomical Study. Bot. Gaz. **31**: 17–37. *f. 1–5.* 21 Ja. 1901.

Howard, A. On *Trichosphaeria sacchari* Massee; A Fungus causing a Disease of the Sugar-cane known as Rind Fungus. Ann. Bot. **14**: 617–645. *pl 34.* D. 1900.

Johnson, D. S. Notes on the Flora of the Banks and Sands at Beaufort, N. C. Bot. Gaz. **30**: 405–410. 20 D. 1900.

Jost, L. Ueber einige Eigenthümlichkeiten des Cambiums der Bäume. Bot. Zeitung, **59**: 1–24. *pl. 1. f. 1–12.* 16 Ja. 1901.

Lloyd, F. E. Some Points in the Anatomy of *Chrysoma pauciflosculosa.* Bull. Torr. Club, **28**: 445–450. *f. 1–3.* 27 Au. 1901.

Lloyd, F. E., & Underwood, L. M. A Review of the Species of *Lycopodium* of North America. Bull. Torr. Club, **27**: 147–168. *pl. 2–4.* 21 Ap. 1900.

Includes descriptions of *Lycopodium porophilum* and *L. Fawcettii* sp. nov.; *L. inundatum adpressum* Chapman and *L. inundatum pinnatum* Chapman are raised to specific rank.

Malme, G. O. A. N. Die Asclepiadaceen des Regnell'schen Herbars. Kongl. Sv. Vet.-Akad. Handl. **34**[7]: 1–101. *pl. 1–8.* 1900.

Contains descriptions of new species and varieties from Brazil in the genera *Hemipogon*, *Orthosia*, *Oxypetalum* (5), *Calostigma* (3), *Widgrenia* (gen. nov.), *Melinia*, *Macroscepis*, *Pseudibatia* (2, gen. nov.), *Nephradinia*, *Blepharodon*, and *Marsdenia.*

Massee, G. *Dacryopsis Ellisiana* Massee. Bull. Torr. Club, **28**: 519. 30 S. 1901.

Massee, G. Redescriptions of Berkeley's Types of Fungi. Part II. Jour. Linn. Soc. **35**: 90–119. *pl. 4, 5.* 15 Jl. 1901.

Mäule, C. Das Verhalten verholzter Membranen gegen Kalium-permanganat, eine Holzreaktion neuer Art. Beitr. wiss. Bot. **4**: 166–185. 1901.

Maxon, W. R. A new *Asplenium*, hitherto referred to *A. Trichomanes* var. *incisum* Moore. Bull. Torr. Club, **27**: 197–199. 21 Ap. 1900.

Asplenium vespertinum Maxon.

Maxon, W. R. Notes on the Validity of *Asplenium ebenoides* as a Species. Bot. Gaz. **30**: 410–415. 20 D. 1900.

Meehan, T. *Callicarpa Americana.* Meehan's Monthly, **11**: 129, 130. *pl. 9.* S. 1901.

Rydberg, P. A. Studies on the Rocky Mountain Flora.—VI. Bull. Torr. Club, **28**: 499–511. 30 S. 1901.

New species in *Trifolium*, *Vicia*, *Primula*, *Cuscuta* (2), *Monarda*, *Castilleja*, *Pentstemon*, *Sambucus*, *Chrysothamnus* (2), *Aster*, *Machaeranthera*, *Erigeron*, *Carduus* (6), *Agoseria* (2), *Taraxacum*, *Crepis*, and *Hieracium*.

Rydberg, P. A. What is *Prunus insititia?* Bull. Torr. Club, **27**: 195, 196. 21 Ap. 1900.

Sargant, E. Recent Work on the Results of Fertilization in Angiosperms. Ann. Bot. **14**: 689–712. D. 1900.

Schneider, A. The probable Function of Calcium oxalate Crystals in Plants. Bot. Gaz. **32**: 142–144. 20 Au. 1901.

Small, J. K. *Dasystoma flava* and some related Species. Bull. Torr. Club, **28**: 451–453. 27 Au. 1901.

Includes three new species and names.

Smith, F. G. A peculiar Case of Contact Irritability. Bull. Torr. Club, **27**: 190–194. 21 Ap. 1900. [Illust.]

Smith, J. D. Undescribed Plants from Guatemala and other Central American Republics. Bot. Gaz. **31**: 109–125. *pl. 1.* 23 F. 1901.

Smith, M. H. Nitrates as a Source of Nitrogen for saprophytic Fungi. Bot. Gaz. **31**: 126. 23 F. 1901.

Smith, R. W. The achromatic Spindle in the Spore Mother Cells of *Osmunda regalis*. Bot. Gaz. **30**: 361–377. *pl. 22.* 20 D. 1900.

Spegazzini, C. Contribución al estudio de la Flora del Tandil, 1–60. 8vo. La Plata and Buenos Ayres. 15 Ap. 1901.

Contains descriptions of new species in *Portulaca*, *Mimosa*, *Opuntia*, *Vernonia*, *Baccharis*, *Perezia*, and *Verbena*.

Spegazzini, C. Nova Addenda ad Floram Patagonicam. An. Soc. Cient. Arg. **47**: 161–177; 224–239; 274–290; **48**: 44–59; 172–190; 238–242; 329–332. 1899.

Contains descriptions of new species in *Ranunculus*, *Draba*, *Sisymbrium*, *Braya*, *Calandrinia*, *Sida*, *Oxalis*, *Adesmia*, *Vicia*, *Hoffmanseggia*, *Acaena*, *Oenothera*, *Petrocactus*, *Tetragonia*, *Azorella*, *Mulinum*, *Boopis*, *Haplopappus*, and *Baccharis*.

Spegazzini, C. Stipeae Platenses. An. Mus. Nac. Montevideo **4**[II]: i.–xviii.; 1–56. 1901. [Illust.]

Includes new species and new names in *Oryzopsis* and *Stipa*.

Steele, E. S. Sixth List of Additions to the Flora of Washington, D. C., and Vicinity. Proc. Biol. Soc. Wash. **14**: 47–86. 19 Je. 1901.

Includes a new species of *Viola* by Greene and a *Lycopus* by Steele.

Stone, G. E. Autumnal Coloration of Leaves. Bull. Torr. Club, **27**: 200, 201. 21 Ap. 1900.

Stuntz, S. C. A Revision of the North American Species of the Genus *Eleutera* Beauv. (*Neckera* Hedw.). Bull. Torr. Club, **27**: 202–211. 21 Ap. 1900.

Thiselton-Dyer, W. T. Note on the Sugar-cane Disease of the West Indies. Ann. Bot. **14**: 609–616. D. 1900.

Uexküll-Gyllenband, M. von. Phylogenie der Blütenformen und der Geschlechterverteilung bei den Compositen. Bibliotheca Botanica, $\mathbf{10}^{52}$: 1–80. *pl. 1, 2.* 1901.

Vail, A. M. Studies in the Asclepiadaceae.—V. A new Species of *Vincetoxicum* from Chihuahua. Bull. Torr. Club, **28**: 485. *pl. 30.* 27 Au. 1901.

V. Wootonii, new species.

Van Hook, J. M. Notes on the Division of the Cell and Nucleus in Liverworts. Bot. Gaz. **30**: 394–399. *pl. 30.* 20 D. 1900.

White, V. S. The Tylostomaceae of North America. Bull. Torr. Club, **28**: 421–444. *pl. 31–40.* 27 Au. 1901.

New species in *Tylostoma* (8) by White and by Peck, *Battarrea* (2) by Underwood, and *Dictyocephalus* (gen. nov.) by Underwood.

Wildeman, E. de. *Amsonia Tabernaemontana* Walt. Ic. Select. Hort. Thenensis, **2**: 121. *pl. 69.* Je. 1901.

Wildeman, E. de. *Cardiospermum grandiflorum* Sw. forma *hirsutum* Radlk. Ic. Select. Hort. Thenensis, **2**: 85. *pl. 61.* My. 1901.

Wildeman, E. de. *Eriogonum Jamesii* Benth. var. *flavescens* S. Wats. Ic. Select. Hort. Thenensis, **2**: 93. *pl. 63.* My. 1901.

Wildeman, E. de. *Petiveria alliacea* L. Ic. Select. Hort. Thenensis, **2**: 77. *pl. 59.* Ap. 1901.

Wildeman, E. de. *Rhipsalis rhombea* Pfeiff. Ic. Select. Hort. Thenensis, **2**: 111. *pl. 67.* Je. 1901.

Wildeman, E. de. *Rosa Engelmanni* S. Wats. Ic. Select. Hort. Thenensis, **2**: 69. *pl. 57.* Ap. 1901.

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BULLETIN

OF THE

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Memoirs (See last page of cover.)

Charles Mohr

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BULLETIN

OF THE

TORREY BOTANICAL CLUB

NOVEMBER 1901

Biographical Sketch of Dr. Charles Mohr

By Eugene A. Smith

Born 28 Dec. 1824, in Esslingem, Württemberg, the early years of Charles Mohr were spent there and at the Cloister Denkendorf where his father owned a manufactory of chemicals. His taste for natural history was first aroused by the reading of the famous Bridgewater Treatises, especially that of Buckland, and association with an uncle who was a pensioned forester of the district, kindled in him early that enthusiasm for botany and forestry which was to play so important a rôle in his after life. At the age of eighteen he entered the polytechnic school at Stuttgart, where he remained about four years, improving the opportunity for the study of exotic plants afforded by the royal gardens, and making valuable acquaintances among scientific men. Here he met with Aug. Kappler, the well-known collector of natural history specimens from South America, and in due course of time Mohr was invited to go on an expedition to the head waters of the Surinam in Dutch Guiana as collector, especially of plants. At Paramaribo, and on the Surinam and Maroni rivers, these collections were prosecuted, not without much suffering from fever and other troubles due to exposure, which, in the case of young Mohr, compelled him, after a seven months' stay in Guiana, to give up the work and to return to Europe, where he arrived early in 1847.

The revolution of 1848 which caused the derangement and breaking up of so many of the business affairs in Germany, led to the emigration to America of Charles Mohr and his elder brother.

After short stays in New York and Philadelphia, they made their home in Cincinnati. In 1849 in company with about fifty young men of that city, he set forth to seek his fortune in California. At Fort Laramie all superfluous baggage was left behind, and at Fort Hall on the upper waters of Lewis Fork of Snake River, the wagons were abandoned and their contents transferred to pack mules, and as the number of mules was limited, many of the party had to make the rest of the journey on foot.

Young Mohr thus lost all his books and a herbarium already well filled. The travellers arrived finally at a settlement in the Sacramento Valley, 110 days after leaving the last settlement on the border of Missouri. A year spent in gold mining with the unavoidable exposure to extremes of climate so told upon the health of young Mohr, as to compel him to give up his interests in the claim and return east, which he did by way of Panama. Stopping there for the purpose of regaining his strength, he had the misfortune to lose by theft all his belongings including his herbarium and a collection of minerals, and to fall a victim to fever, on partial recovery from which he took passage for New Orleans and arrived in Cincinnati towards the end of December, 1850.

The next two years were spent upon a farm in Indiana which he and his brother had purchased jointly, and it was during this time, 1852, that he was married. The rheumatic troubles contracted in California finally making the life of a farmer impossible to him, he went to Louisville where he became interested in the drug business, for which he had always a strong inclination. His long-interrupted botanical studies were renewed mainly through the acquaintance here made with Leo Lesquereux, at that time engaged in the study of the mosses. But the climate of Louisville did not agree with him and an attack of neuralgia which affected the heart and kept him confined to his bed for a long time, led him to seek a more genial one first in Louisiana and then in Vera Cruz, and finally in the highlands of Mexico between Cordova and Orizaba.

During his sojourn in Mexico he met with many congenial friends both among Germans and Mexicans, and he would probably have cast his lot with them but for the political agitations of 1857. Returning to the United States he established himself in the drug business in Mobile, Ala., which continued to be his home till his removal to Asheville, N. C., about two years before his death.

During the Civil War his business suffered greatly, but he was employed by the Confederate government in the manufacture of drugs from native resources, and in testing the medicinal preparations smuggled into the country from Europe. After the close of the war he set to work with vigor to build up his business which soon became profitable. With returning prosperity his enthusiasm for botany revived, and he devoted all his leisure time, first to the investigation of the mosses of his district, instigated thereto by his friend Lesquereux, to whose work on "The Mosses of North America" he contributed no mean share. In these studies the ferns were also included, and his notes and observations thereon were given to Eaton for his "Ferns of North America."

Observations and collections in the other provinces of botany and forestry were by no means neglected, and frequent excursions into the swamps and fields accessible to him gave him that wide and accurate acquaintance with the whole flora of his section that made him easily first of the botanists of the South and the peer of any in the land.

His active mind was not content with botanical studies only, for we find him undertaking, in the interest of the "Grangers," all kinds of laborious investigations of the fertilizing values of native products such as the ashes of pine straw, of the various woods, of cotton seed hulls, etc., and in delivering lectures and writing articles on subjects connected with the improvement of the exhausted soils of the state, and the betterment of agricultural practice.

He also made excursions into the mineral sections of the state, especially into the gold region, enlarging at the same time his collections and observations on plant distribution and forestry.

From about 1878 the results of these investigations began to be made public in a series of articles, at first practical and economic only, afterwards more strictly scientific and specialized, but always directed toward the imparting of useful knowledge to his fellowmen. As with his collections, primarily intended to illustrate some feature of our natural resources, they grew in breadth and completeness until they became illustrative of monographs.

Among the first of these publications were "The Forests of Alabama and their Products"; and "The Grasses and other Forage Plants of Alabama," both written for Berney's Hand Book of Alabama, 1878, but afterwards amplified and published by the Department of Agriculture. In 1878, at the solicitation of the writer of these lines, he undertook the preparation for the Geological Survey of a normal herbarium of Alabama plants, based upon the collections made by himself and the writer. In 1880 we published a "Preliminary List of the Plants growing without Cultivation in Alabama," in which were enumerated the flowering plants and ferns up to that time collected and in the herbarium, numbering about 1,500 species. The expansion and elaboration of this modest "List" has just been published as "Plant Life of Alabama." In similar manner and chiefly through his efforts, the normal herbarium of Alabama plants above mentioned, has grown to be one of the most valuable of the collections of the Geological Survey in the Museum of the University of Alabama. In his honor it is now known as the *Charles Mohr Herbarium.*

His full and accurate knowledge of the natural resources of the Southern States, and his taste and skill in arranging and installing collections of various kinds, were often brought into requisition by the railroads, especially the Louisville and Nashville, and by the Department of Agriculture at Washington, and he made a number of illustrative collections of the varied resources of the territories traversed by these lines for the expositions of New Orleans, Louisville, and Atlanta, and prepared pamphlets descriptive of the same, such as "The Economic Geology of Alabama," "The Natural Resources of Alabama," "The Soils, Climate, and Agricultural Resources of the Territory traversed by the L. and N. R. R. Lines."

These pamphlets were characterized by a scientific spirit and truth to nature, and of them it has been remarked by Professor Lamson-Scribner, that they can "in no way mislead the reader or prospective settler." For the Tenth Census he prepared a Report on the Forestry Conditions of the Gulf States, and while engaged in this work he collected for the Alabama Geological Survey, and for the Arboretum at Harvard and for the Jesup Collection at the American Museum of Natural History, the sections of the trunks of the forest trees which adorn the halls of these institutions.

In 1882 he was invited by the Chief of the Agricultural Department at Washington to superintend the arrangement of the Agricultural and Forestry collections which had been brought together by the great railroad lines of the South and exhibited at the Atlanta Exposition in 1881. This brought him into contact with many scientific men with whom he contracted lasting friendships and from that time till his death he was engaged in investigations for the departments, especially of forestry, then in charge of his friend Fernow. He was enabled to give his entire time to scientific work after 1892, when he turned over to his sons the management of his business in Mobile. The amount of travel by rail, by private conveyance and on foot, which he accomplished in pushing these investigations was enormous, and to be appreciated only by those who enjoyed his personal acquaintance, for he counted no trouble too great, no hardship too severe, when there was something to be determined by his personal inspection, and at the age of seventy-two we find him riding all day on mule back up Cheaha Mountain to establish beyond doubt that the yellow pine grew at altitudes above 1,000 feet. He rarely took account of the fact that his health was not robust, and often overtaxed his powers, paying the penalty by being confined to his room for days.

During his later years he was employed upon "Plant Life of Alabama," and upon monographs for the Forestry Division. That on the timber pines was published in 1896, and those on the cypress, the juniper and the red cedar are now in press; the hard-wood trees were to follow next, the first of the series being that on the oaks, which he had completed just before his death. For our Geological Survey he had planned a second volume (Plant Life of Alabama being the first) on the Economic Botany of Alabama, which was to have been a complete account of the useful and noxious plants of the state. Unfortunately for us all he left of this volume only the general outline and plan.

In March, 1900, he removed to Asheville, N. C., where he spent the two remaining years of his life, enjoying to the utmost his botanical work, and the meetings with the botanists of the country who visited that beautiful spot. The Biltmore herbarium and the society of the botanists there attracted him most strongly, and frequent visits to the forests of the Biltmore estate gave him opportunity for making observations and collecting valuable notes on the hard-wood trees of that section. His last illness came on suddenly after a day spent in the herbarium where he was greatly interested in the new species of *Crataegus*, there being worked out by Mr. Beadle, and in the accessions constantly coming in from the collectors in the different parts of the country, especially the South. He died at Ashville 17 July, 1901.

Personally, Dr. Mohr was one of the gentlest and most lovable of men, totally devoid of affectation and pretense, making fast friends with old and young wherever he went, and inspiring in them love and respect for the fullness and accuracy of his knowledge and for the nobility of his character.

The amount and quality of the botanical work accomplished by him fills us with admiration when we consider that it was done in hours that otherwise would have been hours of rest and recreation. His unselfish devotion to science is coming to be appreciated and the name of Charles Mohr will long be held in loving remembrance by all who recognize and honor true merit.

UNIVERSITY OF ALABAMA.

The American Species of Limnorchis and Piperia, north of Mexico

By Per Axel Rydberg

In revising the manuscript of the Orchidaceae for Dr. Britton's Manual of the Flora of the Northern States and at the same time that of my Catalogue of the Flora of Montana and the Yellowstone Park,* I came to the conclusion that the genus *Habenaria* as treated in America was an altogether too diversified genus and contained species of very distant relationship. In Europe, as a rule, several genera are admitted. Prof. E. Pfitzer, who prepared the Orchidaceae for Engler and Prantl's Die natürlichen Pflanzenfamilien, places the North American *Habenariae* in the following genera: *Coeloglossum*, *Gymnadenia*, *Platanthera*, *Perularia* and *Habenaria*. Kraenzlin in his *Orchidacearum Genera et Species*, admits *Habenaria*, *Gymnadenia* and *Platanthera*. Both these authors place *Habenaria* in a separate subtribe from the rest. The true *Habenariae* are represented in North America by only a few species in the Gulf States, West Indies, Mexico and Central America. They are characterized by the long filiform appendages of the stigmas, anthers and petals. *Platanthera* as understood by Pfitzer is still a very complex genus and had he known the American forms as well as those represented in Europe, he undoubtedly would have restored Rafinesque's *Blephariglottis* for our fringed orchids and established a few more genera. During last July I stayed a few days in London and met Mr. Rolfe, the authority on orchids at Kew. He expressed the opinion that *Habenaria* must be split up, not only so that *Gymnadenia* and *Platanthera* should be taken out, but that all three genera should be subdivided. In one instance he went farther than I had dared, viz., expressing the opinion that *Orchis rotundifolia* perhaps should be removed from *Orchis*.

When doing my work referred to above, I came to the conclusion, that if *Coeloglossum* and *Perularia* should be admitted, certain other groups represented wholly by American species must be

* Mem. N. Y. Bot. Garden, Vol. I.

taken out of *Platanthera* and *Gymnadenia*. I therefore described in my Catalogue of the Flora of Montana the new genera *Lysiella* and *Limnorchis* and in Dr. Britton's Manual *Gymnadeniopsis*.* In the latter I also reëstablished *Blephariglottis* Raf. In the Bulletin of the Torrey Botanical Club,† I added another genus, *Piperia*. Of these, no species belonging to *Gymnadeniopsis*, *Bephariglottis* or *Piperia* are mentioned by Pfitzer, which shows that he was not well acquainted with these plants.

This revision is based on the material found at the New York Botanical Garden together with a few specimens cited from the Canby Herbarium. A few of the *Habenariae*, described from Mexico and Central America may belong to *Limnorchis* or *Piperia*. I have not seen, however, any species from there referable to either genus, but as several are unknown to me I have limited my work to the North American species growing north of Mexico. One of the Siberian specimens in the Columbia University herbarium is evidently a *Limnorchis*, but as it is wrongly named and rather scrappy, I have left it without consideration.

The illustrations are drawn by the writer and represent two views of each species on a scale twice the natural size.

LIMNORCHIS Rydb. Mem. N. Y. Bot. Gard. **1**: 104. 1900

Leafy-stemmed plants with elongated fusiform root-like tubers and fleshy-fibrous roots: flowers whitish or greenish or tinged with purple; upper sepal ovate to almost orbicular, erect, 3–7-nerved but usually 5-nerved; lateral sepals from linear to ovate-lanceolate, free from the lip, 3-nerved, seldom 4–5-nerved, spreading or often somewhat reflexed; upper petals erect, usually slightly shorter than the upper sepal, from narrowly to broadly lanceolate, 3-nerved, oblique at the base and semi-cordate, that is cordate on the lower side; lip entire, usually indistinctly nerved, flat or slightly concave, reflexed, free, not clawed, from linear to rhombic-lanceolate, obtuse; column short and thick; anther-cells parallel, opening in front; stigma broadly triangular; ovary sessile, in fruit elongated ellipsoid.

The mode of propagation in many orchids is very peculiar. Near the base of the stem is produced a short offset, tuber-, corm- or root-like in appearance, usually fleshy. In the upper portion

* Wrongly printed as *Gymnandeniopsis*.

† 28: 269. 1901.

is a hidden bud, from which the stem of the following year will spring, the lower portion is often root-like, elongated, sometimes cleft and functions more or less as a root. What this offset should be called I do not know. It has been called both tuber and corm. The latter name is not applicable from the way in which it arises. This would indicate the name tuber, for it is really formed at the end of a short subterranean branch, but it has only one bud and this is directed towards the place from which the offset sprang. The distal end, which in common tubers usually bears most of the buds, is here often root-like. This is especially the case in *Limnorchis*, and here the offsets are usually taken for roots. It may be that the larger portion thereof really is a fleshy primary root (if the term primary root can be applied to an offset). The secondary roots are developed the next year at its top from the base of the bud.

The first species of *Limnorchis* was described as *Orchis hyperborea* Linn.* The description was drawn from a specimen from Iceland collected by König. About the same time a plant also collected by König (and probably the same as the type of *O. hyperborea*) was figured in Flora Danica without a binominal name. The description accompanying this is a little faulty because it does not agree with the plate nor with any plant known. This description was copied by Retzius † and he gave it the name *Orchis Koenigii*. *Orchis hyperborea* L. is fairly common on Iceland and Greenland but rare on the American continent. Another plant closely related to it but larger and with shorter and more clavate spur has been confounded with it. In preparing the revision of Dr. Britton's manual I had not distinguished the two and the description of the spur refers principally to the larger plant. At my visit to the Botanical Garden at Copenhagen last summer, I first saw good material from Greenland and Iceland, and then I noticed the difference between the two plants. The larger plant has been named *Platanthera hyperborea β major* Lange ‡ and *Platanthera Koenigii* Lindl ; § but it is evidently not *Orchis Koenigii* Retz.

* Linn. Mant. 121. 1767.

† Fl. Scand. 1: 168. 1779.

‡ Consp. Fl. Groenl. 118. 1880.

§ Gen. et Sp. Orchid. Pl. 286. 1835.

In *Habenaria hyperborea* R. Br. or *Platanthera hyperborea* Lindl. there have been included several other forms, as for instance *Orchis Huronensis* Nutt.* (*Platanthera Huronensis* Lindl. *l. c.* 288), *O. dolichorhiza* Fisch.† and *Habenaria borealis β viridiflora* Cham.‡ All three, I think, are good species and they were so regarded by Lindley. The first is common in the northeastern America. In Britton's manual it appeared under the name *Limnorchis Huronensis* (Nutt.) Rydberg.§ I also described another species of the same group as *L. media*. That there were at least three distinct forms of the *L. hyperborea* group in the northeastern United States, I have not been the only one to notice, for Professor Peck ‖ recognized three growing in the same meadow. I did not see his report before the page proofs of the manual had already gone to the printer, but had come to the same conclusion independently. As the *L. hyperborea* of my treatment there contains in my opinion now two species, as I have stated before, the number of the group in the northeastern United States becomes four, and, together with three species of the *L. dilatata* group, our eastern species become seven.

Habenaria borealis β viridiflora Cham. is common throughout the Rocky Mountain region, the Columbia valley and the northern part of the Pacific coast. It is without doubt closer related to the true *L. hypoborea* than any of the other species and differs mainly in the light green flowers and the short clavate spur.

Orchis dolichorhiza (*Platanthera Koenigii β dolichorhiza* Lindl. *l. c.* 287), I have not seen, but from the description it must be distinct from either. This was from the island of Unalaska.

The second in order of the North American species of *Limnorchis* described was published under the name *Orchis dilatata* Pursh¶ (*Limnorchis dilatata* Rydb.**). It is a common plant of the northeastern part of this country. Most of the specimens so named from the Rockies and the west coast belong to *Habenaria borealis* Cham.††

* Gen. N. Am. Pl. 2: 189. 1818.

† Lind. l. c. 287, as a synonym.

‡ Linnaea 3: 28. 1828.

§ Britt. Man. Fl. Northern States and Can. 294. 1901.

‖ See Peck, Regent's Rep. 50: 126. 1897.

¶ Fl. Am. Sept. 588. 1814.

** Britton, Man. Fl. N. St. 294. 1901.

†† Linnaea 3: 28. 1828.

(*Limnorchis dilatatiformis* Rydb.*). This differs from *L. dilatata* mainly in the shorter, more clavate spur, the dull or greenish white flowers and the usually smaller size. It approaches much the form referred to above under *L. hyperborea* viz. *Habenaria borealis β viridiflora* Cham., and in fact connects the *L. hyperborea* and the *L. dilatata* groups. The other specimens from the West labeled *Habenaria dilatata* belong to *L. leucostachys* and a few of the new species described below. No specimen of *L. dilatata* has been seen from any place west of Minnesota.

Lindley in his Genera and Species of Orchideous Plants described the following species which fall within the limits of *Limnorchis: Platanthera convallariaefolia, P. leucostachys, P. gracilis, P. stricta* and *P. graminea*. While staying at Kew in July this year, I had the privilege of seeing Lindley's herbarium as well as Douglas' plant preserved at Kew, which has enabled me to verify my determinations.

P. convallariaefolia was described from specimens collected in Kamtchatka by Fischer. It is a species resembling a slender *L. dilatata*, but the lip is linear, not at all dilated at the base, the spur is filiform and about the length of the lip and the lower leaves are oblanceolate and obtuse. In the Torrey herbarium there is a specimen communicated by Lindley. This is evidently a cotype of that in Lindley's own collection for the two are as like as they can be. In Torrey's herbarium there is also another specimen, collected on Unalaska, which I also refer here.

P. leucostachys was described from a specimen collected by Douglas. This is in the herbarium of the Kew Gardens. In this specimen the spur is slender, filiform, not at all thickened and not very obtuse at the apex. There is a form also common in the Columbia valley with the same habit but with the larger spur much more clavate and very obtuse at the apex. If this should be regarded as a form of *L. leucostachys* or as a distinct species is a question of which opinions may differ, but it is, however, important to know what the original *P. leucostachys* was.

P. gracilis is a slender plant with the white flowers of *L. dilatata*, but the lip is linear and the spur decidedly clavate. In reality it is nearest related to *P. convallariaefolia*, from which it dif-

* Mem. N. Y. Bot. Gar. 1: 105. 1900.

fers mainly in the spur. It is not at all the plant that has gone under the name *Habenaria gracilis* in the United States. This is the following species, belonging to another group of the genus. *P. gracilis* is confined to Alaska and subarctic America.

P. stricta is the tall species, with greenish or purplish flowers, linear lip and short saccate spur, that Watson and others have called *Habenaria gracilis*. This is common in the Columbia region and the valleys of the Rockies as far south as Colorado.

P. graminea resembles *P. gracilis* in habit, but the leaves are narrower and the lip dilated at the base, the spur is longer and more clavate. Its home is Alaska. It was first collected by Menzies, and later by Miss Cooley and by Gorman. A single specimen from the lower St. Lawrence region evidently is to be referred here also.

Hooker's Flora Boreali-Americana contains the same species as Lindley's Genera.

Watson, in the Botany of California, has in his second section of *Habenaria*, which section would correspond to *Limnorchis*, the following species: *H. leucostachys* (Lindl.) S. Wats., *H. sparsiflora* S. Wats., *H. pedicellata* S. Wats., *H. hyperborea* R. Br., *H. Coperi* S. Wats., and *H. gracilis* S. Wats.

In *H. leucostachys*, he includes *H. Thurberi* A. Gray,* but the flowers of this species are greener, the dilated portion of the lip oval instead of rhombic and the spur longer. Watson states the characters of Gray's *H. Thurberi* were mostly drawn from the variety mentioned (*i. e.*, the same as *H. sparsiflora*), a statement which is not correct.

H. sparsiflora Wats. is a good species, which, together with *H. brevifolia* Greene † and two more species, constitute a distinct group, perhaps a subgenus, distinguished by the very broad and thin connective.

H. pedicellata Wats. *l. c.* I have not seen, but from the description it cannot belong to *Limnorchis*.

H. hyperborea of the Botany of California is the same as *H. borealis* β *viridiflora* Cham. and not *O. hyperborea* L.

* Proc. Am. Acad. 7: 389. 1868.

† Proc. Am. Acad. 12: 276. 1876.

‡ Bot. Gaz. 7: 218. 1881.

H. Cooperi Wats. *l. c.* is not a *Limnorchis*, but a *Piperia*.

H. gracilis Wats. is not the same as *Platanthera gracilis* Lindley, but *P. stricta* of the same author.

Kraenzlin's treatment in his *Orchidacearum Genera et Species* is altogether unsatisfactory. He admits only two species, *Platanthera gracilis* and *P. hyperborea*, the latter with several varieties.

His *P. gracilis* is, however, not *P. gracilis* Lindley but *Habenaria gracilis* Wats. (*P. stricta* Lindl.).

Under *P. hyperborea* α var. *genuina* he cites naturally also *Habenaria borealis* β *viridiflora* Cham. as a synonym, but he has printed *viridis* instead of *viridiflora*. I take this, however, as a distinct species.

P. convallariaefolia he has reduced to a variety, *P. hyperborea* β var. *convallariaefolia*. In the same manner, he calls *H. dilatata*, γ var. *dilatata* Lindl. (I do not think that Lindley ever made it a variety; Kraenzlin is very loose in citing authorities.) Under this variety he has as synonyms among others: *Platanthera Huronensis* Lindl., *Habenaria pedicellata* S. Wats., *H. Cooperi* S. Wats., *P. graminea* and *P. borealis* Reichenb. Of these the last named is the only one, that can be referred here with any reason, for that, which is the same as *Habenaria borealis* Cham., belongs to the *dilatata* group, while *P. Huronensis* belongs to the *hyperborea* group and *H. pedicellata* and *H. Cooperi* belong to distinct genera.

Under his δ var. *leucostachys* he has as synonyms besides *P. leucostachys* Lindl., also *Habenaria brevifolia* Greene, *P. Ghiesbrechtiana* Rich. & Gal., *P. sparsiflora* S. Wats., *P. Thurberi v. Grayi* S. Wats. and *H. flagellaris* S. Wats. Of these *Habenaria brevifolia* Greene and *H. sparsiflora* S. Wats. can under no conditions be referred to *H. leucostachys* on account of their broad connective. The habit of *H. brevifolia* alone should throw it out; there is scarcely a more distinct species in the whole family. As far as *H. sparsiflora* S. Wats. is concerned, it would have been more reasonable to refer that species to his *H. gracilis, i. e., H. stricta* Lindl.; the habit and lip in the two are the same and the flowers have some resemblance. The main difference is in the spur and the connective. It is also to be noticed that Watson never published any *Platanthera sparsiflora* but a *Habenaria sparsiflora*, nor any var. *Grayi* of either *Platanthera* or *Habenaria Thurberi*. In the citation of the place of publication of *P. Ghiesbrechtiana* Rich. et Gal., he has Ann. Sc. Nat. (1845) I. 30, when it should have been III. **3**: 30. *Habenaria flagellaris* S. Wats. has never been published.

A work with such numerous and glaring mistakes reflects little credit to the author, and how can it be trusted? He has given the following remarks under his *Platanthera hyperborea*: "Es is ein gänzlisch fruchtloses Bemühen, die unzähligen Formen dieser weitverbeiteten Art unter Diagnosen von besonderen Species zu fixieren. Je tiefer man in die Formenreihe eindringt, desto mehr verschwimmen die bei der Betrachtung einzelner für constant gehaltenen Merkmale. Durch die Liberalität amerikanischer Institute und Botaniker verfügen die europäischen Sammlungen über ein reiches Material, welches die kritische Beurteilung sehr wohl ermöglicht. Alle bisher beschriebenen 'Arten' stellen ihre Berechtigung auf rein habituelle Merkmale, was bei Orchideen stricte zu verwerfen ist."

It is evident that notwithstanding the statement given above the author has not tried very hard to bring the different forms under distinct diagnoses and he has not penetrated very deep into the series of forms when he did not find the broad thin connective of *Habenaria sparsiflora* and *H. breviflora*; perhaps he had seen neither. It is strange if the herbaria of continental Europe should be rich in North American orchids when our own are far from rich and the representation at Kew is very meager. And still if the author had examined the American material when at Kew, he would have been able to correct some of his mistakes. None of the species so far as I know have been merely based on characters in habit, for in all, the spur, the lip, and the stamen have been described more or less completely, and these are the only organs that give any reliable characters. The habit is mostly the same in all and can be used as a diagnostic character only in a few cases.

In discussing *H. brevifolia* Greene, the author remarks: "Der Samler und Autor der Pflanze vergleicht sie mit *Platanthera* oder nach seiner Schreibart *Habenaria sparsiflora* Wats. Der Vergleich is nicht glücklisch, denn *Pl. sparsiflora* ist eine noch dazu wenig charakteristische Form von *hyperborea*." Prof. Greene's comparison of *H. brevifolia* with *H. sparsiflora* was the only logical one; for the latter was the only known species with the flower-structure of *H. brevifolia*, although this has much larger flowers.

Synopsis of Species

Lip more or less lanceolate, *i. e.*, somewhat dilated near the base.
- Flowers greenish or purplish.
  - Spur not twice as long as the lip. (HYPERBOREAE.)
    - Spur decidedly clavate, thickened and obtuse at the apex, shorter than the lip.
      - Petals purplish; spur only one half to two thirds the length of the lip, very saccate.
        - Lip linear or nearly so, 5–7 mm. long; ovary slightly curved; spike usually elongated. 1. *L. stricta.*
        - Lip lanceolate, fleshy, 4–5 mm. long; ovary strongly curved; spike usually short. 2. *L. purpurascens.*
      - Petals greenish; spur almost equalling the lip.
        - Petals ovate, three fourths as long as the upper sepal; spur very saccate. 3. *L. brachypetala.*
        - Petals lanceolate, only slightly shorter than the upper sepal; spur less saccate.
          - Lips less than 5 mm. long, lanceolate. 4. *L. viridiflora.*
          - Lip over 5 mm. long, ovate-lanceolate. 5. *L. major.*
    - Spur slender, scarcely thickened at all towards the apex, often acutish, equalling or slightly exceeding the lip.
      - Plant tall and stout; flowers comparatively large; sepals 4–6 mm. long. 6. *L. media.*
      - Plant slender; flowers small; sepals 2.5–4 mm. long.
        - Flowers almost erect in a rather lax spike. 7. *L. Huronensis.*
        - Flowers lateral in a dense spike. 8. *L. hyperborea.*
  - Spur about twice as long as the lip. (BEHRINGIANAE.) 9. *L. Behringiana.*
- Flowers white or nearly so.
  - Spur about equalling or only slightly exceeding the lip. (DILATATAE.)
    - Spur usually shorter than the lip and clavate. 10. *L. borealis.*
    - Spur equalling or slightly exceeding the lip, slightly or not at all clavate.
      - Plant over 3 dm. high.
        - Bracts all longer than the flowers, the lower three times as long; lips about 1 cm. long, the dilated part oval. 11. *L. foliosa.*
        - Upper bracts shorter than the flowers, the lower at most twice as long; lips 5–7 mm. long, decidedly rhombic at the base.
          - Petals broadly lanceolate; flowers inodorous or nearly so. 12. *L. dilatata.*
          - Petals narrowly linear-lanceolate; flower very fragrant. 13. *L. fragrans.*
      - Plant less than 3 dm. high; petals narrowly linear-lanceolate. 14. *L. leptoceratitis.*
  - Spur from ¼ to ⅔ longer than the lip. (LEUCOSTACHYAE.)
    - Spur filiform, mostly acutish.
      - Plant 3 dm. or less high; spur 7–8 mm. long; lip 5–6 mm. 14. *L. leptoceratitis.*

Plant 5–8 dm. high; spur 10–14 mm. long; lip 7–9 mm.
Dilated portion of the lip oval; spur almost ⅔ longer than the lip. 15. *L. Thurberi.*
Dilated portion of the lip decidedly rhombic; spur scarcely ½ longer than the lip. 16. *L. leucostachys.*
Spur clavate at the apex.
Leaves lanceolate or oblanceolate; stem tall and stout; lip decidedly rhombic at the base. 16. *L. leucostachys robusta.*
Leaves narrowly linear; stem slender; lip not rhombic at the base. 17. *L. graminifolia.*
Lip linear, *i. e.*, not at all dilated at the base.
Spur usually shorter than the lip.
Flowers purplish or greenish; spur very short and decidedly saccate. 1. *L. stricta.*
Flowers white; spur almost equalling the lip. (CONVALLARIAEFOLIAE.)
Spur clavate. 18. *L. gracilis.*
Spur filiform. 19. *L. convallariaefolia.*
Spur much exceeding the lip; flowers greenish or purplish.
Connective narrow; spur almost twice as long as the lip. (ARIZONICAE.) 20. *L. Arizonica.*
Connective broad.
Leaves elongated, lanceolate or linear; spur 8–10 mm. long. (SPARSIFLORAE.)
Spike comparatively dense. 21. *L. ensifolia.*
Spike very lax.
Lip about 6 mm. long; spur about 8 mm., somewhat clavate. 22. *L. laxiflora.*
Lip about 8 mm. long; spur over 10 mm., filiform. 23. *L. sparsiflora.*
Leaves very short, ovate; spur almost 1.5 cm. long. (BREVIFOLIAE.) 24. *L. brevifolia.*

§ HYPERBOREAE: Usually small or middle sized species, spike usually dense, except in the first species; flowers small, greenish or tinged with purple, especially the petals; spur less than twice as long as the lip; lip except in *L. stricta* lanceolate, *i. e.*, somewhat dilated at the base but not at all rhombic; connective narrow and anther-sacs close together.

1. LIMNORCHIS STRICTA (Lindl.) Rydb. Mem. N. Y. Bot. Garden 1: 105. 1900

Platanthera stricta Lindl. Gen. & Sp. Orchid. Pl. 288. 1835–9; *Habenaria gracilis* Wats. Proc. Am. Acad. 11: 277. 1876; *Habenaria hyperborea* Rothrock, Wheeler's Rep. 4: 265. 1878; *Habenaria saccata* Greene, Erythea, 3: 49. 1895; *Habenaria stricta* Ryd. Bull. Torr. Club, 24: 189. 1897; *Platanthera gracilis* Kraenzlin, Orch. Gen. et Spec. 1: 639. 1899. Not Lindl.

Tall and strict 3–10 dm. high: tubers fusiform, .5–1 cm. in diameter: lower leaves oblanceolate, obtuse, 5–12 cm. long, 15–25 mm. wide: the upper lanceolate, acute: spike usually very long, 1–3 dm., and lax: bracts linear-lanceolate, the lower much longer than the flowers, often 3–4 cm. long: flowers 12–14 mm. long: sepals green, rather thin; the upper ovate, erect, 4–5 mm. long; the lateral ones lanceolate, obtuse, 5–6 mm. long: petals purplish, lanceolate, acute; lip linear, obtuse, 5–7 mm. long, thick, purple; spur one-half to two-thirds as long as the lip, purplish, very saccate, *i. e.*, thickened and round at the apex. (Fig. 1.)

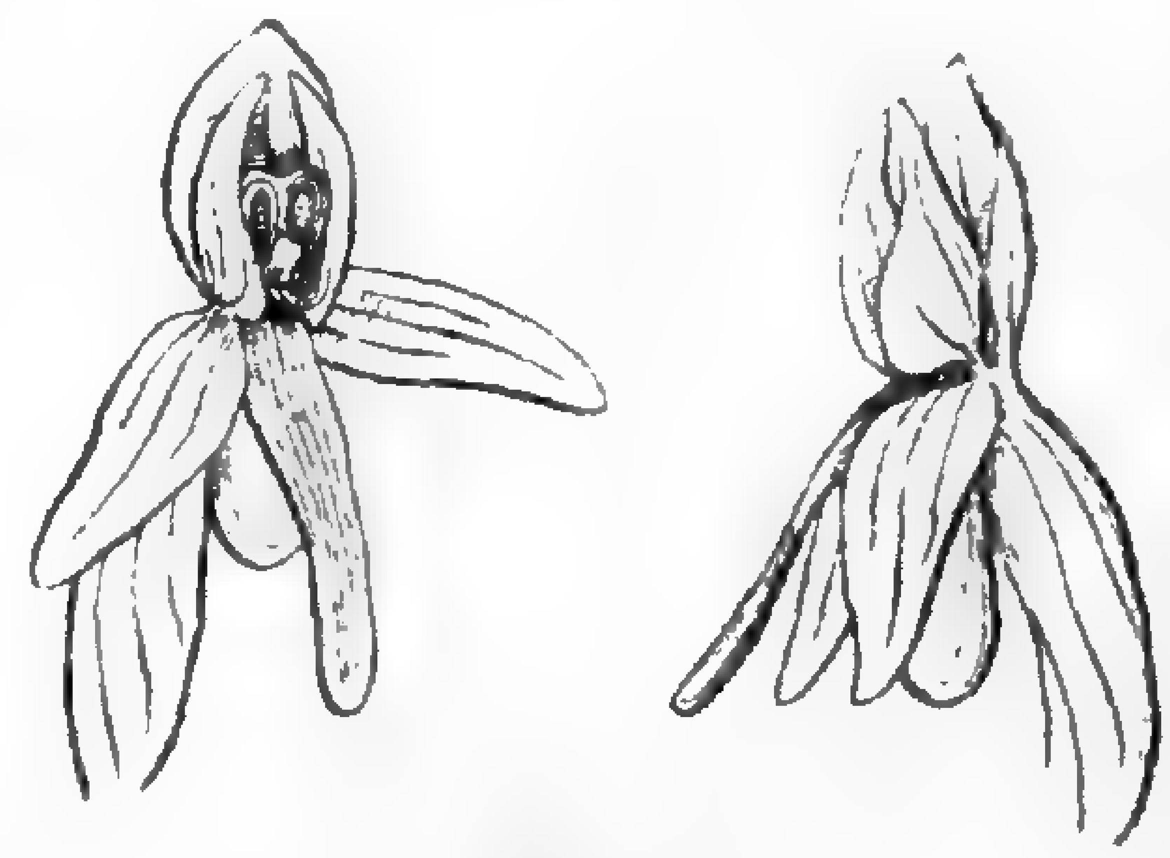

FIG. 1.

The structure of the flowers places this species in the *L. hyperborea* group, although the lip is linear, scarcely at all broadened at the base. This character and the lax spike would place it near *L. laxiflora*, but that is distinguished by the long spur and broad connective. *L. stricta* is common in damp places, swamps, etc., from Alaska to Washington, Wyoming and Montana. It has also been collected in Colorado at Twin Lakes, 1873, *John Wolf, 965*, and Manitou, 1896, *Fred. Clements.*

TYPE: "*America boreali-occidentalis, Douglas.*"

2. LIMNORCHIS PURPURASCENS Rydb. Bull. Torr. Club, **28**: 269. 1901

A rather stout plant, 3–5 dm. high: tubers elongated, fusiform: leaves ovate to lanceolate, acute, 6–10 cm. long, 15–30 cm. wide, dark green: spike dense; bracts lanceolate, the lower exceeding the flowers: these 10–12 mm. long: lateral sepals oblong, linear to lanceolate, obtuse, 4–5 mm. long; the upper broadly ovate, erect, obtuse, tinged with purple: petals slightly shorter, erect, purple, lanceolate; lip broadly linear-lanceolate, obtuse, about 5 mm. long, purplish, thick, slightly dilated at the base; spur one-half to two-thirds as long as the lip, slightly curved and strongly saccate: ovary strongly curved. (Fig. 2.)

FIG. 2.

This species resembles the preceding in the short spur and purplish flowers, but the habit and form of the lip are more like that of *L. hyperborea*. *L. purpurascens* is a rare plant, growing on damp wooded hillsides at an altitude of 2700–3000 m. The following specimens belong here:

COLORADO: Iron Mountain, 1900, *Rydberg & Vreeland, 6414* (type in herb. N. Y. Bot. Gard.); Georgetown, 1878, *M. E. Jones, 314*; Como, South Park, 1895, *C. S. Crandall*; Mouth of Cheyenne Cañon, 1896, *E. A. Bessey*.

3. LIMNORCHIS BRACHYPETALA Rydb. Bull. N. Y. Bot. Garden **2**: 161. 1901.

Stem slender, striate, 4–5-leaved, 1–2 dm. long: tubers elongated fusiform, 7–8 mm. thick: lower leaves oblong, obtuse, 4–6 cm. long, strongly nerved; the upper lanceolate, acute: spike short, 5 cm. long; bracts linear-lanceolate, the lower 2–3 times as long as the flowers: flowers greenish or brownish, 8 mm. long: upper sepals about 2 mm. long, nearly orbicular, slightly truncate and indistinctly 3-toothed at the apex; lateral sepals spreading, oblong, obtuse, nearly 3 mm. long: petals round ovate, acute, slightly over 1 mm. long; lip very narrow, a little dilated at the base and near the apex, acute: spur clavate, almost saccate, nearly straight, about equalling the lip in length. (Fig. 3.)

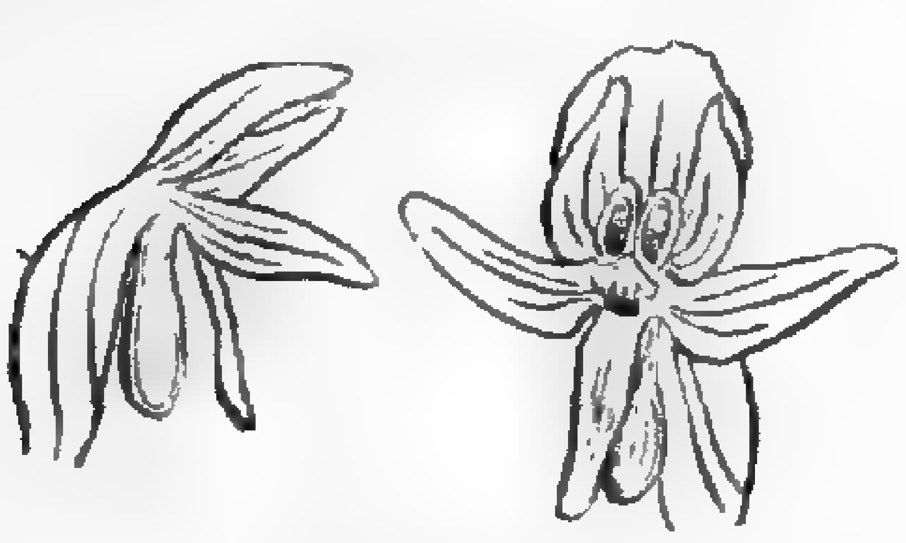

FIG. 3.

In habit and flower most like *L. hyperborea*, but with a narrower lip, shorter petals and shorter and thicker spur, which resembles those of the two preceding but is comparatively longer. *L. brachypetala* grows in wet places in Alaska and the Yukon Territory.

YUKON TERRITORY: Bennett City, 1899, *R. S. Williams* (type in herb. N. Y. Bot. Gard.); above Fort Selkirk, 1899, *J. B. Tarleton, 116*.

ALASKA: Unalaska, 1891, *J. M. Macoun, 142*.

4. **Limnorchis viridiflora** (Cham.)

Habenaria borealis β viridiflora Cham. Linnaea, **3**: 28. 1828; *Habenaria hyperborea* S. Wats. Bot. Cal. **2**: 134. 1880; in part and subsequent authors; *Limnorchis hyperborea* Rydb. Mem. N. Y. Bot. Garden, **1**: 104. 1900.

Stem 2–5 dm. high: tubers elongate fusiform, 5–7 mm. thick: lower leaves 5–15 cm. long, 2–3 cm. wide, oblanceolate, obtuse; the upper lanceolate, acute: spike short and dense; bracts linear-lanceolate, the lower slightly exceeding the flowers: flowers 10–12 mm. long, light green: upper sepal broadly ovate, erect, 3–4 mm. long; lateral ones 5–6 mm. long, lanceolate, acutish or obtuse, spreading; petals erect, lanceolate, acute, slightly shorter than the upper sepal; lip lanceolate, obtuse, less than 5 mm. long; spur decidedly clavate, curved, about equalling the lip. (Fig. 4.)

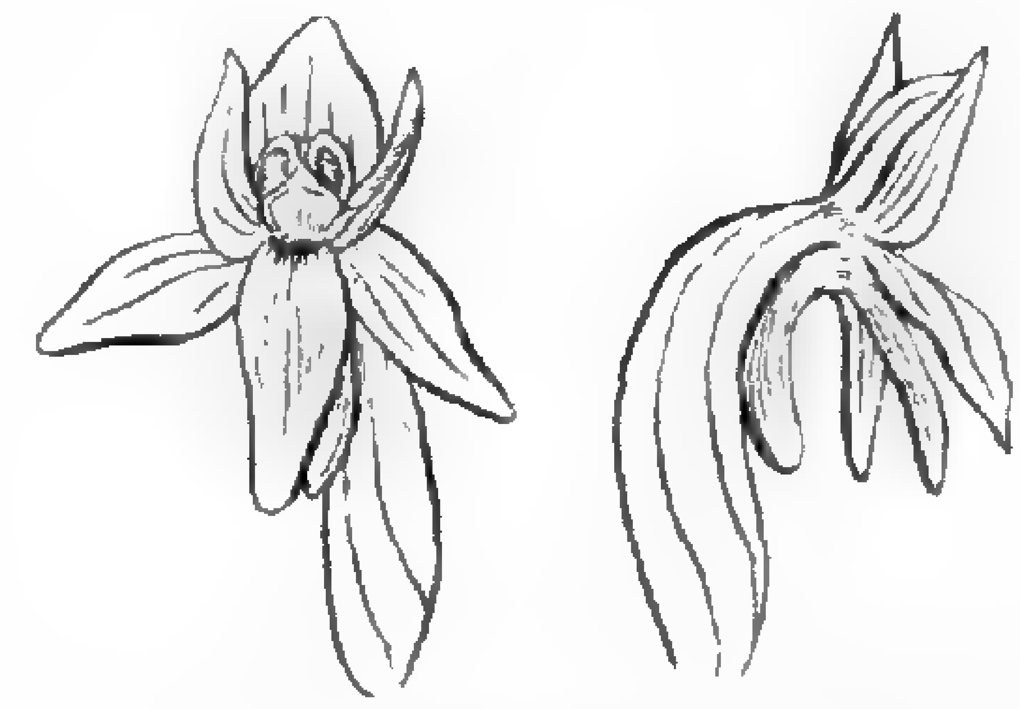
FIG. 4.

This species is closely related to the true *L. hyperborea*, and is its representative in the west. It differs only in the lighter green flower and the thicker and shorter spur. It is also related to *L. borealis* on the other hand, and it is no wonder that Chamisso made it a variety of that species, as it differs only in the green flowers and more saccate spur. Intermediate forms are met with; these are perhaps of hybrid origin. *L. viridiflora* is common in the Rocky Mountain regions and the Cascades. Its range extends from southern Alaska to North Dakota, central Nebraska and Colorado, and is the common plant of the West, known as *Habenaria hyperborea*. Numerous specimens have been examined.

TYPE: "Unalaschca," Chamisso.

5. **Limnorchis major** (Lange)

Platanthera Koenigii Lindley, Gen. & Sp. Orchid. Pl. 286. 1835. Not *Orchis Koenigii* Retz. 1779; *Platanthera dilatata* Torr. Fl. N. Y. **2**: 276, in part. 1843; *Habenaria hyperborea* Gray, Man. Ed. 5: 500, in part. 1867; *Platanthera hyperborea β major* Lange, Consp. Fl. Groenl. 118. 1880; *Limnorchis hyperborea* Rydb.; Britton, Man. Fl. N. St. 294. 1901, in part.


FIG. 5.

Stem stout, 2–6 dm. high: leaves lanceolate, mostly acute, 5–30 cm. long, 1.5–4 cm. wide: spike dense, 5–15 cm. long; bracts lanceolate, the lower slightly exceeding the flowers: flowers 12–14 mm. long: upper sepal broadly ovate, obtuse, 5 mm. long; the lateral ones ovate-lanceolate, obtuse, spreading: petals lanceolate, acute, oblique, a little shorter than the sepals; lip 5–6 mm. long, ovate-lanceolate, obtuse; spur almost equalling or somewhat exceeding the lip, distinctly clavate and curved. (Fig. 5.)

This is the most common species in Greenland, but also found on the North American continent. It differs from *L. hyperborea* in the stouter habit, the larger flowers, the broader lip and the clavate spur. It is more common than the specimens cited below seem to indicate, but I have cited here only the specimens in our herbaria, as these are the only ones presently at hand.

GREENLAND: Godhaven, 1878, *L. Kumlein;* and a specimen by an unknown collector from Hooker's herbarium.

MAINE: Norway, *S. O. Smith.*

WISCONSIN: Milwaukee, *I. A. Lapham.*

NEW YORK: North Yonkers, 1887, *J. F. Poggenburg; Torrey; A. Gray.*

6. LIMNORCHIS MEDIA Rydb.; Britton, Man. N. St. 294. 1901

Habenaria dilatata Torr. Comp. 318, in part. 1826. Not *Orchis dilatata* Pursh. 1813; *Habenaria hyperborea* Gray, Man. Ed. 5: 500, in part. 1867, and subsequent authors.

FIG. 6.

Stem very stout, 4–8 dm. high: tubers narrowly fusiform, 5–7 mm. thick: leaves lanceolate, acute, 1–2 dm. long: spike long, densely flowered; bracts large, longer than the flowers, with scabrous margins: flowers divaricate, about 15 mm. long: upper sepal ovate, obtuse, about 5 mm. long; lateral ones lanceolate or oblong, 5–6 mm. long: petals green or purplish, lanceolate, acute; lips lanceolate, obtuse, about 6 mm. long; spur filiform, *i. e.*, not at all clavate, curved, slightly longer than the lip. (Fig. 6.)

This is nearest related to the preceding, but still stouter, and differs in the narrower lip and more slender, not clavate spur. In habit it is intermediate between *L. major* and *L. dilatata*, and has been confused with both. The name refers to this fact and not to the size, for it is the largest species of the *hyperborea* group.

CANADA: Quebec, *Mrs. Percival.* (Type in Torrey Herbarium.); Notre Dame chez Lac, 1887, *John Northrop.*

VERMONT: Willoughby, 1892, *H. H. Rusby.*

NEW YORK: *John Torrey;* Silver Bay, Lake George, 1901, *J. F. Kemp.*

WISCONSIN: Milwaukee, 1881, *Dr. Hasse.*

MINNESOTA: Minnehaha Creek, 1890, *E. A. Mearns, 77.*

SOUTH DAKOTA: Harney Peak, 1892, *Rydberg, 1028* (in part).

7. LIMNORCHIS HURONENSIS (Nutt.) Rydb.; Britton, Man. Fl. N. St. 294. 1901

Orchis Huronensis Nutt. Gen. N. Am. Pl. **2**: 189. 1818; *Platanthera dilatata* Beck. Bot. 347, in part. 1833. Not *Orchis dilatata* Pursh. 1814; *Platanthera Huronensis* Lindl. Gen. et Sp. Orchid. Pl. 288. 1835; *Habenaria hyperborea* Gray, Man. Ed. 5: 500, in part; *Platanthera hyperborea* γ var. *dilatata* Kraenzlin, Orch. Gen. & Sp. 640. 1899, in part.

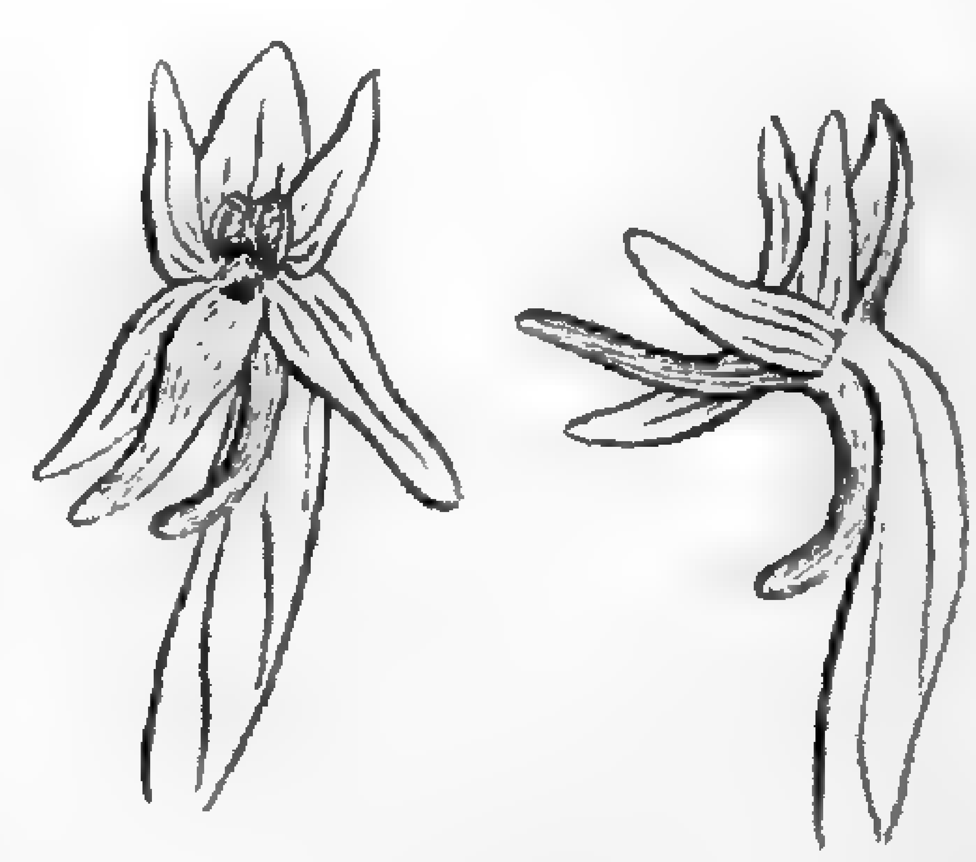

FIG. 7.

Stem slender, 2–4 dm. high: lower leaves oblanceolate, obtuse; the upper lanceolate, acute, 5–10 cm. long, 1.5–2 cm. wide: spike long, lax; bracts lanceolate, the lower often twice as long as the flowers: flowers light green, almost erect: upper sepal ovate, 2–3 mm. long; lateral ones 2–4 mm. long, oblong to lanceolate, obtuse: petals narrowly lanceolate, slightly shorter than the sepals, oblique; lip linear-lanceolate, 3–4 mm. long; spur filiform, not clavate, strongly curved and slightly longer than the lip. (Fig. 7.)

This species is nearest related to *L. hyperborea*, and distinguished by the erect flowers, the narrower lip and the longer pod. It is also usually taller with a laxer spike.

TYPE: "In wet places on the islands of Lake Huron and Michigan."

CANADA: Quebec, *Mrs. Percival.*

VERMONT: Monkton, 1879, *C. G. Pringle.*

MASSACHUSETTS: Shelbourne, 1889, *Geo. F. Taylor.*

CONNECTICUT: Canaan, 1866, *W. H. Leggett.*

NEW YORK: Utica, 1833, *Dr. Gray;* Albany, *L. C. Beck;* Jamesville, 1890, *L. M. Underwood;* Silver Bay, Lake George, 1901, *J. F. Kemp;* Catskills, 1887, *G. Rampsberger.*

MICHIGAN: Long Lake, 1890, *Beardsley & Kofoid.*
MINNESOTA: Chisago Lake, 1892, *B. C. Taylor.*
WISCONSIN: Madison, *S. H. Watson.*

8. LIMNORCHIS HYPERBOREA (L.) Rydb.; Britton, Man. Fl. N. St. 294, in part. 1901

Orchis hyperborea L. Mant. 121. 1767; *Habenaria hyperborea* R. Br. Hort. Kew. Ed. 2: **5**: 193. 1813; *Platanthera hyperborea* Lindl. Gen. & Sp. Orchid. Pl. 287. 1835.

FIG. 8.

Low and slender, 1.5–4 dm. high: tubers almost fleshy-fibrous, slightly thicker than the roots: lower leaves oblanceolate, obtuse, 5–10 cm. long, 1–2 cm. broad; the upper lanceolate, acute: spike rather dense; bracts linear-lanceolate, the lower slightly longer than the flowers: flowers light green, 8–12 mm. long: upper sepal broadly ovate, obtuse, 3–4 mm. long; lateral ones lanceolate: petals lanceolate, slightly shorter than the sepals; lip lanceolate, obtuse, nearly 5 mm. long; spur filiform, strongly curved and a little exceeding the lip. (Fig. 8.)

In habit *L. viridiflora* and this species are much alike and the former would have been merged in the latter, if all the western specimens (*i. e.*, *L. viridiflora*) seen, had not had more or less clavate spur, a character not seen in Icelandic, Greenlandic and eastern specimens.

TYPE: "Islandia, *König.*"

ICELAND: Gardas, 1888, *Prof. & Mrs. Sprague Smith.*

CANADA: Big Swamp, 1866, *J. Macoun.*

NEW BRUNSWICK: Kennebeccosis, 1871, *J. Fowler.*

VERMONT: Willoughby, 1892, *H. H. Rusby.*

NEW YORK: Kirkville, Onondaga county, 1891, *L. M. Underwood, 3155.*

§ BEHRINGIANAE: Low plants, 1–1.5 dm. high: spike short and dense: flowers greenish-purple; lip oblong-lanceolate; spur fully twice as long as the lip; connective narrow.

9. **Limnorchis Behringiana** sp. nov.

Stem low, 1–1.5 dm. high, about 3-leaved: tubers elongated fusiform, about 5 mm. thick: lower leaf ovate-lanceolate, about 5 cm. long and 1.5–2 cm. wide; the upper lanceolate and smaller: spike dense, 3–4 cm. long; bracts linear-lanceolate, the lower about twice as long as the flowers : flowers purplish, about 12 mm. long : upper sepal ovate, obtuse, 4–5 mm. long ; the lateral ones oblong : petals equalling the sepals, broadly lanceolate ; lip about 5 mm. long ; spur fully 10 mm. long, filiform. (Fig. 9.)

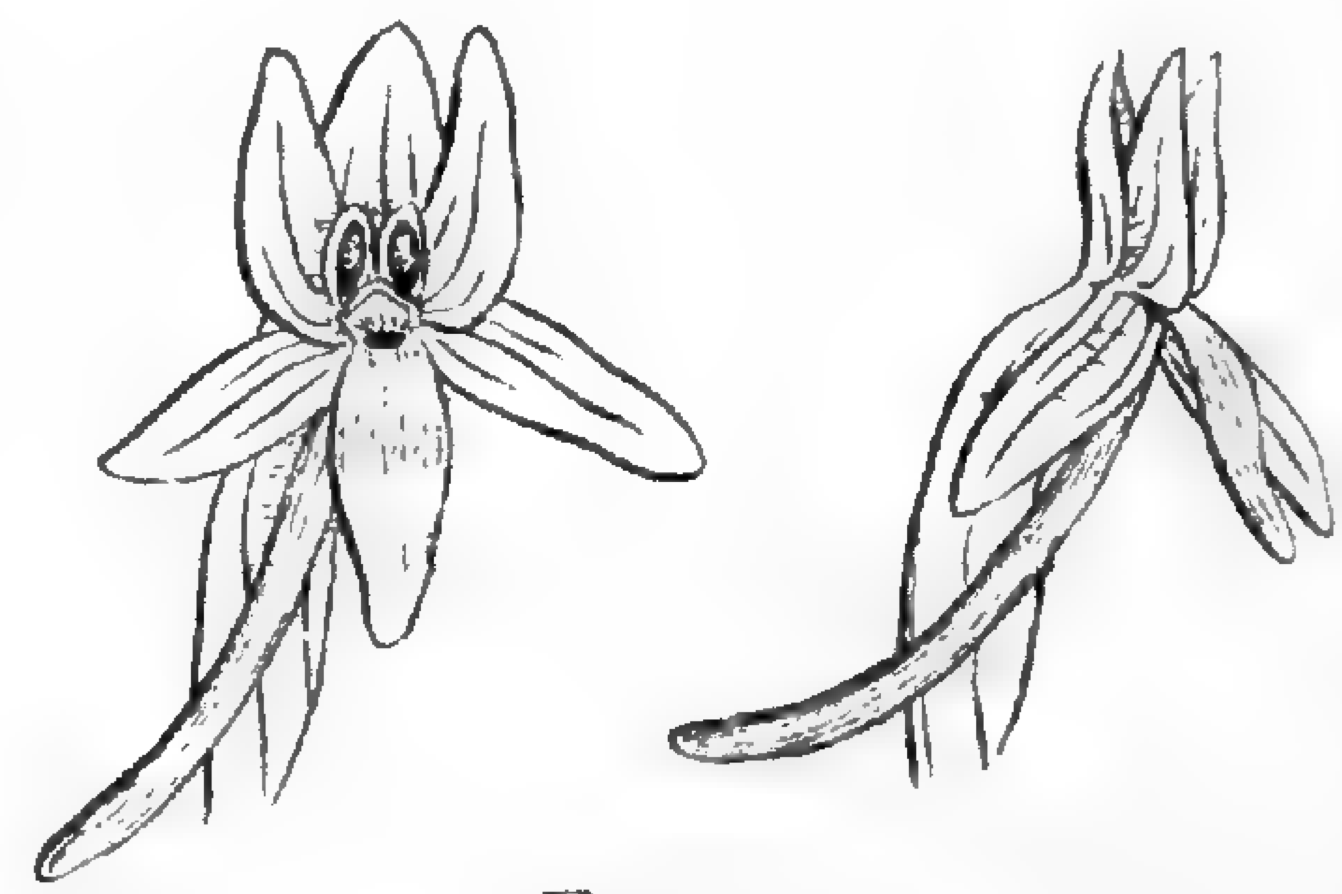

FIG. 9.

This species is not closely related to any of the other species. The type specimens were labelled *Habenaria gracilis* Wats. With this, *i. e.*, *L. stricta* it has scarcely anything common except the color of the flowers and such characters as are found in all species of *Limnorchis*. *L. Behringiana* has not been found in North America but I include it in here, as it would likely be found in Alaska, as *L. convallariaefolia* from the same region has been.

ASIA : Behring Island, 1891, *British Behring Sea Commission, 143* (type in herb. Columbia Univ.).

§ DILATATAE : Plants usually middle sized : flowers white or in the first species yellowish-white ; lip lanceolate, more or less distinctly rhombic dilated near the base ; spur equalling or slightly longer than the tip ; connective narrow.

10. **Limnorchis borealis** (Cham.)

Habenaria borealis Cham. Linnaea, **3** : 28. 1828 ; *Platanthera dilatata* Lindl. Gen. and Sp. Orchid. Pl. 287 ; in part. 1835 ; *Habenaria dilatata* Coult. Man. Rocky Mts. 342. 1885 ; *Habenaria dilatatiformis* Rydb. Bull. Torr. Club, **24** : 189. 1897 ; *Platanthera hyperborea* γ var. *dilatata* Kraenzlin, Orch. Gen. et Sp. 640. 1899, in part ; *Limnorchis dilatatiformis* Rydb. Mem. N. Y. Bot. Garden, **1** : 105. 1900.

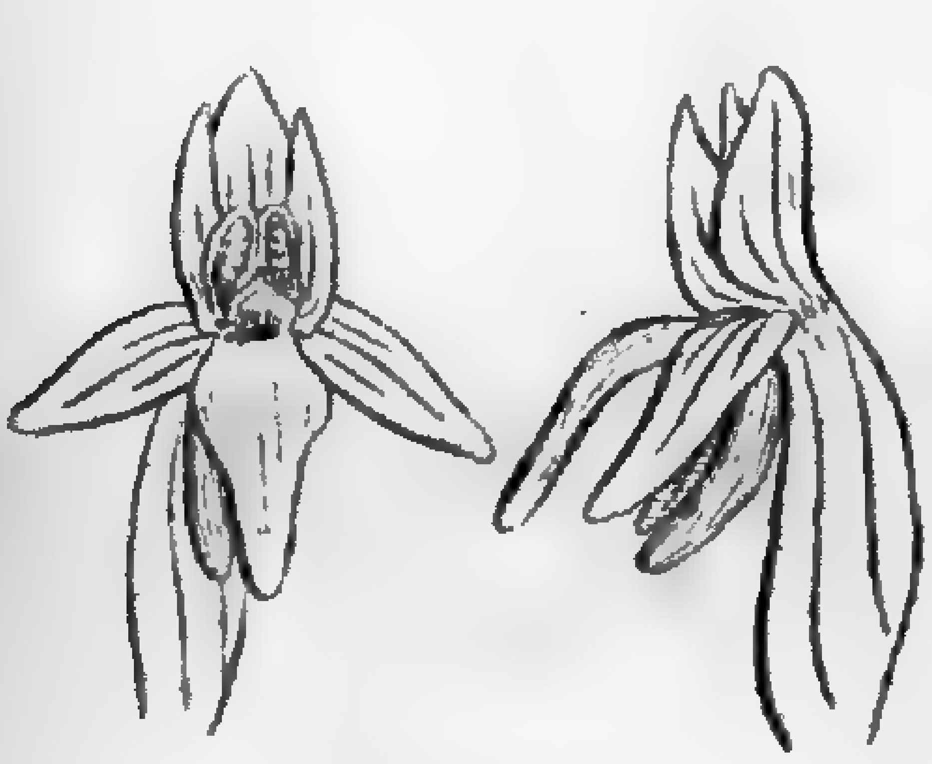

FIG. 10.

Tall and leafy, 4–8 dm. high : tubers elongated fusiform, 5–8 mm. thick : lowest leaves oblanceolate and obtuse ; the rest lanceolate, acute, 5–15 cm. long, 1.5–2.5 cm. wide : spike often rather dense, 1–2 dm. long ; bracts lanceolate, the lower often much exceeding the flowers : flowers 10–14 mm. long, white or sometimes yellowish or greenish white : upper sepal ovate, obtuse, 4–5 mm. long ; the lateral ones oblong-lanceolate, spreading: petals lanceolate, slightly shorter than the sepals; lips rhombic-lanceolate, obtuse, about 5 mm. long; spur usually shorter than the lip, and more or less clavate. (Fig. 10.)

This species represents *L. dilatata* in the Rocky Mountain region, but differs in the smaller flowers and shorter, more clavate spur. It also approaches *L. viridiflora*, from which it differs in the whiter flowers and more rhomboid lip. Where growing together, intermediate forms are often found, perhaps of hybrid origin. *L. borealis* is common from Alaska to Washington and Colorado.

TYPE: "Unalaschca," Chamisso.

11. **Limnorchis foliosa** sp. nov.

Stem stout and very leafy, about 3 dm. high: leaves linear-lanceolate, attenuate, 1–1.5 dm. long: spike short and dense, less than 1 dm. long; bracts linear-lanceolate, attenuate, about three times as long as the flowers: these about 15 mm. long, white: upper sepal broadly linear, obtuse, about 6 mm. long; lateral ones narrowly lanceolate, about 9 mm.: petals narrowly linear-lanceolate, attenuate; lip about 10 mm. with an oval base and an almost linear lower half, obtuse: spur about the length of the lip, filiform, not at all clavate. (Fig. 11.)

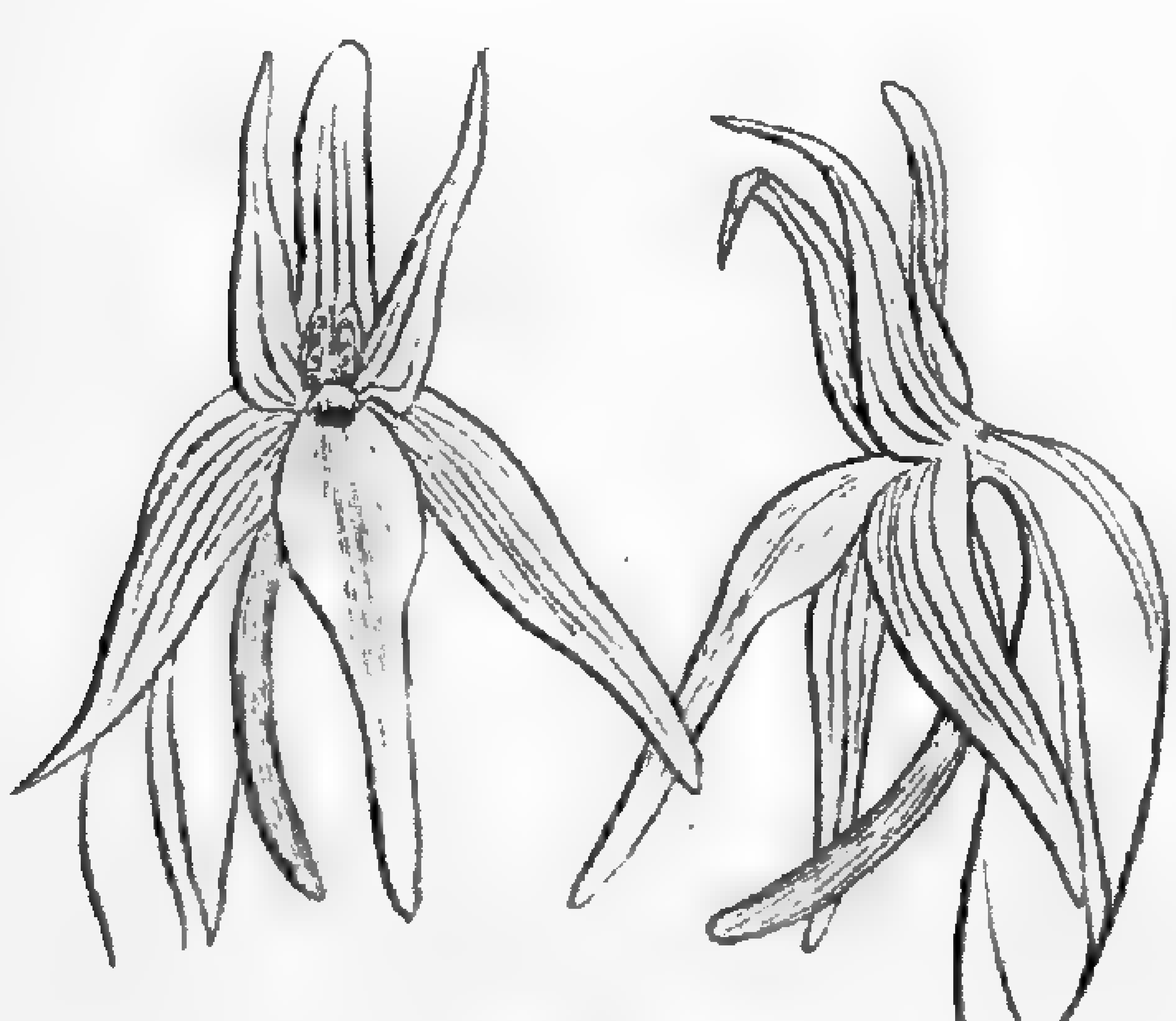

FIG. 11.

This species has the habit of *Perularia flava* and *Coeloglossum bracteatum*, but the flower is of the typical *Limnorchis* type and places it nearest to *L. dilatata*. The flowers, however, are larger and the lip less rhomboid.

ALASKA: Nagai, 1871–2, *M. W. Harrington* (Dall's Exploration; type in the Columbia herb.).

12. LIMNORCHIS DILATATA (Pursh) Rydb.; Britton, Man. Fl. N. States, 294. 1901

Orchis dilatata Pursh, Fl. Am. Sept. 588. 1814; *Habenaria dilatata* Hook. Exot. Fl. *pl. 95*. 1825; *Platanthera dilatata* Lindl.; Beck. Bot. N. & M. St. 347, in part. 1833; *Platanthera hyper-*

borea γ var. *dilatata* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899.

Stem slender, tall, leafy, 3–6 dm. high : leaves lanceolate, 7–20 cm. long, the lower obtuse, the upper acute : spike 5–25 cm. long, usually rather lax ; bracts linear-lanceolate, the lower twice as long as the flowers : flowers white, 15–18 mm. long : upper sepal ovate, obtuse, about 6 mm. long, the lateral ones lanceolate, acutish : petals acute, lanceolate ; lip lanceolate with a rhomboid base, about 7 mm. long ; spur longer than the lip, filiform, scarcely at all clavate. (Fig. 12.)

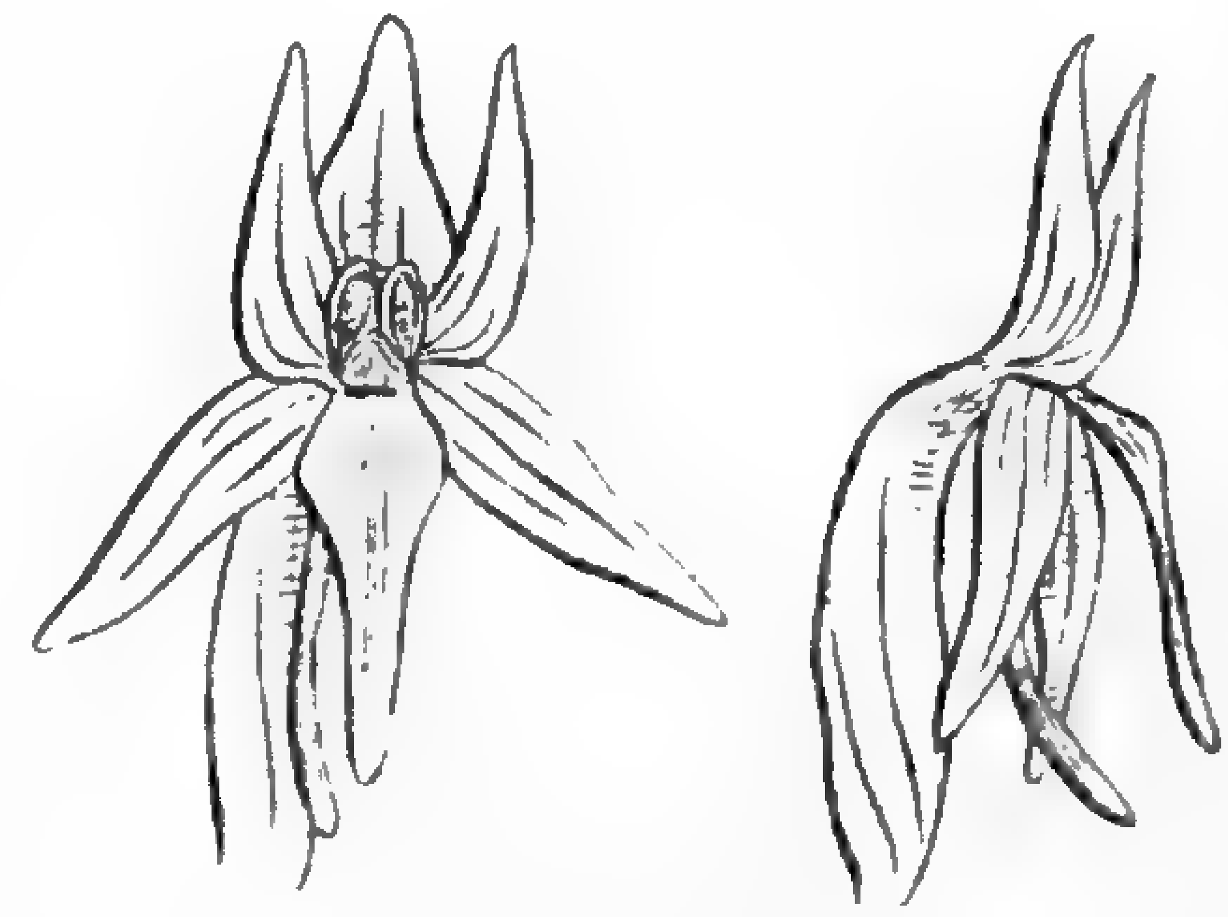

FIG. 12.

L. dilatata is common from Newfoundland to Saskatchewan, south to New York and Nebraska.

TYPE : "In Labrador. *Colmaster, v. s. in Herb. Dickson.*"

Limnorchis dilatata linearifolia var. nov.

Stem slender ; leaves linear, attenuate, 5–10 cm. long, 5–7 mm. wide.

Very different from the species in general habit, but the flowers are exactly the same, and intermediate forms are not lacking.

NEW YORK : Bridgewater, *Dr. Gray* (type in herb. Torrey).

MICHIGAN : Portage of Kee-wana-wa, *Dr. Peters*.

13. LIMNORCHIS FRAGRANS Rydb.; Britton, Man. Fl. N. States, 294. 1901

Stem slender, 2–3 dm. high : tubers narrowly fusiform, about 5 mm. thick : leaves linear, about 1 dm. long and 8–10 mm. wide, acute : spike slender, lax ; bracts lanceolate, acuminate ; the lower longer than the flowers : flowers pure white, very fragrant : upper sepal ovate-lanceolate, obtuse ; the lateral ones linear-lanceolate, acutish, strongly veined : petals narrowly linear-lanceolate, equalling the sepals ; lip lanceolate with an ovate-rhomboid base, about 5 mm. long ; spur filiform, not at all clavate, curved, slightly exceeding lip. (Fig. 13.)

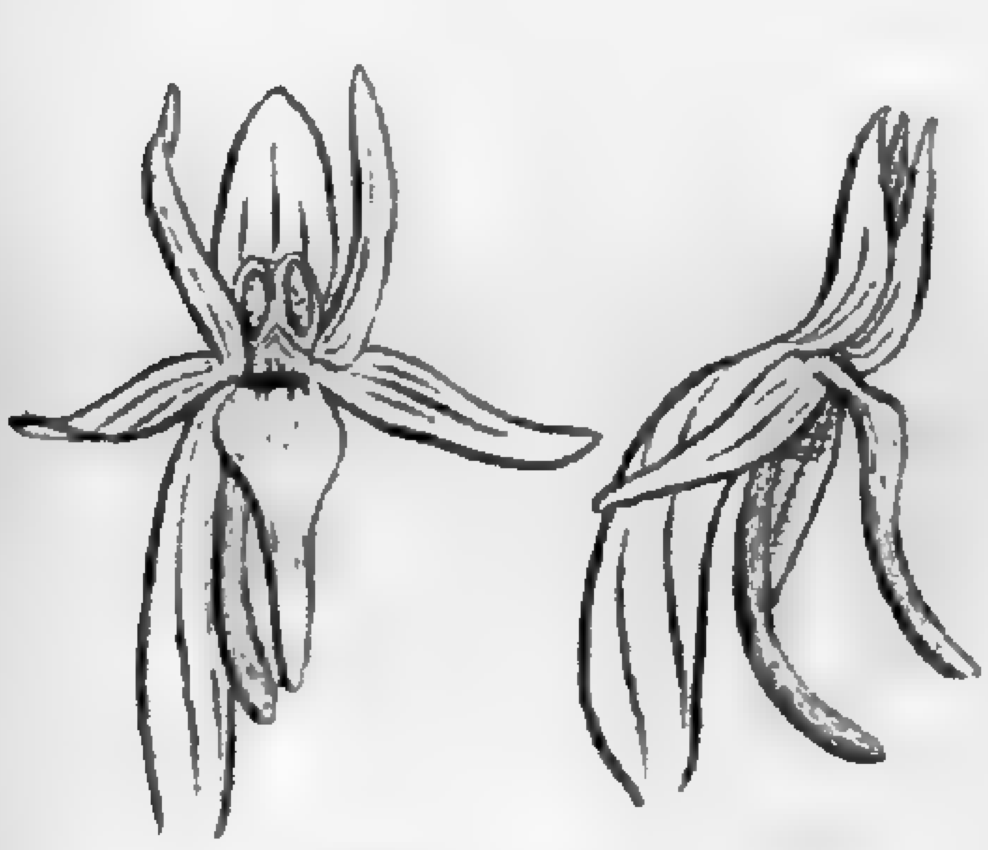

FIG. 13.

Closely resembling the variety of preceding species, it is distinguished by the narrow petals and sepals and by the fragrance.

The two sheets of the orginal collection in the Columbia Herbarium are the only ones seen.

VERMONT: Willoughby Mountain, 1892, *H. H. Rusby* (type in herb. Columbia Univ.).

14. LIMNORCHIS LEPTOCERATITIS Rydb. Bull. N. Y. Bot. Garden, **2**: 162. 1901

Stem slender, 2–4 dm. high: tubers slender, slightly thicker than the fleshy fibrous roots: lower leaves oblong, obtuse, 4–8 cm. long, 1–1.5 cm. wide, the upper linear-lanceolate, acute: spike short, less than 1 dm. long; bracts linear-lanceolate, the lower somewnat longer than the white flowers: sepals 3–4 mm. long, lanceolate: petals linear or narrowly linear-lanceolate, about equalling the sepals; lip lanceolate, somewhat rhombic, dilated at the base; spur very slender, filiform, strongly curved forward, a little exceeding the lip. (Fig. 14.)

FIG. 14.

This is nearest related to the eastern *L. dilatata* and *L. fragrans*, but differs in the smaller size, smaller flowers and shorter leaves. In habit it resembles most a depauperate *L. borealis*, but the spur is different.

YUKON TERRITORY: Bennett City, 1899, *R. S. Williams* (type in herb. N. Y. Bot. Gard.).

ALASKA: Unalaska, 1891, *J. M. Macoun;* southern Alaska, 1883, *J. Albert Rudkin.*

BRITISH COLUMBIA: Tulameen River, 1900, *J. F. Kemp.*

§ LEUCOSTACHYAE: Tall and stout plants: flowers pure white or slightly greenish in *L. Thurberi;* lip lanceolate with a more or less rhombic or oval dilatation near the base; spur more than ¼ longer than the tip; connective narrow: spike long and dense.

15. **Limnorchis Thurberi** (A. Gray) Rydb.

Habenaria Thurberi A. Gray, Proc. Am. Acad. **7**: 389. 1868; *Habenaria leucostachys* S. Wats. Bot. Cal. **2**: 134, in part. 1880; Coville, Cont. U. S. Nat. Herb. **4**: 201. 1893; *Platanthera hyperborea* δ var. *leucostachys* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899.

Stem stout and leafy, 4–6 dm. high: tubers elongated fusiform, 6–7 mm. in diameter: leaves lanceolate to linear-lanceolate, 1–2 dm. long, 1.5–3 cm. wide, acute: spike long and dense; bracts linear-lanceolate, attenuate, about equalling the flowers: these dull white, 16–20 mm. long: upper sepal ovate, obtusish; the lateral ones lanceolate, acute: petals lanceolate, about equalling the sepals; lip 7–8 mm. long, lanceolate, obtuse, the dilated portion ovate; spur filiform, curved, about ⅔ longer than the lip.

FIG. 15.

This has been merged into *L. leucostachys*, which it resembles in habit, but the spike is denser, the flowers are dull or greenish white, and the form of the lip is different.

TYPE: "Arizona, Thurber (925)."

NEW MEXICO: 1851–52, *C. Wright, 1900.*

CALIFORNIA: *Thomas Bridges, 356;* Mammoth, 1891, *Coville & Funston, 1822;* Miner's Ditch, Nevada county, 1867, *N. J. Davis, 37;* Canoe Creek, *J. S. Newberry;* Nevada, 1893, *Michener & Bioletti;* Sisson, 1897, *H. E. Brown, 320;* Marin county, 1873, *Edwards;* Bernardino Mts., 1882, *S. B. & W. F. Parish, 1521;* Fresno county, 1900, *Hall & Chandler, 150.*

16. LIMNORCHIS LEUCOSTACHYS (Lindl.) Rydb. Mem. N. Y. Bot. Garden, **1**: 106. 1900.

Platanthera leucostachys Lindl. Gen. & Sp. Orchid. Pl. 288; *Habenaria leucostachys* S. Wats. Bot. Cal. **2**: 134. 1880; *Platanthera hyperborea δ* var. *leucostachys* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899.

Stem stout and tall, 6–10 dm. high: lower leaves oblanceolate, 1–2 dm. long, 1.5–3 cm. wide; the upper lanceolate, acute: spike 1–3 dm. long, rarely very dense; bracts linear-lanceolate, the lower exceeding the flower: these purely white, 15–20 mm. long: upper sepal ovate, obtuse, about 5 mm. long; lateral ones lanceolate, acute, 7–8 mm. long: petals lanceolate, attenuate, a little shorter than the upper sepal; lip lanceolate with a decidedly rhombic base, about 8 mm. long; spur filiform, scarcely clavate, acutish, about half longer than the lip, less than 1 mm. thick. Fig. 16.)

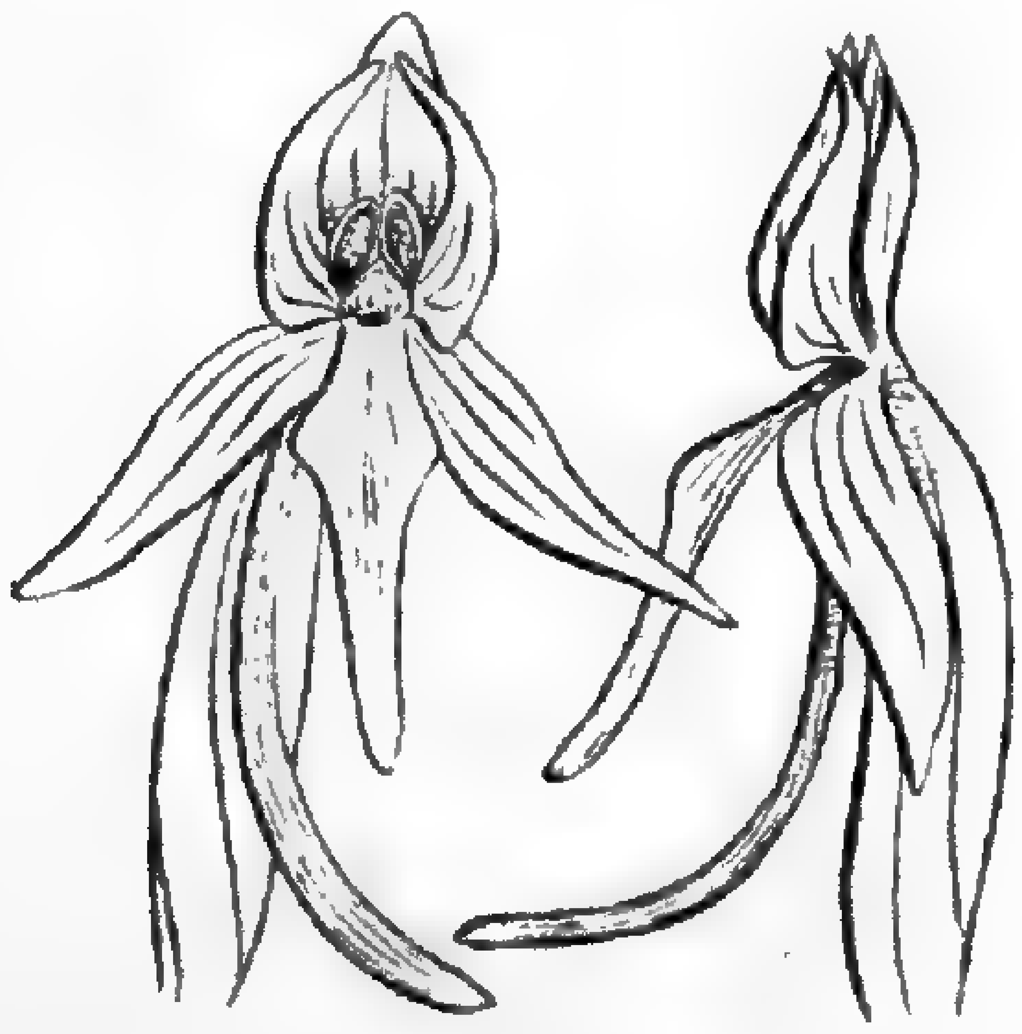
FIG. 16.

Lindley describes this as having the lip half as long as the spur, but I have not seen any with so long a spur, not even in Douglas' specimens at Kew.

TYPE: "In ora *occidentali Americae septentrionalis, Douglas* (*hab. s. sp. comm. Soc. Hort.*)."

ALASKA: Ankow River, 1892, *F. Funston, 52.*

WASHINGTON: Snoqualmie, 1892, *M. Parker;* Wallawalla to Kuskuski, 1838–42, *Wilkes Exp., 526.*

IDAHO: 1892, *Isabel Mulford;* Priest Lake, 1900, *D. T. MacDougal, 7 and 178.*

UTAH: 1871, *Palmer, 461.*

NEVADA: E. Humboldt Mountains, 1868, *S. Watson, 1154.*

CALIFORNIA: Sierra county, 1874, *Lemmon;* Plumas county, 1881, *Mrs. Austin;* Yosemite Valley, 1866, *Bolander, 4936.*

✓ **Limnorchis leucostachys robusta** var. nov.

Very stout and tall, 4–10 dm. high, leafy: spike long and dense, 1–3 dm. long: spur usually clavate, over 1 mm. thick, obtuse, about one-third longer than the lip. (Fig. 17.)

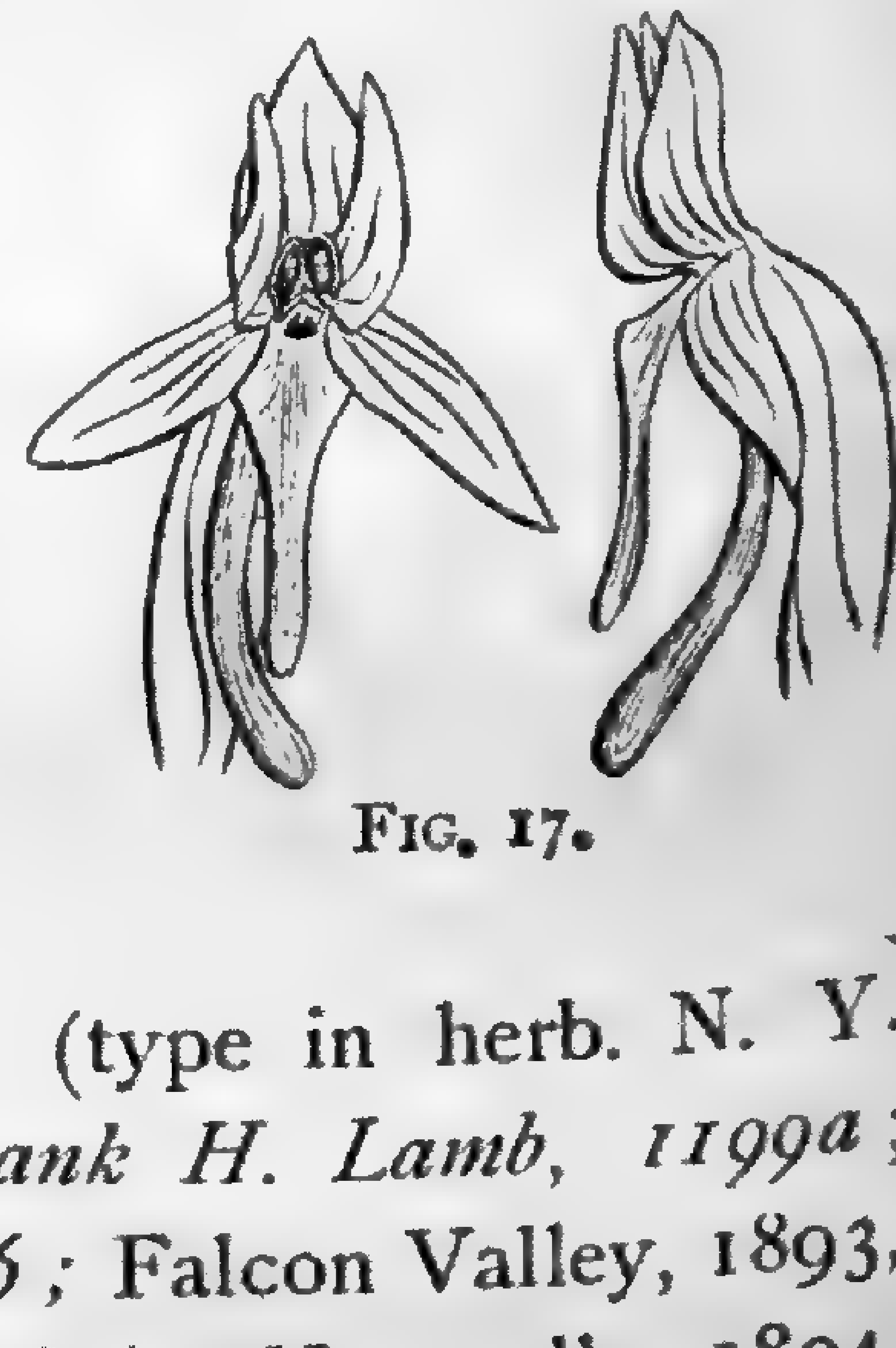
FIG. 17.

This may be distinct from *L. leucostachys* but the only characters distinguishing it from the type is the thicker spur and the denser spike. More field work is needed in order to settle its relationship to *L. leucostachys*. The following specimens are in our herbaria:

OREGON: 1871, *Elihu Hall, 505.*

WASHINGTON: 1889, *R. S. Vasey, 77* (type in herb. N. Y. Bot. Gard.); Chevalis River, 1897, *Frank H. Lamb, 1199a;* Olympia, 1898, *A. A. & E. G. Heller, 4046;* Falcon Valley, 1893, *W. H. Suksdorf, 1356;* Upper Valley of the Nesqually, 1894, *O. D. Allen;* Yakima Region, 1883, *F. Tweedy;* Palace Camp, 1883, *Mrs. Bailey Willis;* Seattle, 1890, *C. V. Piper;* Cascade Mts., 1882, *Brandegee, 480.*

BRITISH COLUMBIA: Vancouver Island, 1887, *John Macoun;* Tulameen River, 1900, *Prof. J. F. Kemp.*

IDAHO: Valley of Clearwater River, 1892, *Sandberg, MacDougal & Heller, 288.*

17. Limnorchis graminifolia

Platanthera graminea Lindley, Gen. & Sp. Orchid. Pl. 289. 1835; not *Habenaria graminea* Spreng. Syst. **3**: 690. 1826; nor *P. graminea* Lindley, *l. c.* 292; *Platanthera hyperborea* γ var. *dilatata* Kraenzlin, Orch. Gen. et Sp. 640, in part, 1890.

Very slender, 3–4 dm. high: leaves narrowly linear, 5–10 cm. long, 3–4 mm. wide: spike short; bracts lanceolate, shorter than the flowers: these white, 12–15 mm. long: upper sepal ovate, 4 mm. long, the lateral ones lanceolate: petals narrowly lanceolate, slightly shorter than the upper sepal; lip lanceolate, obtuse, dilated near the base, but not rhombic; spur one-third to one-half longer than the lip, clavate towards the apex, acute. (Fig. 18.)

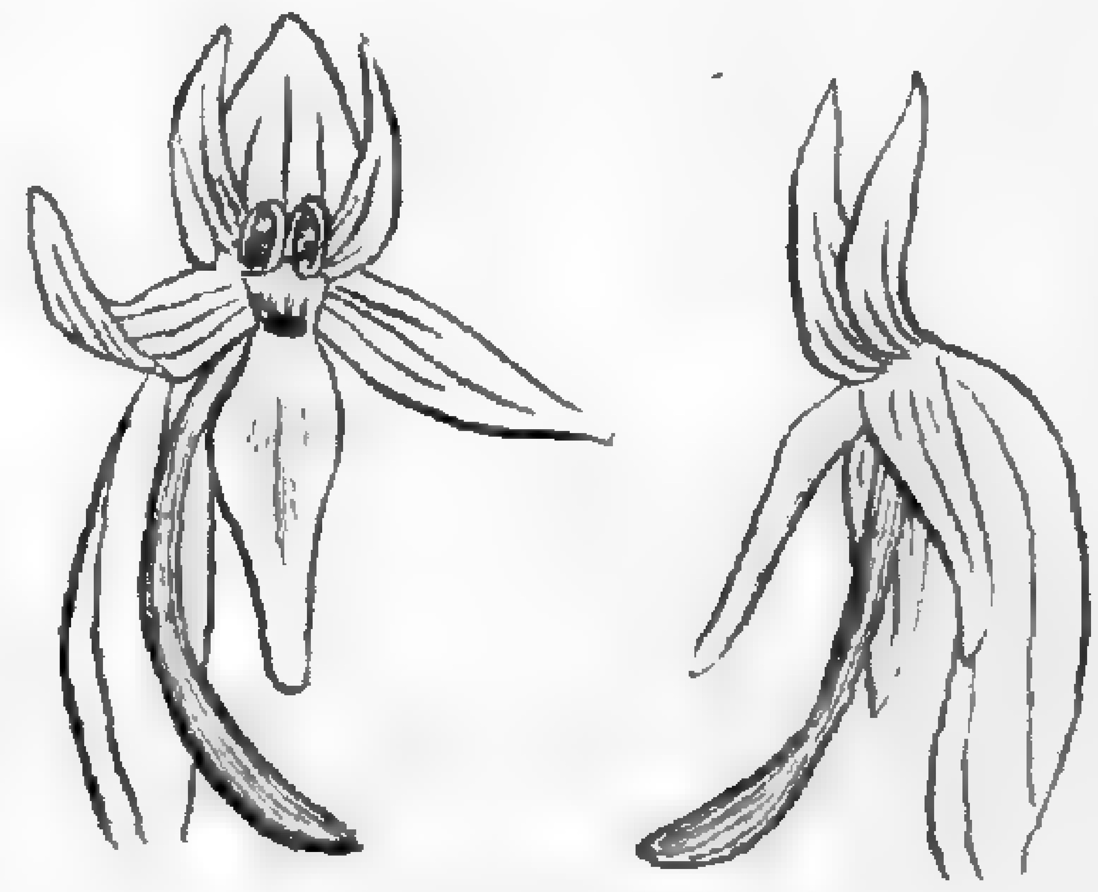

FIG. 18.

This plant is nearest related to *L. leucostachys*, but differs in the slender habit, narrow leaves and the form of the lip. The type is in Lindley's herbarium, where I saw it. The specimens from Lower Canada I cannot distinguish from the Alaskan specimens, although the occurrence of the species on the east coast is exceedingly remarkable.

TYPE: "In ora *occidentali Americae septentrionalis, Menzies (hab. s. sp. comm. cel. Menzies).*"

ALASKA: Douglas Island, 1891, *Grace E. Cooley;* Gorman's Lake, 1895, *M. W. Gorman, 74.*

CANADA: Mouth of Riviere du Loup, *Wm. Canby.*

§ CONVALLARIAEFOLIAE: Slender plants about 3 dm. high: spike short and rather lax: flowers white; lip linear, not at all dilated at the base; spur about equalling the lip; connective narrow.

18. Limnorchis gracilis (Lindl.).

Platanthera gracilis Lindley, Gen. & Sp. Orchid. Pl. 288. 1835.

Slender, about 3 dm. high: leaves oblong to lanceolate, 5–10 cm. long, 1–1.5 cm. wide, the lower obtuse, the upper acute: spike slender and lax, about 1 dm. long; bracts lanceolate the lower slightly exceeding the flowers: these white, 10–12 mm. long: upper sepal broadly oval, about 4 mm. long, the lateral ones linear-lanceolate, acute: petals linear-lanceolate; lip linear, obtuse, 6–7 mm long; spur clavate, only slightly curved, a little shorter than the lip. (Fig. 19.)

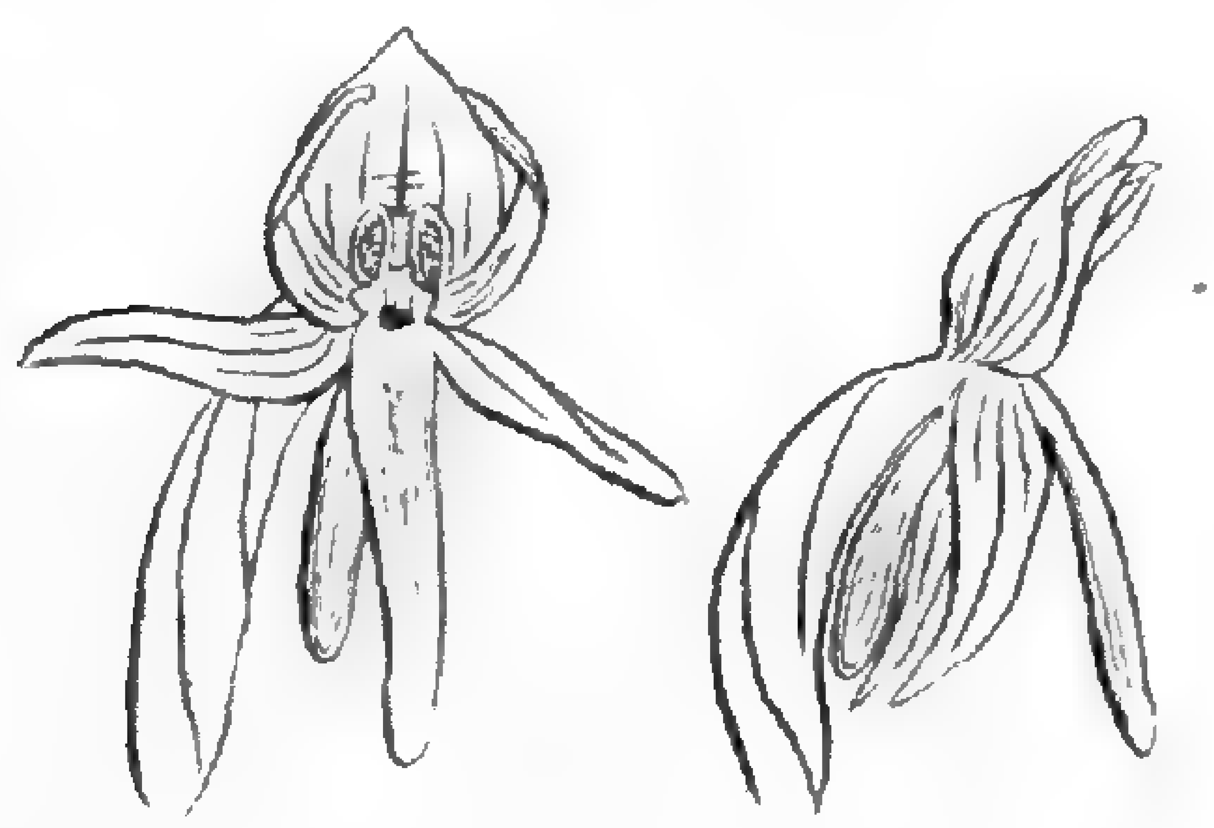

FIG. 19.

This resembles *L. stricta* in the linear lip and the lax spike, but has white flowers and slender spur. Watson confused the two and following him, most authors have used the name *Habenaria gracilis* for *L. stricta.* No one who has seen Lindley's type could confuse the two.

TYPE: "In ora *occidentali Americae septentrionalis, Menzies;* Observatory inlet, *Herb. Hooker* (*hab. s. sp. comm. cel. Menzies*)."

ALASKA: Back Bay, 1895, *M. W. Gorman, 52* (in Columbia Herbarium); *Sitka, 1891, W. G. Wright* (*1559*) (?).

SUBARCTIC AMERICA: 1861–2, *I. S. Onion.*

19. **Limnorchis convallariaefolia** (Lindl.)

Platanthera convallariaefolia Lindl. Gen. & Sp. Orchid. Pl. 287. 1835; *Platanthera hyperborea* β, var. *convallariaefolia* Kraenzlin, Orch. Gen. et Sp. 640. 1899.

Stem slender, about 3 dm. high: leaves oblong-lanceolate or oblanceolate, 4–8 cm. long, 1–2 cm. wide, the lower obtuse, the upper acute: spike short, less than 1 dm. long; bracts lanceolate or linear-lanceolate, equalling or the lower exceeding the whitish flowers: upper sepal almost orbicular or broadly ovate, 3–4 mm. long; lateral ones lanceolate, obtuse: petals lanceolate, acute; lip linear, about 6 mm. long, obtuse; spur filiform, curved, almost equalling the lip. (Fig. 20.)

FIG. 20.

This is closely related to *L. gracilis*, and differs scarcely in any respect except that the flowers are smaller and the spur is longer and more slender. It was described from specimens collected by

Fischer in Kamtchatka. The type is in Lindley's herbarium and a cotype in Torrey's. The Unalaska specimen also collected by Fischer, I cannot distinguish from the Asiatic.

TYPE: "In *Kamtchatka, Fischer (hab. s. sp. comm. cel. Prescott).*"

ASIA: Kamtchatka, *Fischer, ex. herb. Lindley.*

ALASKA: Unalaschca, *Fischer.*

§ ARIZONICAE: Rather stout, 5–7 dm. high: spike long and lax: flowers light greenish; lip linear, not at all dilated at the base; spur filiform, almost twice as long as the lip; connective narrow.

20. **Limnorchis Arizonica** sp. nov.

Stem tall, leafy: lower leaves oblong, about 5 cm. long, obtuse, the middle and upper ones linear, the former 2–3 dm. long, 2–3 cm. wide: spike slender, lax, many-flowered 1.5–3 cm. long; bracts linear-lanceolate, the lower slightly longer than the flowers: these 12–15 mm. long, greenish or purplish: upper sepal broadly ovate, 3–4 mm. long; lateral ones ovate-lanceolate: petals lanceolate, acute, slightly shorter than the upper sepal, 4–5 mm. long. (Fig. 21.)

FIG. 21.

This species resembles somewhat both *L. stricta* and *L. sparsiflora.* From the former it is easily distinguished by the long slender spur and from the latter by the many-flowered spikes, smaller flowers and narrow connective. It grows in rich cañons of Arizona.

ARIZONA: 1891, *Nealley* (type in herb. N. Y. Bot. Gard.); Santa Rita Mts., 1881, *C. G. Pringle;* Ft. Huachuca, 1893, *T. E. Wilcox;* Weber Creek, 1887, *E. A. Mearns, 133.*

§ SPARSIFLORAE: Plant slender, light green: spike elongated: flowers greenish with strongly reflexed sepals; lip linear; spur slender, much longer than the lip; connective very broad: leaves normal.

21. **Limnorchis ensifolia** sp. nov.

Platanthera hyperborea δ var. *leucostachys* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899; not *P. leucostachys* Lindl.

Stem strict, 3–4 dm. high, light colored, few leaved: leaves linear-lanceolate, attenuate, slightly falcate, 1–1.5 dm. long, 1–1.5 cm. wide: spike short and not very lax; bracts lanceolate, acuminate, light green, about equalling the flowers: these greenish, about 15 mm. long: upper sepal broadly ovate, about 5 mm. long; lateral sepals about 7 mm. long, oblong-lanceolate: petals narrowly lanceolate, acute; lip linear, about 8 mm. long, thick; spur filiform, about 1 cm. long. (Fig. 22.)

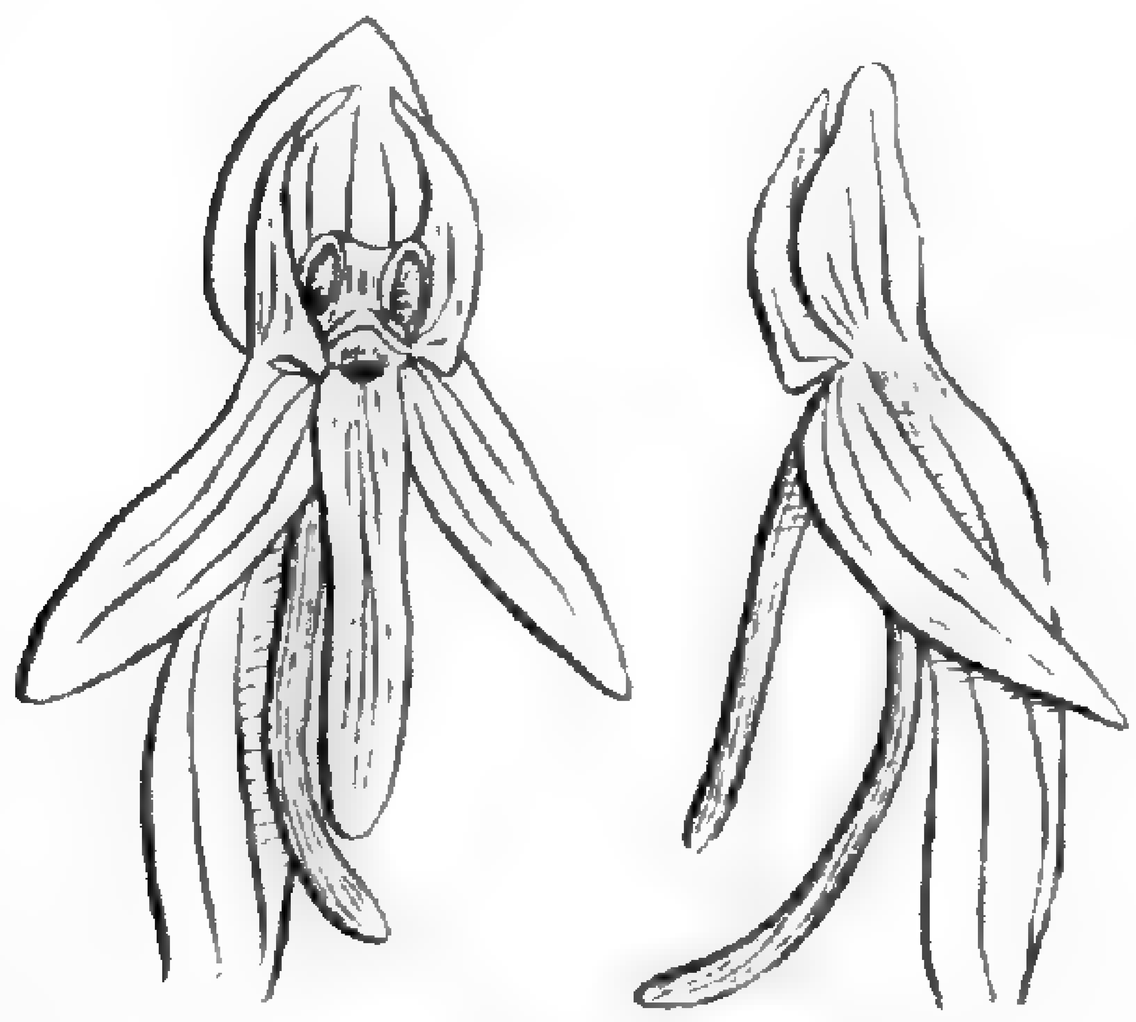

FIG. 22.

This is nearest related to *L. sparsiflora*, but the spike is shorter and denser, the upper sepals and petals larger and the bracts shorter and broader, and light colored. The type was growing at an altitude of about 2600 mm.

ARIZONA: Mt. Humphrey, 1897, *R. E. Kunze* (type in herb. N. Y. Bot. Gard.); Willow Springs, 1874, *Rothrock, 269*.

UTAH: "Central Utah," 1875, *C. C. Parry, 89*; Rock Creek, 1877, *Dr. E. Palmer, 460* (in part).

NEW MEXICO: Silver City, 1880, *E. L. Greene*.*

22. **Limnorchis laxiflora** sp. nov.

Stem slender, 4–6 dm. high: lower leaves oblanceolate, obtuse, 8–10 cm. long, 1–1.5 cm. wide; the upper linear-lanceolate, acute: spike very slender and lax, 1–2 dm. long, few-flowered; bracts linear-lanceolate, usually equalling or shorter than the flowers: these greenish, 10–12 mm. long: upper sepals broadly obovate, obtuse, about 4 mm. long; lateral ones broadly lanceolate, acutish: petals almost equalling the upper sepal, lanceolate; lip linear, obtuse, about 6 mm. long; spur about 8 mm. long, slightly clavate, a little longer than the lip. (Fig. 23.)

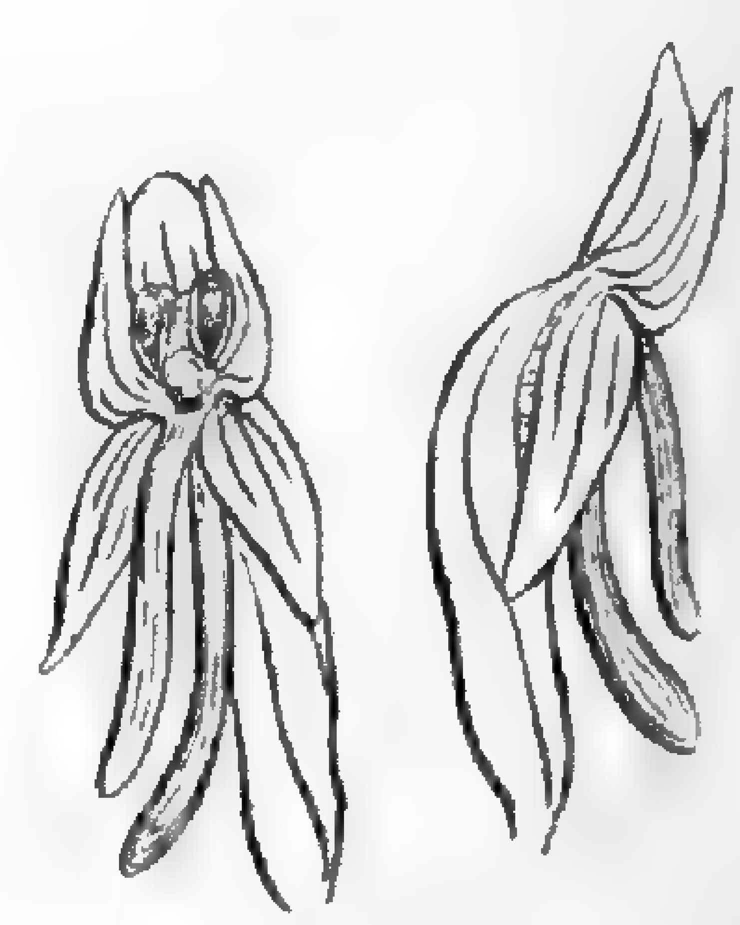

FIG. 23.

This is closely related to and has been mistaken for *L. sparsiflora*, which, however, has larger flowers, longer spur, not at all clavate, longer bracts and more slender stem.

OREGON: Coast Mountains, 1884, *Thomas Howell* (type in herb. Columbia College); Interior of Oregon, 1838–42, *Wilkes Expedition*; 1871, *Elihu Hall, 504*.

UTAH: Rock Creek, 1877, *Dr. E. Palmer* (*460* in part).

* This is labelled *Habenaria flagellaris* Wats.

COLORADO: Uncompahgne Mountains near Los Pinos, 1878, *Wm. F. Flint.*

23. Limnorchis sparsiflora (S. Wats.) Rydb.

Habenaria sparsiflora S. Wats. Proc. Am. Acad. **12**: 276. 1877; *Platanthera hyperborea* δ var. *leucostachys* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899.

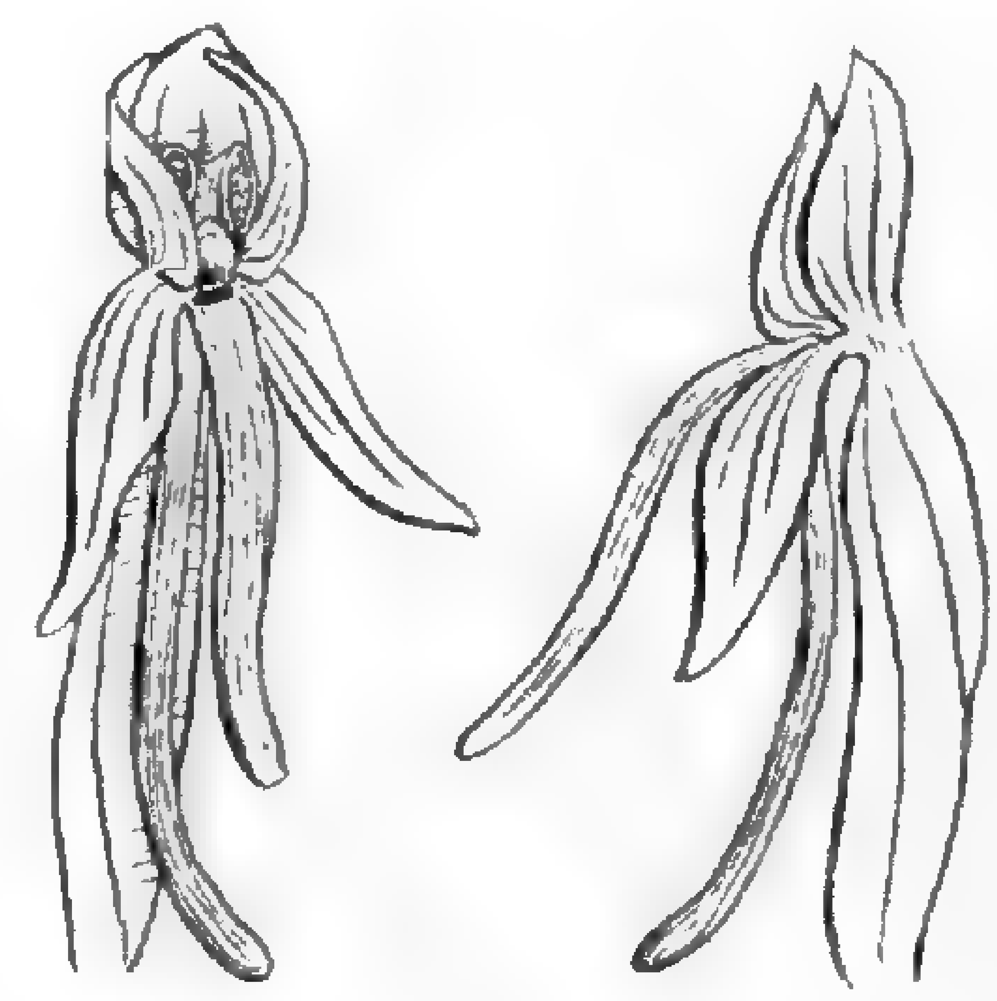

FIG. 24.

Stem tall and slender, 4–6 dm. high: lower leaves oblanceolate, obtuse, 1–2 dm. long, 1.5–3.5 cm. wide; the upper lanceolate, acute: spike long, slender and lax, 2–3 dm. long; bracts linear-lanceolate, usually exceeding the flowers: these light green, very delicate, about 15 mm. long: upper sepal broadly ovate, 4–5 mm. long; the lateral ones lanceolate, acute, about 6 mm. long: petals narrowly lanceolate, acute; lip linear, about 8 mm. long, obtuse; spur filiform, about 1 cm. long. (Fig. 24.)

This is characterized by the long, slender, lax spike, delicate green flowers and long bracts. The type was collected by Bolander, near Mariposa Grove, California.

OREGON: Kerbyville, 1884, *T. Howell.*

CALIFORNIA: Donner Lake, 1865, *J. Torrey, 511;* Pine Ridge, Fresno county, 1900, *Hall & Chandler, 139;* Truckee River, 1893, *C. F. Sonne;* Mt. Dyer, 1879, *R. M. Austin;* Sierra county, 1874, *Lemmon.*

NEW MEXICO: 1881, Mongollon Mountains, *H. H. Rusby.*

§ BREVIFOLIAE: Like the SPARSIFLORAE, but leaves very short, much reduced: flowers nearly twice as large.

24. Limnorchis brevifolia (Greene) Rydb.

Habenaria brevifolia Greene; Coulter, Bot. Gaz. **6**: 218. 1881; *Platanthera hyperborea* δ var. *leucostachys* Kraenzlin, Orch. Gen. et Sp. 640, in part. 1899.

Stem strict, leafy, 3–6 dm. high: leaf-blades ovate, 2–4 cm. long and about 1 cm. wide, acute: spike elongated, 1–2 dm. long; bracts similar to the leaves but smaller, about equalling the flowers: these green, 2–2.5 cm. long: upper sepal ovate, about 5 mm. long; lateral sepals linear, acute, about 8 mm. long: petals

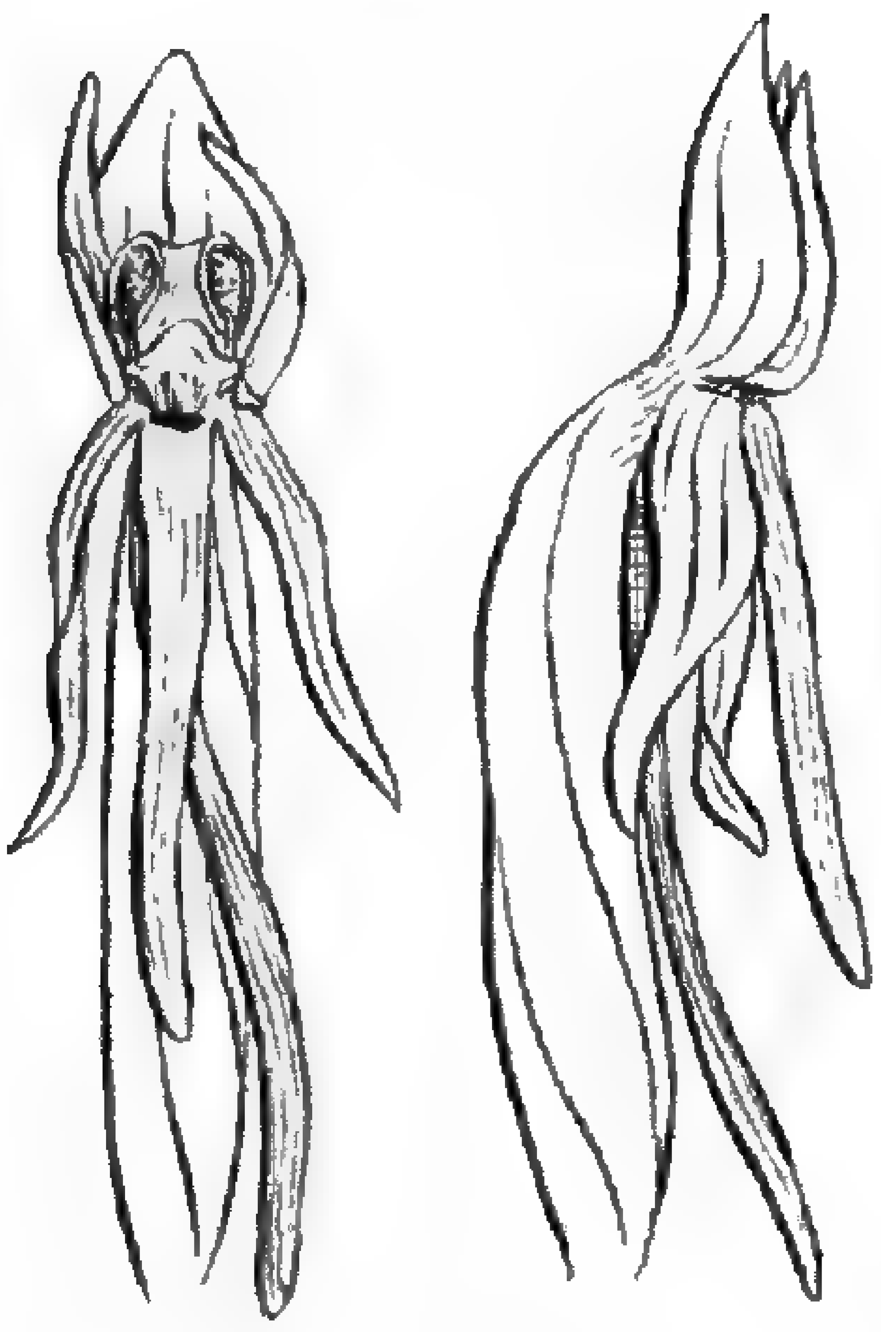

FIG. 25.

linear-lanceolate, acute, a little shorter than the upper sepal; lip linear, obtuse, about 10 mm. long; spur filiform, about 15 mm. long. (Fig. 25.)

This is characterized by its large flowers and reduced leaves.

TYPE: "On dry southward slopes of the Pinos Altos Mountains, New Mexico, in 1880."

NEW MEXICO: White Mountains, 1897, *E. O. Wooton, 544*; Pinas Altos Mountains, *E. L. Greene.*

MEXICO: State of Chihuahua, Sierre Madre, 1887, *C. G. Pringle, 1374.*

PIPERIA Rydb. Bull. Torr. Club, **28**: 269. 1901

Somewhat leafy-stemmed plants, but the leaves are usually near the base and withering at or before the anthesis, the stem-leaves being reduced and bract-like: tubers spherical or rounded ellipsoid; flowers greenish or white; sepals and petals 1-nerved or very obscurely 3-nerved; the upper sepal ovate or lanceolate, erect; the lateral ones spreading, linear to lanceolate, their bases united with the claw of the lip; upper petals free, lanceolate or linear-lanceolate, oblique, but not cordate; the blade of the lip linear-lanceolate to ovate, obtuse, truncate or hastate at the base, concave but with a longitudinal low ridge in the middle produced by the undulation of the lip; the claw, if it can be called so, united with the bases of the lower sepals, bordered with an erect margin which connects the lip with the column; anther cells unusually large for the size of the flower, parallel, opening nearly laterally: stigma a small beak in the angle between the anther-cells; ovary sessile, ellipsoid in fruit.

The principal differences between *Limnorchis* and *Piperia* are the following:

LIMNORCHIS	PIPERIA
Tubers elongated fusiform, root-like.	Tubers rounded.
Stem leafy; leaves remaining until fruit is set.	Stem leafy at the base; leaves withering at or before anthesis.

LIMNORCHIS	PIPERIA
Sepals 3–7-nerved; petals distinctly 3-nerved, without gibbosities.	Petals and sepals 1-nerved or obscurely 3-nerved, with small gibbosities at their bases.
Lateral sepals free.	Lateral sepals with their bases adnate to the claw of the lip.
Lip flat or concave, without median ridge, not truncate at the base, free.	Lip with a more or less distinct median ridge; blade truncate or hastate at the base; a margin connecting the claw with the column.
Anther-cells opening in front.	Anther-cells opening laterally.

The first species of *Piperia* was originally described as *Spiranthes Unalaschensis* Sprengel * and generally known as *Habenaria Unalaschensis* Wats. In the Kew Index this species is referred to *Herminium congestum*, a plant from northern India. We have no specimen of the latter, but the identity is so unlikely that I did not think of making a comparison when I visited Kew last summer. *P. Unalaschensis* is no *Herminium*, however, for that genus is distinguished by the total absence of a spur besides by different structures of the column. Kraenzlin recognizes both *Platanthera Unalaschensis* and *P. foetida.* It is true that no one seems to know exactly what *Spiranthes Unalaschensis* Sprengel really was, but I know of no plant except the present species, which agrees with Sprengel's short description. Kraenzlin placed *P. Unalaschensis* among the scapose species and *P. foetida* among the foliose, but in the description he characterizes the latter as having the leaves near the base. I cannot find any character on which to base a segregation of two species. The publication of *Platanthera foetida* Geyer, is generally given as Hook. Journ. Bot. **7**: 376. 1855; but there is no description, only the name and references to the locality where it was collected. The first real publication seems to have been in King's Report, where Watson gives it as a synonym under *Habenaria foetida* there described. *Gymnadenia longispica* Durand † has been referred to this species, but this must be a mis-

* Syst. **3**: 708. 1826.

† Pl. Pratten, 101. 1855.

take as that species was described as having a spur longer than the ovary, which is not the case with *P. Unalaschensis.*

The second species of *Piperia* was first described as *Platanthera elegans* Lindl.* from specimens collected by Douglas in northwestern America. It seems from the description as if more than one species had been included therein as for instance "*caule squamis parvis ramentaceis, spica longa densa cylindracea.*" Although this species has scale-like stem leaves, they are not by far so conspicuous as in the species that Bolander took for *H. elegans* and that the spike is described as dense does not very well fit this species. Not having any authentic specimen I naturally thought that the name *Platanthera elegans* Lindley belonged to the species named *Habenaria elegans* by Bolander or else the one that I have described here as *Piperia multiflora.* I therefore described the lax-flowered species under the name *P. elongata.* At Kew last summer, I found only one specimen collected by Douglas and this I refer to my *P. elongata* although its spike is more dense than in my type, but not denser than some specimens of the same species in our herbaria. It is, therefore, best to pass my *P. elongata* into synonymy for the present.

With regard to *Habenaria elegans* Bolander it must be stated that it was not properly published before it appeared in the Botany of California, for in Bolander's Catalogue of the Flora of San Francisco it is a *nomen nudum,* without description or synonyms. What Bolander's plant was is not unknown, for there is one specimen in the Torrey herbarium collected and named by Bolander. This can scarcely be distinguished from *Habenaria Michaeli* Greene,† although it has a longer, less crowded spike.

A further study has revealed that several other species than the ones enumerated in the place of publication of *Piperia,* must be included in that genus, *viz., Habenaria Michaeli* Greene, and *Gymnadenia longispica,* both mentioned above, *Habenaria Cooperi* Wats.‡ and *Habenaria maritima* Greene.§ Concerning *H. Cooperi* Wats. it may be remarked that it was placed by Watson in that

* Gen. & Spec. Orchid. Pl. 285. 1835.

† Man. Bay Reg. Bot. 306. 1894.

‡ Proc. Am. Acad. 12: 276. 1876.

§ Pittonia, 2: 298. 1892.

section of *Habenaria* which now constitutes *Limnorchis*, but his description of the flower is the best hitherto given of any species o *Piperia*.

Synopsis of Species

Spur less than twice as long as the lip.
 Stem leafy only at the base; lip oblong; spur slender, slightly exceeding the lip. 1. *P. Unalaschensis*.
 Stem more or less leafy; lip ovate.
  Spur slightly exceeding the lip, very saccate. 2. *P. Cooperi*.
  Spur nearly twice as long as the lip, only slightly clavate. 3. *P. lancifolia*.
Spur 2–3 times as long as the lip, filiform.
 Lip linear to lanceolate.
  Spike very lax; lip 4–5 mm. long; spur about 8–10 mm. 4. *P. leptopetala*.
  Spike dense; lip about 6 mm. long; spur 15–18 mm. long. 5. *P. multiflora*.
 Lip ovate or ovate-lanceolate.
  Spike elongated, lax; leaves withering at anthesis.
   Bracts linear-lanceolate; stem leafy only at the base. 6. *P. elegans*.
   Bracts ovate-lanceolate; stem usually leafy. 7. *P. longispica*.
  Spike short and very dense; flowers crowded; leaves withering before anthesis.
   Petals and sepals about 4 mm. long; petals purplish or greenish. 8. *P. Michaeli*.
   Petals and sepals about 5 mm. long; petals white. 9. *P. maritima*.

1. PIPERIA UNALASCHENSIS (Spreng.) Rydb. Bull. Torr. Club, **28**: 270. 1901

Spiranthes Unalaschensis Spreng. Syst. **3**: 708. 1826; *Habenaria Schischmareffiana* Cham. Linnaea, **3**: 29. 1828; *Herminium Unalaschkense* Reichenb. Fl. Germ. **13**: 107. *pl. 65*; *Platanthera Schischmareffiana* Lindl. Gen. & Sp. Orchid. 286. 1835; *Habenaria foetida* S. Wats. Bot. King's Exped. **5**: 341. 1871; *Platanthera foetida* Geyer. as a synonym under the preceding; *Habenaria Unalaschensis* Wats. Proc. Am. Acad. **12**: 277. 1877; *Montolivaea Unalaschensis* Rydb. Mem. N. Y. Bot. Gard. **1**: 107. 1900.

Stem strict, slender, 3–5 dm. high, leafy only near the base: basal leaves oblanceolate, obtuse or acutish, 1–1.5 dm. long, .8–3 cm. wide, withering at anthesis or soon after; stem leaves bract-like, linear-lanceolate to lanceolate, attenuate, .5–1 cm. long: spike long and lax, 1–3 dm. long; bracts lanceolate to ovate-lanceolate, one-half to two-thirds as long as the flowers: these greenish, distinctly in spirals, 8–10 mm. long: petals and sepals 2–4 mm. long, upper sepal ovate, acutish; lateral ones oblong-lanceolate, obtusish: petals purplish green, somewhat fleshy, lanceolate, oblique at the base; lip oblong, obtuse, slightly hastately lobed near the base; spur filiform or slightly clavate, a little exceeding the lip but shorter than the ovary. (Fig. 26.)

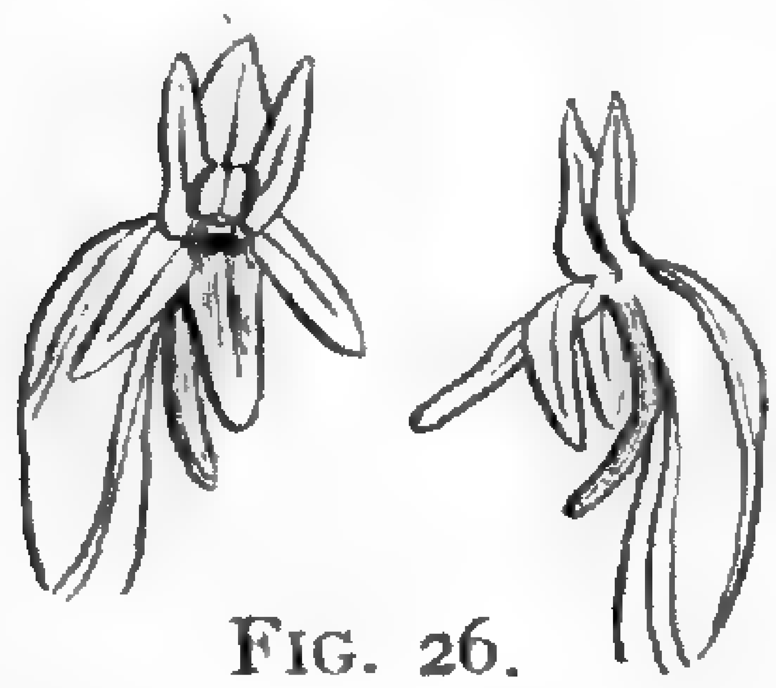

FIG. 26.

P. Unalaschensis is common from southern Alaska and Alberta to California and Colorado, and grows in damp woods.

TYPE: "*Ins. Aleut.*"

The following locality is remarkable, being far out of the supposed range:

QUEBEC: Jupiter River, Anticosti, 1883, *John Macoun.*

2. **Piperia Cooperi** (S. Wats.)

Habenaria Cooperi S. Wats. Proc. Am. Acad. **12**: 276. 1876.

Tall and strict, 3–10 dm. high, leafy below: basal leaves oblong lanceolate, acute, about 1 dm. long; lower stem leaves lanceolate, attenuate, 10–15 cm. long; the upper reduced and bract-like, lanceolate, 1–2 cm. long: spike strict and lax, 1–3 dm. long; bracts ovate-lanceolate, acuminate, two-thirds as long as the flowers: these yellowish-green, about 10 mm. long: sepals and petals about 4 mm. long, obtuse; upper sepal ovate; lateral sepals and petals oblong lanceolate; lip ovate, rounded at the apex, somewhat hastate at the truncate base, but the lobes rounded, rather thick and with prominent ridge in the middle; spur thick, decidedly clavate, about equalling the lip, but much shorter than the ovary. (Fig. 27.)

FIG. 27.

I have not seen the type, collected by Cooper at San Diego, California, but the plants cited below agree with the description and were collected in the same region. It is from these I have drawn the description and figure.

TYPE: "On Clay hills near San Diego, California; Dr. J. G. Cooper."

CALIFORNIA: San Diego, 1884, *C. R. Orcutt;* Point Loma, 1897, *T. S. Brandegee.*

3. **Piperia lancifolia** sp. nov.

Stem stout, 3–5 dm. high, the lower portion leafy; basal leaves and lower stem-leaves lanceolate, attenuate, 10–15 cm. long, 1–2 cm. wide, withering after anthesis: spike many-flowered, but lax, 2–3 dm. long; bracts ovate, acute, striate, about two-thirds as long as the flowers, or the lower almost equalling them: flowers greenish, 11–13 mm. long: upper sepal ovate, obtuse, about 4 mm. long; the lateral ones slightly longer, oblong-lanceolate: petals lanceolate, obtusish, oblique at the base; lip about 4 mm. long; blade round-ovate, rounded at the apex, truncate at the base, scarcely at all hastate, thick, with prominent median ridge; spur filiform, slightly clavate, almost twice as long as the lip and about equalling the ovary. (Fig. 28.)

FIG. 28.

This species is closely related to the preceding, differing in the longer less clavate spur, scarcely at all hastate lip and broader bracts. It is growing in cañons.

CALIFORNIA: Sierra Santa Monica, 1892, *H. E. Hasse, 5675* (type in herb. N. Y. Bot. Gard.).

4. **Piperia leptopetala** sp. nov.

Stem slender, 3–4 dm. high, leafy only at the base: basal leaves two, oblong-lanceolate, obtuse or acutish, about 1 dm. long, 1.5–2.5 cm. wide, withering at anthesis or soon after; stem leaves all reduced and bract-like, few, lanceolate, acute: spike slender, lax, 1–2 dm. high; bracts lanceolate to linear-lanceolate, acuminate, about half as long as the flowers: these greenish, about 1 cm. long: upper sepal lanceolate, obtuse, about 4 mm. long; lateral ones narrowly lanceolate, acute, about 5 mm. long: petals narrowly lanceolate, acute, about equalling the upper sepal; blade of the lip lanceolate, obtuse, hastately toothed at the base; median ridge rather obscure; spur filiform, not clavate, about twice as long as the lip and longer than the ovary. (Fig. 29.)

FIG. 29.

In habit this species resembles most *P. Unalaschensis*, but the sepals and petals are narrower and the spur is almost twice as long.

CALIFORNIA : Mountains east of San Diego, 1850, *C. C. Parry* (Mex. Bound. Surv., type in herb. Columbia Univ.); Plumas county, 1875, *Mrs. Austin*.

WASHINGTON : Nesqually River, 1838–42, *Wilkes Exp.*, *146*, in part.

5. **Piperia multiflora** sp. nov.

Montolivaca elegans Rydb. Mem. N. Y. Bot. Garden, **1** : 106, in part as to specimen cited. 1900; not Reichenb. 1881; *Piperia elegans* Rydb. Bull. Torr. Club, **28** : 270, in part. 1901.

FIG. 30.

Stem stout, 4–6 dm. high, 3–4-leaved only near the base : basal leaves oblong, oblanceolate or obtuse or acutish, 1–1.5 dm. long, 2–3 cm. wide, withering at anthesis; lower stem leaves lanceolate, acute; upper stem leaves much reduced and bract-like, lanceolate or linear-lanceolate, scattered, attenuate, 1–2 cm. long : spike very dense, 1–2 dm. long; bracts linear-lanceolate, almost equalling the flowers : these greenish-white, spreading, about 1.5 cm. long : upper sepal lanceolate, acute, 4–5 mm. long; lateral sepals and petals linear-lanceolate, acutish or obtuse; lip almost linear, obtuse, only slightly hastate at the base, about 6 mm. long; median ridge very low; spur 15–18 mm. long, filiform, not clavate. (Fig. 30.)

This species is perhaps nearest related to *P. elegans*, differing however in the dense spike, the spreading flowers, and narrow petals and sepals.

WASHINGTON : Gray's Harbour, 1838–42, *Wilkes Exped.*, *194* (type in herb. Columb. Univ.); Cascade Mountains, 1882, *Brandegee*, *475*.

MONTANA : Mission Range, 1883, *W. M. Canby*, *307*.

CALIFORNIA : Monterey, *Wm. Rich*.

8

6. PIPERIA ELEGANS (Lindl.) Rydb. Bull. Torr. Club, 26 : 270 in part. 1901

Platanthera elegans Lindl. Gen. & Sp. Orchid. Pl. 285. 1835; *Montolinaca elegans* Rydb. Mem. N. Y. Bot. Gard. **1** : 106, in part, as to synonym. 1900; not Reichenb. 1881; *Piperia elongata* Rydb. Bull. Torr. Club, **28**: 270. 1901.

Stem slender, strict, 4–7 dm. high: tuber ellipsoid, about 2 cm. long, 1 cm. in diameter: basal leaves 2 or 3; blades lanceolate or oblanceolate or rarely oval, acute or obtuse, 8–15 cm. long, 1–3, sometimes even 5 cm. wide; stem-leaves much reduced, lanceolate, acuminate, 5–10 mm. long: spike long and usually lax, 1.5–3 dm. long; bracts lanceolate, acuminate, from half to fully as long as the flowers: these greenish-white, about 1 cm. long: sepals about 5 mm. long; the upper lanceolate, acute; the lateral ones linear-oblong or lanceolate, obtuse: petals lanceolate, acute; blade of the lip broadly or ovate-lanceolate, slightly hastate and truncate at the base; median ridge rather indistinct; spur filiform, 10–12 mm., about two and a half times as long as the lip and longer than the ovary. (Fig. 31.)

FIG. 31.

TYPE: "In *America boreali occidentali, Douglas* (*hab. s. sp. comm. Soc. Hort.*)."

BRITISH COLUMBIA: Vancouver Island, 1887, *John Macoun.*

WASHINGTON: W. Klickitat county, 1885, *W. N. Suksdorf.*

OREGON: Grave Creek Hills, 1887, *Thomas Howell;* 1871, *Elihu Hall, 506.*

IDAHO: Priest Lake near lower end, 1900, *D. T. MacDougal, 168;* Priest River valley, *134;* Kootenai county, 1887, *J. H. Sandberg;* Wiessner's Peak, 1892. *Sandberg, MacDougal & Heller, 584* (broad leaved).

CALIFORNIA: Santa Lucia Mountains, 1898, *R. A. Plaskett, 167;* 1872, *Mrs. Bancroft.*

7. **Piperia longispica** (Durand)

Gymnadenia longispica Durand, Pl. Pratten, 101. 1855.

Stem stout, 3–7 dm. high, more or less leafy below: tuber ellipsoid, 3–4 cm. long, about 1.5 cm. thick, basal leaves and lower stem leaves 2–4, lanceolate, acute, 1–1.5 dm. long, 2–3.5 cm. wide, withering about the time of anthesis: upper stem leaves reduced, 1–3 cm. long, lanceolate: spike many-flowered, but not dense, 1–3 dm. long; bracts ovate-lanceolate, .5–1 cm. long, acuminate: flowers greenish, about 1.5 cm. long: upper sepal ovate, obtuse, about 5 mm. long; lateral sepals oblong-lanceolate, obtuse: petals broadly lanceolate; blade of the lip ovate-hastate, distinctly auricled, and truncate at the base; spur filiform, two and a half times as long as the lip. (Fig. 32.)

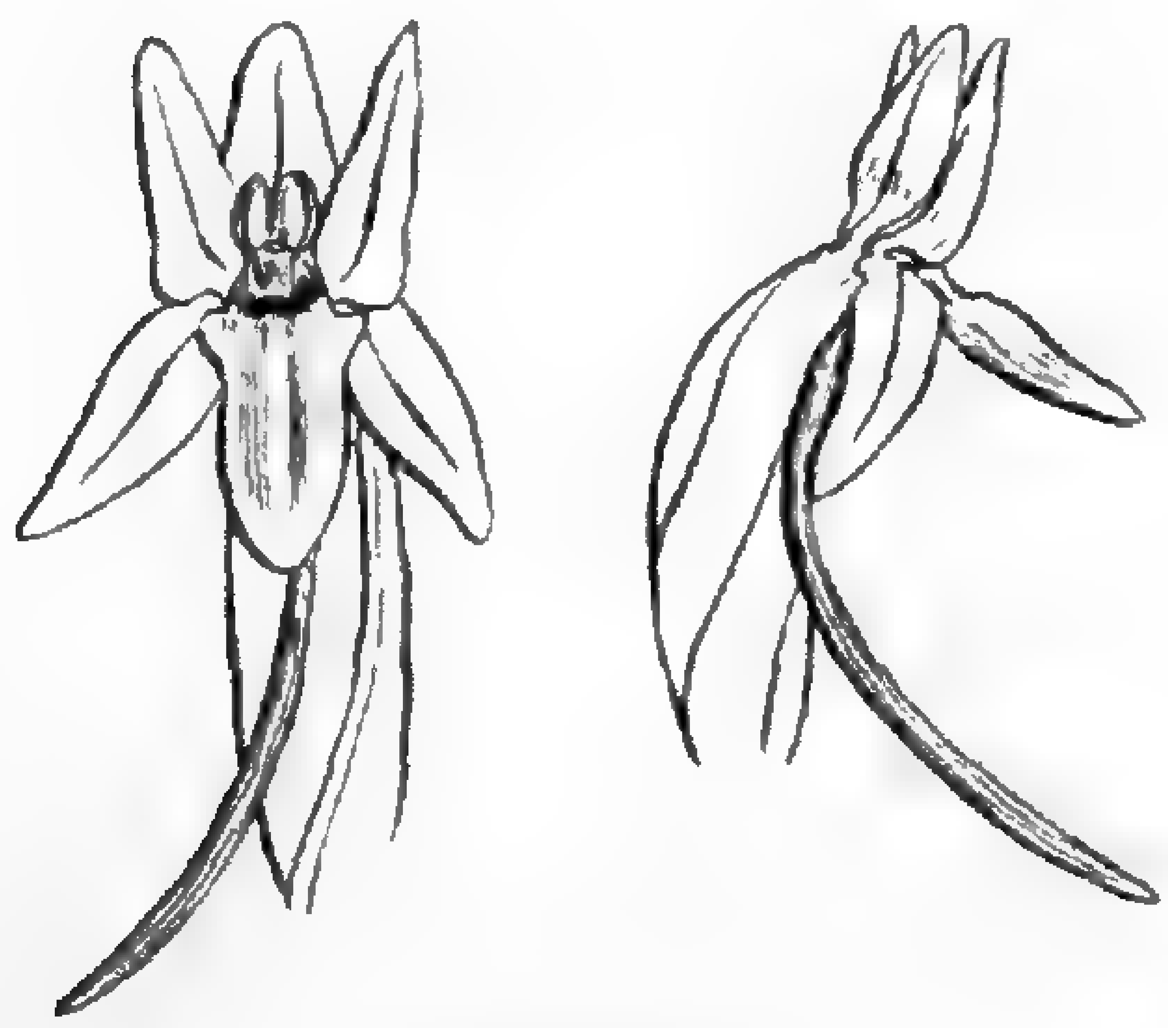

FIG. 32.

I have not seen the type of *Gymnadenia longispica*, which was described from a fragmentary specimen collected by Pratten, *i. e.*, it consisted only of the upper portion without any leaves. Durand's species has been regarded as *P. Unalaschensis* but this cannot be so, for *Gymnadenia longispica* was described as having a spur longer than the ovary, which throws it out of *P. Unalaschensis*. As the spike is described as long and lax it must have been either *P. elegans*, *P. leptopetala* or the species described here. As this is the only species with broad bracts, the name *G. longispica* must belong here, unless it is a species unknown to me. The only discrepancy is that the spur is described as clavate, which is scarcely the case.

CALIFORNIA: Mokelumne River, *Mr. Rich*; Monterey, 1850, *C. C. Parry* (Mex. Bound. Surv.); Cucamonga Mts., 1881, *S. B. & W. F. Parish, 1157*; Santa Monica range, 1892, *H. E. Hasse.*

8. **Piperia Michaeli** (Greene)

Habenaria elegans Boland. (Cat. Pl. San Franc. 29); S. Wats. Bot. Calif. **2**: 133. 1880; not *Platanthera elegans* Lindl. 1835; *Habenaria Michaeli* Greene, Man. Bay-Reg. Bot. 306. 1894; *Montoliveia elegans* Rydb. Mem. N. Y. Bot. Gard. **1**: 106, in part as to synonym, 1900; *Piperia elegans* Rydb. Bull. Torr. Club, **28**: 270, in part as to synonym.

FIG. 33.

Stem stout, at flowering time leafless, 2–3 dm. high: tuber ellipsoid, 2–4 cm. long, 1–1.5 cm. wide: basal leaves elliptic or oblanceolate, about 1.5 dm. long, 4 cm. wide, withering before blooming; stem-leaves numerous, small and bract-like, lanceolate to ovate-lanceolate, acuminate, 1–2 cm. long: spike very dense, 5–15 cm. long: flowers about 1 cm. long, greenish: upper sepal ovate, about 4 mm. long; lateral ones oblong-lanceolate, obtuse: petals lanceolate, acute; blade of the lip ovate, obtuse, scarcely hastate, obtuse or truncate at base; spur filiform, about two and a half times as long as the lip and a third longer than the ovary. (Fig. 33.)

TYPE: "Open hills, under oaks, etc., from near Livermore southward."

CALIFORNIA: San Luis county, 1886, *G. W. Michael;* Stansbury Valley, 1876, *Harry Edwards;* San Francisco, 1838–42, *Wilkes Expedition, 1554,* in part; "California," *Bolander.*

WASHINGTON: Gray's Harbor, 1838–42, *Wilkes Expedition, 1554,* in part; Nesqually River, *146,* in part.

9. **Piperia maritima** (Greene)

Habenaria maritima Greene, Pittonia, **2**: 298. 1892.

Stem stout, 2–3 dm. high, at flowering time leafless: tuber almost spherical, 2–2.5 cm. in diameter: leaf-blades oblong, obtuse or acute, about 1 dm. long, 3–4 cm. wide, withering before anthesis; stem leaves reduced and bract-like, numerous, ovate-lanceolate, acuminate, 1–2 cm. long: spike short and very dense, 4–10 cm. long; bracts about two-thirds as long as the flowers: these 10–12 mm. long, white: upper sepal ovate, obtuse, about 4 mm. long; lateral sepals oblong-lanceolate: petals broadly lanceolate; blade of the lip elliptic, obtusish, scarcely hastate, somewhat truncate at the base, as well as the petals and sepals, white, thin; spur filiform, about 2.5 times as long as the lip and longer than the ovary. (Fig. 34.)

FIG. 34.

This differs from all the other species in its stoutness and white flowers. It resembles most *P. Michaeli* in habit, the short spike, numerous scale-like stem leaves and the absence of root leaves at the time of flowering.

TYPE: "On dry hills near the sea at Point Lobos, near San Francisco."

CALIFORNIA: San Francisco county, 1892 and 1893, *Michener & Bioletti.*

CROSS-REFERENCES AND INDEX

New Plants from Colorado

By George E. Osterhout

Linum Arkansanum

Seemingly a perennial, 1–1.5 dm. high, minutely scabrous pubescent or almost glabrous, branching from the base, the branches becoming almost as long as the stem; very leafy, from the base, the upper leaves often as long as the calyx lobes; stipular glands minute: leaves linear, 1–2 cm. long; the upper wider at the base and glandular toothed, developing a scarious midvein: flowers numerous, the peduncles about 5 mm. long, scarious wing-angled: the sepals glandular toothed, 3-nerved, the middle nerve scarious-winged, the larger sepals 1 cm. long, all aristate-pointed: the petals large, cuneate, 15 mm. long by 10 mm. wide at widest portion, orange-color, rose-tinted at the base: the styles united to the top, the capsule half the length of sepals, the septa thickened for about one-third of their extent.

A species somewhat related to *Linum rigidum* Pursh. Collected on gravelly prairie south of the Arkansas River near Rocky Ford, Otero county, Colorado, June 9, 1900, no. 2037.

Mentzelia aurea

Perennial, the stem whitish, rather stout, finely pubescent, glandular on the pedicels and ovary; corymbosely branched from near the base, the leaves linear to oblong, sinuate-dentate to sinuate-pinnatifid, the lower including the narrowly winged petiole, 10 to 15 cm. long, hispid on both sides: flowers numerous, vespertine, the earlier ones sessile, the others on pedicels 1–2 cm. long: petals 10, the five outer ones whitish on the outside, 2 cm. long and 8 mm. wide at the widest portion, narrowed to a claw which is nearly half the length of the whole petal; the five inner ones narrow and not more than half the size of the outer, a number of the outer filaments also petaloid: the capsule a little more than 2 cm. long, striate: the seeds round, winged, mature ones smooth, *i. e.*, not punctate.

Type specimens collected in Estes Park, Larimer county, Colorado, July 18, 1900, no. 2203. A showy plant, ranging from the edge of the foothills to an altitude of 7000 feet. Before the flowers open they appear to be white on account of the whitish outside of the petals, but when open they are golden yellow. (See P. 689; = M. Speciosa)

Artemisia silvicola

Perennial from creeping rootstocks, 4–6 dm. high, sparingly branched and loosely paniculate, the stems slender, finely pubescent, leafy to near the top with comparatively few leaves; the leaves linear, 4–6 cm. long, the wider 5–8 dm. wide, all entire or with few sharp teeth, acuminate and tapering to the sessile base, almost glabrate and green above, silvery canescent beneath with a close tomentum: inflorescence loosely paniculate, 2–3 dm. long, the heads scattered—*i. e.*, not dense—on the branches of the panicle, 5 mm. high and about the same in width, of about 10–12 marginal flowers and the same number of central ones, the corollas of the latter purple; the involucral bracts oblong, slightly tomentose.

Found along mountain streams at an elevation of 6000 to 8000 feet. The type specimens were collected along MacIntyre Creek, a branch of the Laramie river, in Larimer county, Colo., Aug. 24, 1900, no. 2242. A species belonging to *Euartemisia.* It is an ally of *Artemisia Mexicana* Willd. and distinguished by its fewer and larger leaves, the more lax inflorescence and larger heads.

Agoseris agrestis

A scapous perennial, glabrous and glaucous, especially the leaves; the stems usually single from the root, stout, erect, 2–4 dm. high: leaves numerous, from linear to oblong on the same plant narrowed to a petiole, and either entire, sparingly sinuate, dentate at the middle or some of the larger cleft at the middle, the divisions pointing upward, the larger 10–15 cm. long, acuminate: the involucral bracts finely pubescent, in three series successively longer, oblong, acuminate, about 2 cm. long: the flowers yellow (purple in drying): the ribbed achenes 12 mm. long, including the stout beak of nearly half this length; the pappus copious and very white.

A plant of the meadow lands of the mountains. The type specimens were collected in Estes Park, Larimer county, Colo., July 20, 1900, no. 2215. Collected also by Prof. Aven Nelson at Willow Creek, Albany county, Wyo., no. 3372. This species is readily distinguished from *Agoseris glauca* (Pursh) Greene by the wider leaves, the stout upright scape and the larger heads.

Dacryopsis Ellisiana Massee

By E. J. Durand

In a note with the above title in the Bulletin for September, Mr. George Massee calls attention to my error * in considering *Coryne Ellisii* Berk. to be the same as *Graphium giganteum* (Peck) Sacc. Mr. Massee's point is well taken, and I hasten to acknowledge my mistake, as well as to thank him for pointing it out. In July Mr. Massee wrote me regarding this point, and very kindly enclosed a fragment of the type of *Coryne Ellisii*. This specimen which I have just had opportunity to examine has convinced me that my conclusion was wrong.

Mr. Massee says that he cannot say why I made such a mistake. I will try to explain. I had access to two specimens which I supposed to be authentic. In the first place, the original specimens of *Coryne Ellisii* were collected and sent to Berkeley by Ellis. I assumed, therefore, that the specimens in the N. A. F. 1383 had been compared with duplicates of the type. In the second place, I have in my collection a specimen called *Graphium giganteum* from Professor Burt, which bears on the label the following note: "*Dacryopsis Ellisiana* (Berk.) Massee. A duplicate from the collection authenticated as *D. Ellisiana* by Massee." Both of these specimens are *Graphium giganteum* (Peck) Sacc., with no indications of basidia.

In the light of these specimens I think it only natural that both Professor Burt and myself should conclude that *Dacryopsis Ellisiana* (*Coryne Ellisii* Berk.) and *Graphium giganteum* (Peck) Sacc. were the same.

* Bull. Torr. Club, **28**: 349–355. Je. 1901.

Proceedings of the Club

Tuesday, October 8, 1901

This meeting was held at the Museum, Botanical Garden, Bronx Park, at 3:30 P. M.; Dr. L. M. Underwood in the chair; 27 persons present.

One active member was elected: Mr. W. L. Sherwood, 36 Washington Place, New York City.

The program consisted of informal reports on summer's work.

Dr. Underwood spoke of his collecting in Puerto Rico, examining thoroughly the western part of the island during five weeks spent there; details concerning which will be given later. He collected over 1000 numbers of dried plants and sent back a number of cacti now growing in the Botanical Garden. He afterward attended the A. A. A. S. meeting at Denver, Colorado, and spent some time in botanical work throughout many parts of that state, collecting about 600 numbers of the fall flora, particularly about Ouray.

The Secretary reported extension of range of *Aster curvescens* by his discovery of its growth in quantity in the southern Berkshire hills.

Dr. MacDougal reported that he had aided Prof. Elrod in maintaining a summer laboratory for four weeks at Big Fork at the north end of Flathead Lake, where he entertained Dr. H. C. Cowles and twenty students of the University of Chicago. Dr. MacDougal then joined a collecting party exploring a part of northern Montana not known to have been before visited by a botanist, except Canby, who gave it a flying trip in 1883 or 1884. Dr. MacDougal collected about 900 flowering plants.

Mrs E. G. Britton mentioned her collecting at the end of May last on Slide Mountain in the Catskills, discovering on Slide Moun- near the balsam limit, several interesting mosses not before attributed to the Catskills.

Dr. M. A. Howe reported on his eleven weeks of collecting, mainly of marine algae in Nova Scotia and Newfoundland. He made about ten principal stays of about a week each, at Yarmouth, Digby, Grand Pré, at Pictou, a station for *Fucus serratus;* at North Sydney, Cape Breton; at Channel, near the southwestern end of Newfoundland, the richest locality in the larger kelps. There the coast, Newfoundland is almost treeless, as is generally reputed, though firewood and lumber are obtainable twenty miles inland, but the west coast farther north is forested with spruce, fir, and tamarack, with yellow and white birch. Journeying east through the practically uninhabited interior, a thin coniferous forest was met, especially all around the numerous lakes. Where fires had been through it, for 20 or 30 miles all was a flaming purple of fireweed (*Epilobium*).

Dr. Howe remained four weeks in Newfoundland, and was afterward at Halifax Harbor, N. S., where Harvey, author of the Nereis, had made many collections. Altogether, Dr. Howe, with his two companions, collected about 12,000 specimens, including duplicates, a third of this number being algae.

Mr. R. M. Harper reported collecting again in Georgia, with about 500 numbers, visiting many new localities, traveling about 1400 miles by rail, and doing much work on plant-distribution. He spoke particularly of the remarkable flora of the sand hills in Bulloch county, resembling the "scrub" flora in Florida. Among the interesting plants collected by Mr. Harper were *Elliottia*, and, at Thomasville, Ga., *Nymphaea orbiculata*.

Dr. Rydberg reported on his visit to Sweden and Norway, with interesting comparisons of the subalpine flora of Norwegian moraine and mountain slopes visited, the plants chiefly circumpolar and therefore common to North America.

Mr. William A. Murrill reported his attendance on the Botanical Congress at Geneva and that of the zoölogists at Berlin, with references to kind attentions given him at the Kew Gardens and the Linnaean Society rooms, London.

Mr. Lighthipe mentioned a new locality, at West Orange, for *Nasturtium sylvestre*, rare in New Jersey.

Mrs. Isaac P. Harris spoke of her work in the Adirondacks among the lichens, with one species new to her in that region.

Brief remarks followed regarding fall blossoming and foliation in New York City. It was noted that the maples, lindens, and buttonwoods in Union Square, Washington Square and Madison

Square are now covered with fresh leaves as in May, owing to defoliation by caterpillars. Horsechestnuts have new shoots and some have new blossoms. Cherry trees have also been in flower again. Mrs. Britton mentioned the magnolia and tulip trees of Bronx Park which have blossomed and fruited twice this year.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Andrews, A. L. A natural Hybrid between *Habenaria lacera* and *H. psychodes*. Rhodora, **3**: 245–248. O. 1901.

Andrews, A. L. Several uncommon Fern Allies from northwestern Massachusetts. Rhodora, **3**: 252, 253. O. 1901.

Arber, E. A. N. On the Effect of Salts on the Assimilation of Carbon dioxide in *Ulva latissima* L. Ann. Bot. **15**: 39–69. Mr. 1901.

Barbour, W. C. *Bazzania*. Bryologist, **4**: 68, 69. O. 1901. [Illust.]

Barry, P. *Habenaria Hookeriana oblongifolia* in West Campton, New Hampshire. Rhodora, **3**: 237. 16 S. 1901.

Bates, J. M. Notes on *Astragalus*. Torreya, **1**: 109. 28 S. 1901.

Beille, L. Note sur le développement des Disciflores. Act. Congrès Internat. Bot. Paris, 182–184. 1900. [Illust.]

Berry, E. W. Notes on *Liriodendron* Leaves. Torreya, **1**: 105–107. *pl. 1, 2*. 28 S. 1901.

Best, G. N. North American Thuidiums. Bryologist, **4**: 70–74. O. 1901. [Illust.]

Bicknell, E. P. On *Scirpus robustus* and certain of its near Allies. Torreya, **1**: 94–96. 23 Au. 1901.

Bicknell, E. P. Studies in *Sisyrinchium*—IX.: The Species of Texas and the Southwest. Bull. Torr. Club, **28**: 570–592. 26 O. 1901.
Includes seventeen new species.

Bicknell, E. P. Two new Bush Clovers (*Lespedeza*). Torreya, **1**: 102–105. 28 S. 1901.
Lespedeza velutina and *L. Brittonii* Bicknell.

Biffen, R. H. On the Biology of *Bulgaria polymorpha* Wett. Ann. Bot. **15**: 119–134. *pl. 7*. Mr. 1901.

Bishop, J. N. A Catalogue of all phaenogamous and vascular cryptogamous Plants at present known to grow without Cultivation in the State of Connecticut. 8vo, 1–57. Hartford. Ja. 1901. [3d. Ed.]
Reprinted from Rep. Conn. Board of Agric.

Boodle, L. A. Comparative Anatomy of the Hymenophyllaceae, Schizaeaceae and Gleicheniaceae. II. On the Anatomy of the Schizaeaceae. Ann. Bot. **15**: 359–422. *pl. 9–21*. Ja. 1901.

Boudier, E. Influence de la nature du sol et des végétaux qui y croissent sur le développement des champignons. Act. Congrès Internat. Bot. Paris, 118–131. 1900.

Bower, F. O. Imperfect Sporangia in certain Pteridophyta. Are they vestigial? Ann. Bot. **15**: 225–267. Jl. 1901.

B[randegee], K. The Size of Herbarium Sheets. Zoe, **5**: 138, 139. 26 F. 1901.

B[randegee], K. *Verbascum* in California. Zoe, **5**: 138. 26 F. 1901.

Bray, W. L. The ecological Relations of the Vegetation of Western Texas. Bot. Gaz. **32**: 99–123. *f. 1–6.* 20 Au. 1901; 195–217. *f. 7–13.* 24 S. 1901; 262–291. *f. 14–24.* 21 O. 1901.

Brewster, W. *Euphorbia corollata* at Concord, Massachusetts. Rhodora, **3**: 253. O. 1901.

Britton, E. G. Vanishing wild Flowers. Torreya, **1**: 85–94. 23 Au. 1901.

Britton, E. G. & Smith, A. M. Notes on rare and little-known Mosses. Bryologist, **4**: 62, 63. O. 1901. [Illust.]

Britton, N. L. La flore du Klondike. Act. Congrès Internat. Bot. Paris, 276. 1900.

Britton, N. L. Manual of the Flora of the Northern States and Canada. 8vo, i–x, 1–1080. O. 1901.

Includes numerous new species in various genera.

Brown, N. E. (and others). A Report on two botanical Collections made by Messrs. F. U. McConnell and J. J. Quelch at Mount Roraima in British Guiana. Trans. Linn. Soc. **6**: 1–107. *pl. 1–14.* Ja. 1901.

Includes reports on the Pteridophyta by C. H. Wright, on the Musci by V. F. Brotherus, on the Hepaticae by F. Stephani, and on the Thallophyta by G. Massee. Many new species are described.

Campbell, D. H. The Embryo-sac of *Peperomia*. Ann. Bot. **15**: 103–118. *pl. 6.* Mr. 1901.

Campbell, R. The Flora of Montreal Island. (Supplementary.) Can. Record Sci. **8**: 349–365. 10 Au. 1901.

Chamberlain, E. B. Preliminary Lists of New England Plants.—VII. Boraginaceae. Rhodora, **3**: 214, 215. 9 Au. 1901.

Chodat, R. Le noyau cellulaire dans quelques cas de parasitisme ou de symbiose intracellulaire. Act. Congrès Internat. Bot. Paris, 23–30. 1900.

Cook, O. F. The Origin and Distribution of the Cocoa Palm. Contr. U. S. Nat. Herb. **7**: i–v, 257–293. 1901.
Maintains an American origin for the cocoanut.

Correns, C. Bastarde zwischen Maisrassen, mit besonderer Berücksichtigung der Xenien. Bibliotheca Botanica, **10**[53]: i–xi, 1–161. *pl. 1, 2.* 1901.

Cowles, H. C. The physiographic Ecology of Chicago and Vicinity; a Study of the Origin, Development and Classification of Plant Societies. Bot. Gaz. **31**: 145–182. Mr. 1901. [Illust.]

Czapek, F. Sur quelques substances aromatiques continues dans les membranes cellulaires des plantes. Act. Congrès Internat. Bot. Paris, 14–18. 1900.

Dandeno, J. B. The Application of normal Solutions to biological Problems. Bot. Gaz. **32**: 229–237. 21 O. 1901.

Dangeard, P. A. La reproduction sexuelle des Champignons supérieurs comparée à celle de l' *Actinosphaerium*. Act. Congrès Internat. Bot. Paris, 151–156. 1900.

Davenport, G. E. Miscellaneous Notes on New England Ferns and Allies. Rhodora, **3**: 223–225. 16 S. 1901.

Davis, B. M. Nuclear Studies on *Pellia*. Ann. Bot. **15**: 147–180. *pl. 10, 11.* Mr. 1901.

Deane, W. Notes on the Ericaceae of New England. Rhodora, **3**: 193–198. 12 Jl. 1901.

Deane, W. Notes on the Umbelliferae of New England. Rhodora, 3: 209–213. 9 Au. 1901.

Degagny, C. L. Résumé de recherches comparées sur la division du grand noyau des Liliacées, ou noyau primaire du sac embryonnaire. Act. Congrès Internat. Bot. Paris, 19–22. 1900.

De Vries, H. Variabilité et mutabilité. Act. Congrès Internat. Bot. Paris, 1–6. 1900.

Driggs, A. W. A luxuriant Growth of Juniper. Rhodora, **3**: 254. O. 1901.

Driggs, A. W. Noteworthy Panicums in Connecticut. Rhodora, **3**: 145, 146. 20 My. 1901.

Dutailly, G. Du style géniculé chez certains *Geum*. Act. Congrès Internat. Bot. Paris, 185–195. 1900.

Eastwood, A. Plants used for poisoning Fish. Zoe, **5**: 136. 26 F. 1901.

Eastwood, A. *Atriplex semibaccatum* R. Br. in Marin County. Zoe, **5**: 136, 137. 26 F. 1901.

Eastwood, A. *Habenaria maritima* Greene. Zoe, **5**: 137. 26 F. 1901.

Evans, A. W. Hepaticae collected by William A. Setchell in northern Alaska. Zoe, **5**: 129–132. 26 F. 1901.
Includes *Jungermannia caespiticia*, new to America.

Faurot, F. W. Notes on the early Development of *Astragalus caryocarpus*. Proc. Iowa Acad. Sci. **8**: — (1–5). *pl. 9–11.* 1901.

Fairchild, D. G. Notes on Travel, VII. A tropical Forest in Ceram. Bot. Gaz. **32**: 218–221. 24 S. 1901.

Fedde, F. Versuch einer Monographie der Gattung Mahonia. Engler's Bot. Jahrb. **31**: 30–133. *f. 1–5.* 16 Au. 1901.
Enumerates 37 species and several varieties, mostly American, with several new names and combinations.

Ferguson, M. C. The Development of the Pollen Tube and Fertilization in Pines. Science, II. **13**: 668. 26 Ap. 1901.

Ferguson, M. C. The Development of the Pollen Tube and the Division of the generative Nucleus in certain Species of Pines. Ann. Bot. **15**: 193–224. *pl. 12–14.* Je. 1901.

Fernald, M. L. Extreme Variations of *Alisma Plantago*. Rhodora, **3**: 206. 12 Jl. 1901.

Fernald, M. L. New Stations for *Juncus subtilis*. Rhodora, **3**: 228–230. 16 S. 1901.

Fernald, M. L. Notes on some Trees and Shrubs of western Cheshire County, New Hampshire. Rhodora, **3**: 232–236. 16 S. 1901.

Fernald, M. L. *Scirpus supinus* and its North American Allies. Rhodora, **3**: 249–252. O. 1901.
Includes two new varieties.

Fernald, M. L. *Scutellaria parvula* and *S. ambigua*. Rhodora, **3**: 198–201. 12 Jl. 1901.

Fernald, M. L. Some recent Publications and the nomenclatorial Principles they represent. Bot. Gaz. **31**: 183–197. Mr. 1901.

Fernald, M. L. The vascular Plants of Mount Katahdin. Rhodora, **3**: 166–177. *pl. 32.* 10 Je. 1901.
Carex Katahdinensis, new species.

Flahault, C. Projet de nomenclature phytogéographique. Act. Congrès Internat. Bot. Paris, 427–450. 1900.

Fuller, T. O. *Botrychium matricariaefolium* on Mt. Toby, Massachusetts. Rhodora, **3**: 144, 145. 20 My. 1901.

Furbish, K. *Cardamine bellidifolia* in Cumberland County, Maine. Rhodora, **3**: 185. 10 Je. 1901.

Gagnepain [F.]. A propos d'hybrides. Act. Congrès Internat. Bot. Paris, 359, 360. 1900.

Gallardo, A. La botanique à la République Argentine. Act. Congrèes Internat. Bot. Paris, 401–403. 1900.

Gallardo, A. La phytostatisque. Act. Congrès Internat. Bot. Paris, 102–107. 1900. [Illust.]

Gallardo, A. Sur la variabilité tératologique chez la Digitale. Act. Congrès Internat. Bot. Paris, 108–111. 1900.

Ganong, W. F. Society for Plant Morphology and Physiology. Science, II. **13**: 246–258. 15 F. 1901.

Ganong, W. F. Suggestions for an Attempt to secure a standard college entrance Option in Botany. Science, II. **13**: 611–616. 19 Ap. 1901.

Gerber, C. Étude comparée de la respiration des graines oléagineuses pendant leur développement et pendant leur germination. Act. Congrès Internat. Bot. Paris, 59–101. 1900.

Gillot, X. Étude des flores adventices, adventicité et naturalisation. Act. Congrès Internat. Bot. Paris, 370–386. 1900.

Goff, E. S. The Influence of Light on the Length of the Hypocotyl in Indian Corn. Science, II. **13**: 394. 8 Mr. 1901.

Gwynne-Vaughan, D. T. Observations on the Anatomy of solenostelic Ferns. I. *Loxsoma*. Ann. Bot. **15**: 71–98. *pl. 3*. Mr. 1901.

Harper, R. M. Additions to the Flora of Worcester County, Massachusetts, III. Rhodora, **3**: 185, 186. 10 Je. 1901.

Harris, C. W. The Lichens—*Parmelia*. Bryologist, **4**: 57–61. O. 1901. [Illust.]

Harshberger, J. W. Observations upon the feeding Plasmodia of *Fuligo septica*. Bot. Gaz. **31**: 198–203. Mr. 1901. [Illust.]

Harshberger, J. W. The Limits of Variation in Plants. Proc. Acad. Nat. Sci. Phila. 53: 303–319. 1901.

Hemsley, W. B. *Hazardia detonsa* Greene. Hook. Ic. Pl. IV. **8**: *pl. 2720*. 1901.
From island of Santa Cruz, California.

Hemsley, W. B. *Juliania mollis* Hemsl., and *J. adstringens* Schlecht. Hook. Ic. Pl. IV. **8**: *pl. 2722, 2723.* 1901.

Hemsley, W. B. *Scalesia retroflexa* Hemsl., *S. incisa* Hook. f., *S. pedunculata* Hook. f., *S. affinis* Hook. f., and *S. Darwinii* Hook. f. Hook. Ic. Pl. IV. **8**: *pl. 2715–2719.* 1901.

All from the Galapagos Archipelago.

Hieronymus, G. Selaginellaceae, in Engler–Prantl, Die natürlichen Pflanzenfamilien, 1^4: 621–715. 1901.

Includes *S. Schaffneri* and *S. Novoleonensis*, new species from Mexico, and *S. Wendlandii*, *S. Costaricensis*, *S. Cariori*, and *S. Atirrensis*, new species from Central America. *S. Underwoodii* substituted for *S. Fendleri* (Underw.) Hieron. (not *S. Fendleri* Baker).

Hochreutiner, B. P. G. Sur une manifestation particulière des sensibilités géo- et héliotropiques chez les plantes. Act. Congrès Internat. Bot. Paris, 39–58. 1900. [Illust.]

Holzinger, J. M. The Pasque Flower. Plant World, **4**: 170–172. *pl. 14.* S. 1901.

Huber, J. Sur les campos de l'Amazone inferieur et leur origine. Act. Congrès Internat. Bot. Paris, 387–400. 1900. [Illust.]

Huntington, J. W. *Hottonia inflata* in Amesbury, Massachusetts. Does it occur farther north? Rhodora, **3**: 216. 9 Au. 1901.

Jeffrey, E. C. Infranodal Organs in Calamites and Dicotyledons. Ann. Bot. **15**: 135–146. *pl. 8, 9.* Mr. 1901.

Johnson, T. C. Intramolecular Respiration. Bot. Gaz. **32**: 303, 304. 21 O. 1901.

Jones, L. R. *Lathyrus tuberosus* in Vermont. Rhodora, **3**: 230, 231. 16 S. 1901.

Kastle, J. H. The Vitality of the Enzymes. Science, II. **13**: 765–771. 17 My. 1901.

Keeley, F. J. Structure of Diatoms. Proc. Acad. Nat. Sci. Phila. **53**: 321–323. 1901.

Keller, I. A. Demonstration that Plants give off Oxygen. Proc. Acad. Nat. Sci. Phila. **53**: 320, 321. *f. 1–3.* 1901.

Kennedy, G. G. & Collins, J. F. Bryophytes of Mount Katahdin. Rhodora, **3**: 177–181. 10 Je. 1901.

Koehler, H. J. Two Additions to the Flora of Connecticut. Rhodora, **3**: 144. 20 My. 1901.

Krasan, F. Beitrag zur Klärung einiger phytographischer Begriffe. Engler's Bot. Jahrb. Beiblatt, **69**: 3–38. 16 Au. 1901.

Krasan, F. Variété, Race, Modification. Act. Congrès Internat. Bot. Paris, 366–369. 1900.

Leavitt, R. G. Notes on the Embryology of some New England Orchids. Rhodora, **3**: 61–63. *f. 1, 2.* 5 Mr. 1901; 202–205. *pl. 33.* 12 Jl. 1901.

Léveillé, H. Nouvelle classification des hybrides. Act. Congrès Internat. Bot. Paris, 355–358, 361. 1900.

Lindman, C. A. M. Einige Beiträge zu den Aristolochiaceen. Bull. Herb. Boissier, II. **1**: 522–528. *pl. 7, 8.* 30 Ap. 1901.
Includes two new species of *Aristolochia*.

Livingston, B. E. Further Notes on the Physiology of Polymorphism in Green Algae. Bot. Gaz. **32**: 292–302. 21 O. 1901.

Lutz, L. & Guéguen, F. De l'unification des méthodes de culture pour la détermination des Mucédinées et des levûres. Act. Congrès Internat. Bot. Paris, 415–423. 1900.

Lyon, F. M. A Study of the Sporangia and Gametophytes of *Selaginella apus* and *Selaginella rupestris.* Bot. Gaz. **32**: 124–141. *pl. 5–9.* 20 Au. 1901; 170–194. 24. S. 1901.

Lyon, H. L. Preliminary Note on Embryogeny of *Nelumbo.* Science, II. **12**: 470. 22 Mr. 1901.

MacDougal, D. T. Distribution of *Pterospora.* Torreya, **1**: 101, 102. 28 S. 1901.

Maire, R. L'évolution nucléaire chez les Uredinées et la sexualité. Act. Congrès Internat. Bot. Paris, 135–150. 1900.

Massee, G. & Salmon, E. S. Researches on coprophilous Fungi. Ann. Bot. **15**: 313–358. *pl. 17, 18.* Je. 1901.

Meehan, T. Contributions to the Life-history of Plants. No. XV. The Bending of mature Wood in Trees. Proc. Acad. Nat. Sci. Phila. **53**: 354–365. 1901.

Meehan, T. Thomas Conrad Porter. Rhodora, **3**: 191–193. 12 Jl. 1901.

Metcalf, H. Notes on the Ferns of Maranocook, Maine. Rhodora, **3**: 236, 237. 16 S. 1901.

Morrell, J. M. H. Some Maine Plants and their Uses, "wise and otherwise." Rhodora, **3**: 129–132. 20 My. 1901.

Müller, K. Vorarbeitung zu einer Monographie der Gattung *Scapania* Dum. Bull. Herb. Boissier, II. **1**: 593–614. 31 My. 1901.
Includes several American species.

Mussat, E. Sur l'adoption d'une unité internationale pour les mensurations micrométriques. Act. Congrès Internat. Bot. Paris, 424–426. 1900.

Pammel, L. H. The Thistles in Iowa. Proc. Iowa Acad. Sci. **8**: (1–26). *pl. 12–31* and *f. 9–15*. 1901.
Includes *Cnicus Iowensis* and *C. Nelsoni*, new species.

Pammel, L. H., Weems, J. B. and Lamson-Scribner, F. Pastures and meadows of Iowa. Bull. Iowa Agric. Exper. Sta. **56**: 385–621. *f. 138–230*. Mr. 1901.
Also published with Part I. as Bulletin of the Iowa Geological Survey.

Parish, S. B. Errors in the reported Stations of some Southern California Plants. Zoe, **5**: 109–120. 26 F. 1901.

Perrédès, P. E. F. The Anatomy of the Bark of *Robinia Pseudacacia*. Pharmaceutical Journ. 1901:—(1–11). *pl. 1–4*. 3 Au. 1901.

Pilger, R. Beitrag zur Flora von Mattogrosso. Engler's Bot. Jahrb. **30**: 127, 128. 12 Mr. 1901; 129–238. 2 Jl. 1901. [Map.]
Contains new species and varieties in *Panicum* (3), *Imperata*, *Andropogon* (2), *Gymnopogon*, *Eragrostis*, *Scirpus* [*Stenophyllus*], *Rhynchospora*, *Scleria* (3), *Eriocaulon* (2) (by Ruhland), *Bilbergia* (by Mez), *Habenaria* (by Schlechter), *Connarus*, *Mimosa*, *Cassia*, *Bowdichia*, *Crotalaria*, *Stylosanthes*, *Desmodium*, *Centrosema*, *Croton*, *Cienfuegosia*, *Bombax*, *Doliocarpus*, *Ouratea*, *Cochlospermum*, *Turnera*, *Calyptranthes*, *Microlicia*, *Rhynchanthera*, *Labatia*, *Styrax*, *Plumiera*, *Ipomoea* (2), *Jacquemontia*, *Lippia*, *Salvia*, *Hyptis* (5), *Utricularia*, *Memora*, *Tecoma*, *Acanthura* (gen. nov. by Lindau), *Boneria*, *Centropogon*, *Vernonia*, *Eupatorium*, and *Aspilia*, from Brazil.

Plowright, C. B. Observations sur la biologie de certaines Urédinées, relatives à la valeur de certaines espèces biologiques. Act. Congrès Internat. Bot. Paris, 132–134. 1900.

Power, F. B. The Chemistry of the Bark of *Robinia Pseudacacia*. Pharmaceutical Journ. 1901:—(1–23). 17 and 24 Au. 1901.

Radais, M. Sur la culture des Algues à l'état de pureté. Act. Congrès Internat. Bot. Paris, 163–167. 1900. [Illust.]

Radlkofer, L. Ueber zwei Connaraceen. Bull. Herb. Boissier, II. **1**: 890, 891. 31 Au. 1901.
Connarus haemorrhoeus and *Rourea macrophylla*, both South American.

Rehder, A. Notes on Hybrids of *Quercus ilicifolia*. Rhodora, **3**: 137–140. *pl. 24*. 20 My. 1901.

Renauld, F. *Pseudo-caliergon* Ren., a new Sub-genus of *Hypnum.* Bryologist, **4**: 63–67. *pl. 7, 8.* O. 1901.

Robinson, B. L. Chloranthy in *Anemonella thalictroides.* Rhodora, **3**: 205, 206. 12 Jl. 1901.

Robinson, B. L. *Lycopodium clavatum*, var. *monostachyon* in northern Maine. Rhodora, **3**: 237, 238. 16 S. 1901.

Robinson, B. L. Self-strangulation in the Virginia Creeper. Rhodora, **3**: 239, 240. 16 S. 1901.

Schneck, J. Notes on *Aquilegia Canadensis* Linn. and *A. vulgaris* Linn. Bot. Gaz. **32**: 304, 305. 21 O. 1901.

Schuh, R. E. Further Notes on *Rhadinocladia.* Rhodora, **3**: 218. 9 Au. 1901.
R. cylindrica, new species.

Scribner, F. L., & Merrill, E. D. The New England Species of the Genus *Panicum.* Rhodora, **3**: 93–129. 20 My. 1901.
Includes *P. stipitatum* Nash, new.

Shear, C. L. Field Work of the Division of Agrostology: A Review and Summary of the Work done since the Organization of the Division, July 1, 1895. Bull. U. S. Dept. Agric. (Div. Agrost.) **25**: 1–67. *pl. 1–28.* 1901.

Small, J. K. A weeping *Crataegus.* Torreya, **1**: 96–98. 23 Au. 1901.
Crataegus lacrimata Small, sp. nov.

Small, J. K. Two Species of *Chamaelirium.* Torreya, **1**: 107, 108. 28 S. 1901.
Includes diagnosis of *Chamaelirium obovale* sp. nov.

Smith, R. S. Aërial Runners in *Trientalis Americana.* Rhodora, **3**: 216, 217. *pl. 34.* 9 Au. 1901.

Stephani, F. Species Hepaticarum. Bull. Herb. Boissier, II. **1**: 477–521. 30 Ap. 1901; 1022–1040. 30 S. 1901.
Includes new species in *Jungermannia* (6), *Stephaniella and Jamesoniella.*

Stevens, F. L. Gametogenesis and Fertilization in *Albugo.* Bot. Gaz. **32**: 37–98. *pl. 1–4.* 20 Au. 1901; 157–169. 24 S. 1901; 238–261. 21 O. 1901.

Sweetser, A. R. Preliminary Report on a few Oregon Toadstools. Bull. Pacific Univ. $\mathbf{1}^{4}$: 1–13. My. 1901. [Illust.]
List of 92 Oregon fungi.

Tansley, A. G. Notes on the conducting Tissue System in Bryophyta. Ann. Bot. **15**: 1–38. *pl. 1, 2.* Mr. 1901.

Terry, E. H. *Juniperus communis*, var. *erecta*, in Massachusetts. Rhodora, **3**: 146. 20 My. 1901.

Tilden, J. E. *Hydrocoleum Holdeni* nom. nov. Rhodora, **3**: 254. O. 1901.

Timberlake, H. G. Swarm-spore Formation in *Hydrodictyon utriculatum* Roth. Bot. Gaz. **31**: 203. Mr. 1901.

Tracy, S. M. Dr. Charles Mohr. Plant World, **4**: 167–170. *pl. 13.* S. 1901.

Trow, A. H. Observations on the Biology and Cytology of *Pythium ultimum* n. sp. Ann. Bot. **15**: 269–312. *pl. 15, 16.* Je. 1901.

Ule, E. Ameisengärten in Amazonasgebeit. Engler's Bot. Jahrb. Beiblatt, **68**: 45–52. *pl. 2, 3.* Jl. 1901.

Vilmorin, P. de. Sur une expérience de selection. Act. Congrès Internat. Bot. Paris, 209–212. *pl. 8, 9.* 1900.

Watson, W. Germination of Seeds of *Bertholletia excelsa.* Ann. Bot. **15**: 99–102. *pl. 4, 5.* Mr. 1901.

Webster, H. Boleti collected at Alstead, New Hampshire. Rhodora, **3**: 226–228. 16 S. 1901.

Wheeler, C. F. The Geology and Botany of the Upper Peninsula Experiment Station. Bull. Mich. Agric. Exper. Sta. 186: 17–28. D. 1900. [Illust.]

Wilcox, E. M. A Correction. Bot. Gaz. **32**: 226. 24 S. 1901.
Concerns "A rhizomorphic root-rot of trees."

Williams, E. F. A Comparison of the Floras of Mt. Washington and Mt. Katahdin. Rhodora, **3**: 160–165. 10 Je. 1901. [Illust.]

Winton, A. L. The Anatomy of the Fruit of *Cocos nucifera.* Amer. Jour. Sci. IV. **12**: 265–280. *f. 1–11.* O. 1901.

Woolson, G. A. A third New England Station for *Asplenium ebenoides.* Rhodora, **3**: 248, 249. O. 1901.

Worsdell, W. C. Contributions to the comparative Anatomy of the Cycadaceae. Trans. Linn. Soc. II. **6**: 109–121. *pl. 15, 16.* S. 1901.

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OF THE

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CONTENTS

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Memoirs. (See last page of cover.)

Vol. 28 No. 12

BULLETIN

OF THE

TORREY BOTANICAL CLUB

DECEMBER 1901

New Species of Uredineae.—I

By J. C. Arthur

In the examination of material sent by various collectors for identification, and of other material that has been in the author's herbarium for a time, some forms of *Uredineae* have come to light that seem worthy of description as new species. The collections were made at various localities in the United States west of the Mississippi river. The type specimen is in each case preserved in the author's herbarium, but other specimens of the type collection, which may be identified by data attached, especially by time of collection, have been freely distributed as far as material permitted.

Puccinia Batesiana sp. nov.

Spots inconspicuous; fungus hypophyllous; teleutospores arising from the aecidial mycelium; uredospores wanting.

I. Aecidia in small groups; peridia shallow, rather large, border irregular; spores pale, subglobose, 18–26 μ in diameter, evenly and conspicuously verrucose; wall thin.

III. Teleutosori primarily arising close to the aecidia, black, shining, forming dense rounded masses; spores oblong to obovate, usually much attenuated, very little constricted, 15–20 x 45–58 μ, wall thin; apex obtuse or acuminate, more or less thickened, often up to 12 μ; base narrowed; pedicel slender, colored, 10–25 μ long.

On leaves of *Heliopsis scabra* Dunal, Long Pine, Neb., Aug. 4, Aug. 24 and Oct. 3, 1900. *J. M. Bates.* The first collection is taken as the type. Also Ames, Iowa, July, 1887, *A. S. Hitchcock*, communicated by E. W. D. Holway. This is a very distinctive species, easily recognized. No collection of the aecidial form in its prime has yet been made and the description is necessarily based upon aecidial remains accompanying well developed teleutospores. Since the name of the species was suggested by the writer, it has appeared twice in botanical publications: in Shear's *Ellis and Everhart's Fungi Columbiani continued*, No. 1463, accompanying exsiccati, and in *Botanical Survey of Nebraska*, No. 5 : 23, in both cases as *nomina nuda*. The specific name is bestowed in recognition of the valuable services to uredinology, especially in observations upon the Nebraska rust flora, rendered by the discoverer of the species, Rev. J. M. Bates.

Puccinia epicampus sp. nov.

Sori amphigenous, largely sunken between the veins, oblong or linear.

II. Sori brownish-yellow, soon naked, ruptured epidermis prominent; uredospores oblong or nearly globose, 22–24 x 26–30 μ; wall rather thick, colored, obscurely echinulate or papillose; pores four, equatorial.

III. Sori dark brown, soon naked; teleutospores oblong or elliptical, slightly or not at all constricted, rounded at apex and base, 22–26 x 30–40 μ; wall thick, thicker at apex; pedicel firm, hyaline, tinted at base, once to thrice length of the spore.

On leaves of *Epicampes ringens* Benth., Hot Springs, N. Mex., Sept. 13, 1896. *E. W. D. Holway.*

Puccinia xylorrhizae sp. nov.

O. Spermogonia amphigenous nearly colorless, small, sunken in the substratum.

III. Teleutosori amphigenous, circinating about a small roughened area, nearly black, opening progressively from the center outwardly, soon naked; teleutospores oblong or narrowly oblong, slightly narrowed at both ends, very little constricted at the septum, 21–26 by 43–50 μ, apex subacute or obtuse, much thickened, pedicel thick, firm, somewhat tinted, usually about as long as the spore.

On leaves and stems of *Xylorrhiza glabriuscula*, Laramie Plains, Wyoming, June 27, 1897 (*Aven Nelson*), and Coopers Lake, Wyoming, June 17, 1901 (*Leslie Goodding*, no. 19), the latter being the type.

The sori of this species are deep seated in the tissues of the host, not simply beneath the epidermis, as usually is the case, and the opening at first is a pore, which is gradually enlarged. In each sorus there are generally a few uredospores, which are golden yellow, globose, 24–26 μ in diameter, and minutely verrucose. There are also a few pseudospores, which are colorless, globose, 37–52 μ in diameter, and coarsely verrucose. Before dehiscence of the sorus these are situated between the layer of teleutospores and the roof of the sorus. The nature of the pseudospores is not apparent.

Puccinia vilis sp. nov.

Sori amphigenous, oblong or linear, seated on brown spots, long covered by the epidermis.

II. Sori brown; uredospores elliptical, ovate or globose, 18–26 x 22–30 μ, brownish-yellow; wall thick, 3–4 μ, bluntly echinulate appearing verrucose; pores four, equatorial, conspicuous.

III. Sori dark brown; teleutospores elliptical to obovate, 19–23 x 33–45 μ; wall of medium thickness; apex obtuse, thickened, somewhat deeper color; base rounded or narrowed; pedicel tinted, firm, shorter than the spore.

On leaves of *Panicum Crus-galli* L., Nordness, Iowa, Sept. 17, 1898. *Aloïs F. Kovarik*, comm. by E. W. D. Holway. Appears to be most closely related to the South American *Puccinia Huberi* Henn., which occurs on *Panicum ovalifolium.*

Puccinia paniculariae sp. nov.

Sori amphigenous, oblong, small, long covered by the epidermis.

II. Uredospores subglobose or oblong, pale yellow, 15–21 x 18–26 μ; wall of medium thickness, minutely echinulate; pores six, scattered.

III. Teleutospores oblong, clavate or almost linear, brown, very little constricted, 15–19 x 43–70 μ, apex rounded or obtuse, occasionally with a few papillae, somewhat deeper tinted but not thickened; base narrowed into the very short, colored pedicel; paraphyses none.

On leaves of *Panicularia Americana* (Torr.) MacM. (*Glyceria grandis* Wats.), Spirit Lake, Iowa, Oct. 20, 1894, Dec. 28, 1896, and Aug. 3, 1898, the last taken as the type. *J. C. Arthur.* An inconspicuous species, found in only one locality. In the same locality *Aecidium Boltoniae* was found, and nowhere else, and this exclusive association naturally suggests that the two forms are genetically related. The uredo- and teleutospores are formed beneath the epidermis of the mesophyll, and on the upper surface, beneath the bulliform cells.

Aecidium boltoniae sp. nov.

Spots pale yellow; spermogonia amphigenous, waxy orange; spermatia oblong to ovate, 3 x 5 μ; peridia mostly hypophyllous in well-defined groups, shallow, border irregular; spores pale yellow, subglobose, 13–17 μ, inconspicuously verrucose; wall thin.

On leaves of *Boltonia asteroides* (L.) L'Her., Spirit Lake, Iowa, June 15 and 22, 1900, and June 18, 1901. *J. C. Arthur.* Host growing in wet ground in the midst of *Panicularia Americana.*

Aecidium magnatum sp. nov.

Spots pale, circular; peridia hypophyllous, cylindrical, sometimes elongated, border jagged; spores yellow, subglobose, large, 26–37 μ, prominently, closely and uniformly verrucose.

On leaves of *Vagnera stellata* (L.) Morong (*Smilacina stellata* Desf.). Valley of the Teton, northern Montana, July, 1889. *F. W. Anderson.* This is readily distinguished by the size and roughness of the spores from the aecidium on the same host belonging to *Puccinia majanthae* (Schum.) A. & H.

Aecidium anograe sp. nov.

Spots reddened, somewhat thickened and bullate; peridia densely clustered, mostly hypophyllous, elongated, cylindrical, border torn into narrow fringe, at length somewhat revolute; spores yellow, 22–26 μ, subglobose, evenly verrucose; wall thick, 3 μ.

On leaves of *Anogra pallida* (Lindl.) Britt. Type collection from Long Pine, Neb., May 23, 1900, No. 1325. Subsequent collection from Merriman, Neb., June 6, 1900. Both by *J. M. Bates.* Spores much larger and rougher than in *Aecidium Peckii* De T.

Peridermium ornamentale sp. nov.

Peridia in two rows along the under surface of the leaves, cylindrical, 1–2 μ long, at first bright orange, margin entire or erose; spores obovate, elliptical or nearly globose, 13–17 x 20–26 μ; wall thin, closely and finely verrucose.

On *Abies lasiocarpa* Nutt., Mount Paddo, Wash., at about 6000 ft. alt., Sept. 4, 1900. *W. N. Suksdorf*, comm. by E. W. D. Holway.

Gymnosporangium Nelsoni sp. nov.

Sporiferous masses globose, pulvinate cinnamon-brown, 1–2 μ in diameter, solitary, or occasionally aggregated to form swellings; spores angular-oval or elliptical, not constricted at the septum, 22–26 by 41–52 μ, obtuse, usually narrowed toward each end; wall uniformly thin; pedicels hyaline, slender, firm, once to thrice the length of the spore; mycelium annual.

On the leaves or leafy branches of *Juniperus scopulorum* Sargent, Laramie Hills, Wyoming, May 10, 1895, No. 1886. *Aven Nelson.* The type collection has been rather widely distributed as *G. clavipes*, a species which it resembles, but from which it is readily distinguished by the slender pedicels and general habit.

Roestelia Nelsoni sp. nov.

Spermogonia epiphyllous, in clusters on yellow spots, prominent, nearly black, very numerous.

Aecidia hypophyllous in groups; peridia long, 2–4 mm., linear, somewhat curved, dehiscent by longitudinal slits toward the base, apex subacute, remaining closed; spores globose, 24–30 μ in diameter, wall rather thick, chestnut-brown, minutely verrucose or smooth, pores about eight, without order, prominent.

On leaves of *Amelanchier alnifolia* Nutt., Laramie Hills, Wyoming, August 5, 1901. *A. Nelson*, no. 8597, communicated by F. S. Earle.

An interesting species, and especially so as it appears to be the aecidial form of *Gymnosporangium Nelsoni*, described above. In a letter Professor Nelson says: "This was collected in the exact spot where the *Gymnosporangium* was secured. There can be little doubt of the interrelation of the *Roestelia* and *Gymnosporangium*." I have given the same specific names to both forms, hoping that cultures in the near future will establish their identity.

Roestelia fimbriata sp. nov.

Spermogonia epiphyllous, in clusters on orange spots, prominent, nearly black.

Aecidia hypophyllous, in groups on a thickened substratum; peridia dehiscent into long fibers forming a somewhat curled fringe; spores subglobose, 32–45 μ in diameter, wall of medium thickness, chestnut-brown, verrucose.

On leaves of some species of *Sorbus*, Elk mountains, Wyoming, August 21, 1901, *Leslie Goodding*, no. 554.

Notes on Californian Species of Delphinium

By Alice Eastwood

I. DELPHINIUM DECORUM F. & M. AND ITS ALLIES

The Californian species of *Delphinium*, like those of many other Californian genera, are but little understood. This is owing to the remarkable tendency to variation, to the confusion in regard to the types, and to the generally inadequate material in herbaria.

Delphinium decorum F. & M. is one of the most puzzling species, under which plants quite different in appearance have been included. The species was originally described by Fischer and Meyer (Ind. Sem. Petr. **3**: 33. 1836), and the description was transcribed into the supplement of Linnaea (Linnaea **12**: Suppl. 92). As seen in this description, given in the footnote, the type locality is Bodega Port.*

To rediscover this and some other plants described from the same place, the writer visited this port twice in the spring and summer of 1899. Only one species of *Delphinium* was found around the port. This grew on the ocean side of the promontory which rises about a hundred feet from the sea. The native vegetation of the promontory has been preserved from destruction by a fence which has been built around it to keep the cattle from the danger of being carried down to the surf below on some of the land slides which frequently occur during the wet season. From the specimens collected there the following description has been made :

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* *Delphinium* (*Delphinastrum ; Coh. grumosa :* Petalorum lamina dilatata, bifida : petioli basi vix dilatati : radix tuberosa-grumosa. Huc *D. Menziesii*, *D. elegans*, *D. tricorne*) *decorum Fisch. et Mey.* D. pubescens, subglabrum : foliis tripartitis : segmentis lateralibus bifidis indivisve : lobis oblongis tridentatis I. integerrimis : floralibus bracteisque suboblongis (plerumque) integris : calcare curvulo sepalorum longitudine. —*D. Menziesii* et *D. eleganti* proximum, sed foliis bene distinctum. Flores, speciosi, primo ex coeruleo violascentes, dein violaceo-purpurascentes.—Hab. circa coloniam Ruthenorum Ross in portu Bodega Novae Californiae.

DELPHINIUM DECORUM F. & M.

Roots fibrous from a single roundish or irregularly lobed tuber, about 1 cm. below the true stem. Stems one to several from the root, 1–2 dm. high, diffusely branched from the base or simple, striate, somewhat glabrous or pubescent with short white deflexed curly hairs. Radical leaves on petioles 3–12 cm. long, broadening at base and sheathing the stem: blades with from 3–5 main divisions, these cuneate, separated, 1–3 cm. long, 5–15 mm. broad, 2–3-lobed with rounded, mucronate lobes: pubescence of lower surface similar to that of the stem, upper surface almost glabrous: cauline leaves, if present, with narrower divisions, generally simple and entire. Inflorescence corymbose: lowest bracts with usually simple, entire, oblong divisions on short petioles: upper bracts and bractlets spatulate, entire, 5–10 cm. long, 2–8 mm. broad: pedicels stout, erect or upwardly spreading, often becoming 6 cm. long, with 2 or 3 alternate or, rarely 2 opposite bractlets. Flowers 25 mm. in diameter, purplish blue. Sepals pubescent externally, especially along the median line, with a greenish spot near the top, oblong or oval, obtuse or acute, 10–15 mm. long, 5–10 mm. wide: spur thick, 10 mm. long, straight or curved on the same plant. Lower petals with orbicular, 2-lobed blade and a claw equally long, spurred at base, covered with long white hairs except on a spot above the claw which is clothed with long yellow hairs: upper petals white, tinged or veined with blue, notched at apex, glabrous. Follicles diverging from the first, glabrous or slightly pubescent when ripe, 15 mm. long, including the persistent styles. Seeds brown when ripe, the loose cellular outer coat of the young seed forming a close, tuberculate covering to the ripe seed.

Specimens are represented in the Herbarium of the Academy by no. 801 from Cobum's Mills, collected by T. S. Brandegee, May 29, 1891, and by a specimen collected by the author at Kaweah, Tulare county, May, 1894, no. 789. With this is another specimen similar in all respects except the pubescence, it being glabrous where the other is glandular-hairy. This leads me to think that the character of the pubescence is not to be relied on as a characteristic and that all of these are but forms of the same species modified by environment which cultivation under similar conditions might prove to be identical. If this glandular form should not prove to be a distinct species, it nevertheless deserves varietal rank.

The type descriptions are appended in the footnotes for the benefit of those to whom the original references are not accessible.

II. NEW SPECIES OF DELPHINIUM

Delphinium polycladon sp. nov.

Stems 8 dm. tall with many spreading, slender, rather weak branches. Lower part of plant glabrous, pubescence scanty on the leaves, denser on the upper stems and pedicels, close on the follicles. Leaves mostly near the base, orbicular in outline, 6 cm. across, with 3–5 broad, cuneate divisions having short, acuminate lobes: petioles long and slender, often more than 10 cm., dilated at the clasping base. Inflorescence paniculate, pedicels erect, 2–4 cm. long, bracts narrowly subulate, bractlets filiform near the flower. Flowers small, about 2 cm. across, bluish purple. Sepals obovate, obtuse, spur 8 mm. long, usually curved at tip. Upper petals white veined with blue, lower petals oblong, deeply emarginate, with a prominent spur on the claw and a yellowish, very hairy spot at the base of the blade. Follicles with thin walls through which the outlines of the large seeds are plainly visible, becoming almost moniliform when the seeds are ripe, spreading but little. Ripe seeds brown, angled, rugose, almost 2 mm. in diameter.

This interesting *Delphinium* was collected by the writer near the forks of Bubbs Creek in Fresno county, California. It grew in a thicket where the ground was springy. It was impossible with the tools at my command and the time at my disposal to dig up the roots. It was collected July 9, 1899.

Delphinium pratense sp. nov.

Root grumous, small and near the surface. Stems slender, simple or branched from the base, about 3 dm. high. Pubescence villous with soft, white, deflexed-spreading hairs, usually densest on the lower stem and inflorescence. Radical and lower cauline leaves about 3 cm. broad, with 3–4 cuneate divisions each with linear-oblong mucronate lobes: petioles 3–6 cm. long, broadening at base and sheathing the stem: cauline leaves, except the lowest, really bracts subtending the lowest pedicels, with simple, linear, entire divisions or lobed. Flowers at first scattered on long pedicels, later forming a loosely or closely flowered raceme which is simple or compound: lower pedicels 5 cm. long, upper 1.5 cm.: upper bracts becoming simple and linear, about half as long as the pedicels: bractlets opposite or alternate, on the upper part of the pedicel, narrowly linear. Flowers purple and white, small, 15 mm. across, the spur straight, horizontal, 1 cm. long, very slender, often bidentate at tip. Lower sepals almost equalling the spur, obovate, acute, the upper broader and with a conspicuous saccate spot near the apex. Lower petals bifid and erose, pubescent, white with a purple blotch near the base of the blade, with the broad claw shorter than the blade and with a spur at base: upper petals triangular-ovate, 2-lobed at apex, white, margin undulate. Follicles pubescent, slightly spreading. Seeds with a close, brown, minutely rugose coat, with a membranous crown at summit.

This grows in the high meadows of the Sierra Nevada. The specimens were collected in Horse Corral Meadow on the trail to the Kings River Cañon, July 9, 1899 (by the writer).

Delphinium subnudum sp. nov.

Roots of fleshy, fascicled tubers, near the surface. Stems simple, erect, slender, 2–3 dm. high, pubescent with fine, white, soft, spreading, deflexed hairs. Radical leaves broadly ovate in outline, 2–5 cm. broad at base and of equal length: main divisions 3, each twice dissected, the ultimate divisions linear-spatulate, mucronate: petioles broad and sheathing at base, ribbed: cauline leaves 2 or 3, very small and inconspicuous, the palmately divided blade in most only as broad as the sheathing base of the petiole. Raceme few-flowered: bractlets generally opposite and close under the flower: pedicels slender, erect or somewhat tortuous. Flowers rather large, purplish blue. Sepals somewhat pubescent externally, oval, generally mucronate, 18 mm. long, 12 mm. broad, upper one orbicular, 14 mm. broad: spur straight or recurved at tip, as long as the calyx. Upper petals entire, crenate, or notched, white or bluish: lower petals with orbicular, notched blade, claw with a conspicuous spur near the base. Follicles pubescent, somewhat spreading: style tipped with 2-toothed stigmas. Seeds covered with a loose, white membranous, veiny coat.

This was collected by the writer in Squaw Valley, Fresno county, California, May 4, 1895. It grew in a low spot where water had stood and was distributed over a limited area. I have also included in this species a specimen from Applegate, Placer county, California, collected by Mrs. Helen Smith, May, 1899.

In the specimen from Fresno county the spur is almost straight, in the Placer county specimen the spur is abruptly bent at the tip. This does not seem to be a character of any importance, for in other species the spur is often both straight and curved in the same plant. The follicles and seeds were described from the Placer county plant, that from Fresno county being too young. A search over the entire area covered by the plants failed to discover a single fruiting specimen.

Besides the specimens collected at Bodega Port (no. 770),* there is another typical specimen in the Herbarium of the California Academy of Sciences. This is one collected by Dr. Kellogg, at San Gregorio, in San Mateo county, May 14, 1870 (no. 771).

DELPHINIUM DECORUM **racemosum** var. nov.

This is the form common in the vicinity of San Francisco. It is distinguished by racemose inflorescence, simpler, more glabrose, taller stems, narrower bracts and bractlets, the latter generally opposite and close under the flower, spurs generally straight. The flowers vary somewhat in size and generally are smaller than those of the typical form. This is probably the *D. Menziesii* of the Manual of the Bay Region: *D. decorum* of that work being more like *D. patens* Benth. (Pl. Hartweg. 296). Specimens of this variety are represented in the Herbarium of the Academy from Sausalito (no. 765), and Mt. Tamalpias (no. 766), in Marin county, from Colma (no. 767) and Crystal Springs (no. 763), San Mateo county, and from Mission Hills, Stanford Heights (no. 769), and Bay View Hills (no. 762), San Francisco.

DELPHINIUM DECORUM **Sonomensis** var. nov.

Similar in habit to the preceding variety, but with denser pubescence, more evidently canescent; leaves with narrower, more dissected divisions; flowers with narrower sepals and stouter spurs. This form was collected by the writer at Altruria, Sonoma county, April 7, 1900. (No. 764.)

There are some other specimens in the herbarium of the Academy, which appear to belong under *D. decorum* but the material is too imperfect, as the roots and fruits are wanting, and it is better to leave them unnamed and undescribed than to add to the already existing confusion.

At present the small-flowered species of *Delphinium* which has been named *D. decorum* F. & M. in the "Manual of the

* These numbers are the herbarium numbers of the specimens.

Botany of the Region of San Francisco Bay," seems to be without a name. Professor Greene suggests, in a letter recently received, that it is what he named *D. apiculatum*, Pittonia, I. 285. This can scarcely be the case for the character of the root is quite different. According to his description, the root is similar to that of *D. recurvatum* which he describes on the same page as having a fascicle of fleshy-fibrous thick roots. *D. apiculatum* must be, as he himself there suggests, a near relative of *D. variegatum* T. & G. of which he subsequently made it a variety. (Fl. Francis. 304.)

D. decorum is more like *D. patens* Benth. (Pl. Hartweg, 296.) It is not clear to the writer what difference there is between *D. patens* and *D. gracilentum* Greene. (Pittonia, **3**: 15.)* Until the types are better known and the differences between these species clearly defined it seems best to consider these two species as the same, under the oldest name, recognizing the fact that they do not exactly agree with the original description of *D. patens* which is given in the footnote† nor, in all particulars, with each other.

Specimens have been examined from the following localities represented by specimens in the Herbarium of the California Academy of Sciences:

Santa Inez Mountains, T. S. Brandegee (no. 915).

El Dorado, Katherine Curran (no. 914).

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* DELPHINIUM GRACILENTUM. Slender, usually 2 feet high or more, from a grumous-tuberiform root, sparsely leafy, pale green and glaucescent, appearing glabrous, a lens revealing short stiff white hairs at the base of the stem, and again upon the small bracts of the inflorescence: radical leaves few, long-peduncled, 2 or 3 inchés broad, deeply about 5-parted, the lobes mostly oval or oblong, obtuse and entire; lower cauline more cuneately cleft, and the segments 3-lobed: racemes long, slender and lax: flowers small, deep blue (pink in the frequent albino state), the stoutish slightly curved spur little exceeding the oblong sepals: follicles slightly divergent

Middle elevations of the Sierra Nevada, California. It is the *D. patens* of my Flora Franciscana, and I formerly supposed it to be the plant which Bentham so named; but having seen the specimens on which *D. patens* was founded, I am certain that that is only *D. decorum*: not even a variety of that species. In the "*D. patens*" of my Flora I included a plant which is of a "deeper green, and glandular pubescent." This, I think, will prove to be another distinct species of the Sierra Nevada, though I am not yet able to assign characters enough to warrant its publication. Its root is still unknown to me. Pittonia, **3**: 15. Greene.

† "Delphinium *patens*, sp. n., glabrum v. puberulum, ramosum, petiolis basi dilatatis, foliis profunde 3–5 lobis, lobis inferiorum obovatis obtusis subtrilobis superiorum subintegris angustis, racemis laxis, petalis sepalis brevioribus, inferioribus bifidis barbatis, ungue glabriuscula ecalcarato, calcare curvulo sepalis aequilongo.—Flores iis D. azurei similes sed racemi laxi pedicellis patentibus, et folia multo minus dissecta, lobis latis obtusis.—In valle Sacramento." Pl. Hartweg. 296[2]. Benth.

Cucumongo Mountains, S. B. Parish, no 1718 (no. 912).

Los Gatos, T. S. Brandegee (no. 911).

Mokelumne Hill, Dr. F. E. Blaisdell (no. 909).

Calistoga, Alice Eastwood (no. 907).

Antioch, Katherine Curran (no. 906).

Saucelito, Alice Eastwood (no. 905).

Monterey, Alice Eastwood (no. 908).

Armstrong's Station, Eldorado county, Geo. Hansen, no. 1114 (no. 792).

Stony Creek, Amador county, Geo. Hansen, no. 1606 (no. 913).

Soda Creek, Tulare county, C. A. Purpus, 1848 (no. 791) and (no. 790).

Silver Lake, Amador county, Geo. Hansen, no. 897 (no.788).

Volcano, Amador county, T. S. Brandegee (no. 786.)

Forest Ranch, Butte county, Mrs. C. C. Bruce, 1914 (no. 787).

Modoc county, Mrs. R. M. Austin (no. 916).

These can be characterized as follows: Roots grumous, pubescence little or none, leaves mostly from the base of the stem on rather long petioles, with broad, cuneate, lobed divisions, generally spreading apart: loose open racemes with small flowers on slender, upwardly spreading pedicels: follicles generally glabrous, widely spreading. In Bentham's description, the claw of the lower petal is said to be "glabriuscula ecalcarato." This is the case with the following specimens only, the numbers used to designate them being the herbarium numbers which are in parenthesis. 790, 791, 908, 906 (this is most like the type according to the description), 907, 909 (spur slightly evident), 911, 912 (spur scarcely evident).

The glandular species of the southern Sierra Nevada which Professor Greene alludes to in his description of *D. gracilentum* seems to me also as deserving of specific rank. It is very closely allied to those specimens included under *D. decorum* in the above general description, but differs in some marked particulars. It is as well to name and describe it, as to point out its characters without a formal description, therefore I name it for him who first detected its specific character.

Delphinium Greenei sp. nov.

Many slender fibers from a grumous root, a short distance below the surface of the ground. Stems 3–5 dm. high, generally reddish and glandular pubescent above, inclined to be glabrous below, generally simple. Leaves similar to those of *D. decorum*, the divisions always mucronate at the rounded apex and the sinus between the broad divisions obtuse. Racemes less open, the pedicels shorter and the flowers smaller, frequently dull rose color rather than violet blue. The inflorescence is more distichous and is glandular-hairy on peduncles and pedicels. Sepals surpassing the petals, shorter than the spur, this curved upwards in the bud, generally straight on the open flower, lower petals with blade lobed almost to the base, clothed with long hairs and having a rather broad claw as long as the blade and distinctly spurred near the base; upper petals also lobed, undulate along the upper margin. The immature follicles are glandular-hairy and spreading.

Germination of the Seeds of some common cultivated Plants after prolonged Immersion in Liquid Air*

By A. D. Selby

During the winter season of 1900–1901, Mr. J. E. Woodland, of Wooster, who was traveling at the time conducting experiments with liquid air, suggested to the writer the desirability of subjecting seeds to the low temperatures resulting from immersion in the liquid air, and very kindly offered to conduct the immersion if the seeds and the directions for the work were supplied. This generous offer on the part of Mr. Woodland entailed no small labor as he was traveling from place to place and his time was absorbed in his lecture work. It is needless to state that the offer of coöperation was accepted. Packages of seeds of *Ricinus*, *Lupinus luteus*, maize, flax, wheat, rye, cucumber, *Mimosa pudica*, *Onobrychis sativa*, *Pinus sylvestris*, *Cotoneaster buxifolia*, and *Chenopodium album*, consisting of a limited number of seeds of each species, were tied separately in open Swiss cloth and these were collectively for each set united in small bundles. Properly enclosed these were transmitted by mail and returned after immersion in the medium, liquid air. The seeds were then germinated upon moistened filter paper together with untreated seeds out of most of the original packages from which the immersed seeds were taken. By an oversight or by neglect to reserve them, the seeds of maize, *Ricinus*, *Lupinus luteus* and *Chenopodium album* are not recorded in the check lots. The germination of the untreated seeds of the latter is thought to have been good. The seeds of *Cotoneaster* did not prove germinable.

Similar lots of the seeds were also planted in the greenhouse in flats, and while the germinations were decidedly irregular in the soil, they may possess interest. Those who have endeavored to grow many sorts of seeds in soil under glass in the mid-winter season, may be less surprised than others at this feature. The

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* Presented in abstract before Section G, American Association for the Advancement of Science, Denver Meeting, August, 1901.

lots of seeds consisted of 10 to 25 seeds of each species for germination in soil and tester.

The manner of immersion was by sudden approach of the seeds from room temperature to that of immediate, complete and prolonged immersion beneath the liquid air, the seeds the while being contained in the gauzy cotton, which we may designate "sudden transition," or by gradual approach of the seeds into nearness with the liquid air followed by the complete immersion therein and similar gradual withdrawal, "gradual transition."

Summarized, the treatment of the several lots was as follows:

By sudden transition:

One lot 6 hours' immersion under liquid air.

One lot 12 hours' immersion under liquid air.

By gradual transition:

One lot 24 hours' immersion under liquid air.

One lot 48 hours' immersion under liquid air.

Save the seeds of maize, no apparent change occurred as a result of the low temperature to which they were subjected. The kernels of maize cracked badly, showing that the hardened endosperm could not withstand the stress imposed. It was curious to observe these germinate with fragments of the endosperm missing.

TABLE I

GERMINATION PERCENTAGES OF TREATED AND UNTREATED SEEDS ON FILTER PAPER

NAME OF SEED	Untreated				Immersed in Liquid Air by sudden Transition								Immersed in Liquid Air by gradual Transition							
	Orig. Seeds				6 hours				12 hours				24 hours				48 hours			
	4 days.	8 days.	15 days.	28 days.	4 days.	8 days.	12 days.	23 days.	4 days.	9 days.	16 days.	21 days.	3 days.	6 days.	8 days.	11 days.	3 days	6 days.	8 days.	11 days.
Onobrychis sativa.		8	12	12							4	16			4	4		4	4	4
Mimosa pudiva.		14	34	40		10	34	38			24	48		16	16	16		16	24	24
Pinus sylvestris.			16	18			4	12			20	28				4			4	16
Helianthus annuus.	75	85	85	85	25	90	90	90	80	86	86	86		90	100	100		90	100	100
Cucumis sativus.	28	60	80	80		60	66	66	53	73	73	80		100	100	100		60	70	70
Secale cereale.	90	90	90	90	100	100	100	100	96	96	96	96	100	100	100	100	100	100	100	100
Triticum sativum.	92	92	92	92	96	96	96	96	92	92	92	92	12	96	96	96	12	96	96	96
Linum usitatissimum.	84	86	86	86	80	82	82	82	76	84	84	84	40	72	72	72	36	84	84	84
Zea Mays.	Not tested.				Not tested.					50	50	50		30	30	30		20	20	20
Ricinus communis.	"		"		"		"			60	60	60		50	70	70		30	30	30
Lupinus luteus.	"		"		"		"					0			10	10				0
Chenopodium album.	"		"		"		"			12	76	80		12	92	96		4	68	76

TABLE II

GERMINATION PERCENTAGES OF TREATED AND UNTREATED SEEDS IN SOIL

NAME OF SEED	Untreated				Immersed in Liquid Air by sudden Transition								Immersed in Liquid Air by gradual Transition							
	Orig. Seeds				6 hours				12 hours				24 hours				48 hours			
	4 days.	9 days.	13 days.	25 days.	4 days.	6 days.	14 days.	29 days.	4 days.	7 days.	14 days.	30 days.	4 days.	6 days.	10 days.	30 days.	4 days.	6 days.	10 days.	30 days.
Onobrychis sativa				0				4				4			7	7				0
Mimosa pudica				20				0				24				16				16
Pinus sylvestris				7				0				0				0				0
Helianthus annuus		66	80	80		40	60	60		42	42	50		60	60	60	20	40	40	40
Cucumis sativus				0				0				0	7	7	7	7				0
Secale cereale	20	53	53	53	32	76	76	76	16	56	60	60	72	80	80	80	80	84	84	84
Triticum sativum	20	86	86	86	36	68	88	88	16	92	92	92	72	76	76	76	60	76	80	80
Linum usitatissimum		47	47	47		8	12	12	8	24	36	36	12	44	44	44	36	44	48	48
Zea Mays				0	Not tested.							0				0				0
Ricinus communis				47	"		"					50				0			33	33
Lupinus luteus				0	"		"					0				0				0
Chenopodium album				36	"		"				8	40			13	27			16	32

Somewhat of irregularity in the length of the day periods is due to the fact that these lots were handled at different times and equal intervals were not followed.

It is not apparent to the writer that any marked unfavorable effect on germinable seeds may be traced to the immersion, that is, to the extremely low temperature to which they were subjected. Gradations appear with respect to the results of a longer or shorter operation of the cold, perhaps, more conspicuously on seeds of lower vitality. With sunflower, wheat, rye, even the prolonged period of 48 hours has increased if it has in any manner changed the promptness of germination, comparing the more regular germination upon moistened filter paper.*

The temperature of liquid air is stated at — 190° C. Certainly the seeds immersed in liquid air for 48 or even 24 hours would scarcely fail to come to the temperature of the surrounding medium. Physiologists will doubtless agree that only dry seeds may withstand this low temperature. For the agriculturist the experiments of this class enforce a homely injunction to prepare in advance of the winter.

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* MacDougal, Practical Text-book of Plant Physiology, 89–91. 1901.

The papers upon this subject by Brown and Escombe, and Thisleton-Dyer did not come to my attention until after my work was finished. Since I find a substantial agreement in the results of the three separate series of experiments no further discussion seems necessary.

The writer would acknowledge his obligation to his assistant at the Station, Mr. John F. Hicks, who has conducted the germination tests.

SUPPLEMENTAL NOTE

Upon going over considerable of the literature relating to the effect of cold upon seeds and particularly upon their germination, one is impressed by the discovery in every case of the survival of the germinative power after subjection to the lowest temperature obtainable at the time of the experiment.

M. Edwards and M. Colin (1834) subjected seeds of wheat, barley, rye and broad bean to a temperature which froze mercury, permitting the seeds to remain for fifteen minutes after which their power of germination was unchanged. Wartman (1860) made his experiments upon seeds of *Linaria bipartita*, *Clarkia elegans*, *Nemophila insignis*, *Lepidium sativum*, *Triticum sativum*, *Hordeum vulgare*, *Avena sativa*, *Portulaca oleracea* and *Eschscholtzia Californica*, subjecting one lot to a temperature of — 57° C. for thirty minutes and another to — 110° C. for twenty minutes after which germination was unimpaired.

Wartman concludes "Il est donc certain que la grand froid que l'homme sache produire ne detruit point la vitalité des graines, et ne l'amoindrit pas le meme," a conclusion which seems to apply without change to the later experiments of de Candolle and Pictet when the liquefaction of gases became more easily attained as well as to the briefly announced results of Dewar and McKendrick (1892), to the extended series of seeds experimented upon by Brown and Escombe (1897) and to the more rigorous conditions but fewer seeds under experiment by Thisleton-Dyer.

The experiments of Brown and Escombe were upon twelve sorts of seeds by subjecting them for 110 hours to the temperature secured by immersion in liquid air which they state as 183 degrees C. to 192 degrees C. The seeds represent a wide range of families and a wide difference in composition.

To the writer the consonance of the results of a long series of experiments by different persons, by subjecting seeds to extremely low temperatures, appeals with its cumulative force. The facts lend a new significance to the latent life of seeds.

PARTIAL BIBLIOGRAPHY

1834. **Edwards, M. & Colin, M.** De l'influence de la temperature sur la germination. Ann. Sci. Nat. II. **1**: 257–270.

1860. **Wartman, E.** Note relative a l'influence de froids excessifs sur la graines. Arch. Sci. Phys. et Nat. **8**: 227.

1865. **De Candolle, A.** De la germination sous les degrés divers de temperature constante. Arch. Sci. Phys. et Nat. **24**: 243–282.

1879. **De Candolle, C. & Pictet, R.** Recherches concernant l'action des basses temperatures sur la faculté germinative des graines. Arch. Sci. Phys. et Nat. **2**: 354, 629.

1892. **Dewar & McKendrick.** On Liquid Air. Proc. Roy. Inst. **12**: 699.

1897. **Brown, H. T. & Escombe, F.** Note on the Influence of very low Temperatures on the germinative Power of Seeds. Proc. Roy. Soc. **62**: 160–165.

1899. **Thiselton-Dyer, W.** On the Influence of the Temperature of Liquid Hydrogen on the germinative Power of Seeds. Proc. Roy. Soc. **65**: 361; Ann. of Bot. **13**: 699.

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Dates of Elliott's Sketch

By John Hendley Barnhart

In 1816 Stephen Elliott began the publication of "A Sketch of the Botany of South Carolina and Georgia," now recognized as a classic among works relating to North American botany. It appeared in parts, the title-pages of the two volumes bearing only the dates of their completion, 1821 and 1824 respectively. In deciding questions of priority, it is highly important to know the exact date of publication of every botanical work in which new names are used, and it is my intention in this contribution to collate the known facts and the probabilities relating to the actual dates of the different portions of Elliott's Sketch.

Many references to this subject are to be found in recent literature, but without exception these seem to be based upon two brief notices by Asa Gray, which appeared in January and May, 1877, in the American Journal of Science and Arts, of which Gray was at that time the botanical editor. As the first of these contains several inaccuracies, and the second, if carefully compared with the first, corrects some of these; and as the second note has evidently been overlooked by some persons who have noticed the first, it may be well here to reprint them both in full.

The first note (Am. Journ. Sci. III. **13**: 81. Ja. 1877) is as follows:

"*Date of Publication of Elliott's Botany of South Carolina and Georgia.*—The title-page of the first volume bears the date of 1821. But it is well known that the work was issued in parts, and that the publication began much earlier. The actual time of issue becomes important in respect to the priority of certain generic and specific names, notably those in Nuttall's *Genera*, published in 1818. Contrary to the testimony of the title-pages, it is generally understood that Elliott's names of *Podostigma* and *Acerates* have priority over Nuttall's *Stylandra* and *Anantherix*. To avoid future trouble it is desirable to put upon record such evidence upon the point as is now obtainable. The only printed testimony yet met with is in the *Reliquiae Baldwinianae*, the correspondence of Dr. Wm. Baldwin (Elliott's ablest collaborator), lovingly edited by his friend, Dr. Darlington. By reference to pp. 202, 248, 249, and 585, it is made out that the first number of Elliott's work was issued as early as October, 1816, was recalled, reprinted, and issued anew, along with the second number, before January, 1817. The first number probably ended on p. 96; the second on p. 222. The third and fourth numbers were published before November 10, 1817. The fourth number must have included p. 466: the fifth and concluding number of the volume (to which the title-page assigns the date of 1821) must begin on or before p. 529. For, on the latter page Nuttall's genus *Diamorpha* occurs, and his work is for the first time cited, while the prefatory list of decandrous genera, on p. 466, does not contain *Diamorpha*.

"This is confirmed by Elliott's correspondence with Zaccheus Collins, now in the possession of the Academy of Natural Sciences, Philadelphia, which Mr. Redfield has kindly consulted at my request; from which it appears, in short, that No. 1 was first issued, September 26, 1816; No. 2, on or before February 19, 1817; No. 3, on or before April 3, 1817; No. 4 and No. 5, no data found; No. 6, the commencement of the second volume, appeared on or before October 12, 1821. The title-page of this volume bears the date of 1824."

The unfortunate assumption, reiterated in the foregoing note that No. 5 completed the first volume and No. 6 commenced the second one, vitiates much of Gray's argument. The error is corrected, but no particular attention is called to its importance as affecting the main line of argument in the further note (Am. Journ. Sci. III. **13**: 392. My. 1877):

"*Date of the Parts of Elliott's Botany.*—Referring to our note in the January No. of this Journal, it is worth recording that the first fasciculus actually ended, as was supposed, on p. 96. No. 5 consisted of pages 401–496, and bears the date of 1817. No. 6 contained pages 497–606, and is dated 1821. This information is obtained from the inspection of copies of those parts in their original state, and is obligingly supplied by Mr. F. B. Dexter, of the Yale College Library."

It will be seen that the most accurate evidence given in these two notes relates to No. 1. It consisted of pp. 1–96, was originally issued Sept. 26, 1816, was recalled, reprinted and reissued with No. 2, but Gray makes no reference to the cause of this reprinting. In an "advertisement," published, I believe, with No. 4, Elliott states a reason for this procedure. He says: "THE first and nearly half of the second Number of this sketch had been printed before I could obtain a copy of Pursh's *Flora Americae Septentrionalis*. This work, published in London under the most favorable auspices, has enabled me to add to my own researches, and those of the friends who have aided me, all that has been collected in this country by the travellers and botanists of Europe. Willing to avail myself of the advantages it afforded me, and to present to my readers as comprehensive a view of our Botany as possible; desirous also not to add to the confusion of synonymes, which is becoming a serious evil in American botany, and to correct a few inaccuracies which had been pointed out to me, I immediately reprinted the first number of my work. In the second number, the alterations were too unimportant to render this measure necessary."

One cause which doubtless strongly influenced Elliott to reprint his first number, but is referred to merely incidentally in the foregoing paragraph, is brought out strongly in certain manuscript evidence to which I have had access. Darlington, in the Reliquiae Baldwinianae, did not publish all of Baldwin's letters which have been preserved. Baldwin was evidently in the habit of writing his letters serially in a note-book, and then copying each from the book, and a number of these note-books (including, it would appear, a portion of those published in Reliquiae Baldwinianae) afterward came into the possession of John Torrey, and are now at the New York Botanical Garden, where I have had the privilege of consulting them, through the kindness of the librarian, Miss Vail.

Among these books is one containing all of Baldwin's letters to Elliott, from August 31, 1815, until his death; and of course this correspondence teems with references to the "Sketch," in which Baldwin was almost as much interested as Elliott himself. Under date of October 7, 1816, he writes, from Savannah: "I have looked over your number one, and am completely satisfied that it is by far the best effort that has been made to redeem the Botanical honor of our Country." With this introduction, he proceeds to criticise the work rather harshly, complaining especially that Elliott has credited to him certain names which he never was responsible for, and imperfect descriptions which he did not intend for publication, and which he wished, after perfecting them, to publish himself. Undoubtedly these complaints had their influence in inducing Elliott to recall and reprint his first number. On November 11, 1816, Baldwin writes: "I had this day the pleasure to receive your valuable letter of the 8th. No measure could possibly be adopted more to my satisfaction than that of re-printing your first number. Every thing can now be adjusted to our mutual satisfaction."

Elliott seems to have been remarkably successful in recalling and destroying the original edition of the first number of his "Sketch." No copy is now known to exist, and if any should be discovered it would be of the utmost importance that fac-similes of it should be prepared and distributed, for there is no question whatever that it was properly published in every sense of the word, and if its contents were known it would necessitate the alteration of several names of southern species.

I have often wondered to what extent the first edition differed from the second, which forms pages 1–96 of all known copies, but had never found a line bearing upon the subject until I discovered these letters of Baldwin to Elliott. Baldwin's letters of October 7th and 13th, and November 11th, mention specifically certain features of the original edition which were altered in the reprint, and it seems worth while to place these on record, although I would not advocate taking up the older names as long as no copy of the original edition is known to exist, and we are unable to cite the page with certainty. In the following list, the citations are from the known edition, the differences in the first edition being noted.

P. 36. *Collinsonia verticillata* Baldw. This was not in edition 1; it was first described in Baldwin's letter of November 11.

P. 39. *Erianthus strictus* Baldw. This was described by Baldwin in his letter of November 11, but it is not clear whether the species was not mentioned in the original edition, or Baldwin was dissatisfied with the description as it there appeared.

P. 53. *Xyris juncea* Baldw. This appeared as "*Xyris setifolia* Baldw." originally, but Baldwin indignantly disclaimed responsibility for this name, so Elliott changed it.

P. 90. *Dichromena latifolia* Baldw. This was *Dichromena involucrata* in the first place, but in his letter of October 13, Baldwin called Elliott's attention to the fact that he had named it *D. latifolia* in previous letters, so this name was adopted in the new issue.

So much for the first number. The date of the second number cannot be decided quite as accurately, but we are safe in saying that it was within a very few days of January 1, 1817, and probably before that date. I have seen no original copy of its cover, but there is no doubt that it bore the date 1816. De Candolle (Syst. **2**: 703. 1821), doubtless writing with the first four parts before him in their original covers, says: "ELLIOT (Steph.). A Sketch of the Botany of South-Carolina and Georgia. In-8. Charlestown Fasc. I, II, 1816, III, IV, 1817." Gray, in the note quoted at the beginning of this paper, says "before January, 1817," and I believe he is correct. Alterations suggested in Baldwin's letter of Nov. 11 were made use of in the correction of No. 1, the reissue of which occurred with No. 2, so they could not easily have appeared before December. Baldwin, writing to Darlington during the first half of February, 1817 (Reliq. Baldw. 202), says that he has not yet received them, "although noticed in Charleston several weeks ago;" showing that they must have appeared as early as January, 1817; and it seems altogether probable that they were published in the latter part of December, 1816. At all events, they were almost certainly dated 1816, and in such cases the burden of proof always rests with those who would claim that the date as printed is incorrect.

It may be as well here as anywhere to speak of the pagination of the different parts, for here Gray was far astray in his guesses. In his first note he proves (to his own satisfaction) that No. 4 included p. 466; while his second note shows clearly that No. 5 began with p. 401; but he calls no attention to the discrepancy, nor does he offer any new suggestions. As a matter of fact, each number consisted of as nearly one hundred pages as was possible without breaking a signature. Each signature consisted of eight pages, so that one hundred pages would make twelve and a half signatures. To avoid this, the first part consisted of twelve signatures (96 pages), the second of thirteen (104 pages), the third of twelve, and so on, to the last of volume one. The evidence I have to offer upon this point is incontrovertible. We have seen already that the first part ended with p. 96. Barton (Comp. Fl. Phila., 82), cites p. 197, and as he cites no later pages, it is evident that he had at the time only the first two parts. At the meeting of the Lyceum of Natural History of New York, May 19, 1817 (Am. Mo. Mag. **1**: 127. Je. 1817), Dr. Mitchill "offered the sketch of the botany of South-Carolina and Georgia, by Stephen Elliot, Esq., as far as the same was published. Great satisfaction was expressed on finding this elaborate and classical work had proceeded almost as far as the second order of the fifth class," *i. e.*, almost as far as page 314, which shows that Dr. Mitchill presented Nos. 1–3 at this time. In June, 1818, Rafinesque (Am. Mo. Mag. **3**: 96) reviews the Sketch, "5 Numbers, 8vo., each of 100 pages."

If any further evidence were needed, I have in my possession a copy of pp. 1–400, bound from the original parts. The original covers, except the first, are missing, but the demarcation of the parts is easily discernible.

The third number was doubtless published in March, 1817. Gray says, "on or before April 3, 1817," and I have mentioned the fact that a copy was presented to the New York Lyceum on May 19.

The fourth number was nearly ready for distribution before the end of August. Baldwin (Reliq. Baldw. 242), says that Elliott corrected the last proof-sheet August 21, but owing to an epidemic in Charleston (Reliq. Baldw. 193) it does not seem to have been actually published before October. Baldwin's copy of it reached Wilmington (*i. e.*, Wilmington, *Del.*) November 12 (Reliq. Baldw. 248).

Of No. 5 I have a copy in the original cover and can verify Gray's statement that it bears the date 1817. It probably appeared in December of that year. Baldwin sailed from Hampton Roads for South America on December 3 (Reliq. Baldw. 251, 253), and it is quite certain that he had not seen No. 5 at that time. His letters make no reference to that number, as far as I can discover, and I have no further data to offer.

After the appearance of Number 5, a considerable break occurs in the publication of Elliott's Sketch. As I am not aware that any explanation of this break has ever been given in print, the following extract from a letter of Stephen Elliott to John Torrey, dated at Charleston, November 21, 1818, may be of interest in this connection:

"Early in January last I was attacked by a Rheumatic affection of the Head so severe that for months I was incapable of attending to anything. I could not even sign my name without suffering. With the return of summer my indisposition abated. But excepting a fortnight in July when I prepared for the press the sixth number of my sketch, my letters to you in January were the last literary exertions I have made. In the commencement of August when I was expecting and preparing to resume my usual habits, circumstances occurred which determined me to visit our Western Country and I have just returned from an excursion over a part of the Alabama Territory. I made this expedition so unexpectedly to myself that I had only time to arrange such business as was absolutely necessary and I have returned merely to visit my Family and business for a moment. In two days I expect to leave this for Columbia to attend the Sessions of our Legislature, and from thence it is uncertain whether I may not return immediately to the Alabama. I have not had time since my return to visit my herbarium and Books which are on a small farm I own about two miles from the City." And again, in a letter without date, but postmarked at Charleston "Aug. 19" and bearing an endorsement by Torrey showing that it was received August 30, 1819: "At present I have not my Herbarium nor my Books in Charleston with me. Thay are at a small farm in the country." These two letters are the only ones from Elliott now to be found among Torrey's correspondence. The others, if they could be found, might throw additional light upon the dates of the Sketch.

The sixth part, concluding the first volume, was not published until 1821. Meanwhile Baldwin had died, September 1, 1819, at Franklin, Missouri Territory, so his correspondence is no longer available for data. Gray says, "before October 12," and I can add nothing to this, although I would not be surprised to learn that it occurred early in the year.

To sum up all the evidence brought out in the preceding discussion, we may say:

No. 1. Pp. 1–96, pl. 1–2, originally issued September 26, 1816; recalled, reprinted and reissued with No. 2. This number (at least when reissued) contained an "Advertisement" of two pages (pp. i–ii) and a Glossary of 14 pages, both usually missing from bound copies of the work.

No. 2. Pp. 97–200, almost unquestionably appeared in December, 1816.

No. 3. Pp. 201–296, March, 1817.

No. 4. Pp. 297–400, October, 1817. Plates 3 and 4, which illustrate species described in No. 1, seem to have been distributed with No. 4—also supplementary pages iii–vi, containing the "advertisement," nearly all of which is quoted above after Gray's notes, and descriptions of several species of *Panicum* and *Agrostis*. These supplementary pages are usually found at the end of Volume I. of bound copies of this work, but appeared with No. 4.

No. 5. Pp. 401–496, 1817, probably December.

No. 6. Pp. 497–606, 1821, probably early in the year.

All that has been said thus far relates to the dates of the first volume. Until recently I was under the impression that the second volume was not issued in parts, but appeared as a whole in 1824. It is true that Gray says, "No. 6, the commencement of the second volume, appeared on or before October 12, 1821," but we have seen that No. 6 was *not* the commencement of the second volume. However, a few months ago I secured copies of the first and second numbers of Volume II. in their original covers.

No. 1. Pp. 1–104, is dated 1821.

No. 2. Pp. 105–208 is dated 1822.

This time, it will be noticed, the numbers did not consist of twelve and thirteen signatures alternately, but of thirteen signatures, or 104 pages, each. From a careful inspection of several bound copies of this volume it seems likely that this size was continued through the remaining parts. Plates 7–12, although almost entirely devoted to plants described in the first volume, were not issued with any of the parts of that volume, nor with parts 1 and 2 of the second volume. When plates 5 and 6 were published I cannot say.

On the back cover of Vol. II., No. 1, is the statement: "This work will be comprised in twelve numbers, to be published monthly until the work is completed." It is plain that this promise was not kept, but in view of this announcement it is not likely that many months elapsed between the appearance of Nos. 1 and 2. As one is dated 1821 and the other 1822, it is altogether probable that No. 1 was published late in 1821, and No. 2 early in the following year. Of the remaining numbers I have no data at hand, but I think we shall not be far out of the way if we assign 1822 to No. 3. 1823 to Nos. 4 and 5, and 1824, the title-page date, to No. 6. Perhaps some one who reads these lines may possess original copies of these numbers, and can furnish their pagination and dates. It happens that the exact dates of these numbers are not quite so important as those of the others, for during these years 1822–1824 there was a remarkable hiatus in the publication of works relating to American botany, and I know of no question of priority involving the dates of these parts.

We may sum up Volume 2 as follows:

No. 1. Pp. 1–104, 1821, probably late in the year.
No. 2. Pp. 105–208, 1822, probably early in the year.
No. 3. Pp. 209–312, 1822?.
No. 4. Pp. 313–416, 1823?.
No. 5. Pp. 417–520, 1823?.
No. 6. Pp. 521–743, pl. 7–12?, 1824.

Botanisches Centralblatt

The Botanisches Centralblatt which has become the property of the Association Internationale de Botanistes will, beginning with the first of January, 1902, be sent gratis to all members of the Association. The annual fee for members is twenty-five shillings. The number of representatives on the general committee of the Association to which any country is entitled depends on the number of members living in that country. The names of previous subscribers to the Centralblatt are of course known to the editors in cases where the subscriptions were taken in the subscribers' own names but, where copies were ordered through booksellers or other agents, the subscribers' names or even the countries in which they reside are not known. In order, therefore, that the editors may be enabled to know the exact number of members residing in this country and thus ascertain the number of representatives on the committee to which we are proportionally entitled, all desiring to join the Association who have not already registered as members should send their names at once to the Secretary, Dr. J. P. Lotsy, care of E. J. Brill, Leyden, Holland. Any person may join the Association and institutions, such as colleges, libraries, etc., are eligible to membership and can by joining the Association receive the Centralblatt on the same terms as private individuals. The subscription price of the Centralblatt to non-members of the Association is twenty-eight shillings.

A corrected Name

Mentzelia speciosa

Mentzelia aurea Osterhout, Bull. Torr. Club, **28** : ~~5~~44. 6

Not *Mentzelia aurea* Nutt. Gen. **1** : 300 which is now a synonym of *Mentzelia oligosperma* Nutt.

GEORGE E. OSTERHOUT.

Proceedings of the Club

WEDNESDAY EVENING, 30 OCT., 1901

Meeting at the College of Pharmacy at 8 p. m., Rev. L. H. Lighthipe in the chair, 19 persons present.

Three new members were elected: F. S. Earle, Botanical Garden, Bronx Park, N. Y.; Alexander P. Anderson, Columbia University, N. Y.; Miss Caroline Coventry Haynes, 16 East 36th street.

The scientific program was opened by a paper by Dr. D. T. MacDougal, entitled "Some Characters of alpine Vegetation." The paper was illustrated with numerous sheets of mountain plants from Montana, many of them attached photographs showing the habitat. In the Missoula region where Dr. MacDougal was working this summer, the growing season for many plants was about 40 days only, but the actual light reaching the plants may have been 30 to 40 per cent. greater than at sea level, and with a larger proportion of blue rays. These mountain tops may be among the dryest places on the continent or may contain swamp pockets. There is no distinct type of alpine vegetation as such; but alpine plants are really xerophytes, being such plants as have adapted themselves to an insufficient water-supply.

Our alpine plants are often thought to be identical with polar plants. But the polar plant receives light continuously through a long period, though the light is of little intensity. The polar plant has an atmosphere of much greater humidity but a much colder soil. Polar plants develop much greater thickness of leaf. Alpine plants abound in more numerous protective devices, as waxy coatings, hair, thicker stems, and modes of propagation without seeds. *Poa alpina*, for example, in many mountain regions is never known to flower.

Remarks followed regarding the viviparous form of *Poa alpina*, Dr. Rydberg observing its abundance in Greenland and Spitzbergen, and Miss Isaacs remarking on her collecting it at 7500 ft., the last summer in Switzerland.

Dr. Underwood called attention to the relative amount of sunlight in tropical and in northern regions, pointing out that the amount of light is much greater north of the tropics though more oblique.

Discussion followed regarding relations of moisture. Dr. Schoeney referred to the peculiar erect and densely appressed stems assumed by a cespitose *Opuntia* about Boulder, Colorado.

Dr. MacDougal spoke of the remarkable degree to which many of the cacti have adapted themselves to xerophytic conditions, so that they lose water less than one-three hundredth as readily as in ordinary plant structures in similar positions.

Dr. Rydberg referred to the permanent moisture found within 10 or 12 inches of the surface in the dry sandhills of Nebraska.

The second paper was by Dr. P. A. Rydberg, "Revision of *Limnorchis* and *Piperia*," which was printed in full in the November BULLETIN.

Reference was made by Mr. G. H. Watson to a remarkable growth near Ellenville, New York, where two trees not only different in species but in family had so twisted together as to become incorporated, and in response to the expressed appreciation of its significance, he promised further investigation and a photograph of the trees.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Arechavaleta, J. Flora Uruguaya. An. Mus. Nac. Montevideo, **2**:—(i–xxi, 1–96). 1898; **3**:—(97–200). 1898; —(201–240). 1900; —(241–304). 1900; —(305–416). 1901; —(417–492). 1901.
This completes volume 1 (i–xxi, 1–492). Includes new species in various genera.

Arthur, J. C. Generic Nomenclature of Cedar Apples. Proc. Ind. Acad. Sci. 1900: 131–136. 1901.

Ashe, W. W. Some East American Species of *Crataegus*. Jour. Elisha Mitchell Sci. Soc. **17**^{2}: 6–20. 1901.
15 species and one variety proposed as new.

Atkinson, G. F. Studies of some Shade Tree and Timber Destroying Fungi. Bull. Cornell Agric. Exp. Sta. 193: 199–235. Je. 1901.
Discusses injuries caused by *Polyporus borealis*, *P. sulphureus*, *P. ignarius*, *P. pinicola* and *Trametes abietis*.

Ball, C. R. The Genus *Salix* in Iowa. Proc. Iowa Acad. Sci. **7**: 141–154. *pl. 10–12*. 1900.

Boergesen, F., & Paulsen, O. La Végétation des Antilles Danoises. Rev. Gén. Bot. **12**: 99–107; 138–153; 224–245; 289–297; 344–354; 434–446; 480–510. *f. 1–171* + *pl. 4–14*. 1900. [Also as separate, 1–108.]
Translated and adapted from the original Danish published in Botanisk Tidsskrift, **22**: 1–13. 1898.

Britton, E. G. Spring Foliage in October. Torreya, **1**: 119. 26 O. 1901.

Britton, N. L. *Cupania* on Pine Key, Florida. Torreya, **1**: 132. 25 N. 1901.

Cador, L. Anatomische Untersuchung der Mateblätter unter Berücksichtigung ihres Gehaltes an Thein. [Inaug. Dissert.] 1–39. Cassel, 1900.

Carleton, M. A. Emmer; a Grain for the semiarid Regions. U. S. Dept. Agric., Farmer's Bull. 139: 1–15. *f. 1–3*. 1901.

Chesnut, V. K. Some poisonous Plants of the Northern Stock Ranges. Yearbook U. S. Dept. Agric. 1900: 305–324. *pl. 32–34* + *f. 39–42*. 1901.

Church, A. H. On the Relation of Phyllotaxis to mechanical Laws. Part 1. Construction by orthogonal Trajectories. 8vo. 1–78. *pl. 1–9* + *f. 1–34.* Oxford. S. 1901.

Claassen, E. On the qualitative Determination of the organic Acids in the Fruit of *Rhus glabra* L. and of *Rhus Canadensis* Marsh. Pharm. Review, **19**: 345–350. Au. 1901.

Clark, J. A. Reference List of Publications relating to edible and poisonous Mushrooms. U. S. Dept. Agric. Library Bull. 20: 1–16. 1898.

Copeland, E. B. Cryptogamic and physiological Botany at Cold Spring Harbor in 1901. Torreya, **1**: 127–130. 25 N. 1901.

Copeland, E. B. Meissner on Evergreen Needles. Bot. Gaz. **32**: 356–359. 25 N. 1901. [Illust.]

Coulter, S. Additions to the Flora of Indiana. Proc. Ind. Acad. Sci. 1900: 136–143. 1901.

Coulter, S. Some midsummer Plants of southeastern Tennessee. Proc. Ind. Acad. Sci. 1900: 143–147. 1901.

Davenport, C. B. The Fauna and Flora about Coldspring Harbor, L. I. Science, II. **8**: 685–689. 18 N. 1898.

Davenport, G. E. Miscellaneous Notes on New England Ferns.—II. Rhodora, **3**: 266–270. N. 1901.

Davis, B. M. The Origin of Sex in Plants. Pop. Sci. Monthly, **60**: 66–75. *f. 1–3.* N. 1901.

Deane, W. Albino Fruit of Vacciniums in New England. Rhodora, **3**: 263–266. N. 1901.

V. Pennsylvanicum, forma *leucocarpum*, *V. corymbosum*, var. *atrococcum*, forma *leucococcum*, and *V. Canadense* forma *chiococcum*, described as new.

Deane, W. The Knubble—Advice to Beginners in Botany. Plant World, **4**: 188–191. *pl. 16.* O. 1901.

Duggar, B. M. Studies in the Development of the Pollen Grain in *Symplocarpus foetidus* and *Peltandra undulata*. Bot. Gaz. **29**: 81–98. *pl. 1, 2.* 20 F. 1900.

Dunzinger, G. Beiträge zur Kenntniss der Morphologie und Anatomie der Genera *Hemionitis*, *Gymnogramme* und *Jamesonia*. [Inaug. Dissert.] 1–47. *pl. 1–3.* München, 1901.

Durand, E. J. *Dacryopsis Ellisiana* Massee. Bull. Torr. Club, **28**: 646. 25 N. 1901.

Dusén, P. Zur Kenntniss der Gefässpflanzen des südlichen Patagoniens. Öfvers. Kongl. Vet.-Akad. Förhandl. 1901: 229–264. 1901. [Illust.]

Includes descriptions of *Oxalis loricata* Dusén and *Potamogeton linguatus* Hagstr. sp. nov.

Elliesen, M. Einfluss des Vegetationszustandes verschiedener Hefen auf ihr Vermehrungs- und Gärvermögen. [Inaug. Dissert.] 1–19. Jena, 1901.

Fernald, M. L. The Instability of the Rochester Nomenclature. Bot. Gaz. **32**: 359–367. 25 N. 1901.

Fernald, M. L. The true *Lycopodium complanatum* and its common American Representative. Rhodora, **3**: 278–281. N. 1901.

L. complanatum flabelliforme, var. nov., includes most of the American material.

Fitzpatrick, F. J. & M. F. L. *Veratrum Woodii* in Iowa. Plant World, **4**: 192, 193. 1901.

Fowler, J. A Visit to St. Andrew's, N. B., with a Catalogue of Plants collected in its Vicinity. Proc. Nat. Hist. Assoc. Miramichi, **2**: 21–28. 1901.

Frye, T. C. Development of the Pollen in some Asclepiadaceae. Bot. Gaz. **32**: 325–331. *pl. 13.* 25 N. 1901.

Garman, H. Diseases of Nursery Stock. Bull. Ky. Agric. Exp. Sta. 93: 104–108. 1901. [Illust.]

Discusses crown gall and a knot disease of apple trees.

Garman, H. Enemies of Cucumbers and related Plants. Ky. Agric. Exp. Sta. Bull. 91: 50–56. 1901.

Gattinger, A. The Flora of Tennessee and a Philosophy of Botany. 12mo. 1–296. *Portrait.* Nashville, 1901.

A list of 2,208 species with localities and local distribution.

Gilbert, B. D. Notes on *Lycopodium tristachyum* (*L. chamaecyparissus* A. Br.). Torreya, **1**: 117–119. 26 O. 1901.

Gould, C. N. Additional Notes on the Habitat of the Mesquite in Oklahoma. Plant World, **4**: 193, 194. O. 1901.

Greene, E. L. New Species of *Monardella*. Pittonia, **4**: 321, 322. 7 N. 1901.

M. Modocensis, *M. glauca* and *M. nervosa*, new species.

Greene, E. L. Plantae Bakerianae 3: i–viii, 1–36. 18 N. 1901.

New species in *Ranunculus*, *Cyrtorhyncha*, *Delphinium* (2), *Aconitum*, *Draba* (4), *Arabis* (2), *Thelypodium* (2), *Viola* (6), *Polygonum* (2), *Rumex*, *Eriogonum* (3), *Apocynum* (2), *Mertensia* (6), *Oreocarya* (2), *Monardella*, *Castilleia*, *Pentstemon* (2), *Senecio* (4), *Arnica* (3), *Helianthus*, *Tetraneuris*, *Psilostrophe*, *Hymenopappus* (2), *Artemisia*, *Erigeron*, *Plantago*, *Abronia*, *Allionia*, *Thermopsis* (3), and *Lupinus* (5).

Greenman, J. M. Monographie der nord- und centralamerikanischen Arten der Gattung *Senecio*. I. Theil. Allgemeines und Morphologie. [Inaug. Dissert.] 1–37. Leipzig, 1901.

Griffin, H. H. Diseases of Cantaloupes. Bull. Colo. Agric. Exp. Sta. 62: 7. Ap. 1901.

Describes a blight caused by *Macrosporium cucumerium* Ell. & Ev. new species.

Griffiths, D. The Australian Saltbush in Arizona. Bull. Ariz. Agric. Exp. Sta. 38: 291–293. 1901.

Hall, W. L. Forest Extension in the Middle West. Yearbook U. S. Dept. Agric. 1900: 145–156. *pl. 12–15.* 1901.

Güssow, F. Beiträge zur vergleichenden Anatomie der Araliaceae. [Inaug. Dissert.] 1–67. *pl. 1.* Breslau, 1900.

Halsted, B. D. Bean Diseases and their Remedies. Bull. N. J. Agric. Exp. Sta. 151: 1–28. 1 Je. 1901.

Halsted, B. D. Report of the Botanist. Rep. N. J. Agric. Exp. Sta. 2: 407–476.

Diseases of various garden plants; crosses among cucumbers, lima beans, tomatoes, corn; a hybrid salsify.

Harper, R. M. Some popular Plant-names used in Georgia. Torreya, 1: 115–117. 26 O. 1901.

Harrison, F. C. The weeds of Ontario. 8vo. 1–80. *f. 1–34.* Toronto, Mr. 1900.

Havard, V. Notes on Trees of Cuba. Plant World, 4: 163–166. *pl. 11, 12.* S. 1901; 181–185. *pl. 15.* O. 1901.

Henderson, L. F. Biennial Report, Department of Botany. Bull. Idaho Agric. Exper. Sta. 29: 8, 9. 1901.

Henderson, L. F. Mushrooms or Toadstools, A natural Food Product. Bull. Mont. Agric. Exper. Sta. 27: 27–64. 1901.

Hess, A. W., & Vandivert, H. Basidiomycetae of Central Iowa. Proc. Iowa Acad. Sci. 7: 183–187. *pl. 16.* 1900.

Halsted, B. D. Weeping Tomatoes. Torreya, 1: 130, 131. 25 N. 1901.

Hill, E. J. *Cerastium arvense oblongifolium.* Bot. Gaz. **29**: 141, 142. 20 F. 1900.

Hollick, A. Notes on Block Island. Ann. N. Y. Acad. Sci. **11**: 55–88. *pl. 2–9.* 1898.
Botanical notes, pp. 63–70.

Holm, T. On some Canadian Species of *Gentiana;* Sectio Crossopetalae Froel. Ottawa Nat. **15**: 175–182. *pl. 11–14.* N. 1901.
G. Macounii, G. procera, G. nesophila, and *G. elegans brevicalycina* new.

Holzinger, J. M. Some interesting Cases of Plant Distribution. Plant World, **4**: 185–187. O. 1901.

Howard, L. O. Smyrna Fig Culture in the United States. Yearbook U. S. Dept. Agric. 1900: 79–106. *pl. 1–8. f. 1–7.* 1901.

Huber, J. Aponamentos sobre o Caucho Amazonico. Boletim do Museu Paraense, **3**: 72–87. F. 1900.

Huber, J. Duas Sapotaceas novas do Horto Botanico Paraense. Boletim do Museu Paraense, **3**: 54–59. *pl. 1–2.* F. 1900.
Chrysophyllum excelsum and *Lucuma macrocarpa.*

Huber, J. Materiaes para a Flora Amazonica. III. Fetos do Amazonas inferior e de algumas Regioes limitrophes, colleccionados pelo Dr. J. Huber e determinados pelo Dr. Hermann Christ, Basilea (Suissa). Boletim do Museu Paraense, **3**: 60–64. F. 1900.
New species and variety in *Trichomanes, Pteris* and *Polypodium.*

Jensen, A. E. Structure of the Stem Bark of *Hamamelis Virginica* L. Pharm. Archives, **4**: 121–123. *pl. 1, 2.* Jl. 1901.

Jones, L. R. Report of the Botanist [for 1900]. Rep. Vt. Agric. Exp. Sta. 13: 268–332. 1901.
Potato diseases and their remedies; impurities of grass and clover seeds; a soft rot of carrots and other vegetables caused by *Bacillus carotovorus* Jones, sp. nov.

Kellerman, W. A. Ohio Fungi Exsiccati. (With Reprint of Original Descriptions.) Ohio Naturalist, **2**: 135–140. N. 1901.
16 species enumerated.

Knight, O. W. *Solanum rostratum* in Central Maine. Rhodora, **3**: 276. N. 1901.

Knowlton, F. H. A fossil Nut Pine from Idaho. Torreya, **1**: 113–115. *f. 1–3.* 26 O. 1901.

Krembs, A. G., Jr. The Structure of the Stems of *Myrica Gale* L. and *Myrica cerifera* L. Pharm. Archives, **4**: 128–136. *pl. 3, 4.* Jl. 1901.

MacDougal, D. T. Duplication of Contributions on Physiology of Tendrils. Torreya, **1**: 125–127. 25 N. 1901. [Illust.]

MacDougal, D. T. Sensory Mechanism of Plants. Pop. Sci. Monthly, **60**: 174–176. *f. 1–6.* D. 1901.

Malguth, R. Biologische Eigentümlichkeiten der Früchte epiphytischer Orchideen. [Inaug. Dissert.] 1–58. Breslau, 1901.

Meehan, T. *Hamamelis Virginiana.* Meehan's Monthly, **11**: 145, 146. *pl. 10.* O. 1901.

Meehan, T. *Prinos verticillatus.* Meehan's Monthly, **11**: 161, 162. *pl. 11.* N. 1901.

Meehan, T. *Vitis incisa.* Meehan's Monthly, **11**: 113, 114. Au. 1901.

Merrell, W. D. A Contribution to the Life History of *Silphium.* Bot. Gaz. **29**: 99–133. *pl. 3–10.* 20 F. 1900.

Mohr, C. Notes on the Red Cedar. Bull. U. S. Dept. Agric. (Div. Forestry), 31: 1–37. *pl. 1–3 + f. 1–13.* N. 1901.

Moore, G. T. New or little-known unicellular Algae. II.—*Eremosphaera viridis* and *Excentrosphaera.* Bot. Gaz. **32**: 309–324. *pl. 10–12.* 25 N. 1901.

Murdoch, J., Jr. A new Station for *Lactuca Morssii.* Rhodora, **3**: 278. N. 1901.

Murrill, W. A. The generative Divisions in Gymnosperms. Torreya, **1**: 131, 132. 25 N. 1901.

Nelson, A. A new Violet. Bot. Gaz. **29**: 143. 20 F. 1900.
Viola erectifolia A. Nelson.

Nelson, A. The Brome-Grasses of Wyoming. Bull. Wyo. Exp. Sta. 46: 1–21. *pl. 1–3 + f. 1–9.* Ja. 1901.

Osterhout, G. E. New Plants from Colorado. Bull. Torr. Club, **28**: 644, 645. 25 N. 1901.
New species in *Linum*, *Mentzelia*, *Artemisia* and *Agoseris*, *cf.* correction, l. c., 630.

Pammel, L. H. Powdery Mildew of the Apple. Proc. Iowa Acad. Sci. **7**: 177–182. *pl. 33–35.* 1900.

Pammel, L. H. The weedy Plants of Iowa. Proc. Soc. Prom. Agric. Sci. **21**:—(1–5). 1900.

Parish, S. B. A Group of Western American Solanums. Proc. Cal. Acad. Sci. (Botany) III. **2**: 159–172. 23 O. 1901.

Nine species and varieties enumerated, five of them new.

Pieters, A. J. The Plants of Western Lake Erie with Observations on their Distribution. Bull. U. S. Fish Comm. 1901: 57–79. *pl. 11–20.* 1901.

Price, O. W. Practical Forestry in the Southern Appalachians. Year-Book U. S. Dept. Agric. 1900: 357–368. *pl. 38–43.* 1901.

Ramirez, J. El *Pileus heptaphyllus.*—Nuevo género de las Papayáceas. An. Inst. Med. Nacional, **5**: 24–29. *pl. 1–4.* 1901.

Rendle, A. B. Notes on *Trillium.* Jour. Bot. **39**: 321–335. *pl. 426, A, B.* 1 O. 1901.

Includes descriptions of *T. Rugelii* sp. nov. from North Carolina and *T. affine* sp. nov. from Georgia, and critical notes on various other American species.

Robertson, C. Flower visits of oligotropic Bees. Bot. Gaz. **32**: 367, 368. 25 N. 1901.

Robinson, B. L. Problems and Possibilities of Systematic Botany. Science, II. **14**: 465–474. 27 S. 1901.

Address of the retiring President of the Botanical Society of America, 28 Au. 1901. Reprinted as Publication 15 of the Society.

Robinson, B. L. The North American Euphrasias. Rhodora, **3**: 270–276. N. 1901.

E. Williamsii, E. Randii, E. Randii Farlowi, and *E. Americana Canadensis,* new species, variety and combination.

Rusby, H. H. More concerning Truxillo Coca Leaves. Druggists Circ. and Chem. Gaz. 1901. ? Mr. 1901. [Illust.]

Rydberg, P. A. The American Species of *Limnorchis* and *Piperia,* north of Mexico. Bull. Torr. Club, **28**: 605–643. *f. 1–34.* 25 N. 1901.

Enumerates 32 species, with 22 new species, varieties and combinations.

Salmon, E. G. Bryological Notes (15). *Philocrya* Hagen & Jensen. Jour. Bot. **39**: 339–341. 1 O. 1901.

Transfers *Oligotrichum Lescurii* (James) Mitten to *Lyellia* and makes *Philocrya* a synonym of the latter.

Schaffner, J. H. The maximum Height of Plants, III. Ohio Naturalist, **2**: 142. N. 1901.

Schrenck, H. von. Fungous Diseases of Forest Trees. Yearbook U. S. Dept. Agric. 1900: 199–210. *pl. 21–25.* 1901.

Schulze, H. Beiträge zur vergleichenden Anatomie der Gattungen *Lupinus* und *Argyrolobium*. [Inaug. Dissert.] 1–44. Cöthen, 1901.

Scovell, J. T. The Flora of Lake Maxinkuckee. Proc. Ind. Acad. Sci. 1900: 124–131. 1901.

Scribner, F. L. Our native Pasture Plants. Yearbook U. S. Dept. Agric. 1900: 581–598. *pl. 76–79 + f. 75–85.* 1901.

Seckt, H. Beträge zur mechanischen Theorie der Blattstellungen bei Zellenpflanzen. [Inaug. Dissert.] 1–27. *pl. 1, 2.* Cassel, 1901.

Shull, G. H. Some Plant Abnormalities. Bot. Gaz. **32**: 343–355. *f. 1–36.* 25 N. 1901.

Smith, E. A. Biographical Sketch of Dr. Charles Mohr. Bull. Torr. Club, **28**: 599–604. 25 N. 1901. [Portrait.]

Smith, F. G. On the Distribution of Red Color in the Vegetative Parts in the New England Flora. Bot. Gaz. **32**: 332–342. 25 N. 1901.

Smith, J. G. Commercial Plant Introduction. Yearbook U. S. Dept. Agric. 1900: 131–144. 1901.

Sodiro, L. Anturios Ecuatorianos. 1–17. Quito, 1901. [Illust.]
A key to 174 species of *Anthurium* from Ecuador.

Stuart, W. A bacterial Disease of Tomatoes. Proc. Ind. Acad. Sci. 1900: 153–157. 1901.

Stuart, W. A Study of the Constituents of Corn Smut. Proc. Ind. Acad. Sci. 1900: 148–152. 1901.

Suck, W. Die geographische Verbreitung des Zuckerrohrs. [Inaug. Dissert.] 1–75. Halle, 1900.

Swingle, W. T. The Date Palm and its Culture. Yearbook U. S. Dept. Agric. 1900: 453–490. *pl. 54–62. f. 57–63.* 1901.

Thomas, M. B. Cryptogamic Collections made during the Year. Proc. Ind. Acad. Sci. 1900: 121–123. 1901.

Thomas, M. B. Experiments with Smut. Proc. Ind. Acad. Sci. 1900: 123, 124. 1901.

Tracy, S. M., & Earle, F. S. Fungi. Pl. Bakerianae, **1**: 15–37. 22 F. 1901.

New species in *Guepinia* (2), *Boletus*, *Naucoria*, *Lachnum*, *Charonectria*, *Zignoella*, *Gibberidia* (2), *Otthia* (2), *Amphisphaeria* (2), *Strickeria*, *Trematosphaeria*, *Lophiostoma*, *Platystomum* (4), *Mycosphaerella* (2), *Ophiobolus* (2), *Pleospora* (2), *Monilia*, *Exosporium*, and *Phoma*.

Trelease, W. The Progress made in Botany during the Nineteenth Century. Trans. Acad. Sci. St. Louis, **11**: 125–142. 26 N. 1901.

Tyler, F. J. Geophilous Plants of Ohio, II. Ohio Naturalist, **2**: 132, 133. *f. 1.* N. 1901.

Waugh, F. A. What is *Prunus insititia?* Bot. Gaz. **29**: 144. 20 F. 1900.

Wildeman, É. de. *Alnus occidentalis* Dippel. Ic. Select. Hort. Thenensis, **2**: 147. *pl. 75.* Au. 1901.

Includes a key to the North American species of *Alnus* and a synonymy of the species.

Wildeman, É. de. *Azara microphylla* Hook. f. Ic. Select. Hort. Thenensis, **2**: 129. *pl. 71.* Au. 1901.

A species from the Andes of Chili.

Wildeman, É. de. Les Caféiers. 8vo. 1–43. Bruxelles, 1901.

Wildeman, É. de. *Oreopanax permixtum* El. Marchal. Ic. Select. Hort. Thenensis, **2**: 133. *pl. 72.* Au. 1901.

A Brazilian species.

Williamson, E. B. A few mycological Notes for July and August, 1900, Wells and Whitley Counties. Proc. Ind. Acad. Sci. 1900: 161–165. 1901.

Williams, E. F. Tree Willows at Fort Kent, Maine. Rhodora, **3**: 277, 278. N. 1901.

Salix lucida macrophylla Anderss. recorded for the first time in the United States.

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