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GENERAL INDEX.

(Illustrated articles are designated by an asterisk * before the page number.)

GENERIC INDEX.

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BULLETIN

OF THE

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EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

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The Club meets regularly at Columbia College, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P M. Botanists are cordially invited to attend.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., January 30, 1896. No. 1.

Notes on New England Marine Algae.—VI.

By Frank S. Collins.

The species mentioned in the following notes have not, as far as I know, been recorded from our coast, except that *Ralfsia pusilla* and *Desmotrichum undulatum* were mentioned in the Flora of Mount Desert by Rand & Redfield, and *Entophysalis granulosa* in my list of the algae of Atlantic City, N. J., Bulletin, December 1888. Unless otherwise noted, the specimens were collected by me.

Entophysalis granulosa Kütz. This species I have found at Cape Rosier, Maine; Mr. Isaac Holden finds it at Stratford, Conn.; and it occurs at Atlantic City, N. J.; probably it is common all along the coast. It forms a crumbly incrustation at high-water mark, and seems to prefer lagoons or high tide-pools, where the water is quite salt and where the level does not vary much. It is figured and described in Bornet & Thuret, Notes Algologiques, 1. *pl. 1. fig. 4 and 5*, and distributed in Collins, Holden & Setchell, Phyc. Bor. Am. no. 152.

Spirulina Meneghiniana Zan. Found in August, 1893, in the salt marshes at Revere, Mass., in scattered filaments among other algae in a ditch of brackish water. It has a much looser spiral than *S. subsalsa* Oersted (*S. tenuissima* of Farlow's Manual). Figured and described in Gomont, Monogr. des Oscill., 270. *pl. 7. fig. 28.*

Hydrocoleum lyngbyaceum rupestre Kütz; Gomont, Monogr. des Oscill. 76. *pl. 12. f. 8–10.* This species was abundant at Goose Creek, Cape Rosier, Maine, in July of 1893 and of 1895, forming a rather thick, black, slimy coating on dead sticks Zostera, etc.

AMPHITHRIX JANTHINA (Mont.) Bornet & Flahault. This occurs at Rockport, Mass., on wet cliffs just above high water mark; and var. TORULOSA (Grun.) B. & F. grows in abundance in the autumn months on stones in a ditch in the salt marshes at Revere, Mass. Though described by Bornet and Flahault as a fresh-water plant, at this last station it grows in company with brackish and marine species like *Polysiphonia subtilissima* and *Ectocarpus confervoides*.

EPICLADIA FLUSTRAE Reinke, Atlas Deutscher Meeresalgen, 31. *pl. 24.* Appears to be common along the coast on Sertularia, Flustra, etc., the densely packed branching filaments forming a thin green coating on the host. Distributed in Phyc. Bor. Am., No. 160.

In Farlow's Manual of the Marine Algae of New England, Le Jolis is followed in including the species of *Enteromorpha* in the genus *Ulva*, and considering most of our forms as subspecies or varieties. Subsequent study by Agardh, Ahlner, Reinbold and others has tended to considerably change this arrangement, and it is now generally recognized that *Enteromorpha* should be considered as a distinct genus, represented by quite a number of species in this region. *E. compressa* (L.) Grev., *E. intestinalis* Link, *E. clathrata* (Roth) J. Ag., *E. Hopkirkii* Harv. and *E. ramulosa* (Engl. Bot.) Hook., which appear as synonyms in the manual, are now accepted as specific names, as is also *E. marginata* J. Ag., which was recorded in the BULLETIN for December, 1884, under the name of *Ulva marginata*. *E. micrococca* Kütz was mentioned by the writer in the BULLETIN for November, 1891, and *E. erecta* in J. Agardh, Till Alg. Syst. 3: 152.

To these can now be added the following:

E. PROLIFERA (Fl. Dan.) J. Ag., a species resembling in habit *E. compressa*, from which it is distinguished by having the cells arranged in longitudinal series almost throughout. It appears to be common all along the coast.

E. CRINITA (Roth) J. Ag. This species resembles *E. clathrata* in ramification, but the cells are not arranged in a netlike manner, resembling rather those of *E. compressa*, from which it is distinguished by the uniform arrangement of the cells in longitudinal series. The ramuli often terminate in a single row of cells, which is, however, much shorter and less characteristic than in *E. Hopkirkii.* It appears to be not uncommon.

E. TORTA (Mert.) Reinbold. In this species the fronds are very slender, from two to eight cells in breadth, the cells always in longitudinal series and usually in cross rows; the branches are only one or two cells broad, resembling the filaments of *Tetranema percursum*, but without the exactly symmetrical arrangement of cells in the latter. I found it at Eagle Island, Penobscot Bay, Maine, in July, 1894, growing in company with other *Enteromorphas*, *Cladophora expansa*, *Lyngbya aestuarii*, etc., in a lagoon reached by only the highest tide, and the water of which often became by continued evaporation, salter than the ocean.

At this same locality I found, in July 1893, a plant in regard to which I have been in some doubt, but I venture to describe it as

E. CRUCIATA n. sp.

Fronds branching, mostly of a single series of cells, but at the point of branching of two series or sometimes more; branches issuing at right angles or nearly so, usually opposite, but sometimes alternate or secund, simple, usually short, tapering; monosiphonous filaments usually 20–30 μ. diam.; cells about as long as broad, cell wall very thick; in the irregular cellular masses where several branches issue near together, the cells are rounded, up to 50 μ diam.

The general appearance of the fronds is somewhat like that of *Rhizoclonium*, and the shorter branches somewhat resemble those of the latter genus; but the branches are much more numerous and longer; they are mostly opposite, but sometimes issue two or three on the same side of the main filiment. Younger parts bright green, older nearly colorless. Found unattached, among floating masses of *Cladophora*, *Enteromorpha* and *Lyngbya* in warm shallow water of lagoon, Eagle Island, Maine, July, 1893.

STREBLONEMA FASCICULATUM Thuret. *S. volubilis* Pringsheim, Beiträge zur Morphologie der Meeresalgen, *pl. III., B.* Growing in the fronds of *Castagnea virescens*, Spectacle Island, Penobscot

Bay, Maine. Distinguished by the relatively large, branching plurilocular sporangia.

ECTOCARPUS AECIDIOIDES Rosenvinge, Gronlands Havalger, 894. *fig. 27.* A minute species, forming spots barely visible to naked eye, on old fronds of *Laminaria* species. The vegetative filaments grow in the interior of the frond of the host plant; when fruiting, the sori are formed directly under the epidermis, which is pushed upward and finally ruptured. Found at York Island, near Isle au Haut, Maine, July, 1894.

DESMOTRICHUM UNDULATUM (J. Ag.) Reinke, Atlas, 15. *pl. 11.* Resembles a small *Punctaria*, and grows commonly on *Zostera marina* in quiet bays. The *Punctaria latifolia* var. *Zosterae*, of Farlow's Manual, is probably in part identical with this species. I have found it on the coasts of Maine and Massachusetts, and Mr. Holden finds it at Bridgeport, Conn. Specimens from the latter locality are distributed in Phyc. Bor. Am. no. 129. In company with this species we generally find more or less of the following:

D. BALTICUM Kütz. A much slenderer species, mostly of a single series of cells, ending in a long, colorless hair. See Reinke, Atlas, 15. *pl. 12.* The limits of species are very difficult to define in this and the related genera, and it would not be difficult to arrange an uninterrupted series of specimens from the fine, Ectocarpus-like *D. scopulorum* to the coarse, leathery *Punctaria plantaginea.*

RALFSIA PUSILLA (Strömf.) Holmes & Batters (*Stragularia pusilla* Strömfelt, Notarisia, 3: 382. *pl. 3. f. 4.* 1888). The smallest species of the genus and of quite different habitat from the others, which grow on rocks and woodwork, while this is epiphytic. The original description gives it as occurring on *Laminaria;* on the New England coast I have found it from Marblehead to Mount Desert, growing on *Chaetomorpha aerea* and *C. Melagonium*, forming thin, black "collars" around one or more cells in the upper part of a filament.

SCYTOSIPHON LOMENTARIUS COMPLANATUS Rosenvinge, Gronl. Hav. 863.

This variety, described from Greenland specimens, has been found by Mr. Holden growing abundantly and luxuriantly at Bridgeport, Conn. It is a spring plant, disappearing in early summer; it differs from the type by the flattened, not constricted frond, and by the lack of paraphyses when in fruit. Distributed in Phyc. Bor. Am. no. 173.

FUCUS ARESCHOUGII Kjellman, Handbok i Skandinaviens Hafsalgflora, 1 : 11.

A northern form, growing on exposed rocky shores near high-water mark. It resembles some forms of *F. vesiculosus* that grow in similar localities, but is distinguished by the hermaphrodite conceptacles. The narrow, closely and regularly forked fronds with the ultimate segments at nearly uniform height, and ending in small spherical or ovate receptacles, distinguish it from *F edentatus* and *F. evanescens*, both of which, moreover, grow near low-water mark. It approaches nearer to *F. platycarpus*, and the receptacles are often margined as in the latter; there may be intermediate forms, but the types seem distinct, *F. platycarpus* being a larger plant with broader frond, and having the fruiting segments lateral. *F. Areschougii* occurs from Marblehead northward, and is very common on the coast of Maine.

CHANTRANSIA CORYMBIFERA Thuret.

This interesting species, the only one of the genus in which occurs a true sexual reproduction by means of antheridia, trichogynes and carpospores, was collected for the first time in America by Mr. George Waterman, in August 1893, at Marblehead, Mass. It has since been found at Wood's Hole, Mass., by Mr. C. P. Nott, and specimens from the latter locality are distributed in Phyc. Bor. Am. no. 192. In both localities it grew on *Ceramium rubrum* and *Cystoclonium purpurascens*. Figured and described in Bornet & Thuret, Notes Algologiques, 16. *pl. 5*.

PEYSSONELLIA ROSENVINGII Schmitz, in Rosenvinge, Gronl. Hav. 782. *f. 8*. A specimen which I found at Spectacle Island, July, 1894, is identified by Rosenvinge with this species. It grew on a mussel shell, and I have found the same species on several occasions growing on the shells of live crabs. In every case it grew, not directly on the crab or mussel shell, but on a *Lithothamnion*, which Rosenvinge identifies with *L. circumscriptum* Strömf. Whether the *P. Dubyi* of Farlow's Manual is the same as this, or whether we have two species, I cannot say; as far as I know there have been only sterile plants observed here, probably because the plants fruit in winter.

HALOSACCION SCOPULA Strömfelt, Meeresalgen Islands, 173; Om Algvegetationen vid. Islands Kuster, 29. *pl. 1, f. 16; pl. 2. f. 1.* A form agreeing very well with Strömfelt's description and figure was found by me at York Island, Maine, July, 1894. In view of the great range of variation in *Halosaccion ramentaceum*, it is doubtful if this can be given higher rank than that of a variety.

In my notes on N. E. Marine Algae, V., in the BULLETIN for November, 1891, I mentioned *Calothrix Contarenii* as found at Revere Beach, Mass. Dr. Bornet informs me that the specimens from this locality were wrongly determined, and are nearer to *C. fasciculata*, the difference from the type of the latter being chiefly a matter of dimensions.

Nitella subspicata sp. nov.

BY T. F. ALLEN.

(PLATE 253.)

Nitella monarthrodactyla, furcata, homoeophylla, monoica, gymnocarpa, acuminata.

Plants from fifteen to twenty centimetres high, diffusely branched; leaves acuminate, those of sterile verticils, spreading, diffuse, of the fertile verticils contracted, forming somewhat dense heads (remotely spike-like). Fertile verticils arise from within the verticil of the sterile leaves on peduncles which are sometimes very short and sometimes elongated. The leaves are once divided; terminal segments (3 or 4) one-celled, long-acuminate, somewhat inflated at the middle. Antheridia 240 in diameter. Sporophydia one to three at a node of the leaf (usually two), 306 long from base to tip of coronula. Nucleus 225 long, 200 broad, with six prominent acute ridges, nearly black. Membrane of the spore quite smooth.

Measurements: stem diameter 780 to 830, leaf diameter 488, 500 to 610; terminals diam., 400, 464 and 490.

Collected in Missouri by J. W. Blankinship.

This plant is nearly related to *Nitella subglomerata* A. Br., from which it differs by its more contracted "heads;" its smaller antheridia and oöspores, as well as by the perfectly smooth spore-membrane, by which it is also distinguished from the other species of the *acuminata* group. These specimens show a variation in the character of the leaves of a verticil; they are frequently dimorphous, but never heterophyllous as in *N. clavata* A. Br. of the Pacific coast.

A similar heteromorphous character of the leaves (some simple and sterile, others branched and fertile) may also be found in *Nitella Blankinshipii* (found in the same region), and it has seemed possible that some transitional forms leading toward *N. clavata* A. Br. would be found, especially as in both of these species we find a tendency to an inflation of the terminals so commonly a character of *clavata*. But the difference between *heteromorpha* and true *heterophylla* is constant and fundamental in the development of the nodal cells, rather than accidental and variable.

Explanation of Plate 253.

Fig. 1, plant natural size; fig. 3, stem verticil and leaf $\times 25$; figs. 3 and 4, leaf nodes with terminals $\times 25$, fig. 5, nature spore $\times 50$.

Contributions to the Lichens of Maine.—II.

By F. L. Harvey.

The following list embraces lichens collected last August in the vicinity of Jackman and about Orono by the writer; about Bangor by Mr. O. W. Knight; at N. Lubec and in Aroostook Co., by Miss Cummings and Miss Teller. Miss Cummings' specimens were principally from the head waters of the St. John and were distributed in "Decades of N. A. Lichens." The Jackman specimens were from the headwaters of Penobscot, Kennebec and De Loup rivers. Sandy Bay Mt. mentioned in the list is 12 miles northeast from Jackman and on the Canadian boundary. The numbers above 115 are accessions to the State flora. Those below 115 refer to new localities for species mentioned in a previous list (Bulletin, September, 1894. 389). We are under obligation to Miss Cummings for the examination of specimens.

Fam. USNEEI.

116. Cetraria juniperina pinastri Ach.

On coniferous trees and rail fences, St. Francis, Aroostook Co., no. 94 (Cummings & Teller); Jackman and Orono (Harvey).

7. *C. ciliaris* Ach. On rail fences, Jackman (Harvey).

8. *C. lacunosa* Ach. On spruce trees; very finely developed; Bangor (O. W. Knight); Orono (Harvey).

15. *Usnea barbata plicata* Fr. Jackman (Harvey).

16. *U. longissima* Ach. On spruce trees, Jackman (Harvey).

17. *Alectoria jubata calybeiformis* Ach. Common, Jackman (Harvey).

Fam. PARMELIEI.

19. *Theloschistes concolor* (Dicks.). On apple trees, St. Francis, Aroostook Co., no. 99 (Miss Cummings); Orono (Harvey); Bangor (O. W. Knight).

117. T. lychneus (Nyl.). On maple bark. Orono; (Harvey.)

21. *Parmelia tiliacea* (Hoffm.) Floerk. On various trees; St. Francis, Aroostook Co., no. 102 (Cummings & Teller); Jackman (Harvey).

23. *P. physodes* (L.) Ach. Jackman; (Harvey). Our specimens are like 9b in Dec. N. A. L. (Cummings).

118. P. physodes obscurata Ach. Orono (Harvey).

119. P. olivacea (L.) Ach. On cherry trees, St. Francis Aroostook Co., 105 (Cummings & Teller); Orono (Harvey).

120. P. ambigua (Wulf.) Ach. Dead and charred logs, St. Francis, 108 (Cummings & Teller).

121. P. ambigua albescens Wahl. With the above, 109 (Cummings & Teller).

32. *Physcia speciosa* (Wulf.) Nyl. On various trees, Glacial Lake, Aroostook Co., 110 (Cummings & Teller).

122. P. hypoleuca (Muhl.) Tuck. On Trees, Jackman (Harvey).

33. *P. stellaris* (L.). Orono (Harvey).

Fam. PELTIGERI.

123. Pyxine sorediata Fr. Specimens from Jackman seem to be this (Harvey).

42. *Sticta amplissima* (Scop.) Mass. Rocks and trees, Jackman (Harvey).

44. *S. pulmonaria* (L.) Ach. On trees, Jackman (Harvey).

124. NEPHROMA ARCTICUM (L.) Fr. On rocks; abundant; summit of Sandy Bay Mt., near Jackman (Harvey).

49. *Peltigera aphthosa* (L.) Hoffm. On earth and decaying logs; Ft. Fairfield, no. 160 (Cummings & Teller).

P. polydactyla (Neck.) Hoffm. Jackman (Harvey).

125. P. CANINA SPONGIOSA Tuck. Mossy logs, St. Francis, no. 118 (Cummings & Teller).

126. P. CANINA SOREDIATA Scheer, Ach. On earth, St. Francis, no. 119 (Cummings & Teller).

127. P. CANINA SPURIA Ach. Earth, St. Francis, 119 (Cummings & Teller).

Fam. COLLEMEI.

128. LEPTOGIUM TENUISSIMUM (Dicks.) Koerb. On earth and moss, Van Buren, 125a (Cummings & Teller).

129. PLACODIUM AURANTIACUM (Light.) Naeg. & Hepp, Orono (Harvey).

Fam. LECANOREI.

130. LECANORA SUBFUSCA (L.) Ach. Orono (Harvey).

131. L HAGENI Ach. On logs in railroad embankment, Fort Fairfield, 132 (Cummings & Teller).

67. *L. varia* (Ehrh.) Nyl. Orono (Harvey).

132. L. VARIA SYMMICTA Ach. Rail fences; Van Buren, 167 (Cummings & Teller).

71. *Pertusaria multipunctata* (Turn.) Nyl. Maple trees; Mar's Hill, 135 (Cummings & Teller); Orono (Harvey).

72. *P. communis* DC. Rail fences, N. Lubec, 136 (Cummings & Teller).

133. P. LEIOPLACA (Ach.) Schaer. Rail fences, Van Buren, 137 (Cummings & Teller).

Fam. CLADONIEI.

76. *Sterocaulon paschale* (L.) Fr. Jackman (Harvey).

79. *Cladonia pyxidata* (L.) Fr. Rotten wood and earth, Alla-

quash Plantation, Aroostook Co., 139 (Cummings & Teller); Jackman (Harvey).

134. C. FIMBRIATA TUBAEFORMIS Fr. (Ground). Sandy Bay Mt. near Jackman (Harvey).

81. *C. gracilis verticillata* Fr. Jackman (Harvey); Bangor (O. W. Knight).

83. *C. gracilis hybrida* Schaer. Jackman (Harvey); Bangor (Knight).

84. *C. gracilis elongata* Fr. Earth, Sandy Bay near Jackman (Harvey).

86. *C. squamosa* Hoffm. Jackman (Harvey); Orono (Harvey); Bangor (Knight).

88. *C. furcata crispata* Fr. Jackman (Harvey).

135. C. FURCATA RACEMOSA Fl. In moss on rocks, head of Pamedomcook Lake, Falls of Tumble-down-Dick stream (Harvey); Bangor (O. W. Knight).

90. *C. rangiferina* (L.) Hoffm. Jackman (Harvey).

91. *C. rangiferina sylvatica* L. Jackman (Harvey).

93. *C. amaurocrea* (Fl.) Schaer. Jackman (Harvey).

94. *C. uncialis* (L.) Fr. Orono (Harvey).

136. C. DEFORMIS (L.) Hoffm. On earth and logs, St. Francis 141 (Cummings & Teller); Jackman (Harvey).

137. C. DIGITALA (L.) Hoffm. Rotten wood and earth, St. Francis 142 (Cummings & Teller).

100. *C. cristatella* Tuck. Earth, Sandy Bay Mt. (Harvey); Bangor (O. W. Knight).

Fam. LECIDEEI.

138. BAEOMYCES BYSSOIDES (L.) Schaer. Sandy banks, St. Francis, 144 (Cummings & Teller).

139. BIATORA GRANULOSA (Ehrh.). Bank, St. Francis, Tp. 18, R 10, Aroostook Co., 145 (Cummings & Teller).

140. B. MILLIARIA (Fr.). On wood, Orono (Harvey).

141. LECIDEA MELANCHIMA Tuck. Rail fences, N. Lubec, 146 (Cummings & Teller); Orono (Harvey).

108. *Buellia parasema* (Ach.) Th. Fr. Jackman (Harvey).

Fam. OPEGRAPHEI.

114. GRAPHIS SCRIPTA (L.) Ach. Birch bark, Jackman (Harvey).

Notes on Myriophyllum.

M. Farwellii Morong. When Dr. Morong described this species, material for a full description of the flowers was lacking, and the only known locality for the plant was in a small pond in Keweenaw county, Mich. Since then it has been collected in Wilton, and the Piscataquis River, in Maine, by M. L. Fernald, and by myself in two widely separated localities in Vermont. I first collected it in a small mountain pond in Johnson, Lamoille county, and later in a set-back of the West River at W. Townshend, Windham county. I have thus been able to collect abundant material at different stages of flowering and fruiting and to study the habit of the plant with some care. The habit of the Johnson plant is somewhat different from that of typical *M. Farwellii*; I have never found it rooting, but floating near the surface in large quantities, sometimes sinking to the bottom when heavily fruited. It blossoms in June and early July, and matures fruit in July and early August. Its fruit is almost precisely like that of the type in every particular.

The Townshend plant has the same rooting habit and the same peculiarities of submerged growth and fruiting as the type, but its fruit is larger, darker and matures a month later, in early September. The ridges of tubercules run more irregularly and the tubercules themselves are much larger than those of the type. The lower tubercules take the form of short, hooked spines.

Of the flowers Dr. Morong said: *"Judging from specimens furnished it is dioecious, as I can find only pistillate flowers. Petals four, oblong, delicate, purplish in color, including four abortive stamens, which have silk-like filaments and minute, undeveloped anthers." The flowers were alike in both forms of my collecting, perfect; petals four, oblong, purplish; stamens four, a little shorter than the petals; filaments glabrous, somewhat longer than the short oblong anthers; stigmas plumose, sub-sessile. I have not examined the very earliest flowers, but the later ones were all perfect. As in other species, the upper portion of a stem will often be in flower while the lower portion bears mature fruit.

* Bull. Torr. Bot. Club, 18: 146.

In each case the plant grew in shallow, quiet water with a muddy bottom. I believe this plant will be found all along the northeastern border of the United States and in Canada, and I would suggest that collectors be on the lookout for it.

It is strange that none of the works on North American Botany mention the two bractlets at the base of the flowers in all species of *Myriophyllum.* So far as I know, Engler and Prantl in Natürlichen Pflanzen Familien and Martius in Flora Brasiliensis are the only ones mentioning these bractlets. I first found them in *Myriophyllum Farwellii*, where they are small, lanceolate and hyaline, as also in *M. tenellum* Big., *M. hippuroides* Nutt., *M. pinnatum* (Walt.), *M. Mexicanum* Watson, *M. laxum* Shutt. They are ovate and very large and conspicuous in *M. spicatum*, being two-thirds the size of the bracts and as firm in texture. In *M. alterniflorum* D.C. they are smaller than in *M. spicatum*, but similar in texture and shape. In *M. verticillatum* L. they are quite conspicuous, ovate and hyaline. In *M. heterophyllum* Michx., ovate, serrate and hyaline. In *M. humile* (Raf.), minute, oblong-ovate and membranous. A. J. Grout.

Columbia College, New York.

A Note on Jungermannia Marchica Nees.

By Alexander W. Evans.

(Plates 254, 255.)

The hepatic before us is a most clearly marked species of Dumortier's subgenus *Lophozia ;* but, probably on account of its extreme rarity, it remained for a long time strangely overlooked or misunderstood by both European and American botanists. During the forty years which followed Nees von Esenbeck's publication of the plant, *Jungermannia Marchica*, as a distinct species, quite disappeared from German literature. In the Synopsis Hepaticarum the only allusion to it is a brief description under Nees' first name, *J. socia, var. obtusa ;* and even the type specimen, as Herr Stephani has recently determined, is labeled in the same way. Apparently nothing further was seen of the species in Germany until the beginning of the last decade, when it was rediscovered by Herr Warnstorf near Neuruppin. His specimens were sent for examination to Herr Limpricht, who referred them correctly to *J. Marchica* and published a full and accurate description of the species.* The plant was found last summer by Herr Löske of Berlin and the writer, in the Grunewald near that city, and it has also been reported from Scandinavia.†

Meanwhile, in the United States, Austin found the species, determined it as *J. polita* Nees, and distributed it under this name as No. 46 of his Hepaticae Boreali-Americanae. It here came before the attention of Lindberg, who recognized it as distinct from *J. polita* and described it as *Jungermannia laxa* n. sp. But he soon suspected its identity with *J. Marchica;* for, in 1879,‡ he gives the latter as a possible synonym of *J. laxa*, and, in 1886,§ he states positively that they are the same plant. Quite recently the species has been rediscovered in this country by Mr. Rand.‖

The following description is drawn largely from the Grunewald specimens, which closely agree with those of Austin's distribution, and also, as Herr Stephani kindly informs me, with the type in the Nees herbarium:

JUNGERMANNIA MARCHICA Nees, Naturgesch. der europäisch. Lebermoose, **2**: 77. 1836.

J. socia Nees, var. *obtusa* Nees, l. c. **2**: 72. 1836.

J. polita Aust. Proc. Phil. Acad. **1869**: 220. [not Nees.]

J. laxa Lindb. Acta Soc. Sci. Fenn. **10**: 529. 1875.

Dioicous, creeping among *Sphagna* or loosely caespitose, pale green, becoming bleached or brownish with age; stems prostrate or ascending, thick and wiry, mostly simple, varying in color from pale green through reddish-brown to deep purplish-black, and bearing scattered rhizoids, which exhibit the same variations in color; leaves of the sterile stems and of the fertile stems in the lower part distant, obliquely inserted, not decurrent, broadly quad-

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* Eine verschollene Jungermannia. Flora, **65**: 45. 1882.

†Arnell, H. W. Bot. Notiser, 1894 : 49. Several facts regarding the history and synonymy of the species are also given here.

‡Musci Scand. 7 1879. [Footnote.]

§Meddel. Soc. F. et Fl. Fenn. **13**: 233. 1886.

‖Flora of Mt. Desert Island, Maine. 224. 1894.

rate, 2 to 4-lobed to about the middle, the sinuses usually obtuse or rounded, the lobes mostly plane but occasionally somewhat convex, broadly ovate, with rounded apex and entire margins; underleaves very rarely present, similar to the leaves but smaller; leaves of the fertile stems in the upper part contiguous, sometimes decurrent, the lobes becoming strikingly convex, crispate and irregularly sinuous or dentate; perichaetial bracts two pairs, similar in size and form to the upper stem-leaves but more incised and subdivided; inner bracteole free, usually 2-lobed, of the same character as the bracts; second bracteole (when present) similar to the inner one, but usually a little smaller and frequently bearing on its surface 1 or more ligulate appendages, a cluster of which, in some cases, entirely replaces the leafy expansion of the bracteole; perianth ovate-cylindrical, exserted, terete except in the upper third, where it is very obtusely keeled, the mouth somewhat contracted, minutely denticulate; perigonial bracts in about 5 pairs, imbricated, complicate, 2 or 3-lobed, similar to the leaves when explanate.

Stems up to 2.5 cm. long, 0.50 mm. in diameter; leaves averaging 1 mm. in length and 1.25 mm. in width; perichaetial bracts 1.–1.25 mm. long by 2.–2.5 mm. wide; perianth 3 mm. long, 1 mm. in diameter; perigonial bracts 1.50 mm. long by 1.75 mm. wide; leaf-cells thin-walled, polygonal, in the middle of the leaf 0.044–0.064 mm. in diameter.

Near Closter, New Jersey (Austin): Beach Mountain, Mount Desert Island, Maine (Rand).

The plant is apparently as rare with us as it is in Europe, but it is undoubtedly often passed by. The wiry stems wind in and out among the branches of a sphagnum tuft and are completely hidden from sight, while the pale leaves are scarcely to be distinguished by their color from the sphagnum leaves among which they grow. When we pull the tuft apart, the deep purplish color of the stems becomes apparent and at once distinguishes the plant from its allies. The stem is pentagonal in section and is bounded by an epidermoidal layer of cells with thickened walls; on the postical aspect, the pigmentation is especially well marked and affects the walls of these cells, the rhizoids springing from them, and, to a less degree, the two or three layers of cells just within them;

the other internal cells of the stem have thin and colorless walls. The perianth is one layer of cells in thickness down to the very base.

Jungermannia polita Nees is not a close ally of this plant, and may be at once distinguished from it by its smaller complicate leaves, the cells of which have thickened walls and well developed trigones. A rather closer relationship to *J. Marchica* may be discovered in the *J. Novae-Caesareae** of the writer, which is found in somewhat similar localities. The last named species differs in its weaker habit, in its pale and delicate stems, in its smaller leaves with less rounded lobes and smaller cells, in its simpler bracts and single connate bracteole, and in its perianth, which is keeled to below the middle and more deeply denticulate at the mouth. The nearest European ally, *J. Mildeana* Gottsche, has not yet been reported from America.

*Bull. Torr. Bot. Club, 20: 308. *pl. 163*. 1893.

YALE UNIVERSITY.

Description of Plates 254, 255.

Fig. 1. Plants, twice natural size.
Fig. 2. Sterile stem, postical view (× 18).
Fig. 3. Female stem, antical view (× 18).
Fig. 4. Female stem, lateral view (× 18).
Figs. 5, 6. Inner perichaetial bracts (× 22).
Fig. 7. Inner bracteole (× 22).
Figs. 8, 9. Second perichaetial bracts (× 22).
Fig. 10. Second bracteole (× 22).
Fig. 11. Transverse section of perianth in upper fourth (× 22).
Fig. 12 Male spike, antical view (× 12).
Figs. 13, 14. Perigonial bracts (× 22).
Fig. 15. Cells from middle of leaf (× 265).

New Melastomaceae collected by Miguel Bang in Bolivia.

BY A. COGNIAUX.

MICONIA GLOMERULIFERA (sect. Cremanium); ramis obtuse tetragonis, junioribus petiolis paniculis calycibus foliisque subtus ad nervos brevissime denseque stellato puberulis; foliis longe petiolatis, anguste ovatis, obtusiusculis, basi rotundatis, margine integerrimis vel vix undulato subdenticulatis et brevissime subsparseque setuloso ciliatis, 7-nerviis, supra brevissime subsparseque setuloso-scabriusculis, subtus brevissime et densiuscule plumoso-puberulis; floribus 5-meris, sessilibus, minute glomerulatis; calyce late campanulato, breviter obtuseque 5-dentato; antheris apice biporosis.

Rami robustiusculi, juniores petioli pedunculique cinereo-fusci. Petiolus robustiusculus, 4–9 cm. longus. Folia rigidiuscula, supra intense viridia, subtus viridi-cinerea, 16–25 cm. longa, 8–13 cm. lata, nervis subtus valde prominentibus, nervulis numerosis subrectus satis ramulosis. Paniculae late pyramidatae, 12–13 cm. longae, ramis divaricatis, satis ramulosis. Calyx cinereus, 1.5 mm. longus et latus. Petala albescentia, latae obovata, apice retusa, 0.5 mm. longa. Staminum filamenta flexuosa, 1.5 mm. longa; antherae anguste obovoideae, 0.6–0.7 mm. longae. (No. 2856.)

MICONIA MICRANTHA (sect. Cremanium); ramis obtuse tetragonis, junioribus petiolis paniculisque vix furfuraceo-puberulis; foliis magnis, longiuscule petiolatis, ovato-oblongis, obtusiuscule breviterque acuminatis, inferne satis attenuatis basi acutis vel acutiusculis, margine vix undulato-denticulatis, et brevissime remoteque setuloso-ciliatis, 5-nerviis, utrinque glaberrimis; floribus 5-meris, minutissimis, breviter pedicellatis; calyce glabro, globoso-urceolato, brevissime obtuseque, 5-dentato; antheris apice biporosis; stigmate peltato.

Rami robustiusculi, juniores petioli pedunculique purpurascentes. Petiolus satis gracilis, 2–5 cm. longus. Folia membranacea, supra intense viridia, 12–20 cm. longa, 5–9.5 cm. lata, nervis subtus valde prominentibus, nervulis numerosis leviter prominentibus. Paniculae late pyramidatae multiflorae, 8–12 cm. longae; rami divaricati, acutiusculi-tetragoni, valde ramulosi; pedicelli 1–2 mm. longi. Calyx flavo-viridis, vix 1 mm. longus et crassus. Petala flavescentia, obtuse quadrata; apice truncata vel subemarginata; 0.5 mm. longa et lata. Staminum filamenta flexuosa, 0.5 mm. longa; antherae obovoideae; 0.3 mm. longae. Stylus crassus, 1.5 mm. longus. (No. 2858.)

MICONIA PLUMIFERA Triana, var. BANGII. Rami superne satis compressi, ad nodos longe barbati, caeteris tenuiter stellato-puberuli et setis longissimis subfasciculatis basi incrassatis subsparse hirsuti. Folia longe acuminata, supra tenuiter bulbata non vel vix strigosa, subtus creberrime minuteque foveolata et tenuiter stellato-puberula. (No. 2283.)

Obs.—Dans les *Monographiae Phanerogamarum* 7: 891, ou j'ai d'ecrit le type de cette espèce comme ayant une pétiole long de 5 à 7 cm.; mais d'après mes notes, dans l'exemplaire récolté par Pearce, qui se trouve á l'herbier de Kew, la plus grande feuille a une pétiole long de 18 cm.

MICONIA CYANOCARPA Naud. var. PARVIFOLIA Petiolus 7–17 mm. longus. Folia supra dense hirtella, subtus densissime breviterque villosa, 5–9 cm. longa, 2.5–4 cm. lata. (No. 2259.)

TIBOUCHINA MEMBRANIFOLIA (sect. Dictanthera); ramis obscure tetragonis, densiuscule-longe, adpresseque setosis; foliis lanceolatus, longiuscule acuminatis, basi acutis vel interdum subrotundatis, margine obscure remoteque denticulatis et ciliatis, 5-nerviis nervis lateralibus inferne longiuscule coalitis, utrinque longiuscule sparse adpressique setosis; calyce glanduloso, setis brevibus adpressis sparse vestito, lobis triangularibus, acutis, tubo dimidio brevioribus; staminibus glabris, satis inaequalibus, majorum connectivo basi breviuscule producta.

Rami graciles, cinereo-virides paulo ramulosi. Petiolus gracilis densiuscule adpressique setosus, 7–13 mm. longus. Folia tenuiter membranacea, supra intense viridia, subtus satis pallidiora, in eodem jugo satis inaequalia; majora 8–13 cm. longa et 18 32 mm. lata, minora 3–7 cm. lata et 8–18 mm. lata. Paniculae pauciflorae, foliosae, subcongestae; 2–4 cm. longae. Calycis tubus viridis, anguste campanulatus, 4 mm. longus lobi erecti, 2 mm. longi. Petala longiuscule ciliata. Staminum filamenta 4 vel 6 mm. longa; antherae leviter arcuatae, 4 vel 5 mm. longae, connectivo infra loculos 1 vel 2 mm. longi producto. Stylus gracilis, 8–9 mm. longus. (No. 2857.)

CALYCOPHYSUM PEDUNCULATUM Kars. et Triana var. VILLOSUM Rami cirrhri pedunculi calycisque densiuscule et breviuscule villosi. Petiolus longiuscule denseque villoso-lanatus. Folia supra densiuscule breviterque pilosa vix hirtella, subtus cinereo-canescentia breviter denseque villoso-lanata. Flores (imperfecte evoluti) ut videtur paulo minores. (No. 2244.)

Two new Genera of Saxifragaceae.

By John K. Small.

(Plates 256, 257.)

In the course of a study of the genus *Saxifraga*, several species now referred to it appear to be erroneously so placed. Repeated attempts to retain them where they were originally placed, or to transfer them to related genera have proved fruitless, and I confidently propose the two new genera here to be described.

Dr. Torrey remarks on *Saxifraga Parryi*, in the Botany of the Mexican Boundary Survey and others elsewhere to the same effect, that it is "a remarkable species, with the calyx and habit of a small *Heuchera*, but it is decandrous and the ovary is wholly free as well as two-celled." I make this species the type of a new genus.

JEPSONIA.

Slender acaulescent slightly pubescent herbs, perennial by corms. Leaves (usually vernal) all basal, suboricular in outline, cordate, petioled, slightly lobed and toothed; scapes (usually autumnal) wiry, simple or branched above; flowers in terminal cymes or cymose panicles; calyx campanulate with a flat base, its edge five-toothed; petals five, inserted just below the sinuses of the calyx; stamens ten, inserted on the calyx tube below the petals; filaments subulate, the alternate ones longer and slightly surpassing the calyx; ovary two-celled, free from and partially filling the calyx, its carpels united to about the middle; placenta central; follicles united at the base, tipped by the straight slender styles which diverge at an angle of about ninety degrees; stigmas peltate; seeds irregular in outline, ribbed and crested, with a pinched and curved base; embyro minute, erect in one end of the endosperm.

Leaves sub-orbicular, broader than long; calyx-teeth shorter than the tube.
1. J. Parryi.

Leaves ovate-orbicular, longer than broad; calyx-teeth as long as the tube, or longer.
2. J. malvaefolia.

1. Jepsonia Parryi (Torr.).

Saxifraga Parryi Torr. Bot. Mex. Bound. Surv. 69. *pl. 25.* 1859.

Perennial by an ovoid fleshy corm, scapose, wiry, sparingly pubescent throughout. Leaves (appearing in the spring) all basal, suborbicular in outline, 2–2.5 cm. in diameter, cleft into seven crenately toothed crenate lobes, cordate, slightly pubescent on both surfaces, on petioles about equalling the blade; scapes (appearing in late summer or fall) usually two or four together, rarely solitary, erect, 4–25 cm. tall, simple or branched above; flowers few in a terminal cyme or cymose panicle; calyx campanulate with a truncate base, 4–6 mm. high, marked with ten brown branching nerves, its five triangular obtuse teeth about one-half as long as the tube; petals white with brownish or purple nerves, elliptic-oblong or elliptic-lanceolate, sometimes nearly ovate, 4–6 mm. long, about as long as the calyx, obtuse; stamens ten, the alternate ones longer, inserted on the calyx-tube above the middle (below the petals); filaments slender, subulate; follicles 7–9 mm. long, united at the base, the body nearly included in the calyx, the slender tips surpassing the calyx and diverging at right angles; seeds small, dull-brown, 1 mm. long, irregularly oblong, provided with two ribs and two crests. (Plate 256, copied from Bot. Mex. Bound. Survey.)

Original locality, "Dry Hills near San Diego and San Luis Rey, California." Found later near San Diego (Orcutt, 1885); Ione, Amador County (Parry, 1887). Flowering in November and December.

2. Jepsonia malvaefolia (Greene).

Saxifraga malvaefolia Greene, Bull. Torr. Club, 19: 121. 1882.

Original locality, "Santa Rosa Island." Found later on Santa Cruz Island.

These two remarkable plants form a very distinct and natural genus. They are strikingly different from any species of *Saxifraga* in habit and the flower affords good characters. The calyx is simply toothed instead of cleft or parted, the petals and stamens are inserted in the upper part of the calyx-tube and not down where the ovary and calyx meet. The ovary fills but a small part of the calyx-tube and its stigmas are peltate and conspicuous, opposed to the capitate and inconspicuous ones in *Saxifraga*, the seed with its pinched and twisted base, its ribs and crests, has no parallel in related genera.

SAXIFRAGOPSIS n. gen.

Low caulescent caespitose, sparingly glandular-pilose plants perennial by woody rootstocks. Stems straw-like, rather slender not fleshy, sparingly leafy; leaves alternate, membranous the blade articulated to the petiole and not decurrent;

petiole wiry, dilated into a scarious ribbed base; inflorescence consisting of a terminal thyrsoid-panicle, its cymules peduncled; subtended by small bracts; pedicels usually bearing several opposite or nearly opposite bractlets below the flowers; flowers white, rather crowded; calyx hemispheric, its tube ribbed, united to the ovary, its segments five, unequal in size and shape, reflexed; petals five, inserted just below the sinuses of the calyx tube, long-clawed, at length deflexed; stamens ten, converging; filaments inserted at the bases of the calyx segments, dilated below into two thin wings; anthers ovoid-sagitate or broadly-oblong-sagitate, four-angled especially when old; ovary very short when young, soon elongating, immersed in a red glandular disk; placenta central; follicles slender, the bodies united, the tips erect; seeds minute, smooth, somewhat curved.

1. Saxifragopsis fragarioides (Greene).

Saxifraga fragarioides Greene, Bull. Torr. Club, 8: 121. 1881.

Rootstock horizontal, stout, woody, 1-15 cm. long, covered by the dilated, membranous bases of old petioles; stems somewhat scape-like, erect or ascending, 1-3 dm. high, strict or flexuous above, bearing several leaves which are smaller but otherwise similar to the lower ones; leaves thin, cuneate or cuneate-obovate, 1–5 cm. long, rounded and coarsely toothed at the apex entire below the middle, sparingly ciliate, dark green above, paler beneath, marked with several palmately radiating nerves, obtuse at the base, on slender petioles 2–3 cm. long, flowers greenish, 6 mm. broad, in dense panicled cymules whose branches are subtended by linear entire or toothed bracts; calyx hemispheric, its tube united to the overies, its segments longer than the tube or at length shorter, ovate, ciliate, obtuse, reflexed when dry; petals oblong-spatulate or spatulate, persistent, ⅓ longer than the sepals; at length reflexed; filaments filiform-subulate; follicles narrowly conic, 6–7 mm. high, red, united only ⅓ from base, the summits erect; seeds oblong or obvoid, .5 mm. long, smooth. (Plate 257.)

Original locality, " High mountains west of Mt. Shasta, California."

High altitudes in the mountains of Northern California and Southern Oregon; Cliffs overhanging Castle Lake, Siskyiou county, California and top of the Siskyiou Mountains near Waldo, Oregon.

Carex vulpinoidea Michx. and allied Species.

BY E. P. BICKNELL.

A careful study of *Carex vulpinoidea* Michx., continued from the field into the herbarium, has made it plain to me that this species, as accepted, is a composite one, embracing at least three or four distinct plants on our eastern seaboard alone. One of these plants is an old species, here revived—the *Carex setacea* of Dewey, which I am satisfied should never have been discredited; it will be recalled that it was endorsed by Dr. Torrey. The other two seem never to have been distinguished, and reference to all the citations in the published synonomy of *C. vulpinoidea* discovers no name applicable to either.

CAREX VULPINOIDEA Michx.

Culm 1½°–2½° tall (1°–3°), sharp-angled, very scabrous on the angles above, or throughout, leafy. Leaves long and narrowly attenuate, mostly exceeding the culm, 1°–2° long, 1″–2″, sometimes 2½″ wide, often somewhat appressed and crowded. Head at maturity greenish or dull brown, narrow, commonly 1½′–3′ long, 2″–3″ wide, the spikelets below either in contiguous or separated compound clusters or in short, appressed or ascending densely-flowered branches which often appear like oblong or linear spikes; larger spikelets narrowly oblong, the smaller subglobose. Small forms of the plant show the spikes aggregated into linear heads only 1½′–2′ long; in more attenuate forms the heads may be much interrupted and elongated, even slender and inclined, reaching a length of six inches, the lower branches an inch or more distant on the rachis. Occasionally in stout forms the head is much congested throughout and 4″–6″ wide; rarely it is looser and bears at the base closely compound ascending branches an inch in length. All the clusters of the head are subtended by setaceous, often flexuous bracts, the lowermost usually well-developed and elongated, even 8′ long. Perigynia very small, numerous, loosely spreading, the conspicuous points often somewhat recurved, at maturity greenish or pale brown, sometimes yellowish-brown, membranous, flattish, mostly distinctly few-n rved on the outer face, frequently nerveless on inner face, ovate, often from a dilated or sub-cordate base, acuminate into a mostly slender, smooth to serrulate-hispid, sharply-toothed beak which usually equals or nearly equals the body of the perigynium; body of perigynium ½″–¾″ long and wide, more or less corky in the margins basally or at the sides. Achene broadly ovate-oblong, small, ½″ or less long. Scales small, whitish with a green keel, becoming pale dull brown or sometimes yellowish-brown, little noticeable in the spikelet excepting their awns which, though not usually conspicuous, are evident and, with their spreading points of the perigynia, give the heads a sharply roughened appearance.

In low grounds and meadows, and along ditches, often growing in dense tufts. Canada to Florida and Texas, west at least to Minnesota and Kansas.

CAREX XANTHOCARPA n. sp.

Culm longer and often stouter than in *C. vulpinoidea*, 1½°–4° tall (1°–5°), much exceeding the leaves, scabrous on the angles above, very smooth and bluntly triangular or even subterete below. Leaves fewer and less crowded and appressed than in *vulpinoidea*, mostly under 1° long, rarely 1½°, 1½″–3″ wide. Head early yellowish or tawny, narrowly oblong, sometimes ovoid, mostly dense and uninterrupted, ¾′–2¼′ long, 3″–6″ wide, the spikes closely glomerate-subcompound throughout, or the lowermost more distinctly compound and looser, but not separated, forming ovoid, somewhat spreading clusters. Bracts mostly short and inconspicuous, the lowermost not often noticeably developed. Spikes plump, ovoid, densely many-flowered, the perigynia ascending, often slightly incurved, finally somewhat spreading, becoming bright yellow, markedly plano-convex and narrowly sharp edged, mostly ovate-elliptic from a cuneate pointed base, or sub-rhomboidal (those low in the spikes sometimes with a broader, more abrupt base), nearly beakless, or graduated into a short, very rough-margined, minutely two-toothed beak. Walls of the perigynium thickish and subcoriaceous, but not corky-thickened in the margins, either nerveless or obscurely few-nerved on the somewhat turgid outer face, often with a median ridge on the flat inner face; body of perigynium about twice as large as in *vulpinoidea*, 1″ or more long, 1″ or less wide. Achene broadly oblong, about ¾″ long. Scales longer than in *vulpinoidea*, but shorter awned, early becoming bright tawny or yellowish-brown and very noticeable in the spikes.

Scarcely tufted, growing in low fields or in open levels on higher ground.

In the cover of *C. vulpinoidea* in the Columbia Herbarium, I find specimens as follows:

Cambridge, Mass., 1845, E. Tuckerman, Jun.

Ohio, Sullivant.

The plant is common at New York and is unmistakable when once it is understood. Not infrequently it is found growing with *C. vulpinoidea*, from which it is clearly distinct.

CAREX XANTHOCARPA ANNECTENS n. var.

Lower and more slender than *C. xanthocarpa*, 1½°–3° tall; culms trigonous, scabrous above, smooth and sometimes subterete below, exceeding the leaves. Leaves mostly 6′–1° long, often very narrow, 1″–2″ wide. Head short, ¾′–1½′ long, 3″–4″ wide, green, varying to dull yellowish or greenish-tawny, the spikes noticeably bracteate, the lowest bract frequently exceeding the head. Spikes globose to ovoid-oblong, mostly distinct and loosely aggregated below the apex of the head, or the lowest, or lower two or three, slightly separated, either all simple and distinct or the lower subglomerate with smaller spikelets at their bases. In small forms the head may consist of only 6–8 globose more or less distinct spikes. Spikes relatively few-flowered, the perigynia finally loosely spreading, mostly exceeded by the awns of the scales, which gives the head a somewhat bristly appearance. Perigynia dilated-ovate or suborbicular (rarely narrower) mostly from a broad base, narrowed or abruptly contracted to the short rough-margined beak, sometimes slightly corky in the edges, few-nerved in the middle of the outer face, often broader than long, the body 1″ or more broad, 1″ or less long. Achene broadly ovate-oblong or suborbicular, nearly truncate at base, ½″ or more wide.

About damp thickets in low grounds and in moist woods.

Common at New York. In the Columbia College Herbarium are specimens from Staten Island (Britton) and North Carolina (Curtis).

In the present state of our knowledge of it this is a very puzzling plant. It has an aspect of its own, which makes it easy to recognize in the field, so far as I have observed it, yet certain herbarium specimens suggest that it shades into reduced forms of *xanthocarpa.* I have seen no specimens which were not clearly separable from *C. vulpinoidea*, although the general appearance of the head is often closely similar. Smaller forms having heads of few simple spikes sometimes bear a singularly close resemblance to *C. Mulenberghii enervis.*

The plant differs from *C. xanthocarpa* mainly in simpler, looser and more bracteate, greener heads, more loosely-flowered spikes with spreading perigynia, longer-awned, paler scales which appear more bristly in the spikes, broader and more greenish perigynium, broader achene. From *vulpinoidea* it differs in shorter leaves, longer culm, shorter and simpler heads, larger and broader perigynium, with much shorter and rougher beak, larger achene.

I suspect that a better knowledge of this plant will show that it is sufficiently individualized to stand as a species.

Carex setacea Dewey.

Culm 1 ½°–4° tall, mostly exceeding the long leaves, trigonus, often with concave sides, sharply serrulate-scabrous on the angles above, smooth below. Leaves 1°–2° long, 1′–3′ wide. Head about 2′ long (1 ½′–2 ½′), 3″–5″ wide, silvery-green to chestnut brown, mostly narrow with much broken outlines, often with short ascending branches at the base. Spikelets mostly ovoid-oblong, those terminating the branches sometimes attenuate and loosely flowered at the base, simple and crowded above, becoming somewhat alternate and glomerate-clustered or compound below, the lowest cluster sometimes separated. Head throughout either setaceously short-bracteate, the lowest bract not more prominent than those above, or all the bracts short and inconspicuous. Spikelets rather densely flowered, chaffy, the scales conspicuous, nearly concealing the appressed to subspreading perigynia. Perigynia lanceolate, graduated from a truncate base into a narrow beak, and smooth and nerveless or nearly so (*setacea*), or elliptic-lanceolate to ovate, with less abrupt base and short beak and mostly somewhat wrinkled-nerved (*C. scabrior* Sartwell), 1 ¼″–1 ½″ long, ½″–¾″ wide, the edges of the beak strongly serrulate or subaculeolate hispid. Achene larger than in *vulpinoidea.*

As compared with *vulpinoidea* the perigynium is without corky-thickened margins, and is more evenly graduated into a much rougher beak; the scales are larger, giving a chaffy appearance to the spikes, and are silvery-hyaline (*scabrior*) or becoming chestnut (*setacea*), in contrast with the smaller greenish-white or yellowish-brown scales of *vulpinoidea*, and are mostly more acuminate into a more delicate awn; the lower bract of the head is never much elongated or foliaceous, and altogether the head has a distinctly different appearance. I feel assured that a close acquaintance with this plant in life and a full series of specimens would only serve to emphasize its distinctness from *C. vulpinoidea.*

The description of *Carex setacea* here given is drawn to include the *Carex scabrior* of Sartwell. A type specimen of the latter (Carices Americae Septentrionalis. H. P. Sartwell, M. D., No. 72) is in the Herbarium of Columbia College, and the plant is well figured among Boott's illustrations of *C. vulpinoidea* (Ill. *pl. 409*). With this guidance I have been able without any hesitation to refer to *scabrior* rather than to *setacea*, a specimen collected at New

York. While it would be ill advised to propose a revival of *C. scabrior* on the evidence at command, attention may well be drawn to the very probable distinctness of the two plants.

Two Californian Saxifrages.

SAXIFRAGA FALLAX.

Perennial, fibrous-rooted, propagating by abundant subterranean short rhizomatous offsets; stem scapiform, 8–12 inches high, loosely cymose-paniculate at summit, the whole minutely and sparsely glandular-hispidulous, but with no villous hairs; leaves thin, ovate or oval, subcordate, or truncate at base, saliently toothed or only repand; calyx very deeply cleft, the segments reflexed; petals white, obovate-oblong, obtuse, emarginate; filaments very short; anthers green; mature carpels divergent almost from the base.

A northeast Californian and subalpine ally of the widely distributed *S. Californica*, differing from that in its short subterranean offsets, its emarginate petals and almost completely divergent carpels. I have it only from Lassen's Peak, where it was collected by Mrs. Austin long since, and from above Donner Lake, where I obtained it last summer.

SAXIFRAGA APRICA. *S. umbellulata* Greene, Eryth. 1: 222. The name first assigned to this small, but common and well marked species of sunny exposures near the crest of the Sierra, must yield to the much earlier *S. umbellulata* of Hook. f. & Thoms.

EDW. L. GREENE.

Proceedings of the Club.

ANNUAL MEETING, TUESDAY EVENING, JANUARY 14TH, 1896.

The President occupied the chair and there were 39 persons present.

The following were elected active members: Miss Mary Edgar, Mr. S. Sidney Smith, Mrs. S. Sidney Smith, Miss Mary Appleton, Miss Mary Farley, Miss Laura H. Knupfer, Mr. C. L. Allen, Mr. B. A. Gilbert, Mr. Per Axel Rydberg, Mr. Oliver A. Farwell.

The Finance Committee reported through the Secretary that no business had been before them for transaction during the year.

The Committee on Admissions reported that 41 nominations had been referred to them during the year and all had been reported favorably.

The Instruction Committee reported upon the classes in Anatomy and Morphology, conducted by Dr. Jelliffe during the past summer.

The Herbarium Committee reported a great improvement effected in the condition of the herbarium, as well as an increase in its size during the year.

An interesting general report was made by the Field Committee.

Upon the nomination of the Secretary, Miss Southworth (now Mrs. V. N. Spaulding) was elected a corresponding member.

A communication was read from the Pharmaceutical Era, offering to print abstracts of the proceedings of the Club if the Secretary would furnish the same. The proposition was unanimously approved.

The Treasurer reported the most prosperous year in the Club's history, the total receipts having been $1,885.55, and a balance on hand of $35.02. The Buchanan fund, with accrued interest, now amounts to $493.18.

The Recording Secretary reported the most prosperous year in the history of the Club, the active membership being 191 ; total membership 335, a net gain of 15 for the year. The average attendance had been 41, number of important scientific papers 21, of which 15 had been published.

The Corresponding Secretary reported having attended to all the general correspondence of the Club during the year.

The Editor reported the publication of 522 pages of BULLETIN and 85 pages of MEMOIRS, with a large number of illustrations.

Under election of officers, Mr. Le Brun was unanimously instructed to cast an affirmative ballot for the reëlection of all the officers of the preceding year, with the exception of Dr. Wheelock to succeed Miss Southworth (removed to Michigan) as Librarian, and Miss Ingersoll to succeed Miss Rogers as Curator, Miss Rogers desiring to be relieved. This action having been taken, the following officers were declared elected for the ensuing year :

OFFICERS FOR 1896.

President, Hon. Addison Brown; Vice-Presidents, T. F. Allen, M. D., L. H. Lighthipe; Recording Secretary, Henry H. Rusby, M. D., College of Pharmacy, New York City; Corresponding Secretary, John K. Small, Columbia College, New York City; Treasurer, Henry Ogden, 11 Pine street, New York City; Editor, N. L. Britton, Ph. D., Columbia College, New York City; Associate Editors, Emily L. Gregory, Ph. D., Arthur Hollick, Ph. B., Anna Murray Vail, Byron D. Halsted, Sc. D., A. A. Heller; Curator, Miss Helen Ingersoll; Librarian, Wm. E. Wheelock, M. D.

The announced paper of the evening on "The Anatomy of the Leaf of *Solidago pauciflosculosa*," by Miss Alice M. Isaacs and Miss Marian Satterlee, was then read by Miss Isaacs. The paper was illustrated by colored charts and specimens, and was discussed by the President, Dr. Gregory, Dr. Britton, Prof. Burgess and others. It will be printed in a subsequent issue of the BULLETIN.

Dr. Rusby remarked on cases of poisoning of horses, apparently by fungi growing upon golden rods.

Among the visitors present were Dr. D. Morris, the assistant director of the Royal Gardens at Kew, and Mr. E. P. Sheldon, of the University of Minnesota, both of whom, in response to invitations, favored the Club with interesting remarks.

Mrs. Britton exhibited a copy of the recent work by Prof. Douglas H. Campbell on Ferns and Mosses, and spoke in praise of the book.

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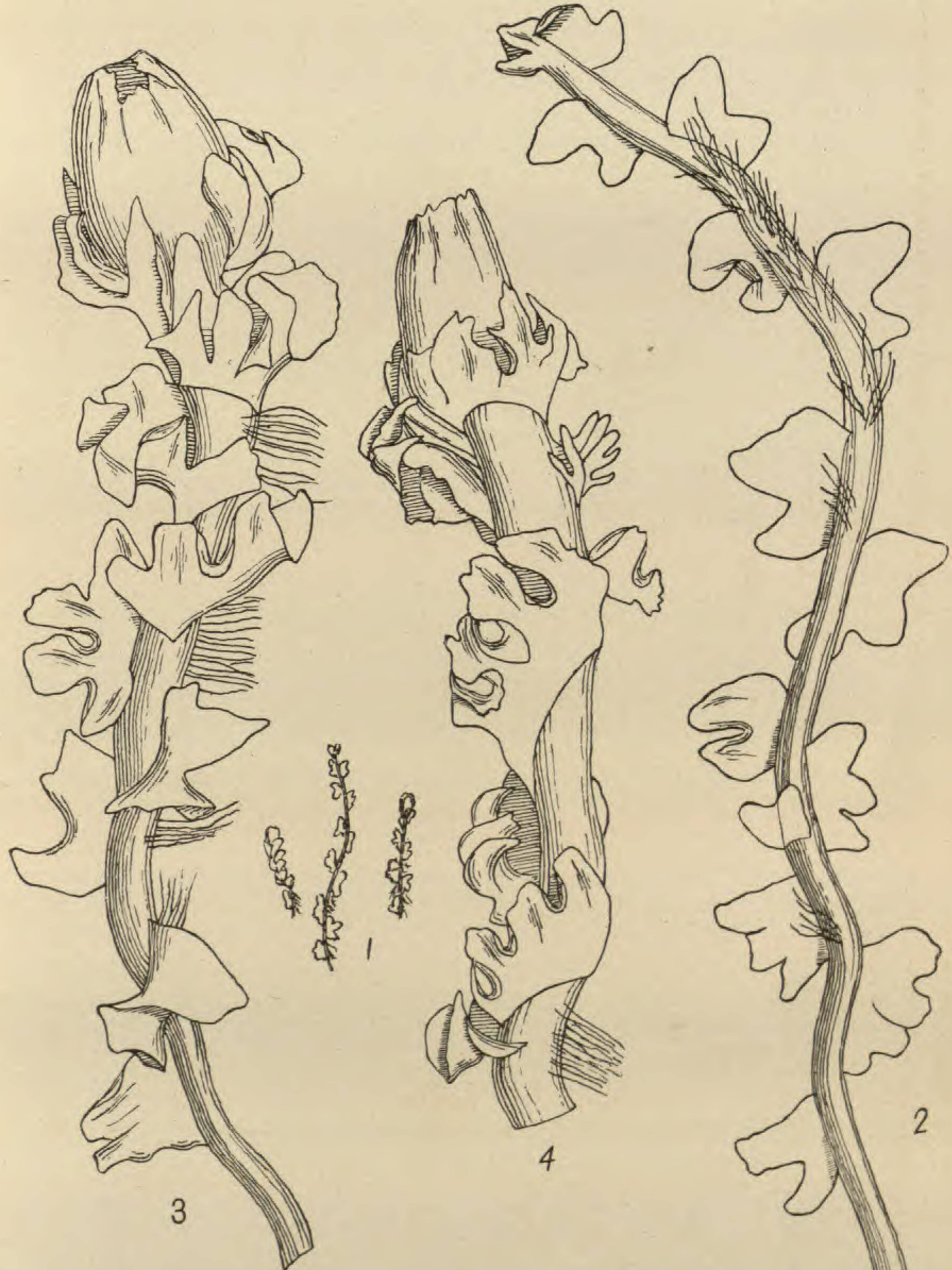

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The Club meets regularly at Columbia College, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

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BULLETIN

OF THE

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Vol. 23. Lancaster, Pa., February 29, 1896. No. 2.

Drink Plants of the North American Indians.

By Dr. V. Havard, U. S. A.

These plants may be considered under three heads:—

1st. Those yielding alcoholic liquors.

2d. Those yielding stimulating, exhilarating or intoxicating principles other than alcohol.

3d. Those furnishing palatable juices, or, by infusion, pleasant beverages more or less used to quench thirst.

As foreign to my purpose, I shall exclude all plants from which drinks are prepared only for medicinal uses.

1. Plants yielding alcoholic liquors.

All authorities substantially agree that American Indians, north of Mexico, had not acquired the knowledge of preparing alcoholic drinks at the time of the landing of Columbus, and that, whatever their vices may have been, they were free from that of drunkenness. Thus the missionary priest Gabriel Sagard, in his History of Canada (1636), after inveighing against intemperance, says:

"Our savages, in their feasts, are, thank God, free from such misfortune, for they use neither wine, beer nor cider; if any one among them asks for a drink, which very rarely happens, he is offered fresh water, not in a glass, but in a dipper or off the kettle itself from which he freely drinks and is thus saved from drunkenness, a great blessing to the body and soul, for it is likely that if they had wine they would become as intemperate as ourselves."

In Mexico, the Maguey (*Agave Americana*) has been cultivated from time immemorial for the abundant sap, or aguamiel, which collects in the cavity made in the heart of the plant by the removal of the young central leaves and is then fermented into pulque, the national drink of Mexico. Pulque smells much like half turned buttermilk, but is cooling, refreshing, nutritious and stimulating. It contains 3 to 4 per cent. of alcohol and is therefore about as strong as beer. The historian Sahagun says that long before the conquest, the use and abuse of pulque were so general that one of the Aztec kings forbade the sale of it and punished drunkenness with death. The Mexican liquor, mescal, or vino mescal, manufactured by distillation from the baked, pounded and fermented heads of several species of *Agave*, was unknown to the Aztecs, who like other American aborigines were ignorant of distillation, an art introduced from Europe. They only knew the first part of the process, how to macerate and boil the baked heads in water and ferment the decoction, so as to obtain a sort of "mescal beer" which, however, does not appear to have been a popular beverage.

The discovery, in some parts of Mexico, of crude stills constructed of native material, has led some authors to think that distillation may have been practiced on this continent before the coming of Columbus, but there is no ground for such belief in the accounts of the first explorers nor in the Indian traditions.

Agave Americana does not grow naturally north of Mexico. Of our few native species of *Agave*, none produce the abundant sap necessary for the making of pulque, and they are mostly used for food purposes. The Indians of Arizona and New Mexico, however, according to Col. Cremony, who lived several years among them before our Civil War, knew then how to prepare "mescal beer" from the heads of *Agave Parryi* and *A. Palmeri*.

According to Oviedo and Von Humboldt, maize was used in the religious rites of both Mexicans and Peruvians, and sugar procured from it, as well as a vinous liquor called chicha, "drunkenness having already become frequent under the Aztec dynasty." How much of this drunkenness is attributable to chicha and how much to pulque would be difficult to determine. It is probable enough that both beverages were important factors in the demoralization and degeneration of the Aztecs which enabled Cortez, with a handful of men, to conquer the whole empire of Montezuma.

The cultivation of Maize, as we know, spread rapidly northward from Mexico, so that even before the days of Columbus it was the principal crop of all the agricultural Indians from the Rio Grande to the St. Lawrence and from the Atlantic to the Colorado of the West. Considering the abundance of corn among our Indians, and their craving for all intoxicants, it seems almost incomprehensible that the primitive and very simple art of making corn beer should never have found its way north of the Rio Grande.

For several generations, the Apaches of Arizona and New Mexico have been known to prepare from corn an alcoholic drink which they called tizwin or tulpi. They are extremely fond of it and have ignored or defied all ordinances for its suppression ; tizwin formerly figured prominently in all their ceremonial dances which were generally preceded by a long fast in order the better to experience its full intoxicating effects. It is one of the strange circumstances of this obscure subject that the Apaches have always been nomadic, hunting and plundering Indians, seldom planting any vegetables and always more inclined to steal corn than to raise it. On the other hand, their agricultural neighbors, the Pimos, Papagos and Pueblo Indians, with always plenty of maize in stock, do not seem to have indulged in tizwin although they must, of course, have known its preparation and effects; their abstinence was probably a matter of indifference, perhaps of principles ; caring less for intoxicants than the roving and murderous Apaches, they had not yet developed a taste for it.

I am unable to determine the exact time when the Apaches began the manufacture of tizwin ; the first explorers of California, Arizona and New Mexico say nothing about it or any other alcoholic drink. I am informed by an army officer, stationed at the San Carlos agency, Arizona, that the old men of the tribe say that it began long before their time, that their fathers learned it from the Chiricahuas (then dwelling on the Mexican border), who themselves learned it from the Mexicans. But it seems impossible that this knowledge should have reached the Indians of Arizona, before the conquest of Mexico, without spreading to all or most agricultural and corn-raising Indians, so that, in the absence of more positive information, we may assume that it was obtained from the Mexicans, or Mexican Indians, who towards the end of the last or the beginning of this century traded among the tribes north of the Gila river, or were carried into captivity to their rancherias. This assumption is strengthened by the fact that the Apaches are of northern origin, and that none of their many tribes ever lived in Mexico. From the Mexicans, likewise, and at about the same time, in my opinion, came the knowledge of the other alcoholic beverages prepared by our southwestern tribes.

It is worth noting that at the only part of the American continent trodden by the foot of Christopher Columbus, namely the coast of Venezuela, the great discoverer observed and recorded the two alcoholic drinks used by the natives; they were the same as in Mexico, one prepared from corn, the other from the Maguey.

The most striking botanical feature of southwest Arizona and northern Sonora, as well as one of the wonders of the vegetable world, is the far-famed Giant Cactus (*Cereus giganteus* Engelm.), the Suhuara or Pitahaya of the Mexicans, a fluted column 30 to 50 feet high, crowned, in season, with handsome pink flowers. The fruit is two to three inches long, full of a rich crimson pulp of fine flavor and a great dainty to the Indians and Mexicans of the region. From it they prepare a clear light-brown syrup which is used as a substitute for sugar, and a fermented liquor having the taste and smell of sour beer, although somewhat stronger. The still larger and sweeter fruit of *Cereus Thurberi* Engelm. or Pitahaya dulce of Sonora and Lower California, is used for the same purposes. According to Colonel Cremony, already quoted, "It is upon this liquor that the Pimos, Maricopas and Yumas get drunk once a year, the revelry continuing for a week or two at a time; but it is also a custom with them to take regular turns so that only one-third of the party is supposed to indulge at a time, the remainder being required to take care of their stimulated comrades and protect them from injuring each other or being injured by other tribes."

The fruit of several species of *Opuntia*, especially *O. Tuna* Mill. and *O. Ficus-Indica* Haw., has also been used by Mexican Indians to make an intoxicating drink, called colonche, with a pink color and the taste of hard cider. They peel and then press it; the juice is passed through straw sieves and placed by the fire or in the sun where it begins to ferment in about an hour. We also have species of *Opuntia* available for the purpose in our southwestern territory but I am not aware that they ever were utilized in this way.

Several species of *Yucca*, notably *Y. baccata* Torr., *Y. macrocarpa* Coville and *Y. Treculeana* Carr., of our southwestern territory and northern Mexico, bear a fleshy, banana-like fruit which is delicious when ripe. It contains a large proportion of sugar and is easily converted by the Chihuahua Indians into a fermented beverage which is sometimes distilled by the Mexicans into indifferent aguardiente.

The Mezquite (*Prosopis juliflora* DC.) is by far the most common tree or shrub of the immense desert tracts drained by the Rio Grande, Gila and Lower Colorado, as it is the most useful to their inhabitants, supplying both food and fuel. The fruit is a bean-like pod containing more than half its weight of nutritive principles, especially sugar in the proportion of 25 to 30 per cent.; when cooked, pounded, mixed in water and strained, it yields a very nutritive and pleasant beverage called "atole;" this readily undergoes fermentation whereby a kind of beer is produced, formerly much used by the Colorado and Gila River Indians.

Another species of Prosopis (*P. pubescens* Benth.), called Screw Bean or Tornillo and also very abundant in the same region, bears likewise a very saccharine fruit used in the same way.

This ends the list of plants yielding alcoholic liquors. It appears that the only United States Indians preparing these liquors were those of our southwestern border. The most obvious reason for this geographical peculiarity is that these Indians have always had relations with the Mexican natives and were visited at a very early date by white men; thus Arizona and New Mexico were pretty thoroughly explored by Spaniards before Hudson entered the Bay of New York or the May Flower landed at Plymouth Rock.

We might perhaps account for the ignorance of our eastern Indians concerning "corn beer" which, after all, is only a vile beverage, but we may well wonder at their failure to make wine.

To say nothing of our many kinds of berries, more species of Grapes grow in this country than in all the rest of the world and, for many tribes, must have been a staple food; again, nothing is easier than to make wine, the process consisting merely in pressing out the juice and letting it ferment. It is strange indeed they should not have stumbled upon it.

2. Plants yielding stimulating, exhilarating or intoxicating principles not alcoholic.

While stationed on the Rio Grande, west of the Pecos, my attention was drawn to a plant, called Peyote, which appears to possess remarkable properties. It is *Anhalonium Engelmanni* Lem. (*A. fissuratum* Engelm.), a napiform, tuberculous cactus, 2–3 inches long and hardly rising above ground. Mexicans cut it into slices which are kept dry for medicinal purposes, being commonly used in fevers. It is principally as an intoxicant, however, that it has become noted along the Mexican border, being eaten raw or added to native tizwin to make it stronger. It is said that Indians or Mexicans partaking of this adulterated tizwin become temporarily crazy and uncontrollable.

Closely related to *Anhalonium* is the genus *Lophophora* recently separated from it by Prof. Coulter. *L. Williamsii* var. *Lewinii* Coult. (*Anhalonium Lewinii* Hennings) is a small hemispherical cactus, 2 to 3 inches wide, with the tubercles in 13 sinuous ribs, and covered above with silky hairy tufts. It is found in barren rocky soil along both sides of the lower Rio Grande and southward. It is said to be the Peyote or Peyotl of northern Mexico, and to possess rather ill-defined deliriant or intoxicant properties whether used alone or added to native drinks.

The "tops," under the name of Mescal Buttons, have been the subject of more or less investigation. Lewin and Heffter found in them several alkaloids and at least two resinous substances, the latter being the active principles. An alcoholic extract, according to Lewin, produces in animals symptoms almost identical with those caused by strychnine, being in small doses a cardiac and respiratory stimulant.

Very different, however, were the results of careful experiments made by Dr. Prentiss and Dr. Morgan of Washington who found that the chief physiological effect was the production of beautiful colored visions in an ever-changing and brilliant picture; it was attended with wonder and admiration, but no merriment, delirium or intoxication. The Kiowa Indians were formerly much addicted to the use of this plant in their religious ceremonies when dwelling on the Rio Grande and, although now living in the Indian territory, have not yet given it up. Each Indian chews and swallows 10 or 12 buttons at intervals between sundown and morning and then sits quietly for a day or two enjoying the pleasurable effects of the drug.

It is impossible to reconcile the results of Lewin with those of Prentiss and Morgan, and I am inclined to believe that they worked with different plants. Further experiments are much needed with all species of *Anhalonium* and *Lophophora*.

According to H. H. Bancroft, Mexican Indians used various herbs and roots to make their drinks more intoxicating, the most powerful of which "was a kind of mushroom which excited the passions and caused the partaker to see snakes and divers other visions."

In Lower California the Indians, says the same author, "found drunkenness in the fumes of a certain herb smoked through a stone tube and used chiefly during festivals." This herb was doubtless a species of *Datura*. According to Dr. Palmer, the California, Colorado River and Payute Indians prepare a beverage from the leaves and seeds of *Datura meteloides* which excites, intoxicates, and then stupefies them. It was also added to alcoholic drinks to render them more effective. The same species is the *Toloachi* of southern Texas and northern Mexico, a name also applied to the Mexican *D. quercifolia* H.B.K., and perhaps other species. The *Toloachi* has marked deliriant properties and is credited, in the popular mind, with having caused the insanity of the unfortunate empress Carlotta.

Another well-known plant which may be mentioned here is *Sophora secundiflora* Lag., the Frijolillo of Texas. The red bean-like seed contains an alkaloid, sophorine, a strong irritant-narcotic poison. According to Bellanger, the Indians near San Antonio formerly used it as an intoxicant, half a bean producing "delirious exhilaration followed by a sleep which lasts 2 or 3 days," and it is asserted that a whole bean would kill a man. I am not aware however that it was used in infusion or decoction, or added to other drinks, although this is likely enough, the bean being very hard and difficult to chew.

The most interesting plant of this class is doubtless *Ilex Vomitoria* Aiton (*I. Cassine* Walt.), the Cassine or Yupon of our southern Indians. It is a handsome evergreen shrub or small tree with thick elliptical leaves about an inch long, crenate-serrate, very obtuse, and small bright red berries. It grows near salt water, never very far in the interior, from Virginia southward along the whole east and west coasts of Florida and the Gulf coast, to the Colorado river of Texas.

Prof. Venable, of the University of North Carolina, in 1883 found in the dried leaves 0.27 per cent. of caffeine. In a previous investigation he had found 0.32 per cent. He also determined that the leaves alone contain this alkaloid and that the two botanically allied species, *I. opaca* and *I. Cassine* L. (*I. Dahoon* Walt.) are entirely destitute of it. The only other kind of *Ilex* containing caffeine appears to be *I. Paraguayensis* St. Hil. of South America, the Paraguay tea or mate of Brazil which, according to Peckolt, averages 0.50 per cent. of the alkaloid.

Long before the advent of the whites, our Southern Indians were in the habit of drinking a decoction of the leaves of this plant, as testified by all early explorers. This decoction or "black drink," as it was called from its color, was used not only by all the coast Indians from Carolina to Florida and Texas, but also by the Indians of the interior on both sides of the Mississippi, the leaves being an important article of trade. It was prepared by thoroughly boiling in water the carefully toasted leaves, then allowing to cool, meanwhile stirring up briskly or pouring it from one bowl to another until it became frothy. Dr. E. M. Hale who gathered much information on the Cassine (Bull. no. 14, U. S. Depart. of Agriculture, 1891), and who appears somewhat biased in its favor, says:

"In my experiments I find that an infusion of cassine leaves with boiling water, after standing till cool, gives a scarcely perceptible taste and slight odor. This infusion, if boiled for half an hour, gives a dark liquid, like very strong black tea, of an aromatic odor, *sui generis*, not like coffee, but more like Oolong tea without its pleasant rose odor. The taste is like that of an inferior black tea, quite bitter, but with little delicacy of flavor. It is not an unpleasant beverage, and I can imagine that the palate would become accustomed to it, as to mate, tea or coffee."

We may then assume that the "black drink" was a weak coffee or tea with a large admixture of tannin, and free from intoxicating effect. It also appeared to contain an ingredient with decided sudorific and diuretic properties.

Wm. Bartram in his "Travels in Florida" (1792), tells of his feasting with the Indian king of Apalachicola, spending the greater part of the night "in drinking cassine and smoking tobacco." He describes the ceremonious presentation of the conch-shells full of "black drink" to the king and his guests, but prudently abstains from expressing any judgment on the quality of the beverage. It does not appear to have been liked by the explorers to whom the hospitable Indians always offered it. Jean Ribault (1666) says: "I tasted it and did not find it very bad," which is faint praise. Dominique de Gourges (1567) "pretended to drink it but swallowed none of it."

It is likely enough that the Indians had several methods of preparing it, sometimes, for purposes of conviviality, making the decoction rather weak, but at religious festivals making it very strong and doubtless adding other ingredients, such as the Button Snakeroot (*Eryngium aquaticum*) and perhaps *Iris versicolor* or even *Lobelia inflata*, with the effect of imparting strong emetic properties to the mixture. At such festivals the Indians drank copious drafts of it which in a short time made them vomit freely and easily; they continued drinking and ejecting for one or two days until they had sufficiently cleansed themselves.

Dr. Hale, in the bulletin above referred to, states that sometimes the decoction was allowed to ferment and then became an alcoholic beverage "capable of causing considerable intoxication." It is strange he should make such an assertion when all the evidence he adduces, from many observers, clearly shows that it never had any such effect. Thus McCullough in his "Researches:" "This tea may have been slightly stimulating, but it seems to have had no other than a diaphoretic or diuretic effect;" also Le Moine in his "Narrative": "It strengthens and nourishes the body and yet does not fly to the head, as we have observed on occasions of these feasts of theirs;" and Mrs. Oliver, as quoted by A. S. Gatschet: "It was very bitter and said to be intoxicating, but, if so, it could only have been when drunk to great excess, as it never seemed to produce any visible effect upon them." We can safely arrive at the same conclusion by the reflexion that no alcohol can be expected from a leaf practically destitute of sugar, or sugar-making elements.

It remains to be said that the "black drink" has never been used by the whites as an habitual beverage, not even in times when tea and coffee were almost unattainable luxuries; but that, considering the abundance of the Cassine along some 2,000 miles of our coast, it seems desirable to definitely ascertain its exact economic value.

3. Plants furnishing palatable juices or, by infusion, pleasant beverages and used mainly for the purpose of quenching thirst.

Among the plants furnishing wholesome and palatable juices the first place belongs to the Maples, specially the Sugar Maple (*Acer saccharum* Marsh.), White or Silver Maple (*A. saccharinum* L.) and the Red Maple (*A. rubrum* L.). It has been clearly shown that the Indians knew the value of the sap of the Sugar Maples, that they drank it and made sugar from it before the advent of the whites; thus the Recollect missionary Le Clercq (1675–1691) writes: "Our ordinary food was that of the savages, namely sagamite, or cornmeal, squashes and beans, to which we added, as seasoning, marjoram, purslane, a certain species of balm and small wild onions. Our drink was water from the brook, or if one of us was indisposed, we split the bark of a Maple from which flows a sweet sap, which is collected in a bark vessel and considered a precious remedy."

The principal use of the maple sap, however, was to sweeten food, as mentioned by Joutel, the companion of La Salle: "We arrived at Chicagou in March (1688) and did not have much food, but Providence gave us, to mix with our cornmeal, a manna, the sap obtained from maples which are common and very large in this region."

The primitive Indian method of making sugar, before the introduction of metal kettles, was to throw red-hot stones in vessels of bark or wood, or again, to freeze the syrup repeatedly in shallow basins and throw off the ice.

Box Elder (*Acer Negundo* L.), one of our most widely distributed trees, also yields an abundant saccharine sap in the spring utilized by our northern and western Indians. Equally valuable, in this respect, is our White Walnut (*Juglans cinerea* L.), for "if tapped immediately before the leaves unfold, it yields a richly saccharine juice from which sugar may be obtained nearly, if not quite, equal to that from the Sugar Maple" (U. S. Disp.).

Most species of Birch (*Betula*) yield the same quality of sap, and the Indians undoubtedly knew its value, although they seem to have been ignorant of the very pleasing effects of modern "birch beer" obtained by fermenting the sap of *B. lenta* and *B. lutea*.

In our western deserts, where water is scant, nature provides pulpy juicy plants from which Indians can often quench their thirst. Chief among these are several species of cactus, especially of *Opuntia* whose fruit (prickly pear), as well as the fleshy leaves or joints, contain an abundance of wholesome juice. Besides *O. Tuna* and *O. Ficus-Indica*, already noticed, *O. Engelmanni* Salm. and 2 or 3 analogous species so abundant along our southwestern boundary are especially noteworthy. Cattle and sheep are very fond of the leaves of these plants which are to them food and drink during the dry season, so that flocks of sheep fed upon them need not be driven to water for several months.

Several species of *Echinocactus* may also be mentioned in this connection, especially *E. Visnaga* Hook. of the central plateau of Mexico and *E. Wislizeni* Engelm. of our southwestern territory; they are called Barrel Cactus from their appearance, the stem being sometimes 4 to 5 feet high and 1 to 2 feet in diameter. The pulp of the stem is full of watery juice of a pleasant acidulous taste and has often been welcomed by thirsty travelers.

Many species of *Agave* with thick fleshy leaves, although mostly used by Mexicans and Indians for food, contain a large proportion of watery juice which can easily be pressed out for drinking. This juice, although not unpalatable, has not the sweet taste which cooking alone develops in it. The Sotol (*Dasylirion Texanum* Sheele) of Texas and northern Mexico shares exactly the properties of *Agave* as a food and drink plant, not only for Indians but also for bear and other animals. The very succulent young stems of *Agave* and *Yucca* are also prized by Indians who are often seen sucking them with marked enjoyment.

Another desert plant which the thirsty native utilizes is *Ammobroma Sonorae* Torr., the Sand-Food, a leafless parasite in the sand-hills of south Arizona and Lower California. The long creeping stems are not only a palatable food but also a good substitute for water.

Many plants contain mucilaginous, starchy or saccharine principles which are readily imparted to water by infusion or decoction, rendering it more nutritive and palatable, maple syrup or sugar, honey, or dried fruit rich in glucose being often added to the mixture. The flour of maize, as well as that of Mezquite and Screw Bean, are thus frequently used by Mexicans and Indians.

Salvia polystachya Ort. is largely cultivated in northern and central Mexico, under the name of Chia, for its small glossy seeds rich in mucilage and oil. After careful roasting they are ground into meal which, when thrown into water, expands to several times its original bulk, the mucilage rapidly dissolving; by the addition of sugar, lemon juice or orange-flower water, a very agreeable, wholesome and demulcent beverage is obtained still very popular in Mexico. Other species used for the same purpose are: *S. Columbariae* Benth., the California Chia, common in California and extending to Arizona and Mexico; *S. carduacea* Benth., of southern California and *S. tiliaefolia* Wahl, of northern Mexico.

Sometimes, tart or acidulous fruits were bruised in water to make it more cooling, refreshing and palatable. This was particularly the case with several species of Sumach: *Rhus glabra* L., *R. hirta* Sudw. and *R. copallina* L., east of the Rocky Mountains; *R. integrifolia* B. & H. and *R. ovata* Wats., of southern California and Lower California. *R. integrifolia* has very acid berries covered with a white oily efflorescence said to be even more tart than the pulp; they are frequently gathered by Indians and used fresh, dried or roasted in preparing a very refreshing drink. The fruit of *R. ovata* is described by Orcutt as being very acid, but coated with a thin crust having the consistency of wax, "as sweet and delicious in flavor as the best of refined sugar" and formerly much collected by the natives; a combination of the acid pulp with the sweet crust making excellent lemonade.

In California, the *Manzanitas* are also used for this purpose. *Arctostaphylos Manzanita* Parry, the Common Manzanita, has a smooth apple-like fruit, 4–6 lines broad, reddish-brown when ripe, mildly astringent, but decidedly acid; it makes a pleasant cooling drink in summer. *A. tomentosa* Douglas has a somewhat smaller pubescent fruit.

Likewise used in this manner is the fruit of our two species of *Shepherdia*, *S. argentea* Nutt., the Bullberry of the Missouri region, and *S. Canadensis* Nutt., the Soapberry of the northern States and British America. That of the former contains 2 to 3 per cent. of free acid; that of the latter contains a small proportion of saponin, so that when triturated in water and beaten up it produces a thick foam which, when sweetened, is highly prized by the natives.

Other common native plants with tart fruit imparting a pleasantly acidulous taste to water are the Barberries, specially *Berberis Canadensis* Mill. of the east, *B. repens* Lindl. and *B. aquifolium* Pursh. of the Rocky Mountains and Pacific States, and *B. trifoliata* Moric. of Texas and Mexico.

Finally, we may note a few of the plants used in infusion to make aromatic teas. These plants are many; in fact, there is hardly any scented vegetable within reach which has not been used at some time by natives in preparing beverages, although perhaps oftener for medicinal purposes than to simply gratify the palate.

Sassafras tea, made from the root of the Sassafras tree, was a favorite substitute for Chinese tea in the South during our Civil War, and had always been appreciated by Indians, although they never suspected the superior charms of "root-beer." During the war for independence, the colonists used, as a substitute for the imported article, the leaves of New Jersey Tea (*Ceanothus Americanus* L.) which had at least the merit of being very common. It is quite probable that its virtues had been indicated by the natives. It does not contain theine but a very minute proportion of a bitter crystalline alkaloid, ceanothine. According to Porcher, when properly dried and prepared, it is aromatic and not unpleasant, . . . certainly a good substitute for indifferent black tea." A very fragrant drink was also prepared from the Spice-Bush (*Lindera Benzoin* Blume), as well as from Wintergreen (*Gaultheria procumbens*) and Sweet Fern (*Myrica asplenifolia*). Much less acceptable must have been the infusion from Marsh Tea (*Ledum palustre* L.) and Labrador Tea (*L. Groenlandicum* Oeder) which, but specially the first, contain an acrid aromatic oil. According to Pursh and more recent observers, the dried leaves and flowers of the Sweet Goldenrod (*Solidago odora* Ait.) are a pleasant and wholesome substitute for tea.

While in western Texas, I became familiar with the Encenilla or Chaparral Tea (*Croton corymbulosus* Engelm.) quite abundant in that region. An infusion of the flowering tops makes a very palatable drink much used by Mexicans and Indians, as well as by our colored U. S. soldiers who prefer it to coffee. It appears to be entirely devoid of theine or any other stimulating principle except volatile oils. Other plants similarly used and valued in the same country and northern Mexico are *Bidens Bigelovii* Gray, *Salvia ballotaeflora* Benth., *Hedeoma Drummundii* Benth. and *Actinella odorata* Gray.

New Species of Leguminous Pods from the Yellow Gravel at Bridgeton, N. J.

By Arthur Hollick.

(Plates 258, 259.)

In a paper read before the Club some years since, and subsequently published in the Bulletin,* I mentioned the occurrence, in great abundance, of leguminous pods, in the Yellow Gravel sandstone at Bridgeton, N. J., with which were associated leaves of common eastern North American trees and shrubs, such as *Magnolia acuminata* L., *Asimina triloba* (L.) Don., *Persea Borbonia* (L.) Spreng. etc. In the final identification of the material these pods remained as incongruous elements, apparently representing

* Palaeobotany of the Yellow Gravel at Bridgeton, N. J., Bull. Torr. Bot. Club, 19: 330–333.

the genera *Mezoneurum* and *Lonchocarpus* (including *Derris* and *Pongamia*), which are of tropical or southern distribution and are not now known north of Mexico. The first named genus is not even reported from any part of the American continent, but is confined to tropical Asia and Africa, with a single species (*M. brachycarpum* Benth.) in Australia. The genus *Lonchocarpus* occurs in South America, Africa, Asia and Australia. The subgenus *Pongamia* is confined to Asia and Australia.

In the fossil state the species thus far described and figured in these genera are few and more or less unsatisfactory.

In *Mezoneurum* four have been recognized, viz.:

1. *Mezoneurum Radobojanum* Ung. Syll. Plant. Foss. Part 2, 28. *pl. 11. fig 1.*

2. *M. lygodioides* Ung. Denksch. Wien Akad. 11: 172. *pl. 8. fig. 18.* 1856.

3. *M. tripos* Ung. l. c. 173. *pl. 8. fig. 19.*

4. *M. dimidiatum* Wat. Plant. Foss. Bass. Paris, 244. *pl. 60. fig. 10.*

Of these the first and last mentioned are pods. The others are mere problematic organisms of but little value in this connection. All are from Tertiary strata in Europe.

In the genus *Lonchocarpus* two fossil forms have been recognized, viz:

1. *Lonchocarpus latifolius* Kth., a living species, reported from the Pleistocene (?) strata of Chorillo, Cuba, by P. P. Galtés, in a work entitled, "Memoria sobre unos fossiles vegetales encontrados en el Chorillo." *

2. *L. obtusifolius* Engelh. Abh. Isis, 1894. 7. *pl. 1. fig. 22;* Abh. Senckb. Naturforsch. Gesellsch. 19: 17. *pl. 3. fig. 1.* 1895; leaves from Tertiary strata in South America.

The only fossil representative of the subgenus *Pongamia* to which I have been able to obtain any reference is *P.*† *protogaea* Massalongo, Neu. Jahrb. Min. 1857, 778, where it is mentioned in a list of plants from the Tertiary strata of Monte Bolca, Italy. It was subsequently described in Atti Reale Inst. Veneto di Sci.

* This reference was given me by Professor Lester F. Ward, of the United States Geological Survey, but neither of us has had access to the work, and we do not know whether the fossil was a pod or a leaf.

† Spelled *Pungamia*.

Lett. ed. Art. (III.) 3: 769, 1858, and later both leaves and fruit were figured in "Specimen Photographicum," 97. *pl. 40. figs. 2, 3*, 1859, but I have unfortunately not had access to these works.

The exact geologic age of the Bridgeton sandstone has not been definitely settled, but it evidently represents late Tertiary or Pleistocene, containing a flora which is almost identical, in both species and genera, with that of the latitude of Virginia at the present time.

The main point of interest in connection with these pods is that whereas their former companions are yet represented, both in genera and species, in the living vegetation of the region, the genera to which they are referred are no longer to be found there, but are elements in a more tropical flora. The fact that I have been unable to compare them satisfactorily with living species would indicate, taken in connection with the other circumstances of their occurrence, that they represent the last struggle for life of these genera in this latitude, due to the changing climatic conditions which preceded the advent of the Ice Age. Previous to that time they were widely distributed throughout both continents. The north temperate species were obliterated, and only those which existed further south were able to continue their existence. This supposition is also strengthened by the reference of the fossil species found further south to the living *Lonchocarpus latifolius*.

The facts in regard to the past history and distribution of these genera are of the utmost significance when taken in connection with their present distribution. Several of the problems of their present distribution would be exceedingly difficult of explanation if we did not have these facts to guide us. The improbable theory of migration in recent times is no longer a necessary one, and we are led to the rational conclusion that genera, the species of which are now widely separated in different portions of the earth, were formerly of universal distribution but have become extinct over many wide areas where they formerly existed, due to changes in environment.*

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* In this connection see "Zur Theorie der Entwickelung der jetzigen Floren der Erde aus der Tertiarflora." C. F. von Ettingshausen. Sitzb. Wien Akad. Wiss. Math. Naturwiss. Classe, 103: 369. 1894.

For purposes of comparison I have introduced figures of pods representing living three species, viz: *Mezoneurum cucullatum* L., *Pongamia glabra* Vent. and *Lonchocarpus neuroscapha* Benth. and copies of two figures representing fossils which have been referred to the first of these genera, viz: *Mezoneurum dimidiatum* Wat. and *M. Radobojanum* Ung.

The new species are:

MEZONEURUM BRIDGETONENSE n. sp.

(Plate 258, Figs. 1–7.)

Pods 2¼ in. to 4 in. long by 1 in. to 1¾ in. wide in middle, obtuse and slightly recurved at end, abruptly rounded or attenuated at base; suture prominent, distant about ¼ in. from middle of nearest margin; reticulations more or less prominent laterally, extending from suture to farthest margin, with occasional cross connections, few or none between suture and nearest margin.

LONCHOCARPUS NOVAE-CAESAREAE n. sp.

(Plate 259, figs. 6–8.)

Pods about 2¾ in. long by 1 in. to 1¼ in. wide in middle, tapering to end and base, recurved at end, curved or recurved at base; suture prominent, distant about ¼ in. from middle of nearest margin; reticulations more or less prominent laterally, between suture and farthest margin, with cross connections which give an appearance of forking, a few more or less obscure and simple nerves between suture and nearest margin.

Explanation of Plates.

PLATE 258.

Figs. 1–7. *Mezoneurum Bridgetonense* Hollick.

PLATE 259.

Fig. 1. *Mezoneurum dimiaiatum* Wat. Plant. Foss. Bass. Paris, 244. *pl. 60. fig. 10.*

Fig. 2. *Mezoneurum cucullatum* L. Cult. in Kew gardens. Specimen in Herb. Columbia College.

Fig. 3. *Pongamia glabra* Vent. Hong Kong. Specimen in Herb. Columbia College.

Fig. 4. *Lonchocarpus neuroscapha* Benth. From Mart. Fl. Brasil. 15: part 1 *pl. 99.*

Fig. 5. *Mezoneurum Radobojanum* Ung. Syll. Plant. Foss. part 2, 28. *pl. 11. fig 1.*

Figs. 6–8. *Lonchocarpus Novae-Caesareae* Hollick.

Contribution to the Pyrenomycetes of Maine.—I.

By F. L. Harvey.

The following list of Pyrenomycetes is based upon collections made by the Rev. Joseph Blake, and in the Blake Herbarium at the Maine State College, or in lists of Maine Cryptogams turned over to the writer by Mr. Blake before his death. To the above are added all the species, so far as known, that have been recorded from Maine in the literature upon fungi, together with such forms as have been detected by the writer since 1886. The list is of course incomplete, as each year several species have been added. It includes a few species not noted by Ellis from the United States, also several species not before reported from Maine.

Additional references to Maine species by collectors will be gratefully received.

We are under great obligations to Mr. J. B. Ellis and Mr. C. H. Peck for the examination of specimens.

Family ERYSIPHEAE.

1. *Sphaerotheca Humuli* (DC.). On *Spiraea salicifolia* L. and *Humulus Lupulus*, Orono (Harvey).

2. *S. Mors-uvae* (Schw.). On species of *Ribes*, Orono (Harvey).

3. *Erysiphe communis* (Wallr.). Herb. Port. Soc. Nat. Hist. (Fuller), Cumberland (Blake). Hosts not stated. On *Pisum sativum*, Orono (Harvey).

4. *E. Cichoracearum* DC. On dandelion leaves (W. C. Stevenson), as *E. Montagnei* Lev.; Harrison (Blake), as *E. phlogis* Schw. On various species of Compositae, Orono (Harvey).

5. *E. graminis* DC. Common on lawn grasses in shaded places, Orono (Harvey).

6. *Uncinula Necator* (Schw.). Very abundant on Delaware grapes, Orono (Harvey).

7. *U. circinata* C. & P. On *Acer dasycarpum*, Orono (Harvey).

8. *N. Salicis* (DC.). On *Salix* species. Very common, Orono (Harvey).

9. *Phyllactinia suffulta* (Reb.). On *Hamamelis Virginiana*, *Celastrus scandens* and *Alnus serrulata*. Very abundant, Orono (Harvey).

10. *Podosphaera Oxyacanthae* (DC.). On cultivated plums, Orono (Harvey).

11. *Microsphaera Vaccinii* (Schw.). Jackman (Harvey). On *V. corymbosum* var. *atrococcum* Gray.

12. *M. Alni* (DC.). On honeysuckle, Portland (C. C. Balles). C. & P. Ery. U. S. 20, as *M. Dubyi* Lev., which is regarded by Burrill as *M. Alni.* On *Alnus serrulata*, very common, Orono (Harvey).

13. *M. quercina* (Schw.). On *Quercus nigra*, Orono (Harvey).

Family II. PERISPORIEAE.

14. *Dimerosporium Collinsii* (Schw.). Wells (Blake). No host given, but probably on *Amelanchier.*

15. *Asterina Celastri* E. & K. On leaves of *Celastrus scandens*, Orono (Harvey).

16. *A. Gaultheriae* Curtis. On living leaves of *G. procumbens.* Common, Orono (Harvey).

17. *Microthyrium microscopicum* Desm. Cumberland (Blake).

Capnodium Pini B. & C. Berk. and Curt. North Am. Fungi n. 982, Me. (Blake).

18. *Eurotium herbariorum* (Wigg.). Common on neglected herbarium specimens, Orono (Harvey).

19. *Claviceps purpurea* (Fr). Common on various species of grasses, cultivated and wild about Orono (Harvey).

20. *Cordyceps militaris* (Linn.). Conidial stage in Blake Herb. as *Isaria farinosa*, also in the ascigerous form as *Torrubia militaris* Fr. Cumberland (Blake).

21. *Cordyceps ophioglossoides* (Ehr.). Cumberland (Blake).

22. *Hypomyces Lactifluorum* (Schw.). Portland (Fuller). Sprague's N. Eng. Myc. from S. Paris, Wells (Blake). On *Lactarius* in beech and birch woods. Orono, August (Harvey).

23. *H. violaceus* Tul. Parasitic upon *Fuligo septica* L. A single infested specimen found on moss at Greenfield, Me., Oct., 1895. (Harvey).

24. *Hypocrea rufa* (Pers.) Blake Herb. as *Trichoderma viride* Pers. Cumberland (Blake), Orono, on decaying wood (Harvey).

25. *H. Schweinitzii* (Fr.). Blake Herb. as *Sphaeria contorta* Schw. Cumberland (Blake.)

26. *H. Richardsoni* Berk. & Mont. Cumberland (Blake) Jour. Mycol. June, '86, p. 62, from Maine, but no authority. On willow and poplar, Orono (Harvey).

According to the recent investigations of Herman Schrenk (BULLETIN, **21**: 385) this form is a *Corticium* and should be *C. pezizoideum* (Schw.).

27. *Hypocrella Hypoxylon* Pk. Stems of living grasses, Me. (Scribner). Journ. Mycol. June, '86, p. 67.

28. *Epichloe typhina* (Pers.). On grass, July, Bradley, Me. (Harvey).

29. *Nectria cinnabarina* (Tode). Portland (Fuller). Cumberland (Blake). Orono (Harvey). Common on honey locust, rock maple, staghorn sumach and apple in the conidial stage (*Tubercularia vulgaris* Tode). On red raspberry, white pine, poplar and basswood we find a form (*Tubercularia nigricans* Fr.), which, if we are correct, should also be referred to *N. cinnabarina* (Tode.). In Blake's Herb. is *T. granulata* P. Cumberland (Blake). We find this mentioned only by Cooke (Vol. II., p. 557–8), where he seems to refer it to the above.

30. *N. Sambuci* E. & E. On *Sambucus Canadensis*. Oldtown (Harvey).

31. *N. coccinea* (Pers.). Cumberland (Blake). On dead branches of *Acer saccharinum*. Orono (Harvey).

32. *N. vulpina* Cke. Pushaw Lake, Oldtown, Aug., 1895 (Harvey).

33. *N. dispersa* C. & E. Maine (Blake), on pine bark. Jour. Mycol. Dec., '86, p. 133, as *Dialonectria dispersa* C. & E.

34. *N. episphaeria* (Tode). On species of *Sphaeria* upon *Alnus serrulata*. Orono (Harvey).

35. *Chilonectria Coryli* (Fckl.). Hard maple. Orono, Dec. (Harvey).

36. *Gibberella pulicaris* (Fr.). Blake Herb. as *Sphaeria pulicaris*. Cumberland (Blake).

Family TRICHOSPHAERIEAE.

37. *Venturia compacta* Pk. Orono (Harvey).

38. *Lasiosphaeria hirsuta* (Fr.). Oldtown, Aug., 1895 (Harvey).

39. *L. mutabilis* (Pers.). In Blake Herb. as *Sphaeria mutabilis* Pers. Harrison (Blake).

Family MELANOMMEAE.

40. *Rosellinia Desmazierii* (B. & Br.). Cumberland (Blake). On birch in Maine (Grev. 4: 106). Probably the Maine specimens were from Blake (?) Blake Herb. as *Sphaeria Desmazierii.*

41. *R. Clavariae* (Tul.). On *Clavaria spinulosa* Pers. Orono, Aug. (Harvey).

42. *Bombardia fasciculata* Fr. In Blake Herb. as *Sphaeria bombarda* Batsch, from Cumberland (Blake).

43. *Bertia moriformis* (Tode.). Rotten firwood, Orono, November; Oldtown, Sept., 1895 (Harvey).

44. *Melanomma pulvis-pyrius* (Pers.). Blake Herb. as *Sphaeria myriocarpa* Fr. Cumberland (Blake).

Family CERATOSTOMEAE.

45. *Ceratostoma spina* (Schw.). Blake Herb. as *Sphaeria spina* Schw. Cumberland (Blake).

Family AMPHISPHAERIEAE.

46. *Amphisphaeria Oronoensis* E. & E. *Sphaeria Oronoensis* E. & E. Journ. Mycol. 3: 117. On spruce timbers in a cellar in Orono, 1887 (Harvey). Also found on spruce in the woods.

47. *A. applanata* (Fr.). Blake Herb. as *Sphaeria applanata* Fr. Wells (Blake).

Family LOPHIOSTOMEAE.

48. *Lophidium compressum* (Pers.). Blake Herb. as *Sphaeria angustata* Pers. Cumberland (Blake).

Family CUCURBITARIEAE.

49. *Cucurbitaria elongata* (Fr.). Blake Herb. as *Sphaeria elongata* Fr. Cumberland (Blake).

50. *C. Berberidis* (Pers.). Blake Herb. as *Cucurbitaria Berberidis* Fr. Cumberland (Blake).

51. *Fraechiaea callista* (B. & C.). Cumberland (Blake). Blake Herb. as *Sphaeria callista* B. & C.

52. *Otthia morbosa* (Schw.)= *Plowrightia morbosa* (Schw.) Sacc. Common on *Prunus Pennsylvanica* and domestic plums. Orono (Harvey).

53. *Parodiella grammodes* (Kze.). Herb. Port. Socy. Nat. Hist. (Fuller) as *Dothidia perisporioides* B. & C.

Family SPHAERELLOIDEAE.

54. *Sphaerella maculiformis* (Pers.). Blake Herb. as *Sphaerella maculiformis* Pers. Cumberland (Blake).

55. *S. Smilacicola* (Schw.). Sprague's New. Eng. Mycol. (Proc. B. S. N. H. 6: 319 (Morse) as *Depazea Smilacicola* Schw.

Family GNOMONIEAE.

56. *Gnomonia Corylii* (Batsch.). Port. Socy. Nat. Hist. Coll. as *Gnomoniella Corylii.* Blake Herb. as *Sphaeria Corylii* Batsch. Cumberland (Blake). On leaves of *Corylus Americana.* Orono (Harvey).

57. *G. fimbriata* (Pers.). Harrison (Blake).

58. *G. errabunda* (R. et D.). Spragues N. Eng. Mycol. Portland (E. S. Morse) as *Sphaeria errabunda* Desm.

Family PLEOSPOREAE.

59. *Leptosphaeria fuscella* (B. & Br.). Blake Herb., Cumberland (Blake).

60. *L. Doliolum* (Pers.). Blake Herb., Cumberland (Blake).

61. *L. comatella* (C. and C.). Blake Herb., Cumberland (Blake).

62. *Ophiobolus porphyrogonus* (Tode.). Blake Herb. as *Sphaeria rubella* Pers. Cumberland (Blake).

Family MASSARIEAE.

63. *Marsaria inquinans* (Tode.). On dead maple limbs. Orono, Dec. (Harvey).

64. *Massariella scoriadea* (Fr.). Blake Herb. as *Sphaeria scoridea* Fr. Cumberland (Blake).

65. *M. pupula* (Fr.). Conidial stage on sugar maple, *Steganosporium pyriforme* Hoff. Orono, Nov. (Harvey).

Family VALSEAE.

66. *Diaporthe leiphaemia* (Fr.). Blake Herb. as *Valsa leiphaemia* Fr. Cumberland, Me. (Blake).

67. *D. Salicella* (Fr.). Proc. Bost. Soc. Nat. Hist. 6: 319 (Blake). Blake Herb. as *Sphaeria Salicella* Fr. Cumberland (Blake). This species, in the conidial form, was sent by Blake to Sprague, Berkeley and Curtis, and appears in their lists as *Discella carbonacea* B. & Br. On Willow, Orono (Harvey).

68. *D. syngenesia* (Fr.). Blake Herb. as *Sphaeria Frangulae* Pers. Cumberland (Blake).

69. *Valsa Americana* B. & C. Blake Herb. Wells and Cumberland (Blake).

70. *V. modesta* (Schw.). Blake Herb. Cumberland (Blake).

71. *V. deformis* (Fr.). On birch. The ferruginous stroma appearing as waxy spots on the bark. Orono, Dec. (Harvey).

72. *V. rufescens* (Schw.). Blake Herb. as *Sphaeria aculeans* Schw.=*Sphaeria rufescens* Schw. Cumberland (Blake).

73. *V. truncata* C. & P. Wells (Blake.)

74. *V. rhizina* (Schw). Berk. & Curt. N. A. F. (Blake).

75. *V. ambiens* (Pers). Wells (Blake). On willow, Orono (Harvey).

76. *V. salicina* (Pers.). Spermogonia in Blake Coll. as *Cytispora fugax* Fr. Cumberland (Blake).

77. *V. quaternata* (Pers.). Blake Coll. as *Sphaeria quaternata* Fr. Cumberland (Blake). The spermogonial stage (*Libertella faginea*) is very common on birch bark. Orono (Harvey).

78. *V. nivea* (Hoff.). Dead poplar. Orono, Dec. (Harvey).

79. *V. colliculus* (Wormsk.). In Blake Herb. as *Sphaeria colliculus*, which we have not been able to trace, but presume it is the above. Cumberland (Blake).

80. *Eutypella cerviculata* (Fr.). Orono (Harvey).

81. *E. similis* (Karst.). On *Alnus serrulata*, Orono, Sept. (Harvey).

82. *Eutypa spinosa* (Pers.). Blake Herb. as *Sphaeria spinosa* Pers. Cumberland (Blake).

83. *Calosphaeria ciliatula* (Fr.). On dead birch limbs. Orono (Harvey).

Family MELANCONIDEAE.

84. *Melanconis stilbostoma* (Fr.). Blake Herb. as *Sphaeria pulchella* and the spermogonia as *Nemaspora crocea* Fr. Cumberland (Blake). Sprague's New Eng. Mycol. Portland (E. S. Morse). On birch, Orono (Harvey).

85. *M. tiliacea* (Ell.). On *Tilia Americana*, Orono, Dec. (Harvey).

86. *Pseudovalsa profusa* (Fr.). Blake Coll. as *Sphaeria Sartwellii*, Cumberland (Blake).

87. *P. lanciformis* (Fr.). Blake Herb. as *Sphaeria lanciformis* Fr. Cumberland (Blake).

Family MELOGRAMMEAE.

88. *Valsaria exasperans* (Gerard). Harrison (Blake). maple, Orono, Dec. (Harvey).

Family DIATRYPEAE.

89. *Diatrypa stigma* (Hoff.). Orono (Harvey).

90. *D. platystoma* (Schw.). Hard maple. Orono (Harvey).

91. *D. disciformis* (Hoff.). On beech. Wells (Blake).

92. *D. albopruinosa* (Schw.). Blake Herb. as *Sphaeria Diesieni* Mont. Cumberland (Blake).

93. *Anthostoma microsporum* Karst. On *Alnus*. Wells (Blake). Orono (Harvey). Blake Herb. as *Diatrype microspora* Ell.

94. *Diatrypella quercina* (Pers.). Harrison (Blake). Blake Coll. as *Sphaeria quercina* Pers.

95. *D. verrucaeformis* (Ehr.). Blake Herb. as *Sphaeria verrucaeformis*. Cumberland (Blake).

96. *D. betulina* Pk. On dead birch twigs, Orono (Harvey).

97. *Phyllachora Trifolii* (Pers.). On clover leaves, Blake Herb. as *Polythrincium Trifolii* Kze., which according to Cooke is probably the conidial form of the above. Harrison (Blake). Also in Blake Herb. as *Sphaeria Trifolii* Pers. Cumberland (Blake).

98. *P. Pteridis* (Reb.). On leaves of *Pteris aquilina*, Mt. Desert (Redfield). Common about Orono (Harvey).

99. *Dothidella betulina* (Fr.). Blake Herb. as *Dothidea betulina* Fr. Cumberland (Blake).

100. *D. Ulmi* Schw. Harrison (Blake).

101. *Dothidea Ribesia* (Pers.). Berk. and Curt. N. A. Fungi from Me. (Blake). Blake Herb. Cumberland (Blake).

Family XYLARIEAE.

102. *Hypoxylon coccineum* Bull. Blake Herb. as *Sphaeria fragiformis* Pers. Cumberland (Blake). On beech, Orono. Jackman (Harvey).

103. *H. enteromelon* (Schw.). Sprague's N. Eng. Myc. Portland (Morse). Blake Herb. as *Sphaeria enteromela* Schw.

104. *H. fuscum* (Pers.). Blake Herb. as *Sphaeria fusca* Pers., and *S. confluens* Willd. On dead alder, beech, etc., Orono. Jackman (Harvey).

105. *H. multiforme* Fr. Blake Herb. Cumberland (Blake). Common, Orono (Harvey).

106. *H. multiforme* var. *adultum* Fr. On yellow birch, Orono (Harvey). This form was named by Peck from specimens from Orono, and is not mentioned by Ellis.

107. *H. glomiforme* B. & C. Cumberland (Blake).

108. *H. cohaerens* (Pers.). Blake Herb. as *Sphaeria cohaerens* Pers. Cumberland (Blake). On beech, Orono (Harvey).

109. *H. Morsei* B. & C. Ber. & Curt. N. A. F. from Maine (Blake & Morse). Blake Coll. as *H. Blakei* B. & C.; Cumberland (Blake). On dead alder. Common, Orono (Harvey).

110. *H. perforatum* (Schw.). Dead wood, Orono (Harvey).

111. *H. rubiginosum* (Pers.). Orono (Harvey). Our form is regarded as varietal by Peck. *H. fuscopurpureum* Schw. Orono, Me., Oct., 1895 (Harvey).

112. *Daldinia concentrica* (Bolt.). Sprague's Cont. N. Eng. Myc. Portland (Fuller). Common on *Salix*, Orono (Harvey).

113. *D. vernicosa* (Schw.). Orono (Harvey).

114. *Xylaria polymorpha* (Pers.) Portland Soc. Nat. Hist. Coll. no. 54. Portland (Fuller); Cumberland (Blake).

115. *X. corniformis* Fr. Rotten wood and ground, Orono (Harvey).

116. *Angelina rufescens* (Schw.). Orono (Harvey).

117. *Hysterium pulicare* Pers. Cumberland (Blake).

118. *Hysterographium Fraxini* (Pers.). Blake Herb. as *Hysterium Fraxini* Pers. Cumberland (Blake).

Family HYPODERMIEAE.

119. *Lophodermium Juniperinum* (Fries). Port. Soc. N. H. Coll., No. 107, Portland (Fuller). In above Coll. as *Hysterium Juniperinum* Fr.

120. *L. Arundinaceum culmigenum* (Fr.). Sprague's New Eng. Myc. Wells (Blake). Common on grasses and sedges, Orono (Harvey).

121. *L. Pinastri* (Schrad.). Blake Herb. as *Hysterium Pinastri*

Schrad. Cumberland (Blake). Port. Soc. Nat. Hist. Coll., No. 100. Portland (Fuller).

Family DICHAENACEAE.

122. *Dichaena Faginae* (Pers.). On living beech. Cumberland (Blake).

A new Oscillatoria from California.

OSCILLATORIA TRAPEZOIDEA n. sp.

Trichomes aeruginous, forming a thin loosely-woven stratum of a dull blue-green color, firm, straight, 12–15 μ in diameter, slightly attenuated and in most instances somewhat arcuate at the apices, provided with a delicate sheath; articulations 2½–3½ times shorter than the diameter, 4μ–6μ long, with delicately granulose protoplasm, near the end of the filament prominently enlarged at the joints, giving, in sectional view, a somewhat trapezoidal form to the secondary cells; apical cell pyramidal or conical, sometimes bluntly rounded, not capitate; no calyptra.

Hab.: bottom of pond. Pasadena, California. October, 1895. Collected by Prof. A. J. McClatchie.

The hormogones are almost constantly arcuate at each end and, with few exceptions in opposite directions, so that they may be said to be somewhat sigmoid in form. In the mature filaments this arcuate character is, however, not always present, at least at both ends. In the same way the degree of attenuation and the shape of the end of the filament may vary to a considerable degree. Thus the apex may be globose or bulging, truncated, giving an almost square outline to the cell, or, going to the other extreme, it may be somewhat pointed, which is more common.

The bulging character furnished by the ends of the mature cells near the extremity of the filament is constant and peculiar to the species so far as is known. One might represent such a cell by placing, base to base, two low glass beakers with flaring edges. The two flaring edges would then be the ends of the primary cell, while the line made by the bases of the beakers could be taken as the new cell-wall thrown across, separating the two secondary cells.

The middle portion of the filament presents a straight, unbroken outline. Rarely a distinct constriction at all the joints of a filament occurs.

The difficulty of distinguishing between *Lyngbya* and *Oscillatoria* is well illustrated by this species. The existence of a sheath would naturally lead one to place it in the former genus, but the sheath in this case is extremely delicate and observed only in a few instances. In *Lyngbya* there is a distinct sheath containing numerous sliding hormogones.

In general character *O. trapezoidea* perhaps resembles *O. chalybea* Mertens, but is larger, shows no spiral arrangement and is clearly distinguished by the shape of the terminating cells of the filament.

JOSEPHINE E. TILDEN.

UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINN.

Botanical Notes.

Notes from Plum Island and Fisher's Island, N. Y.—It may be of interest to note the occurrence upon Plum Island and Fisher's Island, N. Y., of a few plants beyond their hitherto recorded range.

In August, 1892, the writer discovered *Juncus dichotomus* Ell. growing upon Plum Island, and during the past summer found it to be not rare upon Fisher's Island also.

Ligusticum Scoticum L. has been known for some years to be frequent upon Fisher's Island; in August, 1895, a station for it was found on the north shore of Plum Island.

In 1892 *Plantago elongata* Pursh (*P. pusilla* Nutt.) was detected growing on the south side of Fisher's Island. Near the east end of the same island is a small colony of *Euphorbia glyptosperma* Engelm. far out of its cited range.

CHARLES B. GRAVES.

NEW LONDON, CONN.

Schizohyllum Egelingianum E. & E., BULLETIN, 22: 439. I have lately found this fungus on a dead apple tree in Mr. Bull's orchard, at Mesilla, New Mexico; the specimens have been identified by Mr. Ellis. It is new to the U. S. flora.

T. D. A. COCKERELL.

N. M. AGR. EX. STA. Nov., 1895.

Reviews.

Introduction to the Study of Fungi: By M. C. Cooke, LLD. 8vo, pp. 360. London, Adam and Charles Black, 1895.

This is in some respects an elementary work and in others the author may presuppose a fair working knowledge of Fungi. It is designed for the use of collectors, not so much in giving rules for gathering and preserving specimens, as to put before them a large fund of information the bringing together of which has been the work of a long and busy life spent largely among the objects treated. Dr. Cooke has been one of the great workers in fungi from the standpoint of the collector and systematic student.

The work before us is divided into three parts, namely, organography, classification and distribution. Under Part I. chapters are given upon mycelium, carpophore, receptacle, fertilization and similar divisions. In general the plan under each heading is to pass from the simpler to the more complex forms, whether it be mycelium, spores or fertilization.

The main portion (Part II.) of the work takes up by chapters the leading groups and, mentioning the leading genera, introduces the reader to the types and their modifications.

While the work is fairly well illustrated it is noticed that many of the cuts have done service in the author's "Handbook of British Fungi," and other works. Some disappointment may be experienced in working with the index, as it is brief and the glossary has a similar fault. The classification worked out by Brefeld is presented in tabulated form, not that it is accepted by the author, but because suggestive and influential.

In its presentation the publishers might have been more fortunate in the selection of paper, etc. It is a heavy book without reason sufficient to the reviewer, and this will detract, in America at least, from its usefulness. BYRON D. HALSTED.

Contribution to the Flora of Yucatan. C. F. Millspaugh. Pub. Field Col. Mus. Bot. Ser. 1: 1–64. *pl. 1–4.*

In this first botanical paper from the Field Columbian Museum, of Chicago, Dr. Millspaugh enumerates the species collected by him while accompanying Mr. Allison V. Armour's yacht expedition to Yucatan last winter. He has also compiled in the publication the little previous knowledge of the region from the incidental collections of Johnson, Linden, Schott and Gaumer. His collections embrace 136 forms new to the region, of which two (*Euphorbia Armourii* and *E. astroites heterappendculata*) are described as new. We congratulate the Museum upon the character of its publications, and specially upon the style of issue, which seems to include all the excellent points of a perfect departmental serial.

The series included are: Botany, Geology, Zoölogy, Ornithology and Ethnology.

Die Laubmoose. Part 27, Hypnaceae. K. G. Limpricht. (Rab. Kryptfl. 4: part 3, 1–64. 1896).

This part begins the third volume of the mosses, which is to include three families or groups as called by the author, comprising the Isothecieae, Brachythecieae and Hypneae. Of these, the Isotheciae are treated in this number, including the genera *Cylindrothecium*, *Climacium*, *Isothecium*, *Orthothecium*, *Homalothecium*, *Platygyrium* and *Pylaisia*. The *Camptotheciums* also are described and the key to the *Brachytheciums* is given. The keys, descriptions and illustrations are of the usual high order of merit, and we welcome this part as throwing much light on the species of the same genera occurring in the United States. We note that *Platygyrium repens* var. *sciuroides* is described from specimens so named and distributed by Sauter in Breutel's Musci Frondosi, No. 296. According to some studies recently undertaken by Mr. Grout, at the Herbarium of Columbia College, the description of this variety under the name is antedated by *P. repens* var. *orthocladon* Kindb., showing that Kindberg did not sufficiently study and compare his variety with European exsiccatae, and that Limpricht was not aware that an American name antedated his description. A similar case occurs in *Climacium*, where Austin published in the Musci App. No. 289. 1874, a variety of *C. Americanum*, which he called var. *fluitans*. Subsequently Renauld and Cardot published a description (Bot. Gaz. 15: 59. 1890) for this same variety under the name of *C. Americanum* var. *Kindbergi*, a name much less suitable and acceptable to us than Austin's for this aquatic form of the species. It is interesting to learn that there also exists a variety *fluitans* of *C. dendroides*, which also grows floating on the edges of ponds and lakes, while the normal form of both species may be found higher up on the dry banks. E. G. Britton.

Elements of Plant Anatomy. By Emily L. Gregory, Ph. D. Ginn & Co., Boston.

The present small volume of 150 pages is a welcome addition to the few works which deal exclusively with plant anatomy. The author's preface defines the scope of the work, and if it is taken within the definition of its writer we consider it a very excellent guide to the study of plant anatomy for beginners, especially if it is accompanied by class-room work.

The book begins with a general description of the morphology of the plant cell, and is followed by a study of the cell-wall, in which the morphology and the chemical modifications are described. This second chapter is, we think, a very excellent one. In chapter 3, upon cell-contents, the general chemical features of the cytoplasm and the nucleoplasm, in view of the vast amount of recent cytological work, might have been more definite and extended; especially could this be said of the process of karyokinesis. Chapter 4, upon the tissues, is brief and might have been better illustrated. It deals with the general anatomy of the tissues and serves as an introduction to chapter 5, which treats of the anatomical features of the Algae, Fungi, Lichens and Thallose Hepaticae; and to chapter 6, which deals with the details of the anatomy of the Cormophytes, the Mosses, Ferns, Monocotyledons and Dicotyledons. Chapter 7 describes the secondary growth of the stems of Dicotyledons and Gymnosperms, and is an excellent condensed account of this somewhat complicated process.

The book is one that is especially intended as a class-room work to follow a given line of lectures, and as such the fewness of the illustrations may not be said to constitute a fault, but a few more would certainly add to its value. There is a lack of bibliographical references which we think would serve as a direct stimulus to further work to a few students at least. The author is perhaps fuller on some controversial points still in dispute than one would expect in a work of this size, but this, when supplemented by oral teaching, could be put in proper correlation with the rest.

The book is in no sense a work for technical students, and in this respect may lose a certain amount of influence that it otherwise would gain.

On the whole the work is timely, as there has been little published in this country which makes such an easy and yet comprehensive introduction to the work of Sachs, DeBary and Vines. Hitherto, the student has had, in the main, to search through a mass of detail in these works to find the underlying principles, but in Dr. Gregory's work the main facts are outlined clearly, in excellent English, and the book loses nothing of its scientific value by being simple and concise.

S. E. J.

Proceedings of the Club.

WEDNESDAY EVENING, JANUARY 29TH, 1896.

Dr. Britton occupied the chair and there were 38 persons present.

The following persons were elected active members:

Miss Helen A. Parsons, Miss Helen M. Smith, Dr. Max Mayer, Miss Laura Skinner, Mr. James A. Kelsey, Dr. Albert Schneider, Dr. E. H. James, Mr. Frank G. Hills, Mr. Charles H. Allen and Mr. Eustice H. Gane.

The club then listened to the reading of the announced papers.

Dr. Valery Havard, in his paper on "Drink Plants of the North American Indians," discussed three classes of such plants: first, those like Maguay and Maize, yielding alcoholic beverages; second, those like *Lophophora* and *Ilex vomitoria*, yielding beverages which intoxicate or stimulate, but not by virtue of alcoholic constituents; third, those like Chia seeds and *Rhus* fruits, yielding beverages drunk only for their refreshing properties. The paper was discussed by Dr. Britton and Dr. Rusby, and is published in full in this issue of the BULLETIN.

Dr. John K. Small was unable to present his paper, "Preliminary Notes on the North American species of *Saxifraga*" in full, owing to delay in the receipt of material required for study. He proposed to separate from *Saxifraga* two new genera, *Jepsonia* and *Saxifragopsis*, as published in the January BULLETIN.

Dr. N. L. Britton proposed a number of new species of Cyperaceæ, reducing two others, and contributing a large number of interesting notes upon this family.

Dr. Britton also upheld Pursh's *Lilium umbellatum*, which has usually been accepted in herbaria as *L. Philadelphicum*. His position was supported by numerous specimens, and was endorsed by Mr. Rydberg.

TUESDAY EVENING, FEBRUARY 11, 1896.

The President occupied the chair and there were 38 persons present.

Miss E. J. Stone and Miss Susie E. Brown were elected active members.

Mr. A. A. Heller read his announced paper, "Botanizing in Hawaii." The paper was illustrated by lantern views and was listened to with great interest. It was discussed by the President, Dr. Britton, Mr. Gilbert and the Secretary, after which Mr. Heller communicated furthed observations on the subject.

Mr. Arthur Hollick was unable to be present to read his paper entitled "Leguminous Pods from the Yellow Gravel Sandstone at Bridgeton, N. J." In his place Dr. Britton presented the chief points in connection with the subject, exhibiting specimens of the fossils. The paper is published in this issue of the BULLETIN.

Mr. B. D. Gilbert announced that he had brought to the meeting some specimens of a peculiar species of *Ophioglossum* from Iceland, which he invited the members to examine.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., March 29, 1896. No. 3.

A List of Species of the smaller herbaceous Genera of North American Saxifragaceae.

By Wm. E. Wheelock.

In studying the herbaceous North American Saxifragaceae, it has seemed desirable to present a preliminary enumeration of the species, with their synonymy and distribution as known to me at the present time, with a view of eliciting comment and to request additional material for examination. The species of *Saxifraga* will be enumerated by Dr. Small in a subsequent contribution.

The genera have been taken up in the sequence adopted by Professor Engler, in Engler und Prantl's "Naturliche Pflanzenfamilien," and I find myself able to agree with him in most of his generic limitations.

The following key will serve to indicate these limitations.

The synonymy is given only for those species not enumerated in the "List of Pteridophyta and Spermatophyta of Northeastern North America," Mem. Torr. Club, 5: 177–180. 1894.

Staminodia wanting.
  Large herbs with 3-ternate leaves and polygamous flowers. 1. Astilbe.
  Herbs with simple cleft lobed or 3-foliolate leaves and perfect flowers.
    Leaves coriaceous; carpels distinct. 2. Leptarrhena.
    Leaves membranous, coriaceous or fleshy, carpels more or less united at the base.
      Placentae axial.
        Ovary superior or nearly so.
          Stamens five. 3. Bolandra.
          Stamens ten.

Calyx five-toothed, stamens inserted just under the sinuses.
4. JEPSONIA.

Calyx five-cleft or five-parted, stamens inserted under the ovary.
5. SAXIFRAGA.

Ovary not superior, more or less adnate to the calyx-tube.

Petals mostly deciduous; stamens five or ten; seeds ovoid, rough.
6. THEROFON.

Petals persistent.

Stamens five. 7. SULLIVANTIA.

Stamens ten.

Leaves not peltate.

Petals at length deflexed; leaves papery-membranous, the blade obscurely articulated to the petiole. 8. SAXIFRAGOPSIS.

Petals not deflexed; leaves coriaceous or fleshy, the blade more or less decurrent. 5. SAXIFRAGA.

Leaves peltate. 9. PELTIPHYLLUM.

Ovary almost entirely inferior; stamens five. 10. HEMIEVA.

Placentae almost basal. 11. TIARELLA.

Placentae parietal.

Petals present (except in some species of *Heuchera*).

Plants large, at least several centimeters high.

Petals entire, relatively small.

Stamens five. 12 HEUCHERA.

Stamens three. 13. LEPTAXIS.

Petals variously toothed, cleft, lobed or parted, or if entire relatively large; stamens five or ten.

Capsule beaked.

Corolla regular. 14. TELLIMA.

Corolla often somewhat irregular; petals sometimes entire, the upper often smaller. 15. LITHOPHRAGMA.

Capsule not beaked. 16. MITELLA.

Plants minute, about one centimeter high. 17. LEPUROPETALON.

Petals always wanting. 18. CHRYSOSPLENIUM.

Staminodia present, alternate with the stamens. 19. PARNASSIA.

1. ASTILBE Hamilt.

1. **Astilbe biternata** (Vent.) Britton, Bull. Torr. Club, **20**: 475. 1893. Mountains of Virginia and Kentucky to Georgia and Tennessee.

1*a*. **Astilbe biternata crenatiloba** (Britton).

Astilbe decandra var. *crenatiloba* Britton, Bull. Torr. Club, **15**: 98. 1888.

This plant has been seen only from the original station on the slope of Roan Mountain, East Tennessee.

2. LEPTARRHENA R. Br. in Parry's 1st Voy. Suppl. cclxxiii. 1824.

1. **Leptarrhena amplexifolia** (Sternb.) Ser. in DC. Prodr. 4: 48. 1830.

Saxifraga amplexifolia Sternb. Rev. Sax. Suppl. 2. *pl. 2.* 1822.
Saxifraga pyrolifolia D. Don, Trans. Linn. Soc. 13: 389. 1822.
Leptarrhena pyrolifolia Ser. in DC. Prodr. 4: 48. 1830.
Alaska to British Columbia and Washington.

I have followed Mr. Jackson in "Index Kewensis," in giving priority to the specific name *amplexifolia* over *pyrolifolia.*

3. BOLANDRA A. Gray, Proc. Am. Acad. 7: 341. 1868.

1. **Bolandra Californica** A. Gray, Proc. Am. Acad. 7: 341. 1868.
California to Oregon.

2. **Bolandra Oregana** S. Wats. Proc. Am. Acad. 14: 292. 1879
Oregon, Washington.

4. JEPSONIA Small, Bull. Torr. Club, 23: 18. 1896.

Leaves sub-orbicular, broader than long; calyx-teeth shorter than the tube. 1. J. PARRYI.
Leaves ovate-orbicular, longer than broad; calyx-teeth as long as the tube, or longer. 2. J. MALVAEFOLIA.

1. **Jepsonia Parryi** (Torr.) Small, Bull. Torr. Club, 23: 18. 1896.
Saxifraga Parryi Torr. Bot. Mex. Bound. Surv. 69. *pl. 25.* 1859.
Middle and southern California.

2. **Jepsonia malvaefolia** (Greene) Small, Bull. Torr. Club, 23: 19. 1896.
Saxifaga malvaefolia Greene, Bull. Torr. Club, 19: 121. 1882.
Santa Rosa Island and Santa Cruz Island.

6. THEROFON Raf.

Stamens 5.
Stipules wanting, or represented by bristles.
Leaves 3–7-lobed or 3–7-cleft.
East American species. 1. *T. aconitifolium.*
West American species. 2. *T. elatum.*
Leaves crenate-dentate or incised.
Petals small, hardly longer than calyx-teeth; Californian species. 3. *T. rotundifolium.*
Petals relatively large; arctic species. 4. *T. Richardsoni.*
Stipules present, often foliaceous and conspicuous. 5. *T. majus.*
Stamens 10. 6. *T. Jamesii.*

1. **Therofon aconitifolium** (Nutt.) Millsp. Bull. West Va. Agric. Exp. Sta. 2: 361. 1892.
Virginia to Tennessee and Georgia.

2. **Therofon elatum** (Nutt.) Greene, Man. 121. 1894.
Saxifraga elata Nutt.; T. & G. Fl. N. A. 1: 575. 1840.
Boykinia occidentalis T. & G. Fl. N. A. 1: 577. 1840.
Boykinia elata Greene, Fl. Francis. 190. 1891.
Boykinia Nuttallii J. M. Macoun, Can. Rec. Sci. 1895.
British Columbia to southern California.

The plant for which Mr. J. M. Macoun suggests the name *Boykinia Nutallii* does not seem to us sufficiently distinct from *B. occidentalis* T. & G. We have the form to which Mr. Macoun evidently refers even from Santa Cruz, California, but hardly hirsute. We must consider, that Mr. Nuttall was describing a *Saxifraga* when he wrote "a very remarkable robust species."

3. **Therofon rotundifolium** (Parry).
Boykinia rotundifolia Parry; A. Gray, Proc. Am. Acad. 371. 1878.
Southern California.

4. **Therofon Richardsoni** (Hook.).
Saxifraga Richardsonii Hook. Fl. Bor. Am. 1: 247. 1833.
Saxifraga Nelsoniana Hook. & Arn. Bot. Beechey, 124. *pl. 29*. 1832. Not D. Don. 1822.
Hemieva Richardsoni Raf. Fl. Tell. 2: 70. 1836.
Boykinia Richardsoni A. Gray, Bot. Cal. 1: 196. 1876.
Arctic America.

5. **Therofon majus** (A. Gray).
Boykinia occidentalis var. *elata* A. Gray, Proc. Am. Acad. 8: 383, name only. 1872. Not *Saxifraga elata* Nutt. 1840.
Boykinia major A. Gray, Bot. Cal. 1: 196. 1876.
California to Oregon.

6. **Therofon Jamesii** (Torr.).
Saxifraga Jamesii Torr. Ann. Lyc. N. Y. 2: 204. 1826.
Telesonix Jamesii Raf. Fl. Tell. 2: 69. 1836.
Rocky Mountains, Montana, Dakota.

7. SULLIVANTIA T. & G.

1. **Sullivantia Sullivantii** (T. & G.) Britton, Mem. Torr. Club, **5**: 178. 1894.

Ohio, Indiana, Wisconsin.

2. **Sullivantia Oregana** S. Wats. Proc. Am. Acad. **14**: 292. 1879.

Sullivantia Hapemani Coulter, Bot. Gazette, **17**: 421. 1892.
Oregon, Wyoming.

8. SAXIFRAGOPSIS Small, Bull. Torr. Club, **23**: 20. 1896.

1. **Saxifragopsis fragarioides** (Greene) Small, Bull. Torr. Club, **23**: 20. 1896.

Saxifraga fragarioides Greene, Bull. Torr. Club, **8**: 121. 1881.

High altitudes in the mountains of northern California and southern Oregon.

9. PELTIPHYLLUM Engler, Nat. Pfl. Fam. 3: Abt. 2, 61. 1891.

1. **Peltiphyllum peltatum** (Torr.) Engl. Nat. Pfl. Fam. **3**: Abt. 2, 61. 1891.

Saxifraga peltata Torr.; Benth. Pl. Hartw. 311. 1849.
In and near the Sierra Nevada, California.

10. HEMIEVA Raf. Fl. Tell. 2: 70. 1836.

[SUKSDORFIA A. Gray, Proc. Am. Acad. **15**: 42. 1879.]

Petals short-clawed.	1. *H. ranunculifolia.*
Petals long-clawed.	2. *H. violacea.*

1. **Hemieva ranunculifolia** (Hook.) Raf. Fl. Tell. 2: 70. 1836.

Saxifraga ranunculifolia Hook. Fl. Bor. Am. **1**: 246. *pl. 83.* 1833.

Boykinia ranunculifolia Greene, Fl. Fran. 190. 1891.

Suksdorfia ranunculifolia Engl. in Engl. & Prantl, Nat. Pfl. **3**: 2a, 52. 1891.

British Columbia.

2. **Hemieva violacea** (Raf.).

Suksdorfia violacea A. Gray, Proc. Am. Acad. **15**: 42. 1879.
Washington; Oregon.

11. TIARELLA L.

Stem a scape; or rarely bearing one small leaf.	1. *T. cordifolia.*
Stem leaf-bearing.	
Leaves triangular-cordate.	2. *T. unifoliata.*
Leaves ternately divided, or trifoliolate.	3. *T. trifoliata.*

1. **Tiarella cordifolia** L. Sp. Pl. 405. 1753.
Canada to Alabama.

2. **Tiarella unifoliata** Hook. Fl. Bor. Am. 1: 238. *pl. 81.* 1833.
Heuchera longipetala Moc. Icon. Fl. Mex. ined. *pl. 423.*
Petalosteira unifolia Raf. Fl. Tell. 2: 74. 1836.
Oregon to British Columbia.

3. **Tiarella trifoliata** L. Sp. Pl. 406. 1753.
Tiarella stenopetala Presl, Rel. Haenk. 2: 55. 1835.
Blondia trifoliata Raf. Fl. Tell. 2: 75. 1836.
Petalosteira laciniata Raf. l. c. 74. 1836.
Southern Alaska to British Columbia.

3a. **Tiarella trifoliata laciniata** (Hook.).
Tiarella laciniata Hook. Fl. Bor. Am. 1: 239. *pl. 77.* 1833.
Vancouver Island; Washington.

12. HEUCHERA L.

Since the publication of "A Descriptive List of Species of the Genus *Heuchera*," Bull. Torr. Club, 17: 191–204, 1890, the original specimen on which *H. Curtisii* A. Gray was founded has come to light. I referred this plant, with doubt, to *H. villosa* Michx., but an examination of the type shows that it is to be referred to *H. pubescens* Pursh.

13. LEPTAXIS Raf. Fl. Tell. 2: 75. 1836.

[Tolmiea T. & G. Fl. N. A. 1: 582. 1840. Not Hook. 1834.]

1. **Leptaxis Menziesii** (Pursh) Raf. Fl. Tell. 2: 76. 1836.
Tiarella Menziesii Pursh, Fl. Am. Sept. 1: 313. 1814.
Heuchera Menziesii Hook. Fl. Bor. Am. 1: 237. *pl. 80.* 1833.
Tolmiea Menziesii T. & G. Fl. N. A. 1: 582. 1840.
British Columbia to Oregon.

14. TELLIMA R. Br. App. Frank. Journ. 765. 1823.

Stamens 10; stems 1½°–2° tall.	1. *T. grandiflora.*
Stamens 5; stems 6′–8′ tall.	2. *T. racemosa.*

1. **Tellima grandiflora** (Pursh) Dougl. Bot. Reg. *pl. 1178.* 1828.
Mitella grandiflora Pursh, Fl. Am. Sept. 1: 314. 1814.
Tiarella alternifolia Fisch.; Seringe, DC. Prodr. 4: 50. 1830.
Alaska to California.

Mr. Thos. Howell sends us from the Columbia River, near the Cascades, as *T. odorata*, a plant which we do not find sufficiently distinct from *T. grandiflora*, to maintain as a species.

2. **Tellima racemosa** (S. Wats.) Greene, Erythea, 3: 55. 1895.
Heuchera racemosa S. Wats. Proc. Am. Acad. 20: 365. 1885.
Washington.

In Erythea, 3: 55, Prof. E. L. Greene gives the reasons why, in his judgment, *Heuchera racemosa* S. Watson should be referred to *Tellima*, and in the same volume at page 102, after giving new reasons why he would restore to generic rank the genus *Lithophragma*, refers *Heuchera Williamsii* Eaton, to this latter genus. There certainly seems to be ground for both these positions. With reference to the plant collected by Mr. Williams it is interesting to note that both Mr. Canby and Prof. Eaton referred it to *Tellima* at first, and the latter put the plant finally into *Heuchera* simply because it had entire petals and five stamens. In the Flora of North America, Torrey and Gray, 1: 585, we are told that Mr. Nuttall, in his manuscript notes, called attention to the accordance of *Tellima Cymbalaria* Walp. (*Saxifraga Californica* Nutt. mss.) with *Lithophragma*, while he also noticed the fact that the styles are sometimes two only. This makes it easier for us to refer *Heuchera Williamsii* to *Lithophragma*.

If through the adoption of the arrangement above referred to, we sacrifice a stamen character, we gain by removing from the genus *Heuchera* the only two species that seem to be out of sympathy with the rest through having a purely racemose inflorescence.

15. LITHOPHRAGMA Nutt. Journ. Acad. Phila. 7: 26. 1834.*

Petals deeply palmately 3–7-parted.	
Raceme 3-6-flowered.	1. *L. tenella.*
Raceme 12–20-flowered.	2. *L. rupicola.*
Petals variously cleft or lobed.	
Calyx-tube obconic.	3. *L. parviflora.*
Calyx turbinate.	4. *L. affinis.*
Calyx campanulate.	
Pedicels very short.	5. *L. heterophylla.*
Pedicels about as long as the calyx.	6. *L. tripartita.*
Petals entire, undulate, or minutely toothed.	
Calyx campanulate, with a broad base.	
Pedicels very short.	7. *L. Bolanderi.*
Pedicels about as long as the calyx.	8. *L. scabrella.*
Calyx campanulate, narrowed at the base; stamens 10.	9. *L. Cymbalaria.*
Calyx obconic; stamens 5.	10. *L. Williamsii.*

1. **Lithophragma tenella** T. & G. Fl. N. A. 1: 584. 1840.
Lithophragma glabra T. & G. Fl. N. A. 1: 584. 1840.
Tellima tenella and *T. glabra* Walp. Rep. 2: 371. 1843.
Lithophragma parviflora A. Gray, Ives Rep. 15. 1860. Name only.
Vancouver Island to Utah.

2. **Lithophragma rupicola** Greene, Erythea, 3: 102. 1895.
California.

3. **Lithophragma parviflora** Nutt.; T. & G. Fl. N. A. 1: 584. 1840.
Tellima parviflora Hook. Fl. Bor. Am. 1: 239. 1833.
Pleurendotria parviflora and *P. reniformis* Raf. Fl. Tell. 2: 73. 1836.
Mitella parviflora Dietr. Syn. 2: 1539. 1840.
Vancouver Island, Oregon, Utah, Wyoming.

4. **Lithophragma affinis** A. Gray; Proc. Am. Acad. 6: 534. 1865.
Lithophragma heterophylla Torr. Pac. R. R. Rep. 4: 90. 1857.
Tellima affinis Boland. Catal. 11. 1870.
California.

5. **Lithophragma heterophylla** T. & G. Fl. N. A. 1: 584. 1840.
Tellima heterophylla Hook. & Arn. Bot. Beech. 346. 1840.
California.

* Original spelling, *Lithofragma*.

6. **Lithophragma tripartita** Greene, Erythea, 3: 102. 1895.
Tellima tripartita Greene, Erythea, 1: 106. 1893.
California.

7. **Lithophragma Bolanderi** A. Gray; Proc. Am. Acad. 6: 535. 1865.
Tellima Bolanderi Boland. Catal. 11. 1870.
California.

8. **Lithophragma scabrella** Greene, Erythea, 3: 102. 1895.
Tellima scabrella Greene; Pittonia, 2: 162. 1891.
California.

9. **Lithophragma Cymbalaria** T. & G. Fl. N. A. 1: 585. 1840.
Tellima Cymbalaria Walp. Rep. 2: 372. 1843.
California.

10. **Lithophragma Williamsii** (D. C. Eaton) Greene, Erythea, 3: 102. 1895.
Heuchera Williamsii D. C. Eaton, Bot. Gaz. 15: 62. 1890.
Tellima nudicaulis Greene, Pittonia, 2: 162. 1891.
Montana, Wyoming.

16. MITELLA L.

Stem leafy.	
Stem-leaves a single pair, opposite; stamens 10.	1. *M. diphylla.*
Stem-leaves 2–3, alternate; stamens 5.	2. *M. caulescens.*
Stem a leafless scape.	
Stamens 10.	3. *M. nuda.*
Stamens 5.	
Stamens opposite the petals.	4. *M. pentandra.*
Stamens alternate with the petals.	
Petals greenish or yellow, pinnately-parted.	
Leaves round-reniform, mostly glabrous.	5. *M. Breweri.*
Leaves oval, hirsute on upper surface.	6. *M. ovalis.*
Petals white, 3-cleft.	
Calyx campanulate, lobes long, spreading.	7. *M. trifida.*
Calyx-lobes short; leaves angulate-lobed.	8. *M. diversifolia.*

1. **Mitella diphylla** L. Sp. Pl. 406. 1753.
Quebec to Minnesota, North Carolina and Missouri.

2. **Mitella caulescens** Nutt.; T. & G. Fl. N. A. 1: 586. 1840.
Washington, Oregon, Idaho.

3. **Mitella nuda** L. Sp. Pl. 406. 1753.
Newfoundland to British Columbia, Pennsylvania and Michigan.

4. **Mitella pentandra** Hook. Bot. Mag. *pl. 2933.* 1828.
Drummondia mitelloides DC. Prodr. 4: 50. 1830.
Pectiantia mitelloides Raf. Fl. Tell. 2: 72. 1836.
Mitellopsis Drummondia Meisner, Pl. Vasc. Gen. 1: 100. 1836.
Mitellopsis pentandra Walp. Rep. 2: 370. 1843.
Alaska, British Columbia, Montana, Colorado, Utah.

5. **Mitella Breweri** A. Gray, Proc. Am. Acad. 6: 533. 1865.
British Columbia, Washington, California.

6. **Mitella ovalis** Greene, Pittonia, 1: 32. 1887.
Mitella Hallii Howell, Erythea, 3: 33. 1895.
Vancouver Island.

7. **Mitella trifida** Graham, Edinb. New Phil. Journ. April, 1829. 185.
Ozomelis varians Raf. Fl. Tell. 2: 73. 1836.
Mitellopsis Hookeri Meisner, Pl. Vasc. Gen. 1: 100. 1836.

8. **Mitella diversifolia** Greene, Pittonia, 1: 32. 1887.
California, Oregon.

17. LEPUROPETALON Ell. Bot. S.C. & Ga. 1: 370. 1817.

1. **Lepuropetalon spathulatum** (Muhl.) Ell. Bot. S.C. & Ga. 1: 370. 1817.
Pyxidanthera spathulata Muhl. Cat. 24. 1813.
Cryptopetalum pusillum Hook. & Arn. Bot. Misc. 3: 345. 1832.
Lepuropetalon pusillum C. Gay, Fl. Chil. 3: 42. 1847.
South Carolina, Chile.

18. CHRYSOSPLENIUM L.

Leaves alternate; stamens 8.	1. *C. alternifolium.*
Leaves opposite, or alternate; stamens 4.	2. *C. tetrandrum.*
Leaves opposite; stamens 8.	
Leaves obscurely crenate-lobed.	3. *C. Americanum.*
Leaves crenate-dentate.	4. *C. glechomaefolium.*

1. **Chrysosplenium alternifolium** L. Sp. Pl. 398. 1753.
Alaska, Europe, Asia.

2. **Chrysosplenium tetrandrum** Th. Fries, Bot. Notis. 193. 1858.
Chrysosplenium alternifolium var. *tetrandrum* Lund. in Sched. ex Maxim, Mel. biol. 9: 761.

British Columbia. Recorded by Franchet (Nouv. Arch. Mus. Paris (III.) 2: 107 from Alaska and the mountains of Colorado (Harbour 575).

3. **Chrysosplenium Americanum** Schweinitz; Hook. Fl. Bor. Am. 1: 242. 1833.

New Jersey, Pennsylvania, New York, Wisconsin.

4. **Chrysosplenium glechomaefolium** Nutt.; T. & G. Fl. N. A. 1: 589. 1840.

Chrysosplenium oppositifolium var. β Hook. Fl. Bor. Am. 1: 242. 1833.

Columbia, Washington.

19. PARNASSIA L.

Petals fimbriate toward the base.	1. *P. fimbriata.*
Petals not fimbriate.	
Sterile filaments 3 in each set; flowers large, 1 inch in diameter or more.	
Leaves ovate or cordate ovate.	
Sterile filaments longer than the stamens.	2. *P. grandifolia.*
Sterile filaments about equalling the stamens.	3. *P. Caroliniana.*
Leaves reniform.	4. *P. asarifolia.*
Sterile filaments 3–8 in set; flowers small, less than 1 inch in diameter.	
Low, 8 inches or less; scape leafless, or with a small leaf near the base.	5. *P. Kotzebuei.*
Taller, the leaf not much below the middle of the scape.	6. *P. parviflora.*
Sterile filaments about 10 (9–15) in each set.	7. *P. palustris.*
Sterile filaments about 20 in each set.	8. *P. Californica.*

1. **Parnassia fimbriata** Banks; Sims & Koen. Ann. Bot. 1: 391. 1805.

Alaska, Washington, California, Montana, Wyoming, Colorado, Nevada, Utah.

2. **Parnassia grandifolia** DC. Prodr. 1: 320. 1824.

North Carolina, southwestern Virginia, Missouri, Florida.

3. **Parnassia Caroliniana** Michx. Fl. Bor. Am. 1: 184. 1803.

New Brunswick to Manitoba, Virginia, Illinois and Iowa.

4. **Parnassia asarifolia** Vent. Jard. Malm. *pl. 39.* 1803.

orth Carolinia, Georgia, Virginia.

5. **Parnassia Kotzebuei** Cham. & Schlecht. Linnaea, **1**: 549. 1826.
Labrador, Bering Strait, Rocky Mountains.

6. **Parnassia parviflora** DC. Prodr. **1**: 320. 1824.
Canada, Utah.

7. **Parnassia palustris** L. Sp. Pl. 273. 1753.
Labrador, Minnesota, Canada, Northwest Territory, Lake Superior.

8. **Parnassia Californica** (A. Gray) Greene, Pittonia, **2**: 102. 1890.
Parnassia palustris var. *Californica* A. Gray, Bot. Calif. **1**: 202. 1876.

Revision of the North American Thuidiums.

By G. N. Best.

The larger part of the material on which this revision is based was furnished by the collection of *Thuidiums* in the herbarium of Columbia University, consisting of a large number of both American and European specimens and exsiccatae. These have been especially useful in that they made a comparison possible between native and foreign species by which diagnostic characters could be deduced with more certainty than could otherwise have been done.

My thanks are due Mrs. Britton for verifying all the citations, arranging the synonymy and in securing the loan of type specimens; also M. Eugene Autran, Prof. John Macoun and Dr. B. L. Robinson for the loan of type specimens. For valuable contributions I am indebted to Dr. C. R. Barnes, Dr. Henri Philibert, Dr. T. C. Porter, Mr. E. A. Rau, Dr. J. K. Small and Rev. A. C. Waghorne.

The *Thuidiums* are widely dispersed over both continents. In North America they range from Greenland to Florida and from the Labrador to Vancouver's Island. Most common in the United States east of the Rocky Mountains, they are rare or absent on the Pacific slope.

In studying a specific type of wide distribution it should be borne in mind that it has its centers of maximum as well as minimum development. In other words, it has its evolute and involute forms. In some instances these differ considerably, so much so that without the connecting forms they appear as distinct species. In fact they are not infrequently so treated, especially by those systematists who see a "new species" in the most trifling variation and who do not care to dispel the illusion by the necessary investigation.

In this revision I have endeavored to establish the commonly recognized species rather than to make new ones. Without ascertaing the precise limits of the former, it would be impossible to be sure of the latter. And as many of the *Thuidiums* are sterile in certain localities, diagnostic characters have been drawn largely from the vegetative system. The number and position of the papillae of the leaf cells, more than their size, have been found quite constant and therefore of value in discriminating closely related species. The paraphyllia, important from a generic standpoint, are less so from a specific, because of their variability. The cilia and perichetial bracts in these, as in nearly all mosses, are the parts most likely to be modified by changed conditions of growth.

Types have been seen when possible; when not, as was too frequently the case, authentic specimens. These have been studied with so much care as to almost preclude the possibility of mistake. Those species admitted into the Manual as peculiar to North America have likewise been closely investigated with the following results: *Thuidium erectum* Duby is *Th. delicatulum*, as is proved by the type and the author's own correction; *Hypnum calyptratum* Sulliv. is *Th. microphyllum*, with abnormal capsules, due to parasites; *Thuidium Alleni* Aust. is a dubious sterile form most probably of *Th. delicatulum*; *Hypnum remotifolium* Grev. is not a *Thuidium*, neither is it North American. *Thuidium lignicola* Kindb., admitted in Macoun's Catalogue of Canadian Musci, represents the northern variation of *Th. microphylium* from which it seems impossible to separate it on good grounds. *Hypnum tamariscinum* Hedw., although quite common in Europe, appears to go by default in North America. The tripinnate ramification and the unipapillate apical cell of the branch-leaves serve to distinguish it from *Th. delicatulum*.

NOTE.—When unipapillate, bipapillate and pluripapillate are used in connection with leaf cells they mean respectively one, two, three or more papillae on each surface, unless otherwise stated; when leaf cells are referred to they invariably mean those of the stem leaves. ! indicates that the type has been seen by the author.

Thuidium Br. and Sch. Br. Eu. fasc. 49–51. 1852

Stem radiculose, creeping or ascending, erect, pinnately branched; branches simple, pinnate or bipinnate; stem and branches more or less thickly covered with simple or multiform paraphyllia; stem-leaves ovate-triangular to oblong-lanceolate, acuminate, cordate, plicate, strongly costate, papillate on one or both surfaces; branch-leaves ovate, or ovate-lanceolate, acuminate. Monoicous or dioicous; perichetial bracts rather long, costate, plicate; capsule oblong-cylindrical, asymetrical, suberect, horizontal or pendulous; annulus compound; internal membrane fully one-third the length of the teeth; cilia two to four, usually well developed; operculum from short conical to long rostrate; calyptra tubular-cucullate, long; spores small.

Plants of unequal size growing in thin or thick mats on the ground, stones, rocks, rotten wood and on the base of trees.

Synopsis of the Species.

Plants ascending-erect,
  Leaves rigid, cells quadrate-oblong; branch-leaves appressed when dry. — 7. *abietinum.*
  Leaves soft, cells oblong-linear; branch-leaves crispate when dry. — 10. *Blandowii.*
Plants creeping-ascending,
  Small; paraphyllia simple; branch-leaves appressed-incurved when dry,
    Branches papillate, capillary. — 1. *pygmaeum.*
    Branches not papillate. — 2. *minutulum.*
  Large; paraphyllia multiform; branch-leaves appressed when dry,
    Stem-leaves spreading-recurved, margins plane; perichetium not ciliate. — 4. *recognitum.*
    Stem-leaves erect-spreading, margins recurved,
      Perichetium not ciliate; annulus narrow, indistinct. — 5. *Philiberti.*
      Perichetium ciliate; annulus compound, distinct. — 6. *delicatulum.*
  Medium sized; paraphyllia mostly linear-geniculate.
    Leaf-cells with several minute papillae. — 3. *scitum.*
    Leaf-cells with one, rarely two papillae.
      Leaves smooth or lightly papillate. — 11. *paludosum.*
      Leaves strongly papillate on both surfaces.
        Branch-leaves roundish-ovate, short-acuminate. — 8. *Virginianum.*
        Branch-leaves ovate-lanceolate, long-acuminate. — 9. *microphyllum.*

EUTHUIDIUM: Stem-leaves and branch-leaves heteromorphous, papillate on both surfaces; leaf-cells quadrate-hexagonal to oblong-rhomboidal; paraphyllia simple or multiform.

1. THUIDIUM PYGMAEUM Br. & Sch.

Thuidium pygmaeum Br. and Sch. Bryol. Eu. fasc. 49–51: 6. 1852.

Hypnum pygmaeum Sull. Mosses U. S. 67. 1856.

* Plants *very small,* dirty green in felt-like mats; stem 1 to 2 cm. long, creeping, pinnately branched; branches pinnate, capillary, subcompressed, *papillate;* paraphyllia *simple,* short, 2 to 5 cells long; stem-leaves triangular-ovate, narrowly acuminate, distant; leaf-cells quadrate-hexagonal (.006 mm.) pluripapillate; branch leaves (.15 mm) ovate, obtuse, *appressed-incurved* when dry. Monoicous; perichetial bracts erect, lanceolate or oblong-lanceolate, entire or serrulate above; pedicel long, flexuous; capsule oblong, *inequilateral,* inclined or horizontal, wide-mouthed; annulus broad, compound; cilia 2 to 3; operculum broadly conical, obliquely rostrate; spores .007 to .009 mm.

On stones, rarely on the ground, in calciferous districts. New Jersey (Austin); Pennsylvania (James, Porter, Rau); Ohio (Sullivant); Canada (Macoun).

Type locality American; collected by W. S. Sullivant, at Columbus, Ohio. Type at Kew. in Herb. Schimper.

ILLUST. Sulliv. Icon. Musc. 153. *pl. 98.* 1864.

EXSIC. S. & L. Musc. Bor. Am. Ed. 1, no. 275; Ed. 2, no. 408. Aust. Musc. App. no. 296.

2. THUIDIUM MINUTULUM (Hedw.) Br. & Sch.

Thuidium minutulum Br. & Sch. Bryol. Eu. fasc. 49–51. 1852.

Hypnum minutulum Hedw. Musc. frond. 4: 99. 1791.

Plants small, dark green, in thin mats: stem 2 to 4 cm. long, creeping, pinnately branched; branches simple or pinnate, spreading, subcompressed; paraphyllia *simple,* 3 to 6 cells long; stem leaves ovate-triangular, acuminate, recurved or revolute below, margins papillate-crenulate, costa vanishing in the abrupt usually curved acumen; leaf-cells quadrate-hexagonal (.009 mm.) pluripapillate, *marginal larger*; branch-leaves ovate-acuminate, *subcrispate* and *appressed incurved* when dry. Monoicous; perichetial bracts erect, long and narrowly acuminate, entire; pedicel long, flexuose; capsule *oval-oblong* to obovoid-oblong, asymetrical, hori-

* Apical cell of ultimate branch leaves crowned with two or more papillae.

zontal, *rough;* annulus compound, deciduous; operculum conical, slenderly beaked, usually oblique, as long as the capsule; spores .007 to .010 mm., almost smooth., maturing in autumn.

On rotton wood, not rarely on the ground and on stones in the Southern States. From New Brunswick to Minnesota and from Canada to Florida.

Type locality, Lancaster, Pennsylvania, Muhlenberg.

ILLUST. Hedw. Musc. frond. *pl. 34.* 1791. Br. & Sch. Bryol. Eu. 5. *pl. 481.* 1852. Husnot, Musc. Gall. *pl. 87.* 1894.

EXSIC. Drumm. Musc. Am. ed. 2. No. 137. Sull. Musci All. No. 4. Sull. & Lesq. Musc. Bor. Am. ed 2. no. 481. Aust. Musc. App. No. 297. Macoun, Can. Musc. no. 268.

Rem. Distinguished from the closely related *Th. pygmaeum* by its larger size, dark green color, stem-leaves with longer costa and branch-leaves subcrispate when dry.

3. THUIDIUM SCITUM (Beauv.) Aust.

3. *Hypnum scitum* Beauv. Prodr. 69. 1805.

Hypnum Stereodon scitus Brid. Bryol. Univ. 2: 575. 1827.

Thuidium scitum Aust. Musci App. 51. 1870.

Rauia scita Aust. Bull. Torr. Club, 7: 16. 1880.

Medium sized plants, glaucous-green to yellow-brown, in appressed mats. Stem 4–6 cm. long, prostrate, simple or divided, *densely pinnately* branched; branches simple, spreading, *terete* when dry; paraphyllia multiform, mostly linear; stem-leaves broadly triangular, *subauriculate-cordate*, the pellucid costa vanishing at the base of the long narrow curved acumen, bisulcate; leaf-cells roundish hexagonal (.006 mm.) middle basal oblong, pluripapillate (3–6); branch-leaves broadly ovate-acuminate. Monoicous; perichetial bracts erect, long filiform-acuminate; capsule oblong-cylindrical, *straight* or slightly curved; *erect* or inclined; annulus of three rows of large pellucid cells; teeth linear-lanceolate, *pale;* cilia 2–3, rarely perfect; operculum conical-rostrate; spores rough .009–.011 mm. Maturing in the autumn and winter.

On the roots, at base of trees, more commonly the beech, rarely on stones, or on the ground. Canada (Macoun); Ohio (Miss Biddlecome); New Jersey (Austin); Wisconsin (Gillman); District of Columbia (Holzinger.)

Type locality, North American. Type in Delessert Herbarium, Geneva, Switzerland.

ILLUST. Sull. Icon. Musc. 155. *pl. 99.* 1864.

EXSIC. Sull. Musc. All. no. 6. S. & L. Musc. bor. Am. ed. 2. no. 409. Aust. Musc. App. no. 300. Macoun, Can. Musc. no. 269.

3a. THUIDIUM SCITUM ÆSTIVALE Austin, Musci App. 51. 1870.

Thuidium aestivum Aust. Bull. Torr. Club, 5, 23. 1874.

Thuidium scitum var. *aestivale* Aust. Musc. App. no. 301. 1870.

Hynum scitum var *aestivale* Lesq. & Jas. Mosses, of N. A. 323. 1884.

Stem more diffusely divided, less densely pinnate; perichetial bracts more abruptly filiform-acuminate; capsule *oblong-cylindrical. horizontal*, wide-mouthed; cilia well-developed; teeth lanceolate, yellowish below; operculum more abruptly and shorter beaked; spores larger.

Canada (Macoun); Ohio (Miss Biddlecome); New York (Howe, Peck); New Jersey (Austin); North Carolina (Small & Heller); Pennsylvania (Porter, Rau); Wisconsin (Cheney & True); Vermont (Grout.)

EXSIC. Aust. Musc. App. no. 301.

Rem. An evolute, as *Th. scitum* is the involute form of the same specific type. Both are neat, pretty mosses with finely granular leaves and very small papillae.

4. THUIDIUM RECOGNITUM (Hedw.) Lindb.

Hypnum recognitum Hedw. Musc. frond. 4: 92. 1791.

Hypnum protensum Michx. Fl. Bor. Am. 2: 317. 1803.

Hypnum tamariscinum var. *recognitum* Brid. Bryol. Univ. 2: 440. 1827.

Thuidium delicatulum Br. & Sch. Bryol. Eu. Fasc. 49-51. 1852.

Thuidium recognitum Lindb. Not Sallsk. pro Fauna et Flora Fenn. Forh. 13: 416. 1874. Schimp. Syn. Musc. ed. 2, 614. 1876.

Rather large plants in intricate mats, dark green to yellow-brown; stem 5 to 19 cm. long, creeping or ascending, pinnately branched; branches pinnate, spreading; paraphyllia multiform; stem leaves *spreading-recurved*, broadly triangular, abruptly acuminate, *subauriculate-cordate*, the papillate-serrate margins usually *plane*, sometimes recurved; the curved acumen *thickened* by the *percurrent* costa; leaf-cells unipapillate, not rarely bipapillate (papillae large), oblong-quadrate at the basal margins, oblong-rhomboidal above, broadly linear along the costa; branch-leaves much smaller, ovate-acuminate. Dioicous; perichetial bracts rigid, the narrow acumen about as long as the body, serrate or with a few jagged teeth; capsule narrowly cylindrical, curved, horizontal; annulus broad, compound, operculum long conical to conic-rostrate; cilia 3 or 4; spores .011 to .013 mm.

On the ground, rotten wood and on rocks in damp shady places. From the Labrador (Waghorne) to British Columbia (Macoun) southward. Rare or absent on the Pacific slope and in the Gulf States.

Type locality in Saxony, Germany. Type in the Boissier Herbarium, at Geneva, Switzerland!

ILLUST. Hedw. Musc. frond. *pl. 35.* 1791. Husnot, Musc. Gall. *pl. 88.* 1894. Lindberg, l. c. 416. *pl. 1. fig. 9.* 1874.

EXSIC. Drummond, Musci. Am. no. 214. S. & L. Musc. Bor. Am. ed. 2, no. 404; Aust. Musc. App. no. 303; Macoun, Can. Musc. no. 271.

Rem. Easily distinguished from *T. delicatulum* by its spreading-recurved leaves with their *long-celled thickened* acumen and the *absence* of cilia on the perichetial bracts. In some European specimens the perichetial bracts are longer than those of American plants.

5. THUIDIUM PHILIBERTI Limpr.

Thuidium intermedium Philib. Rev. Bryol. **20**: 33. 1893. Not Mitt. 1851.

Thuidium Philiberti Limpr. Rab. Kryptfl. 4: 2, 835. 1895.

Medium sized plants, yellow to dark green, in intricate mats; stem 4 to 8 cm. long, creeping, pinnately branched; branches pinnate or bipinnate; paraphyllia multiform; stem-leaves triangular-cordate-acuminate, usually with a *hyaline filiform* point, margins revolute or recurved, at least below; leaf-cells oblong-quadrate to oblong-rhomboidal. Dioicous; perichetial bracts loose, *flexuous spreading* or reflexed, serrate, rarely with a few short cilia on the innermost, acumen about *three* times as long as the short, scarcely costate body; capsule oblong-cylindrical, curved, horizontal; annulus *narrow, indistinct,* tardily or imperfectly deciduous; operculum conic-rostate, curved; spores .012 to .016 mm., almost smooth, maturing in October. (Plate 260.)

In wet, swampy places on the ground or the base of small trees. New Jersey (Best); Pennsylvania (Porter).

Type locality, European (France)!

Rem. Probably an involute form of the preceding, from which it differs by its pointed leaves, indistinct annulus, looser perichetial bracts, which are usually destitute of cilia, and more uniform leaf cells.

6. THUIDIUM DELICATULUM (L.) Mitt.

Hypnum delicatulum L. Sp. Pl. 1125. 1753.

Hypnum delicatulum Hedw. Musc. frond. 4: 95. 1791.

Thuidium delicatulum Mitt. Journ. Linn. Soc. 12: 578. 1869.

Plants large, in intricate spreading mats, yellow-green; stems 5 to 10 cm. long. creeping-ascending, pinnately branched; branches pinnate or *bipinnate;* paraphyllia numerous, multiform; stem leaves *appressed* when dry, erect-spreading when moist, triangular-cordate, rather *gradually* acuminate, costa *vanishing in the acumen*, the papillate-serrate margins recurved; leaf-cells unipapillate or bipapillate, oblong-quadrate to elliptical-rhomboidal; branch-leaves ovate or ovate-acuminate. Dioicous; perichetial bracts rather loose, inner more or less *ciliate*, the loricate-filiform serrate acumen about twice as long as the blade; capsule cylindrical, strongly curved, horizontal; annulus compound, tardily deciduous; operculum conic-rostrate, beak curved; cilia 3 to 4; spores rough, .014 to .018 mm, maturing in winter.

On the ground, rotten wood, stones and rocks in shady places. From Labrador (Waghorne) to British Columbia (Macoun) southward through the United States; rare or absent in the Pacific States. Also in the West Indies and Central and South America.

Type localities, "Pennsylvania, Maryland and Virginia."

ILLUST. Dill. Hist. Musc. 546. *pl. 83. fig. 6.* 1741. Hedw. Musc. frond. 4: *pl. 33.* 1791. Lindberg, l. c. *pl. 1. fig. 8.* 1874. Husnot, Musc. Gall. *pl. 89.* 1894.

EXSIC. Drumm. Musc. Bor. Am. no. 213; 2d ed. no. 136. Sull. Musc. All. no. 3. as *H. tamariscinum* Hedw. S. & L. Musc. Bor. Am. ed. 1, no. 272; ed. 2, no. 403. Aust. Musc. App. 302. Macoun, Can. Musc. no. 272.

Rem. This and the preceding species often grow together. In American herbaria they are confused. *Th. delicatulum* is frequently named *Th. recognitum* and vice versa. The names *Hypnum tamariscinum* and *Hypnum proliferum* have been used indiscriminately for either.

7. THUIDIUM ABIETINUM (L.) Br. & Sch.

Hypnum abietinum L. Sp. Pl. ed. 2, 1591. 1763.

Hynum Stereodon abietinus Brid. Bryol. Univ. 2: 573. 1827.

Thuidium abietinum Br. & Sch. Bryol. Eu. fasc. 49–51. 1852.

Plants rather large, densely caespitose, yellow-green above, darker below; stem 5 to 9 cm. long, ascending-erect, rigid, simple or divided, *closely pinnately* branched; branches simple, unequal, attenuate, spreading or recurved, terete when dry; paraphyllia multiform, mostly linear; stem-leaves broadly ovate, acuminate, deeply biplicate, margins papillate-serrulate, plane or recurved, costate to the base of the acumen, appressed when dry; leafcells *in rows*, unipapillate, roundish, quadrate-hexagonal and very small at basal margins, oval-rhombic and much larger above; branch-leaves similar but smaller, apical cell with usually two papillae, sometimes only one. Dioicous; perichetial bracts mostly entire; capsule narrowly cylindrical, suberect, curved, strumose; annulus compound; segments widely open, papillate-striate; cilia 1 to 3, usually imperfect; operculum long-conical, acute; spores papillose, .012 to .016 mm., maturing in spring.

On rocks, stones and the ground, in dry sterile places. Common in Europe and North America, from Greenland to Virginia (E. G. Britton), and from Newfoundland (Waghorne) to British Columbia (Macoun.). Fruiting in Colorado (T. C. Porter) and in Montana (F. W. Anderson). Rare or absent in the Gulf States and on the Pacific slope.

Type locality European.

ILLUST. Hedw. Musc. frond. 4: *pl. 32.* 1791. Br. & Sch. Bryol. Eu. 5. *pl. 485.* 1852. Husnot, Musc. Gall. *pl. 88.* 1894.

EXSIC. Drumm. Musc. Bor. Am. no. 216. Aust. Musc. App. no. 304. Macoun, Can. Musc. no. 273.

8. THUIDIUM VIRGINIANUM (Brid.) Lindb.

Hypnum Stereodon Virginianus Brid. Bryol. Univ. 2: 276. 1827.

Thuidium Virginianus Lindb. Musc. Scand. 36. 1868. Besch. Prodr. Bryol. Mex. 91. 1871.

Hypnum gracile Lancastriense L. & J. Mosses N. A. 324. 1884.

Thuidium punctulatum De Not. Erbar. Critt. Ital. no. 909. 1863. et. Epil. 234. 1869. Limpr. Rab. Kryptfl. 4: 3, 825. 1895.

Plants small, dark or dirty green, intricately caespitose; stem 2–4 cm. long, creeping, pinnately branched; branches simple, erect-spreading; paraphyllia multiform; stem leaves *roundish*, ovate-triangular, costa vanishing in the short acumen, scarcly plicate, margin *plane*, erose-dentate below, serrate above; leaf-cells oblong-quadrate to hexagonal (.009 mm.) unipapillate; papillae *stout*, broad at base, rarely bifurcate; branch leaves *roundish, ovate-acuminate*, acumen *short, broad, sharply serrate*. Monoicous; perichetial bracts erect, rigid, deeply plicate, margins denticulate-serrate; pedicel long, purplish; capsule oblong-cylindrical, inclined or horizontal, curved; annulus compound; cilia 2–3, nodose or appendiculate; operculum conical, obtusely short-beaked; spores smooth .008–.012 mm; maturing in spring. (Plate 261.)

In open woods on the ground, about stumps and roots of trees; from Massachusetts to Wisconsin south to Mexico. New York (Howe, Pease); New Jersey (Austin, Best); North Carolina (Small and Heller); Pennsylvania (James, Porter, Rau); Massachusetts (Faxon); Virginia (E. G. Britton, Small); Wisconsin (True).

Type locality, Virginia, Bannister and Mitchell.

ILLUST. Dill. Hist. Musc. 282. *pl. 36. f. 18.* 1741.

EXSIC. S. & L. Musc. Bor. Am. ed. 1, no. 278; ed. 2, no. 411. Aust. Musc. App. no. 299.

9. THUIDIUM MICROPHYLLUM (Sw.).

Hypnum microphyllum Sw. Prod. 142. 1788. Muhl. Cat. 99. 1813.

Hypnum gracile Br. & Sch. Lond. Journ. Bot. 2: 668, name only. 1843. Mueller, Syn. Musc. 2: 488. 1851.

Hypnum calyptratum Sull. Pac. R. Rep. 4: 190. *pl. 10.* 1856.

Thuidium gracile Br. & Sch. Bryol. Eu. fasc. 49-51. 1852. Schimper Syn. Musc. ed. 2, 611. 1876.

Thuidium pallens Lindb. Ms. 1864.

Plants of medium size, flavescent to pale green, in spreading mats; stem 3 to 5 cm. long, creeping, pinnately branched; branches simple, spreading, subcompressed; paraphyllia multiform; stem leaves broadly ovate to ovate-lanceolate, long and narrowly acuminate, biplicate, margins sinuate-serrulate, rarely entire, plane or revolute, costa subpercurrent; leaf-cells oblong-quadrate to short-rhomboidal, usually *echlorophyllose, unipapillate*; papillae blunt; branch-leaves ovate-lanceolate, acuminate, the narrowly *oval* apical cell unipapillate. Monoicous, perichetial bracts erect, serrulate or entire; pedicel flexuous-curved; capsule oblong or oblong-cylindrical, horizontal, curved; annulus compound; cilia 2 to 4; operculum *mammilate* to *short conical*, acute or obtuse; spores, .008–.012 mm., rough, maturing in summer.

On rotton wood, base of trees, stones and the ground. Canada, Manitoba and Vancouver's Island, southward, through the United States, east of the Rocky Mountains, to New Mexico. (Bigelow.)

Type from Jamaica, Swartz, in Herb. Boissier. !

ILLUST.: Hedw. Spec. Musc. *pl. 69. figs. 1–5.* 1801. Sull. Icon. Musc. 156. *pl. 100.* 1864.

EXSIC.: Drumm. Musc. Bor. Am. no. 217; ed. 2, nos. 140-141. Sull. Musc. All. no. 5. Sull. & Lesq. Musc. Bor. Am. ed. 1, no. 277; ed. 2, no. 410. Aust. Musc. App. no. 298.

Rem. Quite variable, yet easily distinguished by its characters. Var. *Ravenellii* S. & L. is one of many involute forms growing on stones and in the sand in South Carolina and Florida.

9a. THUIDIUM MICROPHYLLUM LIGNICOLUM (Kindb.).

Thuidium lignicola Kindb. Ott. Nat. 4: 63. 1890.

Plants larger, often rufescent, leaves broader, margins more or less recurved; leaf-cells more uniformly rhombic or rhomboidal; capsules usually shorter and more turgid.

From Ohio northward to Canada and westward to Vancouver's Island, with the type and scarcely separable from it!

HETEROTHUIDIUM: Stem leaves and branch leaves similar, smooth or more strongly papillate on lower surface; leaf cells oblong-linear to narrowly rhomboidal; paraphyllia dense, filamentous.

10. THUIDIUM BLANDOWII (W. & M.) Br. & Sch.

Hypnum Blandowii Web. & Mohr, Bot. Tasch. 332. 1807.

Hypnum abietinum var. *paludosum* Wahl. Fl. Suec. 698. 1826.

Hypnum laricinum Wils. Eng. Bot. Suppl. 2: *pl. 2760.* 1832.

Thuidium Blandowii Br. & Sch. Bryol. Eu. fasc. 49-51: 10. 1852.

Plants of *large* size, densely caespitose, yellow-green above, darker below; stem 5 to 10 cm., long, *erect*, *rigid*, simple or divided, closely pinnately branched; branches simple, spreading or recurved; paraphyllia very numerous, tomentose, from an *oblong-linear rufescent* base, long-filamentous; stem-leaves *soft*, ovate-triangular, narrowly acuminate, deeply concave, sulcate, abruptly contracted to a *subclasping* decurrent base with paraphyllose *appendages*; margins entire or sinuate-serrulate; costa vanishing above the middle; leaf-cells oblong-fusiform to linear-rhomboidal, with a *large* papilla at the *distal* end of each below, nearly smooth above; branch-leaves ovate or ovate-lanceolate acuminate, *subcrispate* when dry. Monoicous; perichetial bracts entire or denticulate; capsule oblong-cylindrical, curved, horizontal; cilia 3; segments scarcely rimose; annulus compound; operculum conical; spores smooth, .012 to .014 mm.

On wet marshy ground, with a northern range. Greenland (Fl. Gr.); Labrador (Waghorne); Canada and British Columbia (Macoun); southward to Idaho (Leiberg); Colorado (Wolf & Rothrock); Ohio (Sullivant); New York (Clinton); Vermont (Faxon).

Type locality, Megapolitania, Germany.

ILLUST. Schwaegr. Suppl. 2: 1, 158. *pl. 142.* 1824.

Br. & Sch. Bryol. Eur. 5: *pl. 486.* 1852.

Husnot, Muscol. Gall. *pl. 89.* 1894.

EXSIC. Drumm. Musc. Bor. Am. ed. 1, no. 215. S. & L. Musc. Bor. Am. ed. 2, no. 414. Aust. Musc. App. no. 305. Macoun, Can. Musc. no. 274.

Rem. Involute forms are found as far south as New Jersey and generally referred to the following species. The relation between *Th. paludosum* and *Th. Blandowii* is very close, and specimens are occasionally met with, a satisfactory reference of which is very difficult. It is probable that the former is a derivative from the latter, the difference due to a more southern habitat with a consequent tendency to spread to drier situations.

11. THUIDIUM PALUDOSUM (Sulliv.) Rau & Herv.

Hypnum paludosum Sull. Musc. All. No. 7. 1846. Mosses U. S., 68. 1856.

Elodium paludosum Austin, Musc. App. no. 306. 1870. Ren. & Cardot, Musci Am. Sept. 63. 1893.

Thuidium paludosum Rau & Herv. Cat. 38. 1880.

Plants of medium size, in spreading mats, yellow-green; stem 4 to 6 cm. long, pinnately branched; branches simple, spreading, subcompressed; paraphyllia numerous, geniculate-branching, filamentous; stem leaves rather *rigid*, *plicate-striate*, oblong-lanceolate, acuminate, the subdecurrent base usually with *1 to 3 cilia*, margins revolute below, recurved above, sinuate-serrulate, costa *subpercurrent;* leaf-cells oblong to linear-rhomboidal, *smooth* (in type) or with a small papilla at the *distal* end of each cell on under surface, sometimes above; branch-leaves ovate-lanceolate, acuminate. Monoicous; perichetial bracts rigid, erect, entire or serrulate above; pedicel long, slender, *wiry;* capsule oblong-cylindrical, curved, horizontal; cilia 3; annulus compound; operculum conic-apiculate; spores smooth, .012 to .014 mm.

On the ground in swamps and grassy fields, Eastern and Middle States.

Type from Ohio, in Col. Sullivant. Gray Herbarium!

ILLUST.: Sull. Icon. Musc. 157. *pl. 101.* 1864.

EXSIC.: Sull. Musc. All. No. 7. S. & L. Musc. Bor. Am. ed. 1, No. 281; ed. 2, no. 415. Aust. Musc. App. no. 306.

10 a. THUIDIUM PALUDOSUM ELODIOIDES (R. & C.).

Thuidium elodioides Ren. & Card. Hewd. 32: 251. 1893.

Often dark green, leaves smaller, margins not rarely serrate-dentate; leaf-cells papillate on both surfaces, papillae sometimes central.

With the type. More common from New York (E. G. Britton) westward. Indiana (Schuh).

Hypnum Notarisii Boul. (*Thuidium decipiens* De Not), not yet found in North America, but likely to be, connects *Heterothuidium* with *Cratoneuron* Sch.

Three Editions of Emory's Report, 1848.

A note "On the two editions of Emory's report, 1848" has recently been published by Mr. John H. Barnhart,* describing the principal differences in the botanical appendices of Major W. H. Emory's "Notes of a military reconnoissance, from Fort Leavenworth, in Missouri, to San Diego, in California, including part of the Arkansas, Del Norte and Gila rivers." These differences are that in Document 41, printed for the Senate, the "explanation of plates" is omitted, as well as the matter on *Zinnia grandiflora*, *Convolvulus nuttallii*, and *Altenanthera lanuginosa*, the last two being new names; that the plates in No. 41 were lithographed by C. B. Graham, Washington; those in No. 7 by E. Weber & Co., Baltimore, the name on plate vi. in the former being *Baileya multiflora*, in the latter *Baileya multiradiata*; and

*Bull. Torr. Club. 22: 394–5. 1895.

that while in both reports the botanical appendix occupied pages 135 to 159, the same matter does not always occur on identical pages.

The Senate document was transmitted by the Secretary of War, December 15, 1847; the House document February 9, 1848, but in examining the two editions to ascertain which was issued the earlier, it is evident, from the correction of the name *Baileya multiflora* on plate vi. to *Baileya multiradiata* to correspond with the text, and from the reference, on Abert and Peck's map of New Mexico, to "the unpublished map of Lieut. Emory," as well as the nature of other changes in the body of the report, and the fact that the House and Senate papers were issued in different series, that Document 41 was the one first published.

In the body of the report the differences are almost exclusively botanical, consisting chiefly of the omission in Document 7 of many popular and scientific names of plants in sentences describing the vegetation. To the differences in the two documents noted by Mr. Barnhart it may be added that in Document 41 typographical errors in plant names are more frequent; that the capsule and seed of *Ipomoea leptophylla* are omitted from plate xi., and that the matter relative to *Cereus giganteus* was wholly revised in the other edition. Mr. Barnhart's statement that certain pages of Document 41 bear the mark [7] in the upper outside corner applies only to a part of the edition. This error was evidently either made or discovered and corrected during the printing of the edition. But perhaps the most important difference in the two documents is that No. 41 does not contain the general map of Major Emory's route from Fort Leavenworth to San Diego. It does, however, contain Abert and Peck's map of New Mexico and another map showing the distinctive route of Lieutenant Colonel Cooke, both of which were incorporated in Major Emory's large map published in Document 7. Both documents were printed by Wendell & Van Benthuysen, Washington. It is clear that the first edition of the Emory report is the one issued as House Document No. 41, the second as Senate Document No. 7.

The third edition of the report was published not by the government, but by H. Long & Brotner, New York, in the same year as the others, 1828. Not only is this edition an exact copy of

Doccment 7, but it is printed from the very same type, which has been double-leaded so as to extend the first 178 pages of the original (the remainder not being reproduced in the third edition) to 230 pages. As in Document 7, the lithograph plates and map are by E. Weber & Co., Baltimore. The botanical appendix occupies pages 179 to 211.

The three editions of Emory's report give evidence of sharp practice on the part of the printers. Of the two issued as public documents, the second, instead of being corrected upon the type pages so as to incorporate the necessary changes, was wholly reset, the government doubtless paying the cost of double composition. The type pages of the second edition, after suitable leading, were used in issuing a third edition under the name of the New York firm, who thus avoided the expense of composition.

FREDERICK V. COVILLE.

WASHINGTON, D. C.

A neglected Carex.

BY EUGENE P. BICKNELL.

In his "Analytical Table" (1824) Schweinitz published the name *Carex typhinoides*. No description of the plant appears beyond that which is afforded by five formal propositions of the "Table" which lead up to the name. The outline thus presented proves to be too lightly sketched to fix with certainty the identity of the plant intended, nor is there to be found in the "Monograph" of Schweinitz and Torrey, subsequent to the "Table" by only two years, any hint as to what the plant may have been. Later caricologists have referred the name to *Carex squarrosa* as a synonym.

The absence of any allusion to the name in Schweinitz and Torrey's "Monograph" would now be hard to explain were there not still in existence a letter written by Schweinitz to Torrey bearing on precisely this point. This letter is now on file at the Columbia College Herbarium and bears date "Bethl[ehem, Pa.], July 6 1824." I quote as follows; "I have very carefully revised the Carices this season, but have no other corrections to make of consequence, except requesting you by all means to strike out the whole of the description of my proposed new species *Carex typhinoides*, for I have found it in great plenty this year, growing in such a manner as to leave no doubt that it is only a variety of *C. squarrosa*."

This statement, however, although enlightening as regards the "Monograph," is less conclusive than it might appear respecting the status of *Carex typhinoides.* The plant may indeed have been a several-spiked form of *Carex squarrosa*, long supposed to be a monostachyous species, as the "Table" has it, and known as *Carex typhina* Michx., or it may have been another plant, a species nearly allied to *Carex squarrosa*, which it is the purpose of this paper to define. Indeed Dewey interpreted the Schweinitzian plant in terms of this very species which he described as *Carex squarrosa* var. *typhinoides* (11: 316, 1826). But, while Dewey's description leaves no doubt as to the plant he had in view, it may fairly be doubted whether Schweinitz's name was correctly taken up for it. Should such a doubt be insisted on, another name would have to be added to the already overcrowded lists of *Carex.* It would therefore seem to be a reasonable, if technically vulnerable course to accept the interpretation of Dewey, a contemporary of Schweinitz, and base on it the identity of the plant which Schweinitz inadequately described and subsequently abandoned.

In now delimiting *Carex squarrosa* from *Carex typhinoides* it becomes necessary to redescribe in detail the former plant in connection with the description of its near ally with which it has all along been confounded.

CAREX SQUARROSA L.

About two feet high, culm slender, smooth below, rough on the angles above. Leaves and bracts long and narrowly accuminate, 2″ wide (1″–3″), pale green, rough on the edges. Spikes usually 1 or 2, sometimes 3, becoming tawny-stramineous, globose to oblong-cylindric, rounded at the top, rarely over 1′ long, the terminal one 6″–14″ long, 8″–9″ wide, the lower ones much smaller and often sub-globose, on short, slender, ascending peduncles; staminate portion of terminal spike conspicuous, clavate, rarely less than ½ the length of the fertile upper portion, sometimes ¾ its length, the loosely imbricated scales very acute or acuminate. Perigynia numerous, much crowded, reflexed at the base of the spike, above spreading or slightly ascending, 4″–4½″

long, somewhat inflated, obovoid-oblong or narrower, few-nerved, tapering more or less abruptly into the long and slender, straight, mostly smooth two-toothed beak. Achene stipitate, linear-oblong, trigonous with blunt angles and flat sides, minutely granular-puncticulate, often faintly striate, tapering into the continuous, persistent, brown style, which is stout at the base, turgid, and sinuously bent.

Specimens examined show a range of this species from Connecticut and New York to North Carolina, Tennessee, Indiana and Texas. The few records of *Carex squarossa* from Massachusetts appear to refer to the typical plant.

CAREX TYPHINOIDES Schw.

About two feet high or rather less, darker green than *C. squarrosa*, the culm usually stouter and more sharply angled, the lower leaves often more approximate and with shorter sheaths. Culm smooth below, rough on the angles at the top, leaves and bracts broad, 2″–5″ wide, rough on the edges, the leafy bracts much exceeding the culm, spikes becoming dull stramineous, 2–6, mostly 3, contiguous or separated, when more than 3 the longer ones often distant, all but the terminal one (or upper two) on slender, erect or ascending peduncles, which are sometimes 2′–3′ long; all the spikes are longer and narrower than in *C. squarrosa*, the terminal one 12″–20″ long, 6″–7″ wide, conoid-cylindric, usually truncate at base and slightly tapering above the middle to the conical apex which is usually pointed with a more or less evident tuft of sterile scales. Basal staminate portion of spikes very short or obscure, even in the terminal spike rarely over 3″ long, the scales oblong or oblong-lanceolate, mostly obtuse, the upper ones curiously reflexed in a rosette against the lower perigynia. Perigynia densely compressed-crowded, the beaks sharply ascending except those near the base of the spike, of rather thicker texture than those of *C. squarrosa* and shorter, 3″–3½″ long, cuneate-obovate, truncate or abruptly contracted to the slender but strong, roughish, minutely two-toothed beak, which is strongly nerved at the base, and often slightly incurved as well as upwardly bent. Scales mostly equalling the body of the perigynium, oblong-lanceolate, obtuse. Achene ovate-elliptic, trigonous with concave sides, the angles slightly swollen in the middle, very minutely granular-puncticulate, not striate, not tapering into the style which is very slender, straight, greenish, easily detaching at the base or a little above.

Quebec to Washington, D. C., Missouri and Louisiana.

About New York I find *C. squarrosa* in damp or wet places in woods and meadows; *C. typhinoides* occurs more particularly in overflowed meadows and along river bottoms. In such places the two plants often grow together, but in woods or wet places on higher ground, where *C. squarrosa* often grows in abundance, *C. typhinoides* seems never to occur.

Extreme forms of these two sedges are strikingly unlike in appearance; other forms show a similarity of aspect which is sometimes confusing. However the identity of such forms comes out plainly enough upon closer observation, and can always be instantly established by an appeal to fruit characters. The differences in the achenes and styles of the two plants is especially noteworthy and have proved to be singularly constant in a large number of specimens from widely separated localities.

It may be added that *Carex squarrosa* as described by Linnaeus is clearly that species as distinguished from *Carex typhinoides;* so also is the *Carex typhina* of Michaux. The species was first figured by Schweinitz and Torrey (Monograph, plate 27); later it was figured by Dewey (11: *pl. 2. fig. 29.* 1826). Boott's illustrations of *Carex squarrosa* (1860) refer in part only to that species as here defined. His plate 281 is unmistakably *Carex typhinoides*, while plate 280 can scarcely be other than a composite figure made up partly of each species.

Notes on some Florida Plants.—II.

By Geo. V. Nash.

My second collection of Florida plants was made in 1895, beginning late in May and ending early in September. Very little collecting, except among the Fungi and Lichens, was done in Eustis or its vicinity, the field of my operations the previous year, although I again made this place my headquarters. The area explored extended from the Manatee River in the south to Jacksonville in the north, thence westward through Columbia, Jefferson, Leon and Gadsden Counties, to the Apalachicola River. This was my main collecting ground, and is all tributary to the Florida Central and Peninsular Railroad. The country traversed by this road is very interesting, particularly from a botanical standpoint, the flora varying from semi-tropical to temperate. The terminus of the southern division is at Tampa, where the vegetation is semi-tropical. The country to the north of this is an alternation of high pine land, called locally "black jack ridges," and flatwoods, yielding a most interesting lot of plants. The western division extends from Baldwin to River Junction in Gadsden county. The flora of this section is quite different from that of the peninsula, and more nearly approaches that of the North. This is particularly the case at Tallahassee and in its immediate vicinity. The soil is a red clay, and the country one of hills and valleys, a most unusual condition for this State. Familiar plants of the North were continually turning up. This red clay country is only a few miles in extent, however, and soon disappears, the pine lands again becoming prominent.

As stated above, my main collecting field was from the Manatee river to the Apalachicola river. In addition to this I made two or three trips to Sanford, in Orange Co.; one to Titusville, on the Indian River, in Brevard Co., my only approach to the east coast; and a short trip from Tallahassee to St. Marks, in Wakulla Co., where Rugel collected in 1843 and discovered some interesting things, some of which I succeeded in again finding.

The Mantatee river is nearly tropical in its flora. On Sneed's Island, at the mouth of this river, are found a number of strictly tropical plants, which cannot be secured on the mainland for a number of miles further south. Their occurrence on this island is probably due to the immunity it enjoys from frost, the water serving as a protection.

The above brief account will give some idea of the varied nature of my collections in 1895. A large number of species and varieties new to science, some plants hitherto unknown to occur in the State, and a number of rare things were secured. The following notes on the more important acquisitions may be of interest:

Tumion taxifolium (Arn.) Greene. (*Torreya taxifolia* Arn.) The only known locality, the Apalachicola river, for this rare conifer was visited in August and September. The natives, by whom it is called " stinking cedar," informed me that it occurred from just south of the Georgia line to a distance of some fifteen miles down the river, and that it was confined exclusively to the eastern bank. The locality where I saw it growing was about one quarter of a mile north of River Junction. In this spot there were some twenty or thirty trees. The tree is conical in outline, the branches horizontal and widely spreading. The foliage is a fine deep green, the upper surface shining. The odor of the bruised leaves is very disagreeable, as I discovered on climbing one of the trees, and the local name of "stinking cedar" is well applied. The leaves are also quite sharp-pointed and irritate the skin considerably, causing an unpleasant burning sensation. On my first visit in August I succeeded in finding only one tree in fruit. On my next visit, on September 5, I discovered further up two or three more fruiting specimens.

The tree is evidently having a hard struggle to maintain itself. In the locality visited by me it occupies the very extremities and sides of the small ridges extending from the high pine land out into the river swamp. I could find none in the low-lying ground at the base of the ridges nor in the high pine land further back. Its evident inability to thrive in the very low land and the antagonism of the other surrounding trees which are better suited to the environment make its final extinction apparently certain. No. 2381.

Paspalum arenarium Schrad. In the low pine land around Eustis, Lake Co. Not very common. No. 2074.

Paspalum racemosum Nutt. Rare. Found in the pine land at River Junction, Gadsden Co. In the living state the plant has a decidedly glaucous hue. No. 2579.

Cenchrus gracillimus Nash. Further observation of this grass in the field confirms the disposition I made of it last year. It is very distinct from *C. tribuloides.* This grass is very common around Eustis, Lake Co., but its occurrence in the northern and western parts of the State was not noticed. No. 1766.

Cenchrus incertus M. A. Curtis. Quite common in the pine land at River Junction, Gadsden Co., but not seen east of that place, nor in the peninsula. It is very distinct. The broader spines, and the entire absence of reflexed spines at the base of the involucre, giving it a naked appearance, well distinguish it from any form of *C. tribuloides.* No. 2580.

HYDROCHLOA FLUITANS (Michx.) (*Hydrochloa Carolinensis* Beauv.). At Lloyds, Jefferson Co., flowering profusely, in which condition it is very rare. In a sterile state it is very common in many bodies of still water. No. 2512.

ARISTIDA PATULA Chapm. ined. (*Aristida scabra* Chapm. Fl. S. St. 663. 1884. Not Kunth, 1833.) In the pine land back of Titusville, Brevard Co., No. 2295; near Sanford, Orange Co., No. 2276; and very common just back of the beach line at Ballast Point, near Tampa, where it grew luxuriantly, forming large tufts, No. 2424a.

ERAGROSTIS HIRSUTA (Michx.) Not Nees, 1829, nor Wood, 1861. (*Poa hirsuta* Michx.) Very common in fields at Tallahassee, Leon Co., forming broad tufts, 2–3 feet tall. No. 2521. The synonymy of this grass is exceedingly mixed. The *E. hirsuta* Nees (Fl. Bras. 2: Part 2, 508. 1829), *E. hirsuta* Wood (Classbook, 796. 1861), and *Poa hirsuta* Muhl. (Gram. 145. 1817), appear to be the *E. pectinacea* A. Gray, judging from the descriptions given in each case. The *Poa hirsuta* Michx. is apparently an entirely different plant, as evidenced by a fragment of the type of Michaux, preserved in the Columbia College Herbarium. This grass ranges from North Carolina to Florida, thence west to Louisiana, and possibly to Texas. It has been confounded with *E. capilliaris* Nees. Curtiss' No. 3499 belongs here.

Uniola longifolia Scribn. Found growing abundantly along the edge of a dry woods, near Tallahassee, No 2521; also in pine woods at River Junction, Gadsden Co., about forty miles to the west of the above place, No. 2591a. I was much surprised at its further occurrence in some abundance in a tropical hammock on Sneed's Island, near the mouth of the Manatee River, in the southern part of the peninsula, over 400 miles from the above named localities. The villous sheaths of this species are constant, and readily separate it from the others of the genus.

Rynchospora miliacea (Lam.) A. Gray. Apparently rare, as I found it in only two places, both within a few miles of Eustis, Lake Co., No. 1845.

Scleria hirtella Sw. Rare. Among tall grass in the low pine land, near Eustis, Lake Co., No. 1917.

SABAL ETONIA Swingle, n. sp.

Plant 8–14 dm. tall. Rootstock more or less contorted, elongated, bearing numerous roots on the lower surface along its entire length; leaves nearly orbicular in outline, 4–6 dm. long, about two-thirds the length of the petioles, strongly folded at the base along the middle, divided almost to the bottom, the divisions linear, acuminate, the sinuses long-filiferous; petioles 1–1.5 cm. broad, smooth, triangular, the back rounded, the edges sharp; spadix a little shorter than the leaves, branching above, erect or ascending in flower, prostrate in fruit; flowers yellowish white; divisions of the perianth elliptic, obtuse, 5-nerved, 3–3.5 mm. long, 1.5–1.75 mm. broad, concave; stamens a little longer than the perianth, the filaments broad-subulate, slightly exceeding 3 mm. in length; anthers narrowly ovate, about 1.5 mm. long; fruit 1.3–1.5 cm. in diameter.

Very common in and confined strictly to the "scrub." Collected in 1894 in the vicinity of Eustis, Lake Co., and distributed under No. 999.

Mr. W. T. Swingle, of the Sub-Tropical Laboratory at Eustis, first called attention to this new palm at the meeting of the Botanical Club, A. A. A. S., in Madison Wis., in August, 1893,* but no description of it has hitherto been published, so far as I am able to ascertain.

It is related to *S. Palmetto*, but it is abundantly distinct from that species, particularly in its manner of growth. The rootstocks of the two species are totally unlike. In the seedling state they are probably very similar, judging from examinations made on comparatively young plants of both forms. As they grow older, however, the differences in manner of growth become very marked. In *S. Etonia* the rootstock is elongated and more or less contorted, in some instances doubling and redoubling on itself, forming a perfect S. It is firmly anchored in the soil by innumerable roots, borne along its under surface, the growing end running along the surface of the soil, but never rising above it. As stated above, the rootstock is always elongated, from 2–3 feet in length, the rear part apparently dying and rotting away as the bud advances.

In *S. Palmetto* the behavior of the rootstock is very different, and only in very young plants can its early stages be found. It goes directly down, then bends sharply and rises to the surface,

*Bull. Torr. Bot Club, 20:364. 1893. Bot. Gaz. 18:348. 1893.

continuing in an erect aërial stem which often attains a height of 50–70 feet. In the young plants this downward portion is manifest as an erect spur-like body, appressed to and much smaller than the ascending part of the rootstock, but it soon disappears and in plants but a few feet in height no trace of it can be found. In old individuals, therefore, the subterranean extremity of the trunk is knob-like, with hundreds of roots radiating in all directions, making a marked contrast to the elongated and contorted rootstock of *S. Etonia*, bearing roots its entire length. The fruit in *S. Etonia* is larger than that in *S. Palmetto*.

Lachnocaulon Beyrichianum Sporleder. Very abundant around the shores of Blue Lake and Lake Gracie, both near Eustis, Lake Co. No. 1855.

Lachnocaulon glabrum Koern. Not as common as the above. Along the sandy shore of Blue Lake, near Eustis. No. 1981.

✓HABENARIA CONSPICUA n. sp.

Whole plant glabrous, 4–8 dm. tall. Leaves linear to lanceolate-linear, erect or ascending, usually acute, the lower one 10–25 cm. long, 1–2 cm. broad, the remaining ones gradually becoming shorter and passing into the bracts of the inflorescence; spike ovate to oblong, 6–12 cm. long, 5–7 cm. in diameter; flowers numerous, white; tube of the calyx 2–2.5 cm. long, the sepals orbicular or nearly so, 7 mm. in diameter; petals oblanceolate, about 5 mm. long, from nearly entire to more or less toothed at the apex; lip 12–15 mm. in length, narrowly oblong, the claw 4–5 mm. long, the blade deeply fimbriate; spur curved, narrowly cylindric, 4–5 cm. in length.

Collected on the edge of a sphagnum bog at Lake City, Columbia Co., No. 2501, and observed at a number of other places. It was distributed in my collection of 1894, under No. 1700, as *H. blephariglottis*, from which it is abundantly distinct, the larger flowers, longer spur, and deeply fimbriate lip readily separating it.

Tipularia unifolia (Muhl.) B. S. P. In great abundance and in fine condition on a damp hillside near Tallahassee, Leon Co. No. 2361.

Persea humilis Nash. Further observation in the field confirms me in the disposition made of this tree last year. It is confined exclusively to the "scrub," a sandy area covered with scrub oaks, intermixed with the scrub pine, *P. clausa*, and the home of *Sabal Etonia*. When in the virgin "scrub," it rarely attains a height of more than 6 or 8 feet. In the open, or along the roadside, where the surrounding shrubs have been cut away, it often becomes 15 or 20 feet tall. Mr. H. J. Webber, of the Sub-Tropical Laboratory at Eustis, kindly collected for me last November a lot of fine fruiting specimens, thus enabling me to distribute it in fruit, No. 2601.

WAREA SESSILIFOLIA n. sp.

Annual. Whole plant glabrous, branched, sometimes diffusely so, 3–6 dm. tall; leaves erect or ascending, ovate, sessile, those on the stem 1–2 cm. long, 5–10 mm. broad, those on the branches gradually reduced, the uppermost one usually about 5 mm. long; racemes densely flowered, 2–3 cm. in length; pedicels filiform, 6–10 mm. long; sepals spatulate, purple at the broadened base, becoming greenish towards the apex, 7–8 mm. long, about 1 mm. broad, reflexed; petals deep purple, the claw 5–6 mm. long, filiform above, gradually broadened toward the base, pubescent on the lower half, the blade broadly ovate or oval, abruptly narrowed into the claw, about 5 mm. long, 4–4.5 mm. broad; stamens about 1.5 cm. in length, the filaments thread-like, purple except toward the white summit; anthers linear, coiled when dry, 2 mm. long, .5 mm. broad; pod not seen.

Collected in the pine lands at Bellair, about 4 miles south of Tallahassee, Leon Co. The larger deep purple flowers and the ovate merely sessile leaves, not sagittate nor clasping as in *W. amplexifolia*, readily distinguish this plant from either of the other species. No. 2544.

GLOTTIDIUM FLORIDANUM ATRO-RUBRUM n. var.

Flowers a deep black-purple. Otherwise much as in the type.

Occurring from Tampa, where my specimens were secured, southward, No. 2415. In this region it entirely replaces the yellow-flowered form which is very common from Lake Co. north to Jacksonville and west to Tallahassee.

Melia Azederach L. Escaping into the low woods around Eustis, Lake Co.; also at Tallahassee, Leon Co., where my specimens were obtained. No. 2359.

Crotonopsis spinosa Nash. Found in great abundance about three miles north of Eustis, Lake Co., No. 1971. Very common from Lake City, Columbia Co., westward.

CYRILLA PARVIFOLIA Shuttlw. n. sp.

A compact and much branched shrub about two metres tall.

Glabrous; leaves cuneate-obovate or oblanceolate, short-petioled, reticulate, acute, or the smaller ones obtusish, 1.5–5 cm. long, 5–12 mm. wide; racemes 3–8 cm. in length; flowers numerous, sepals triangular, 1 mm. long, slightly longer than broad, petals narrowly elliptic-ovate, rugose-thickened at the base and along the middle for about two-thirds their length, obtuse, 2.5 mm. long, 1 mm. broad; stamens 2.5 mm. long, filaments linear-subulate, anthers oval, .6 mm. long; capsule nearly globuse, slightly flattened laterally, 2.5–3 mm. in diameter.

Collected in fruit at St. Marks, Wakulla Co., No. 2543. Since distributing my plants I find that the name parvifolia was applied, but not published, by Shuttleworth to specimens of the same thing collected in flower by Rugel, in 1843, also at St. Marks. I therefore publish it as above.

It is quite distinct from *C. racemiflora*, the lower habit, smaller leaves, shorter racemes, and globose, not ovoid, capsules readily serving to separate it from that species.

Acer Drummondii Hook. & Arn. Very common in swamps, No. 2147. My No. 872, of the 1894 collection, is also this species, and not *Acer rubrum* L., under which name it was distributed.

Sapindus Manatensis Radlkofer. I secured good fruiting specimens of this tree, No. 2460. The type locality is the mouth of the Manatee River. My collection was made on the south side of Sneed's Island, not far from the mouth of this river. Mr. J. H. Simpson, of Manatee, a gentleman very familiar with the flora of that region, informs me that the tree is confined to the above named island, and thrives only there; that there are a few trees on the mainland, but that they are stunted and not at home.

From the above it would seem that my specimens were from the type locality, as it is not known to occur anywhere else near the mouth of the Manatee River. It is certainly distinct from *S. marginatus*, not only in the shape and size of the glabrous leaves, but also in the larger and oblong fruit. In *S. marginatus* the fruit is globose, and the leaves pubescent.

SIDA RUBRO-MARGINATA n. sp.

Much branched, 6–10 dm. tall. Stems purple, sparingly pubescent or glabrous; stipules linear, 5–10 mm. long; leaves bright light green, glabrous, lanceolate, narrow-elliptic, or obovate, serrate, purple-margined, acutish at the apex, narrowed and rounded at the base, 1.5–5.5 cm. long, 3–20 mm. wide, on slender petioles 3–5 mm. long; peduncles single, shorter than the leaves, 7–15 mm. long; flowers light orange, 3–3.5 cm. in diameter; calyx angled, its teeth deltoid, acute or acuminate, about 5 mm. long; petals obovate-deltoid, about 1.5 cm. long, unequally 2-lobed at the apex, the margins, except toward the base, ciliate with short glandular hairs; carpels 8-10, usually 2-awned.

Collected at Ballast Point, near Tampa, No. 2472. Also secured by Dr. Palmer in 1874, at Fort Capron, on the Indian River, No. 54.

Abundantly distinct from *S. rhombifolia* L. by its taller habit, bright light green thicker leaves, shorter peduncles, and larger deeper colored flowers. *S. rhombifolia*, moreover, is apparently introduced into Florida, as it occurs only in waste places, while this plant is evidently indigenous to the state.

CORNUS MICROCARPA n. sp.

Shrub 3–4 metres tall, stems slender and recurved, branching toward the top. Bark gray; branches brownish, sparingly pubescent; leaves 3–9 cm. long, 1.5–4.5 cm. broad, oval, acute at the base, abruptly blunt-pointed at the apex, appressed-pubescent on both sides, sparingly so on the upper surface, the hairs on the lower surface curled; petioles 2–6 mm. long, more or less pubescent; cymes pubescent; flowers white, 6 mm. in diameter; calyx-teeth deltoid, about .5 mm. long; petals ovate, about 2.5 mm. long, 1–1.3 mm. broad, appressed-pubescent on the outside; filaments subulate, 2.5 mm. long; anthers 1.5 mm. long; fruit light blue, about 4 mm. in diameter, the stone slightly compressed, longer than broad, 2.5–3 mm. long, 2–2.5 mm. broad.

Collected in fruit in low woods at River Junction, Gadsden Co., No. 2589. Specimens of the same in flower, collected by Dr. Chapman, are in the Herbarium of Columbia College, and also in the National Herbarium.

Nearest to *C. asperifolia*, but easily distinguished by its smaller flowers and fruit, the latter light blue and with a stone longer than broad.

Dr. Chapman, in his Flora of the Southern United States, p. 168, describes the fruit of the *C. asperifolia* of that work as "pale blue." In Coulter & Evan's monograph of the genus Cornus, the fruit of *C. asperifolia* is given as white. I do not remember having seen a white-fruited Cornus in the state. It is probable that all of the Florida material, hitherto referred to *C. asperifolia*, belongs here.

Bumelia lanuginosa Pers. Quite frequent around Lake City, Columbia Co., No. 2167. The plant I distributed in my 1894 collection, under the above name, No. 818, is probably *B. tenax*.

Jacquemontia tamnifolia (L.) Griseb. Quite common in a field at Tallahassee, Leon Co., No. 2516. I do not find that it has before been recorded from Florida.

Nama corymbosa (Ell.) Kuntze. (*Hydrolea corymbosa* Ell.) In 1894 I secured a few specimens of this rare plant. Last summer I found it growing in great abundance in the flatwoods along the Jacksonville, Tampa & Key West R. R., between Paola and Sanford. No. 2281.

VERBENA (§NOBILES) TAMPENSIS n. sp.

Glabrous, or pubescent with short appressed hairs. Stems erect from a decumbent and often creeping base, usually more or less branched; leaves oval or ovate, paler beneath, 2.5–7 cm. long, acute, cuneate and entire at the base, narrowed into margined petioles .5–2.5 cm. long, coarsely and irregularly crenate-serrate; spikes 2–10 cm. in length, capitate when young, cylindric in age and often interrupted below, its bracts subulate, strigillose, ciliate, about one-half as long as the calyx; calyx strigillose, 12–15 mm. in length, its teeth subulate, 2–4 mm. long: corolla purple, the tube pubescent on the outside and in the throat, about 1.5 cm. long, the limb 1 cm. in diameter, its lobes obovate, emarginate at the apex; anthers without a gland on the connective; nutlets cylindric with a broadened base, about 4 mm. long, furrowed at the base and areolate toward the apex.

Collected just back of the beach line at Ballast Point, near Tampa, No. 2470. Curtiss's No. 1963, distributed as *V. Aubletia* L., belongs here; also Garber's plant, collected at Tampa in May, 1876. In general appearance this plant has some resemblance to *V. Aubletia*, but a critical examination will readily show its differences. The entire absence of the gland on the anther connective, a character of the section in which *V. Aubletia* is placed, at once makes manifest its dissimilarity to that species.

MONARDA PUNCTATA LEUCANTHA n. var.

Of much taller habit, 10–15 dm., the flowers pure white, spotted with purple; otherwise much like the type.

Tampa, No. 2420; but on Sneed's Island, near the mouth of the Manatee River, it occurred in great abundance and luxuriance, forming large masses, at the foot of a shell mound, No. 2456. In both localities the flowers were a pure white. *Monarda punctata* was observed in great abundance in the northern tier of counties from Lake City westward, being particularly common around Tallahassee and River Junction. The flowers were invariably of a dull golden yellow. From Tampa south this was entirely replaced by the white-flowered form.

SCOPARIA GRANDIFLORA n. sp.

Plant glabrous, or sparingly puberulent, 7–12 dm. tall, usually much branched, the branches erect or ascending, in whorls of three. Leaves in 3's, 2–5 cm. long, 3–10 mm. wide, oblanceolate, acute, entire and attenuate at the base into short margined petioles, remotely and irregularly serrate above the middle with obtuse teeth ; pedicels single in the axils of the leaves, filiform, 4–8 mm. long, spreading or ascending; calyx 3 mm. long, its 4 lobes oval, obtuse or acutish, about 2.5 mm. long, 3-nerved, strongly glandular on the outside, ciliate; corolla white, 1 cm. broad, its 4 lobes oblong obovate, 4 mm. long, 2.5 mm. broad; stamens 4, the filaments about 2.5 mm. long, the anthers oblong, 1.5 mm. long, .75 mm. broad; ovary oval, one-half as long as the style; capsule ovoid, about 2.5 mm. long, equalling or slightly shorter than the calyx and as long as or exceeded by the style; seeds .5 mm. long, oblong.

Collected in the flatwoods at Tampa, where it was quite frequent, No. 2417. Also secured by Mr. J. H. Simpson in 1889, and determined as *S. dulcis*, to which species it has but a superficial resemblance. What appears to be the same thing was found by Mr. H. J. Webber at Manatee.

This plant is readily distinguished from *S. dulcis* L. by its greater height; the larger corolla, twice the diameter of that of *S. dulcis*; the ciliate and less strongly nerved calyx lobes; the capsule not exceeding the sepals; the longer style; and the much larger seeds, nearly twice the size of those in *S. dulcis*.

UTRICULARIA FLORIDANA n. sp.

Stems rooting at the base, 6–15 dm. in length. Leaves capillary, much divided; scapes simple, or sometimes with a single branch, weak and tortuous, 15–40 cm. in length, 10–25-flowered, thick and spongy, much attenuated toward the base; pedicels erect or ascending, even in fruit, 1–1.5 cm. long, slender; flowers yellow, about 1.5 cm. in diameter; spur conic-cylindric, straight, obtuse, ascending, about 7 mm. long, shorter than the lower lip; capsule 5–8 mm., in diameter.

Very abundant in a small pond between Eustis and Umatilla, Lake Co., No. 1970. It formed a belt, a few feet from the shore, some 15 feet wide. This is apparently the same as my No. 492 of the 1894 collection, obtained in a sterile condition at Lake Irma, near Eustis. It grew nearer the shore and in shallower water than the plant I collected the past summer, so I was enabled to secure the lower portions of the plant. The stem crept along the mud at the bottom, sending up two kinds of branches, one bearing leaves and no bladders, the other the reverse of this. In this respect it is related to *U. oligosperma*, but in that species the stem is free-swimming; it also differs much in other particulars.

Plantago aristata Michx. This plant is just making its appearance around Eustis, Lake Co., in waste places and orange groves. None of it was observed in 1894, and but a few specimens this past summer. No. 1828.

EUPATORIUM ANOMALUM n. sp.

Whole plant, particularly the branches of the inflorescence, pubescent with short appressed rigid hairs. Stem 8–15 dm. tall; leaves spreading or ascending, 3–7 cm. long, 1–3 cm. broad, ovate to ovate-lanceolate, acute at both ends, short-petioled, coarsely and irregularly serrate, obscurely 3-nerved; involucre 5-flowered, resinous-dotted, cylindric, 5–6 mm. long, about 2 mm. in diameter, its 10-12 acute or acutish scales appressed-pubescent, scarious on the margins, the 5 inner ones linear or linear-lanceolate, much exceeded by the pappus, the outer scales much shorter than the inner; achenes resinous-dotted.

Collected at Lloyds, Jefferson Co., at the margin of a low woods, No. 2515. Apparently the same plant occurs at Fortress Monroe, Va., represented by a specimen in the National Herbarium, collected by Dr. Geo. Vasey.

Its affinity is with *E. hyssopifolium*, but readily separated from any form of that species by its much taller habit, and the broader and differently shaped leaves which are coarsely and irregularly serrate.

LACINARIA CHAPMANII LONGIFOLIA n. var.

Stems minutely pubescent, 6–15 dm. tall. Leaves narrowly linear, much attenuated at the base, glabrous, punctate, 1-nerved, the lower 10–15 cm. in length; inflorescence, involucre and flowers much as in the type.

In pine lands between Tampa and Ballast Point, about 5 miles from the former place, along the line of the electric railroad, No. 2473. The taller stem, the constantly glabrous and longer leaves, and the more southern range, would seem to make this plant worthy of varietal rank. Further field observations may, however, prove it to be but a form of the type, which occurs in the western extension of the State.

Lacinaria Garberi (A. Gray) Kuntze. This rare plant was very plentiful on the prairies near Palmetto, Manatee Co., No. 2430. Dr. Garber, in whose honor it was named, collected it first at Tampa.

CHRYSOPSIS FLEXUOSA n. sp.

Whole plant, with the exception of the involucres and upper surface of the leaves, copiously lanate, the hairs silky and deciduous. Stems 2–4 dm. tall, flexuous, ascending, branching above; leaves ascending, rough on the upper surface, oblong-linear to linear or linear-lanceolate, acuminate, often curved, about 5-nerved, those on the stem 3–6 cm. long, 2–8 mm. broad; involucres long-peduncled, cylindric-campanulate, about 1 cm. long, 6 mm. in diameter; scales of the involucre imbricated in 4–6 rows, linear to linear-lanceolate, acuminate, prominently keeled, glabrous or sparsely pubescent with long loose hairs; rays broadly linear to oval, 7–9 mm. long, usually shortly toothed at the apex.

In the pine lands at Bellair, Leon Co., about four miles south of Tallahassee, No. 2545. Nearest to *C. falcata*, from which it is readily distinguished by its much larger involucres, pubescence, and range. *C. falcata* Ell. is confined to the coast from Massachusetts to New Jersey.

ERIOCARPUM MEGACEPHALUM n. sp.

Plant much branched, about one metre in height. Stem and branches pubescent with short villous hairs, striate; leaves sparsely pubescent, sessile, lanceolate to linear-oblong, 2–7 cm. in length, 5–20 mm. broad, coarsely and remotely serrate with curved spreading teeth; short peduncles very villous at the summit and bearing a single head 2–3 cm. in diameter; involucres about 1 cm. high, its scales short-hispid, acute, linear to linear-lanceolate, the outer ones slightly shorter than the inner; rays numerous linear to linear-oblong, obtuse or acute, about 1 cm. long, 2–3.5 mm. broad.

Quite common on the south shore of Sneed's Island, near the mouth of the Manatee River, No. 2432.

PLUCHEA LONGIFOLIA n. sp.

Whole plant, particularly the inflorescence, pubescent with short villous hairs. Stem 6–10 dm. tall, branched at the summit; leaves crowded, erect or ascending, somewhat rough especially on or near the margins, denticulate or serrate, oblong or oval, those on the stem 6–16 cm. long, 2.5–5.5 cm. broad, the lower ones acute and sessile at the base, the upper ones truncate or rounded and slightly clasping at the base; inflorescence corymbiform, compact; involucres campanulate, 7–10 mm. long, exceeded by the slightly tawny pappus; scales of the involucre imbricated in 4–6 rows, ciliate, the outer ones broadly ovate and obtuse or apiculate, the innermost linear, acute.

Common in an open swamp just back of Titusville, Brevard Co., No. 2293. In the field the tawny white pappus makes the plant very conspicuous.

PLUCHEA IMBRICATA (Kearney) (*Pluchea foetida imbricata* Kearney). Further observation of this plant in the field convinces me that it is worthy of specific rank, and so I raise it to that distinction. It often attains a height of 1–2 metres, being much taller than *P. foetida*, which rarely exceeds 6 dm. in height. The color of the foliage is much different, giving the plant a purplish hue. In *P. foetida* the leaves are a dull green. The most marked difference between the two species lies in the time of flowering, *P. foetida* having matured its seed before *P. imbricata* is fairly in bud. There is a difference of some six weeks between the flowering periods.

Rudbeckia bupleuroides Shuttlw. Collected in the flatwoods at St. Marks, Wakulla Co., No. 2538. I visited this place early in September, a little too late to secure good specimens of this rare composite. By diligent search I managed to obtain about a dozen presentable plants. It grows in the swampy part of the flatwoods, in company with *Lacinaria spicata*, *Eryngium Ravenelii*, *and E. virgatum.*

Reviews.

Essentials of Vegetable Pharmacognosy. A Treatise on Structural Botany. Designed especially for Pharmaceutical and Medical Students, Pharmacists and Physicians. By Henry H. Rusby, M. D. and Smith Ely Jelliffe, M. D.

Pharmacognosy is that branch of pharmacology which treats of unprepared drugs. It is therefore comprehensive, including several sciences, specially botany and chemistry. The work before us takes up vegetable pharmacognosy, in other words, it is a botanical treatise clearly and intelligently displaying the relations of morphology and organography to the study of vegetable drugs. It consists of two parts: the first, by Prof. Rusby, on the gross structure of plants; the second, by Prof. Jelliffe, on their minute structure. Both parts have been carried out in a manner worthy of the high reputation of their authors. Prof. Rusby's extended original studies as a systematic botanist, together with his experience as a teacher, have made him not only familiar with the needs of students, but thoroughly fitted to supply them. His work will be profitably consulted by all interested in botany. It is inspired by the truly scientific and natural method, following the laws of development and logically bringing out the relations and homology of parts, a philosophical process which leads the author, for instance, to define the flower as "a reduced branch modified for the production of seeds," and to find in the leaf "all the elements which characterize primary stem structure." It is hardly necessary to add that it embodies, so far as the limits permit, all the latest advanccs of science, as specially made clear under the headings of fertilization, pollination, dissemination of fruit, etc. It contains only 100 closely printed pages, but omits nothing of interest and may be truly regarded as a model of condensation; seldom can so much assimilable information be found in the same space. In spite of the direct and lucid style of the author, such condensation might prove bewildering to the beginner were it not for the richness and excellence of illustration, an admirable feature of the work, so that there is hardly a definition without its appropriate cut. It should be mentioned that most of the illustrations have been taken from nature.

In subsequent editions I would suggest the freer use of capitalized and italicized terms to strike the eye and memory of students.

The second part by Prof. Jelliffe is, likewise, an excellent example of adaptation of means to an end, this end being the study of plant tissues with a view to their practical determination in drugs. The first chapter is given to microscopy. After treating of cells and their contents, the author describes the tissues, from a point of view both anatomical and physiological, as formative, protective, nutritive and reproductive. The last chapter is devoted to micro-chemical relations. This part, although of only 50 pages, is made by judicious condensation, to cover a large amount of clearly expressed, easily apprehended matter, made still more intelligible by the same profusion of excellent cuts.

A full alphabetical index of the whole work is a desideratum.

V. H.

Remarques sur la Nomenclature Bryologique. Par Auguste Le Jolis. Mem. Soc. Sci. Nat. et Math. de Cherbourg, **29**: 229–328.

The author considers in detail the changes in the names of mosses originated by Lindberg, and since followed by Braithwaite and other bryologists. He believes that the majority of bryologists have been pained by the trouble and confusion which Lindberg has made in the meaning of the names consecrated by the best authors, by replacing names which had a universal usage, by those old and unknown ones, which are almost unintelligible except to the initiated. He says that "The protests which have been made against these changes have been attributed to the perturbation of previous habits and have not been discussed from the side of the principles involved." He discusses at some length the "Revisio generum plantarum" of Otto Kuntze, also the Laws of the Paris Congress of 1867, and then proceeds to a detailed explanation of the changes made by Lindberg in the nomenclature of the Mosses. He indulges in several sneers at his expense, implying that these changes were made for the sake of replacing the names of other authors by his own, and in many cases fails to give any conclusive reasons why the changes should not have been made; but he also shows, in several instances, that Lindberg made these changes on insufficient descriptions and poor characterizations. The following is a list of the names to which he objects: *Sekra*, *Dorcadion*, *Astrophyllus*, *Sphaerocephalus*, *Webera*, *Lamprophyllum*, *Schistophyllum*, *Weissia*, *Georgia*, *Leersia*, *Mollia*, *Trichostomum*, *Stableria*, *Diaphanophyllum* and *Cyclodictyon*. He vents his spleen on Otto Kuntze for changing the application of *Hookeria* and reaches a climax of indignation by stating that 24 *Brodiaeas* transferred to *Hookeria* gave him that number of "nobis," 59 *Hookerias* transferred to *Cyclodictyon* added as many more, a small matter, however, after "306 OK.," which Dr. Kuntze seized by transferring *Selaginella* to *Lycopodioides*. "Le nobissime chronique degenere ici en nobisite aigue."

He makes his argument much more impressive by omitting the parenthetical citations, and attributing all changes to a desire for personal notoriety, rather than adherence to a fixed principle. He then proceeds to discuss changes in specific names, including the following: *Bartramia Norvegica*, *Breutelia chrysocoma*, *Bryum cernuum*, *Buxbaumia viridis*, *Camptothecium trichoides*, *Campylopus subulatus*, *Cryphaea arborea*, *Dicranella secunda*, *D. vaginalis*, *Dicranum schisti*, *Didymodon denudatus*, *Entodon palatinus*, *Grimmia ovalis*, *G. campestris*, *Hylocomium proliferum and H. palatinum*, *Hypnum elodes*, *Isothecium viviparum*, *Lesquereuxia filamentosa*, *Mnium serpyllifolium*, *Neckera fontinaloides*, *Oligotrichum incurvum*, *Phascum acaulon*, *Pterogonium ornithopodioides*, *Rhacomitrium aquaticum*, *R. hypnoides*, *Salaenia caesia*, *Seligeria setacea*, *Splachnum pedunculatum*, *Swartzia montana*, *Tetraplodon bryoides*, *Tortula mutica*, *Barbula acuta* and *Weisia Americana*. Judging from the remarks on page 303, which he attributes to "Mrs. Elis J. Britton," it is evident that M. Le Jolis has not followed up my subsequent notes on the question of *Orthotrichum Americanum* Beauv. and *U. Americana* Mitt. If he will consult the BULLETIN (**21**: 66–68, 1894), he will learn that I have since seen the types of both species, and have come to agree with Lindberg in believing that the name *O. Americanum* Beauv. antedated *U. Hutchinsiae* Smith by eight years, and that they are unquestionably the same species.

He finally considers the names of genera which exist in Bryology, but which should not be used, because they have been employed in other families. *Coelidium*, Reicht., 1855, should be replaced by that of Vogel, 1839, for a genus of the Leguminosae.

Cryptangium C. M., 1843, should fall on account of a homonym of Schrader's, used in the Cyperaceae, in 1842. *Cryptocarpus* C. M. is replaced by Austin's name for a genus of Hepatics. *Decodon* (C. M.) Broth. is antedated by a synonym, *Rhachithecium* Broth. and by a homonym of Gmelin, used for a genus of Lythraceae in 1791. *Lasia* P. B., 1805, is antedated by *Lasia* Lour., 1790, in the Aroideae, and should be replaced by *Forstromia*, Lindb., 1862. including *F. Ohioensis* (Sull.) Lindb. (*Leptodon trichomitrium* Mohr.) *Mniopsis* Mitt., 1860, is attended by two homonyms: one of Dumortier, in the Hepaticae; the other of Martius in the Podostemaceae.

Three genera of Phanerogams are displaced by homonyms in mosses. They are *Hedwigia* Swartz, 1788, Burseraceae, by *Hedwigia* Ehrh., 1781. *Sporledera* Bernh., 1842, Pedaliaceae, by *Sporledera*, Hampe, 1827. *Swartzia* Schreb., 1791, Leguminosae, by *Swartzia* Ehrh., 1787. A table of hononyms in Bryophyta and Spermatophyta is given, and a long list of works he has consulted. There is also a complete index. In many cases the original citations are quoted, which renders this criticism of particular value to those who cannot verify the original descriptions.

ELIZABETH G. BRITTON

Proceedings of the Club.

WEDNESDAY EVENING, FEBRUARY 26, 1896.

Vice-President Allen in the chair and 29 persons present.

Mr. C. D. Lippencott and Miss Amy Schüssler were elected active members.

The announced paper of the evening by Prof. Byron D. Halsted, "Economic Field Botany," was illustrated by numerous interesting lantern-slides.

A communication was read from Mr. Chas. H. Winston, of Richmond College, submitting a specimen of *Ligusticum Canadense*.

Dr. Britton made some remarks upon the separation of the Liliaceae, as usually understood, into four distinct families.

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Notes appearance in California as a ballast plant.

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AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

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THE TORREY BOTANICAL CLUB.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., April 30, 1896. No. 4.

Notes on Kuhnistera.

BY A. A. HELLER.

PLATE 262.

The genus *Kuhnistera* was published by Lamarck, in Encyclopedie Methodique, 3: 370 (1789), who based it upon the "Kuhniae affinis" or "Anonymos pinnat." of Walter, and gave it the name of *Kuhnistera Carolinensis*, from its resemblance to the genus *Kuhnia* of the Compositae. Walter, who did not know exactly where to place the plant, consigned it to his convenient *Anonymos*.

This in some respects peculiar plant has had an interesting history and a variety of names. Jussieu, in Gen. Pl. 355 (1789), under the description of *Dalea*, adds: "Speciam habeo siccam, habitu flosculosam Eupatorii instar sed Dalea fere congeneram cui calix communis polyphyllus imbricatus multiflorus, calix proprius inferus 5-partitus plumosus, petala 5 subaequalia unguiculata, caetera similia."

This is followed by an observation of Ventenat, in Tab. 3: 395 (1794) under *Kuhnistera Carolinensis*, who says that the plant of which Jussieu gave a short description, after having presented the characters of *Dalea*, is, according to Michaux, this Anonymos of Walter; *Kuhnistera* differs above all from the genera following by the disposition of the flowers in a corymb, by its involucre and by the plumose divisions of the calyx proper. The genera following are *Dalea* and *Psoralea*. The reference to Michaux evidently means that the information was given either verbally or by correspondence, as they were co-workers.

Michaux, in Fl. Bor. Am. 2: 50 (1803), described the genus *Petalostemum*, taking as types *P. albidum, pl. 37, f. 1*, and *P. violaceum, pl. 37, f. 2.* Under it he included *Kuhnistera Carolinensis* Lam., calling it *P. corymbosum.*

Willdenow, in Sp. Pl. 1338 (1803), issued subsequent to Michaux's Flora, places the plant under *Dalea*, and calls it *Dalea Kuhnistera*, taking his characters from Ventenat, the latter clause of whose description reads: "Quodlibet florum, capitulum magnobractearum numero est tectum, quae calycem communem quasi repraesentant et totae plantae habitum Eupatorii conciliant."

Poiret, in Lam., Encycl. 5: 694 (1804), calls it *Psoralea corymbosa.* After mentioning the corymbose heads, he adds: "They are provided with large oval bracts, scales, almost like an involucre, at the base of the flowers."

Pursh, in Fl. Am. Sept. 462 (1814), takes up the name *Petalostemon corymbosum*, of Michaux, and remarks: "This singular plant appears, at first sight, to belong to the class Syngenesia (Compositae), and certainly is the connecting link between that class and the present."

De Candolle, in Prodr. 2: 244 (1825), assigns it to a section Kuhnistera, of *Petalostemon*, and asks: "An genus proprium?"

Bartling, in Ord. Nat. Pl. 410 (1830), treats *Kuhnistera* and *Petalostemon*, as separate genera.

Don, in Gen. Syst. 2: 222 (1832), follows De Candolle, and quotes him throughout.

Torrey and Gray, in Fl. N. Am. 1: 312 (1838), say, speaking of *Petalostemon corymbosus:* "This species, on account of its habit, its large involucrate bracts, deeply divided and plumose calyx, and narrow petals, has been separated as a distinct genus, but scarcely on sufficient grounds, for several other species have a similar calyx and very narrow petals and in *P. multiflorum* the stem is somewhat corymbosely branched. There is no other species, however, with similar spikes."

Endlicher, in Gen. Pl. 1270 (1840), divides *Petalostemon* into two sections, Eupetalostemon and Kuhnistera.

Lindley, in Veg. King. Ed. 3, 554 (1853), considers *Kuhnistera* and *Petalostemon* as separate genera.

With the idea of finding sufficient characters to separate *Kuhnistera* of Lamarck from *Petalostemon* of Michaux, I have spent some time in hunting up the literature of the subject. As will be seen from the extracts given above, botanists since the time of Michaux who were really acquainted with the plants which they described have maintained but one genus, some of them making a section of *Kuhnistera*.

My own examinations of the different species have failed to establish enough constant differences to separate them into two genera. The plant of Walter is strikingly different in its general appearance from the other species, but the differences are of degree rather than of kind. All of the species have a greater or less number of empty bracts at the base of the flower-head. In *pinnata* these are broadly ovate or almost orbicular, especially the outer row, which usually bears small leaflets. If these outer empty bracts were constant and of a different shape from the inner ones we would have a good character, but they are not. The outermost bracts are almost obicular, the innermost oblong, with a gradual transition from the one to the other, as we proceed from the outside to within.

The narrow petals and slender plumose calyx-lobes can hardly be considered sufficient ground for generic distinction, for as noted by Torrey and Gray we have these conditions in several other species, although no other species has the calyx-lobes so long in proportion to the length of the tube.

Unless better and more constant characters can be found to keep up to distinct genera, the latter name of *Petalostemon* Michaux must give way to *Kuhnistera* of Lamarck, as set forth by Kuntze, in Rev. Gen. Pl. 192 (1891).

The following is a provisional list of the species as known to me at the present time, and is printed preliminary to a descriptive monograph of the genus.

KUHNISTERA Lam. Encycl. 3: 370. 1789.

KUHNISTERA CANDIDA (Michx.) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon candidum Michx. Fl. Bor. Am. 2: 49. 1803.

Dalea candida Poir. in Lam. Encycl. 5: 694. 1804.

Petalostemon virgatum Nees & Schwein., in Neuwied, Reise Nord. Am. 2: 432. 1839.

A Mississippi Valley species, occurring in Minnesota, Wisconsin, Illinois, Nebraska, Kansas, Kentucky, Tennessee, Mississippi, Louisiana, and in the Saskatchewan region, where it was collected by Bourgeau.

KUHNISTERA CARNEA (Michx.) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemum carneum Michx. Fl. Bor. Am. 2: 49. 1803.

Psoralea carnea Poir. in Lam. Encycl. 5: 694. 1804.

Dalea carnea Spreng. Syst. 3: 326. 1826.

Petalostemon roseum Nutt. Amer. Journ. Sci. (I.) 5: 298. 1822.

Georgia and northern Florida. Nuttall's *P. roseum* does not seem to be distinct from this species.

KUHNISTERA COMPACTA (Spreng.) Kuntze, Rev. Gen. Pl. 192. 1891.

Dalea compacta Spreng. Syst. 3: 327. 1826.

Petalostemon macrostachyum Torr. Ann. Lyc. N. Y. 2: 176. 1828.

Petalostemon compactus Swezey, Neb. Fl. Pl. 6. 1891.

Nebraska and Colorado.

KUHNISTERA DECUMBENS (Nutt.) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon decumbens Nutt. Journ. Acad. Phila. 7: 93. 1834.

Northeastern Texas.

KUHNISTERA EMARGINATA (T. & G.) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon emarginatum T. & G. Fl. N. Am. 1: 311. 1838.

A Texan species.

KUHNISTERA EXILIS (A. Gray) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon exilis A. Gray, Pl. Wright. 2: 41. 1893.

New Mexico, Arizona and Mexico. The bracts of this plant are like those of true *Dalea*, but there are only five stamens, having the structure of those of *Kuhnistera*. As stated by Gray in the original description, "The lowest bracts broader and less subulate-pointed than the upper," in this respect having the same character as *K. pinnata*.

KUHNISTERA FEAYI (Chapm.) Nash, Bull. Torr. Club, 22: 149. 1895.

Petalostemon Feayi Chapm. Fl. States, Suppl. 615. 1884.

Apparently confined to central Florida. It is close to *K. carnea*, but seems to be distinct.

KUHNISTERA FLAVESCENS (S. Wats.) Kuntze, Rev. Gen. Pl. 192. 1891.
Petalostemon flavescens, S. Wats. Amer. Nat. 7: 299. 1873.

KUHNISTERA FOLIOSA (A. Gray) Kuntze, Rev. Gen. Pl. 192. 1891.
Petalostemon foliosus A. Gray, Proc. Amer. Acad. 7: 336. 1868.
Illinois and Tennessee.

KUHNISTERA GATTINGERI n. sp.

Perennial, stems a foot in length or more, usually branching from the base, sometimes decumbent, sparingly glandular and pubescent, sometimes villous on the peduncles; leaflets two or three pairs, narrowly linear or oblong, one-half to three-fourths of an inch long, one line in width or less, dull and glandular on the upper side, light green beneath, the mid-vein prominent; spikes on rather short peduncles, cylindrical, loose, especially when old, one inch to two and a half inches long; bracts slightly longer than the calyx, oval-lanceolate, slender-pointed, glandular, pubescent; calyx pubescent with spreading hairs, the lanceolate lobes slightly shorter than the tube and more pubescent; petals deep rose-purple; ovary and base of style pubescent.

This plant has been distributed as *Petalostemon decumbens* Nutt., but Nuttall's type, collected "on the plains of the Red River," is preserved in the herbarium of Columbia University, and is a very different species. I take pleasure in dedicating it to Dr. A. Gattinger, who first collected it about Nashville and Lavergne, Tenn. Some of his specimens are in Curtiss' North American Plants, no. 565. Dr. Chas. Mohr has also collected it at Russelville, Ala., a form with somewhat laxer inflorescence, and more pubescent calyx.

KUHNISTERA GRACILIS (Nutt.) Kuntze, Rev. Gen. Pl. 192. 1891.
Petalostemon gracile Nutt. Journ. Acad. Phila. 7: 92. 1834.
Petalostemon bicolor Bertol. Bot. Zeit. 9: 902. 1842–51. Fide A. Gray.

A species of the gulf coast extending from Florida to Louisiana. The majority of the plants which are in herbaria labeled *Petalostemon gracile* belong to *K. oligophylla*. True *gracilis* has not been found outside of the range given.

KUHNISTERA GRISEA (T. & G.) Kuntze, Rev. Gen. Pl. 192. 1891.
Petalostemon griseum T. & G. Fl. N. Am. 1: 310. 1838.

Texas and Indian Territory.

Petalostemon luteolus S. Wats., is *P. Sabinalis* S. Wats. Although the name *luteolus* appears in Patterson's Check-List, it has no foundation, being a label name given to a specimen of *P. Sàbinalis*.

KUHNISTERA MICROPHYLLA (T. & G.).

Petalostemon phleoides var. *microphyllum* T. & G. Fl. N. Am. 1: 310. 1838.

The much smaller and more numerous leaflets, as well as the pubescence, readily separate this plant from *K. phleoides*.

A Texan species.

KUHNISTERA MULTIFLORA (Nutt.) Heller, Mem. Torr. Club, 5: 197. 1894.

Petalostemon multiflorum Nutt. Journ. Acad. Phila. 7: 92. 1834.

Kuhnistera candida var. *multiflora* Rydberg, Cont. U. S. Nat. Herb. 3: 54. 1895.

The corymbose and capitate inflorescence of this species debar it from being classed with *K. candida*. The ovate bracts, shorter than the calyx, although of lesser importance, do not agree with *candida* either, as shown by Mr. Rydberg's description. There is only one other species in the genus, *K. pinnata*, which is corymbosely branched. I have seen specimens from Kansas, Indian Territory and Texas only.

KUHNISTERA OBOVATA (T. & G.).

Petalostemon obovatum T. & G. Fl. N. Am. 1: 310. 1838.

Dalea agastachya Moric. Pl. Nouv. 65. *pl. 44*. 1839.

Kuhnistera agastachya Kuntze, Rev. Gen. Pl. 192. 1891.

In Mem. Am. Acad. (Plantae Fendlerianae) 4: 33 (1849), Dr. Gray says in a foot note: "*Dalea agastachya* Moric. Pl. Nouv. Amer. *pl. 44* (1839) is *Petalostemon obovatum* T. & G.," thus proving conclusively that *obovatum* is the earlier name. Moricand's work was issued in parts, dating from 1833–46.

A Texan species.

KUHNISTERA OLIGOPHYLLA (Torr.).

Petalostemon gracile var. *oligophyllum* Torr. in Emory's Mil. Rec. 139. 1848.

Kuhnistera occidentalis Heller, Trans. N. Y. Acad. Sci. 14: 33. F. 1895.

Kuhnistera candida var. *occidentalis* Rydberg, Cont. U. S. Nat. Herb. 3: 154. S. 1895.

The Mexican Boundary Survey of Emory having been confused with the work cited above, the identity of this species was only recently established. The type, but unnamed, is in the herbarium of Columbia University. On a small slip of paper pasted upon the sheet is recorded in Torrey's hand "Emory, Sept. 28th, 1846. Valley of Del Norte." By referring to the journal, we find that on September 28, 1846, the expedition was near Albuquerque, New Mexico. Specimens from Arizona, New Mexico, Kansas, Indian Territory and South Dakota are typical, and readily distinguished from *K. candida* by the lax inflorescence, blunt spikes, and smaller, thicker and more obtuse leaflets, but in Nebraska there are some forms which approach *candida*. It has a more western and southwestern range than any other of the white-flowered species. In the lower part of its range, *candida* is not found far from the Mississippi river, and the typical plant is found only from the original region, Tennessee, Illinois and northward.

KUHNISTERA ORNATA (Dougl.) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon ornatus Dougl.; Hook. Fl. Bor. Am. 1: 138. 1830.

Dalea ornata Eaton & Wright, 219. 1840.

Petalostemon macrostachys T. & G. Fl. N. Am. 1: 309. In part. 1838.

An Oregon species.

KUHNISTERA PHLEOIDES (T. & G.) Kuntze, Rev. Gen. Pl. 182. 1891.

Petalostemon phleoides T. & G. Fl. N. Am. 1: 310. 1838.

Petalostemon glandulosus Coult. & Fish. Bot. Gaz. 18: 299. 1893.

A comparison of the type of *phleoides* and a duplicate type of *glandulosus*, both of which are in the Columbia University herbarium, clearly shows them to be identical. The oblique calyx is a marked character in this species.

Texas.

KUHNISTERA PINNATA (Walt.) Kuntze, Rev. Gen. Pl. 192. 1891.

Anonymos pinnat. Walt. Fl. Car. 103. 1788.

Kuhnistera Carolinensis Lam. Encycl. 3: 370. 1789.

Petalostemum corymbosum Michx. Fl. Bor. Am. 2: 50. 1803.

Dalea Kuhnistera Willd. Sp. pl. **3**: 1337. 1803.

Psoralea corymbosa Poir. in Lam. Encycl. **5**: 694. 1804.

Cylipogon virgatum Raf. Journ. Phys. **89**: 97. 1819.

Gatesia Alabamensis Bertol. Bot. Zeit. 899. 1842–51.

In the coast region from North Carolina to Alabama.

KUHNISTERA PULCHERRIMA Heller, Cont. Herb. F. & M. Coll. **1**: 50. *pl.* 2. 1895.

Petalostemon virgatum Scheele, Linnaea, **21**: 401. 1848. Not Nees, 1839.

North central Texas.

KUHNISTERA PURPUREA (Vent.) MacM. Met. Minn. Val. 32. 1892.

Dalea purpurea Vent. Hort. Cels. *pl.* 40. 1800.

Petalostemum purpureum Michx. Fl. Bor. Am. **2**: 50. *pl. 37. f. 2.* 1803.

Dalea violacea Willd. Sp. Pl. **3**: 1337. 1803.

Psoralea purpurea Poir. in Lam. Encycl. **5**: 694. 1804.

Northwest Territory, Saskatchewan, Dakota, Minnesota, Nebraska, Illinois, Missouri, Kansas and Arkansas.

KUHNISTERA REVERCHONI (S. Wats.).

Petalostemon Reverchoni S. Wats. Proc. Am. Acad. **21**: 449. 1886.

A species of northern Texas.

KUHNISTERA SABINALIS (S. Wats.).

Petalostemon Sabinalis S. Wats. Proc. Am. Acad. **21**: 448. 1886.

Bandera County, southwestern Texas.

KUHNISTERA SEARLSIAE (A.Gray) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon Searlsiae A. Gray, Proc. Am. Acad. **8**: 380. 1873.

Nevada, the original locality, and Arizona.

KUHNISTERA TENUIFOLIA (A. Gray) Kuntze, Rev. Gen. Pl. 192. 1891.

Petalostemon tenuifolius A. Gray, Proc. Am. Acad. **11**: 73. 1876.

Arkansas, New Mexico, Arizona.

KUHNISTERA TENUIS (Coulter).

Petalostemon violaceus var. *tenuis* Coulter, Cont. U. S. Nat. Herb. **1**: 34. 1890.

This is a very good species, quite distinct from the *Petalostemon violaceus*, which has been made dumping ground of various red-flowered species which are not at all related to it. This species is much more closely related to *Reverchoni* than to *purpurea*.

Coleman county, southeastern Texas.

KUHNISTERA VILLOSA (Nutt.) Kuntze, Rev. Gen. Pl. 192. 1891.
Petalostemon villosum Nutt. Gen. 2: 85. 1818.
Dalea villosa Spreng. Syst. 3: 326. 182).
Sackatchewan, Minnesota, South Dakota, Nebraska, Kansas.

Studies in the Botany of the Southeastern United States.—V.

By JOHN K. SMALL.

ASPLENIUM BRADLEYI D. C. Eaton, Bull. Torr. Club, 6: 11. 1873.

Although not extending the known geographic area, King's and Crowder's mountains, N. C., furnish two more stations for this rare fern. I found it on the two isolated peaks just mentioned, in th summer of 1894; it grew both on the cliffs at the summits and in crevices on large boulders on the slopes and at the base of the mountains. The leaves varied from less than one decimeter to between two and three decimeters in length.

PIAROPUS CRASSIPES (Mart.) Britton, Ann. N. Y. Acad. Sci. 7: 241. 1893.

Mr. A. H. Curtiss informs me that this plant escaped from cultivation a few years ago and has now become a serious obstruction to navigation in the tributaries of the St. John's river. It has established itself in other parts of Florida.

IRIS CAROLINIANA S. Wats. in A. Gray, Man. Ed. 6, 514. 1890.

In the spring of 1893 great quantities of this lately described *Iris* were found east of the great Dismal Swamp in Virginia by Dr. Britton and myself. During the spring of 1894 Tracy and Earle secured good fruiting specimens at Pointe du Chene, Louisiana (no. 2898), and last summer I found it very common in the swamps about Macon, Georgia, and throughout the middle part of that state.

Myrica pumila (Michx.).

Myrica cerifera var. *pumila* Michx. Fl. Bor. Am. **2**: 228. 1803.

It seems strange that this so-called variety of *Myrica cerifera* has never before been given specific rank.

Castanea nana Muhl. Cat. 86. 1813.

Mr. Kearney has recently given us an excellent description* of this characteristic chinquapin. He omitted, however, the most striking character of the species. During last July and August I had an opportunity to observe *C. nana* at various points in southeastern Georgia, where it is plentiful and distributed in large patches over the hot sandy wastes. In its relatives, *Castanea dentata* and *C. pumila*, we find typical trunks or main stems developed above ground, but in the case of *C. nana* the main stem never rises to the surface of the soil, but grows along at the depth of one or several inches beneath the surface, sending up lateral branches at intervals. A comparative study of the anatomy of this stem would doubtless prove interesting.

Aristolochia Nashii Kearney, Bull. Torr. Club, **21**: 485. 1894.

Last July I collected good fruiting specimens of this plant along the Flint River, below Albany, Ga. The species is readily separable from the related *A. Serpentaria* by its more deeply lobed capsule, which is just about one-half as long. Mr. A. H. Curtiss has sent me specimens which he gathered in northeastern Florida several years ago.

Portulaca coronata n. sp.

Rather stout, succulent, glabrous and somewhat shining, the roots fibrous, descending and freely branching; stem simple and erect, or diffusely branched from 1 or 2 cm. above the root, nearly terete, its branches spreading and ascending, bright flesh-colored or magenta, rarely lead-colored, the branches usually alternate, sometimes almost opposite, conspicuously articulated with the stem, the ends clavate and more or less tinged with green; leaves sessile or nearly so, the lower ones usually oblanceolate, the upper ones oblong or oblong-lanceolate, alternate, except a whorl of from three to eight at the ends of the branches, flat, obtuse or rarely acutish, conspicuously articulated with the stem, somewhat fugacious, bright green, inconspicuously ciliolate with depressed

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* Bull. Torr. Club, **21**: 261.

trichomes; midrib rather indistinct; flowers about 5 mm. broad, yellow; sepals 2 mm. long, triangular, sometimes broader than high, obtuse, hooded at the apex; petals small, 2 mm. long, ovate or oblong-obovate, obtuse, marked with five or seven nerves; stamens eleven or twelve; pistil 2 mm. long, three to four-cleft, the segments obovate or spatulate, well covered with stigmatic processes; capsule hemispheric or turbinate-hemispheric, 2–3 mm. long, 5 mm. in diameter, surmounted by a conspicuous crown, developed from the edge of the calyx where the lid joins the capsule; lid flattish, not crested, sometimes slightly depressed in the center; seeds twenty to forty, cochleate, gray, covered with acute or acutish pyramidal papillae.

Collected in September, 1894, just below the summit of Little Stone Mountain, De Kalb County, Georgia. It grows in company with *P. pilosa* in shallow depressions which have become partially filled with a sandy soil by the disintegration of the granite. There is a great contrast between it and the last named species, the plants are usually stouter, less dense in habit and the stems and branches bright magenta, whilst those of *P. pilosa* are of a light or dark shade of green. It is more closely allied to *P. lanceolata* Engelm. of southern and western Texas, from which it differs in the smaller flowers, and the sessile or nearly sessile leaves. The leaves are also different in shape and are never acute. The petals are not like those of *P. lanceolata*, and unfold in cultivated specimens about eight o'clock in the morning.

TWO SPECIES OF HIBISCUS.

Dr. Gray, in revising this genus for the Synoptical Flora, and in the fifth edition of his Manual, merged Michaux's *H. grandiflorus* into *H. lasiocarpus* of Cavanilles. It is difficult to understand on what grounds he did this, as the two species are so strikingly dissimilar. A comparison of their diagnostic characters is here given.

HIBISCUS LASIOCARPUS Cav. Diss. 3: 159. *pl. 70. f. 1.* 1787.

Hibiscus grandiflorus A. Gray, Man. Ed. 5, 102. 1867. Not Michx.

Stem pubescent, leaves ovate, the upper surface clothed with a dense pubescence consisting of long branched strigose-like hairs with a metallic or brownish-green tinge, the lower surface somewhat paler and less densely pubescent; calyx inconspicuously ribbed; bractlets as long as the calyx or longer, pectinateciliate; petals 6–8 cm. long; style slender, its branches not arising from the same point.

HIBISCUS GRANDIFLORUS Michx. Fl. Bor. Am. **2**: 46. 1803.

Stem glabrous; leaves hastate, three-lobed, broader than long (except the uppermost), the upper surface velvety with dense pubescence, bright green, the lower surface whitish, densely canescent; petioles glabrous; calyx prominently ribbed; bractlets about one-half the length of the calyx, velvety; petals 12–15 cm. long; style stout, its branches arising from the same point.

I have seen specimens of *H. grandiflorus* from several places in Florida. Michaux says it also occurs in Georgia and Mississippi. On the other hand *H. lasiocarpus* ranges from Louisville westward and north in the Mississippi Valley to Illinois and Missouri. Cavanilles gives a good figure of *H. lasiocarpus* which in no way suggests Michaux's plant.

NYMPHAEA ORBICULATA n. sp.

Perennial, robust, pubescent, except the upper surface of the leaves, bright green. Leaves orbicular or nearly so, 3–4 dm. in diameter, somewhat crisped, the lobes at the base conspicuously overlapping, the upper surface rough with irregular papillae, the lower surface pubescent with short shining silvery hairs, marked with numerous secondary nerves; petiole variable in length, faintly striate, clothed with silky pubescence, like the lower surface of the leaves; flowers about 6 cm. in diameter; sepals oblong-obovate, 5 cm. long, obtuse, somewhat eroded, faintly ribbed; disk 2 cm. in diameter; fruit subglobose, 4–5 cm. in diameter; seeds ovoid, 4.5 mm. long, with a ridge on one side.

Collected in a small lake near Thomasville, southern Georgia. In flower and fruit throughout July. Differs from *Nymphaea advena* in its orbicular leaves with their overlapping basal lobes, the peculiar pubescence and the ovoid seeds instead of the more nearly globose ones of that species.

CROTONOPSIS SPINOSA Nash, Bull. Torr. Club, **22**: 157. 1895.

I met with quantities of this very distinct species during the past summer in the valley of the St. Mary's River, in southeastern Georgia. In the field, as in the herbarium, this plant does not suggest *C. linearis*, its mode of growth and habit separating it at once. In Engler & Prantl we notice a figure of *P. spinosa*, which is intended to represent *P. linearis*. This shows that the species was collected some years ago and that a specimen found its way to Europe.

RHEXIA FLORIDANA Nash, Bull. Torr. Club, **22**: 150. 1895.

This *Rhexia*, hitherto known from but a single locality in Florida, is now known to occur in Georgia. I collected fine specimens of it during the past season north of the St. Mary's River, in the neighborhood of hammocks, in Charlton county. Their characters show nothing different from the originals, except that my specimens are more robust.

JUSSAEA SUFFRUTICOSA L. Sp. Pl. 388. 1753.

Dr. Carl Mohr has found this plant established on the river bank at Mobile, Alabama. This is the first record of its occurrence within the Southern States.

GAYLUSSACIA URSINA (M. A. Curtis) T. & G.; Gray, Mem. Amer. Acad. (II). **3**: 49. 1846.

While in the mountains of northern Georgia, in the summer of 1893, I found this rare *Gaylussacia* at three localities. It is quite scarce in the canon at Tallulah Falls and produces little fruit, but some miles north, on the North Carolina boundary, the damp mountain slopes about Estotoah Falls and the Thomas Bald are covered with the shrub, growing from one to four feet tall and producing quantities of the large black fruit, which is not at all insipid, as has been stated. On some mountains it covers areas many acres in extent.

CYNOCTONUM ANGUSTIFOLIUM (T. & G.).

Mitreola sessilifolia var. *angustifolia* T. & G. Fl. N. A. **2**: 45. 1841.

Annual, or perennial (?), slender, glabrous, pale green and *Sabbatia*-like. Stems erect, 2–6 dm., simple or sparingly branched above, virgate; leaves varying from narrowly lanceolate, 2–4 cm. long, somewhat fleshy, becoming thin in drying, obtuse or acutish at the apex, entirely sessile or the lowest short-petioled, not prominently nerved; flowers usually in a somewhat compound terminal cyme; calyx narrowly campanulate, 2.5–3 mm. long, parted to below the middle, its segments ovate-lanceolate, obtuse, denticulate; corolla at length much longer than the calyx, whitish, 3–5 mm. long, marked with dark stripes (3 to each segment), its tube somewhat constricted at the throat, about as long as the linear-lanceolate, erect or converging, rather obtuse segments; capsule sessile or nearly so, 4 mm. long, its two horns slightly longer than the body, converging; seeds brown, .3 mm. long, ovoid, rather pointed at the apex, slightly and minutely pitted.

Original locality, Middle Florida. In wet places, southern Georgia and Florida.

RUDBECKIA BICOLOR Nutt. Journ. Acad. Phila. 7: 81 (1834).

This species of more western distribution has been collected in eastern Florida. Mr. A. H. Curtiss has found it growing in pine barrens near Jacksonville (no. 4759). Some years since he secured it in fertile fields in Duval county, but distributed it under the name of another species (no. 1423). In 1894 Prof. Tracy secured a remarkably slender form at Biloxi, Mississippi (no. 2896).

The Blue-eyed Grasses of the eastern United States (Genus Sisyrinchium).

BY EUGENE P. BICKNELL.

(PLATES 263–265).

No conclusive answer has yet been given to the old question whether there exists more than one East American species of Blue-eyed Grass. The common resource of throwing together under one name all eastern specimens belonging to the genus is easy botany but poor morals. Neither does the recognition of two forms or species satisfy the botanical conscience. It would appear that only when we take notice of three or more kinds of Blue-eyed Grasses do we find ourselves bearing somewhere near the truth. It matters little whether these *kinds* be rated, according to the conceptions of different minds, as species or as forms of less signal rank; the pith of the matter lies in this, that each kind upholds a certain definite type of individualization which has been established in nature.

I venture to propose a new eastern species in this confused genus only on the authority of facts perfectly clear to my mind. Nor do I doubt that any student who may approach the subject guided by out-of-doors study will reach views not greatly at variance with my own.

Nomenclature.

An inquiry into the nomenclature of the East American forms of *Sisyrinchium* discloses the unsuspected fact that our common Blue-eyed grass of the Atlantic States is without any available name. The plant has been variously known as *S. Bermudianum* L., *S. angustifolium* Miller and *S. anceps* Cav. These names are in indiscriminate use to-day.

It has been a subject of disagreement whether the name *Bermudiana* of Linnaeus belongs more properly to the Bermudan than to the American plant. The title of the insular species is certainly not without a slight flaw of indirection; on the other hand it can scarcely be held that the claim of the continental plant is better founded—its support involves an undue insistence on merely technical points at best of uncertain bearing in this particular case. In these circumstances that course seems to be right which unreservedly concedes the name *Bermudiana* to the Bermudan plant.

But even in its time-honored employment in American botany the name *Bermudiana*, it appears, has been used to designate quite another form of *Sisyrinchium* than the one to which it was applied in Species Plantarum. Its application by Linnaeus was not at all, or only in doubtful part, to the plant of our Atlantic seaboard which has borne the name—the plant with broadly-winged, branching stem and subequal spathal bracts. The species which was primarily, if not solely designated by Linnaeus, is the plant of more northward extension, having a slender, simple stem and unequally bracted spathe, which has been known by Michaux's name, *mucronatum*. Linnaeus's description is distinctive of neither species, but his plant was based on Plukenet (Phyt. *pl. 61, f. 1.* 1691, and Almag. 345, 1696) and on Dillenius (Hort. Elth. 49, *pl. 41, f. 49.* 1732). Plukenet both by description and illustration is perfectly clear; his plant is the one we have been calling *mucronatum*. It may be added that the precedence given to the American over the Bermudan plant in Species Plantarum is in conformity with the numbering of Plukenet's figures, which, singularly enough, reverses the order of the figures themselve, and of the descriptions as well.

The exact plant of the Species Plantarum is so perfectly established by the primary reference to Plukenet that it is of little consequence to find that Dillenius is ambiguous. Watson, indeed, has interpreted the Dillenian plant as being the equivalent of our so-called *mucronatum*. Still, the figure in Hort. Elth. appears to represent, in part at least, our Atlantic States plant, and it would thus seem probable that Dillenius actually had both species, but failed to distinguish between them. This, however, is fortunately not now material to the proper assignment of names.

First after Linnaeus, Miller (Dict. ed. VII., 1759) discussed the American plant, as he understood it, naming it *S. angustifolium* and citing Dillenius. To the extent of this citation the exact significance of Miller's name might be held to be doubtful, but his description, as Watson has emphasized, points unmistakably to our simple-stemmed plant. Whatever doubt of this might otherwise have been is forestalled by Miller himself. In his "Gardeners' and Botanists' Dictionary" (1807) he redescribes his plant in clear terms, adopting for it the name *S. anceps* Cav., and citing his own earlier name as a synonym. The bearing of *S. anceps* Cav. is not doubtful; the plant falls conclusively into line with that of Linnaeus and of Miller as our simple-stemmed species.

The true name of this plant is thus found to be *S. angustifolium* Miller, as Watson has already maintained (Proc. Am. Acad. 24: 86–7).

The name *S. anceps* Cav. was adopted by Watson for our branched species on the ground that Cavanilles' illustration shows one plant bearing a short branch. The remaining evidence of the figures, as well as the unequivocal text, was thus quite unaccountably overlooked. As a matter of fact, also, *S. angustifolium* sometimes develops a short lateral branch, just as the figure shows.

Earlier than Cavanilles, Lamarck described the American plant as *S. gramineum* from specimens cultivated in France (Encyc. 1: 408. 1783). His description is entirely satisfactory and identifies his plant perfectly with Miller's *S. angustifolium* described from specimens cultivated in England.

The synonomy of *S. angustifolium* will therefore stand as follows:

S. angustifolium Miller, Dict. ed. VII. (1759).
S. Bermudiana L. Sp. Pl. 954. In part. 1753.
S. gramineum Lam. Encyc. **1**: 408. 1783.
S. anceps Cav. Diss. **6**: 345. *pl. 190, f. 2.* 1788.
S. mucronatum Michx. Fl. Bor. Am. **2**. 33. 1803.

The first clear presentation of our branched species was by

Curtis (Bot. Mag. *pl. 464. 1799*), who gives an excellent illustration of our exact plant naming it *S. gramineum*. This name, however, as we have seen, was preoccupied through its use by Lamarck. The curious fact thus develops that this plant appears never to have been described under a name not a synonym of *S. angustifolium*. It may now, therefore be called *S. gramnoides*.

Our eastern Species of Blue-Eyed Grass.

SISYRINCHIUM GRAMINOIDES nom. nov.

S. gramineum Curtis, Bot. Mag. *pl. 464.* 1799. Not *S. gramineum* Lam. Encyc. 1 : 408. 1783.

S. Bermudianum of American authors, not Linnaeus.

S. anceps S. Watson in A. Gray's Manual, Ed. 6, 515. Not Cavanilles.

Specific Characters: Green or subglaucous, drying dark; stem bifurcate, winged; leaves thin; stem and leaves with scabrous edges, 1″–3″ wide; bracts of spathe subequal, acuminate; floral-scales brownish-tinged; capsule large, 1½″–3″ wide; seeds ½″ or more in diameter, pitted.

Commonly over 1° high (6′–2°); green or somewhat glaucous, usually drying dark. Stems wing-flattened, mostly 1½″–2″ wide (1″–3″), the wing-margins perceptibly broadened upward from base to top. Leaves thin and grass-like, as broad as the stem and from one-half to three-quarters its length, or rarely equalling it, minutely serrulate or denticulate on the edges, as are the stem and the branches, or usually so. Stem dividing above or from about the middle into two (exceptionally three or four) branches 2′–8′ long, subtended by a conspicuous grass-like leaf which is slightly narrowed above the compressed-clasping base and broadened higher up, as are the larger basal leaves. Branches winged, mostly suberect and unequal, but variable, usually the inner one elongated and erect, the outer one about half its length, often curved, broader, sometimes over 1″ wide with its margins passing uninterruptedly into the continuous spathe; rarely the outer branch may be the longer, or the two may be subequal; occasionally the outer one divides into two peduncles subtended by a leafy bract. Not infrequently simple and leafless scapes rise among the normally branched ones, simulating the stem of *S. angustifolium*. Bracts of spathe usually green and herbaceous (sometimes purplish), compressed, usually serrulate-scabrous on the keel, the outer one with scarious margins usually only below the middle, subequal (occasionally the outer one is sowewhat elongated, especially when the scape is simple); inner bract narrowly acuminate or acute, 6″–10″ long. Hyaline floral scales narrow, becoming distinctly brownish-tinged. Divisions of perianth 4″–5″ long, 1½″–2″ wide, sparsely pubescent on outer surface. Young capsule pubescent as in our other species. Capsules usually 3 or 4 (exceptionally more) subglobose, about 2″ long and broad (1½″–3″), disposed to be spreading or even recurved on slender pedicels 8″–12″ long. Seeds .04–05 in. in diameter, black, globose, more or less pitted. (Plate 263.)

Eastern States south from Massachusetts, but exact distribution not well made out.

Grassy places generally, preferably in damp soil; sometimes it occurs in shaded woods, where it is deep green and forms large separate tufts producing a profusion of finally prostrate stems. In drier, open situations it is erect and somewhat glaucous; among deep grass in low grounds the stems may be weak and ascending, and the tufted habit nearly or quite lost.

Several specimens from coastwise localities from New Jersey southward agree in having three and four clustered branches, decidedly purplish spathes, narrow stem and narrow attenuate leaves. Specimens from Florida, which will doubtless prove to be separable, are coarser in habit with elongated narrowly attenuate, even flexuous leaves often exceeding the stem, short, clustered peduncles, the bracts of the spathe strongly white-margined, the inner bract commonly longer than the outer one, the hyaline floral scales long and often exerted beyond the bracts.

✓Sisyrinchium Atlanticum n. sp.

Specific Characters: Pale and glaucous, not drying dark; stem slender and wiry, branched, margined or narrowly winged; stem and leaves ¼″–1″ wide, very smooth, leaves rather stiff; bracts of spathe subequal; inner bract obtuse or truncate; floral scales silvery white; capules oblong ¾″–1½″ wide; seeds ¼″–½″ in diameter, pitted or nearly smooth.

Much slenderer than *S. graminoides*, when growing with it mostly taller. Pale and glaucous, not drying dark; very smooth except the branches and tips of the leaves which are minutely denticulate-scabrous. Stem often inclined or becoming prostrate, much longer than the leaves, 8′–2° high, slender and rather wiry, uniformly margined or narrowly winged, often subterete at base, usually less than 1″ wide, sometimes only ¼″, dividing above into two (1–3) short slender branches, or the outer branch elongated as a spreading prolongation of the stem and again branched. Occasionally a simple stem is developed, its spathe sometimes showing a slightly elongated outer bract. Leaves rather firm and stiff, narrow, 1″ wide or less, attenuate often arcuate, from ¼–¾ the length of the stem. Stem-leaf much smaller and narrower than in *S. graminoides*, scarcely or not at all broadened above. Branches slender, even filiform, narrowly margined, especially the outer one, 1½′–4′ long, mostly short and subequal, either parallel or somewhat spreading, when branched again often widely spreading, geniculate at the node and bearing a secondary leaf. Stem and branches usually purple-spotted and slightly constricted at the nodes and below the spathes. Spathes as a rule plumper and more narrowed at the base than in *S. graminoides*, often deflected, the bracts subequal, somewhat membranous, usually purplish; outer bract commonly with white scarious margins extending to the tip; inner bract 5″–8″ long, broader than in *S. graminoides*, the tip white-scarious, rounded or truncate, or even retuse, the midvein excurrent as a minute point. Hyaline floral scales mostly longer and broader than in *S. graminoides*, clear white. Divisions of perianth generally shorter and broader than in *S. graminoides*, 4″–4½″ long, 1½″–2½″ wide, finely pubescent on outer surface. Capsules 2–7, usually 5, oblong, ¾″–1½″ wide, 1″–2″ long, at maturity more contiguous than in *graminoides* on shorter suberect pedicels, the valves usually thicker; pedicels often flattened and finely margined. Seeds .02–.04 inches in diameter, subglobose, dark, finely wrinkled-pitted to nearly smooth. (Plate 264).

East Massachusetts to Florida, mostly near the coast in sandy soil, or about the borders of salt marshes. It may be either densely caespitose or of scattered growth.

I have observed this plant closely for a number of years in Van Cortlandt Park, New York City, where it grows in abundance over a low field bordering a brackish marsh often in company with *S. graminoides*. The two plants as they grow together are seen to be clearly distinct and no intergrading forms are found. I have also collected the plant on the New Jersey coast, and Dr. Britton informs me that it is the common species on Staten Island.

Sisyrinchium angustifolium Miller.

Low, commonly 6′–8′ high (3′–14′), pale and glaucous, usually strict and stiff. Leaves narrow, from almost setaceous to 1″ wide (rarely more lax, and 1½″ wide), sometimes equalling or exceeding the stem but mostly about one-half its length; edges of leaves and stem either smooth or minutely serrulate or denticulate. Stem simple (rarely with a short lateral branch), narrow, ½″ or less to

1″ wide, slightly winged or merely margined, terminated by the solitary spathe, or with two spathes geminate within the enclosing outer bracts. Bracts often conspicuously purplish, very unequal, the outer one commonly twice the length of the inner, sometimes rigidly prolonged to four times its length, becoming over two inches long, sometimes minutely papillose or even papillose-puberulent; inner bract often appearing gibbous in the spathe, 6″–12″ long, attenuate or acute. Flowers variable, sometimes very delicate on slender curved pedicels, often large with the pedicels strict and erect; divisions of perianth sometimes 6″ long, the broader series 2½″ wide, minutely pubescent on outer surface; floral scales either clear white or brownish-tinged. Capsules 1–9, globose, often larger than in *graminoides*, on straighter, less exserted pedicels, seeds often larger than in *graminoides*, .04–.06 in. long, mostly obliquely obovate-oblong, often angled, brownish, smooth or with coarse shallow pitting. (Plate 265.)

In damp or dry soil, sometimes on sterile hills and in dry upland pastures.

From Newfoundland to Saskatchewan, south to Connecticut and New York and along the mountains to North Carolina, in the interior to Kentucky, Missouri and Kansas.

It would appear from the foregoing description of *S. angustifolium* that the species is subject to not a few rather striking variations. I have little doubt, however, that my description embraces rather a group of closely related plants than the mere range of variation shown by a single one. In the material at command, however, I cannot find any certain warrant for the subdivision of the group, nor can I fully assure myself as to the value of any one of the apparently several component forms. It is probable, indeed, that study of these plants in life shall have to lead the way to the correct understanding of their relationships.

The true *S. angustifolium* would appear to range from Newfoundland far westward through Canada and southward through the Alleghenies to North Carolina, finding in Connecticut and New York its southern limit near the coast. Specimens agree generally in drying blackish like *S. graminoides*, and in having the edges of stem and leaves decidedly rough-serrulate. At the southern limit of its coastwise range this form seems to show a closer affinity to *S. graminoides*, and it is in plants from this region that a short lateral branch is occasionally found. It is quite possible, therefore, that plants practically intermediate between this form and *S. graminoides* may occur, especially as starved forms of the latter would naturally tend to assume the general character of *S. angustifolium.*

An Allegheny Mountain form of *S. angustifolium* is very slender and delicate, with highly-colored spathe and linear-elongated outer bract; the edges of the stem, in certain specimens at least, is perfectly smooth. This form also turns blackish in drying.

Plants from the prairie region, from Minnesota to Kansas, do not blacken in drying, and commonly have the edges of the stem and leaves perfectly smooth. The bracts of the spathe are often minutely papillose or even puberulent, a character of which I have found no suggestion in eastern specimens. Both East and West, however, furnish ambiguous plants which seem to contradict the indications of the general run of specimens from each region.

Among the large number of specimens examined, three only have geminate spathes. These specimens are all from the same general region, viz., Kentucky, Missouri and Illinois. Collectors' notes on two of them record "flowers white;" another is labeled further by Dr. Englemann "*S. albidum*, Raf., Dry Hills, St. Louis, earlier than the blue form, May, 1863."

In Rafinesque's description of his *S. albidum** (Atlantic Journ. 17, 1832) we read "spathe unequally 4 valved," the habitat of the plant is given as "in West Kentucky." These developments certainly point strongly to the validity of *S. albidum* Raf., and suggest a promising subject of field study to anyone who may be in a position to prosecute it.

Three Editions of Stansbury's Report.

By Frederick V. Coville.

The report of Captain Stansbury's exploration of the Great Salt Lake, was published as Senate Executive Document No. 3, Special Sesssion (32d Congress), March, 1851, with the following title:

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*It may be stated here as a matter of record that, eight years prior to his description of *S. albidum*, Rafinesque wrote the plant down without description as *S. album* Raf. So it will be found printed in the "First Catalogues and Circulars of the Botanical Garden of Transylvania University at Lexington, in Kentucky, for the year 1824," p. 16. This reference is wanting in Index Kewensis.

STANSBURY, HOWARD.

Exploration and Survey of the Valley of the Great Salt Lake of Utah, including a reconnoissance of a new route through the Rocky Mountains. Philadelphia; Lippincott, Grambo & Co. 1852.

Appendix D of this Report, by John Torrey, is entitled: "Botany. Catalogue of Plants collected by the Expedition." It occupies pages 383 to 397 and is accompanied by nine lithograph plates.

A second edition of the report, with the same title, was printed by order of the House of Representatives, the publisher being Robert Armstrong, of the City of Washington, in the year 1853, though all the copies of it I have seen bear at the top of the title page the same document legend as the first edition. In the second edition the type was entirely reset, but no new matter was added in the body of the report and the pagination is maintained almost precisely throughout. In the botanical appendix, however, which occupies the same pages as in the first edition and is accompanied by the same plates, there are a few important changes in the text. The principal one of these occurs on page 389, on which in the first edition the new genus Monothrix is described, and on the following page the species *Monothrix Stansburiana.* In the second edition the genus Monothrix is discarded, the name given for this plant being *Laphamia Stansburii* (Gray, Plant, Wright. 101. 1852), with the following footnote:

"The Laphamia of Dr. Gray, although published subsequently to Monothrix, must take precedence of that genus, as it now embraces one species with a pappus of many bristles, another with a bisetose pappus, and two other species that are quite destitute of a pappus; so that the latter name is no longer appropriate."

From this footnote it would appear that the generic name Monothrix has precedence over Laphamia, but an examination of the date of publication of the first part of Dr. Gray's Plantae Wrightianae and of the first edition of the Stansbury report shows that the former was issued in March, 1852, while the manuscript of the latter was not submitted to Congress until April 19, of the same year. It is evident, therefore, that by the word "published" in his footnote, Dr. Torrey could not have meant what we now mean technically by that word. In both editions of the Stansbury report the plate of this plant, No. 7, bears the name "Monothrix stansburiana Torr." It is evident that Monothrix does not have priority over Laphamia.

Another change in the second edition is the reduction on page 389 of *Linosyris serrulata*, published on the same page of the first edition, to varietal rank under *Linosyris viscidiflora* without any citation of the first edition. On page 395 there is also a change in the remarks under *Abronia mellifera* Doug., the wording in the first edition being as follows: *A. micranthus*, Torr. in Fremont's first Report, p. 96, and in Emory's Report, p. 149, seems to be a particular state of the plant *Abronia mellifera*, in which it bears very small but perfect flowers. In those works I noticed the peculiarity of the embryo; the inner cotyledon being constantly abortive." The second edition reads, "In Fremont's first report, p. 96, and in Emory's Report, p. 149, I noticed a peculiarity of the embryo; the inner cotyledon being constantly abortive."

Beyond these differences no change of importance occur in the botanical appendices of the two editions, the matter being almost identical, page for page and line for line, with the exception of the correction of a few typographical errors.

Stansbury's report appears also in a third form which hardly merits the name of an "edition." It is the same precisely as the first edition, being printed from the same stereotype plates, except the title page, which is reset and dated 1855. In the absence of any reference to an earlier edition the date is wholly misleading.

Studies in the Leguminosae.—I.

By Anna Murray Vail.

NOTES ON MEIBOMIA.

Meibomia arenicola.

Hedysarum lineatum Michx. Fl. Bor. Am. 2: 72. 1803. Not of Linn. Syst. Ed. 10, 1170. 1759.

Desmodium lineatum DC. Prodr. 2: 330. 1825.

Meibomia lineata Kuntze, Rev. Gen. Pl. 196. 1891.

MEIBOMIA MICHAUXII.

Heysarum rotundifolium Michx. Fl. Bor. Am. 2: 72. 1803. Not of Vahl, Symb. 2: 81. 1791.

Desmodium rotundifolium DC. Prodr. 2: 330. 1825.

Meibomia rotundifolia Kuntze, Rev. Gen. Pl. 197. 1891.

MEIBOMIA TENUIFOLIA (T. & G.) Kuntze.

In Bull. Torr. Club, 19: 110, this species, owing to a mistake on a written label, was erroneously recorded as having been collected in Missouri. The label should have read Mississippi.

MEIBOMIA LONGIFOLIA (T. & G.).

Perennial, erect, 6 dm.–1 m. high or more; stems stout, branched, angled, striate, channelled, uncinate-pubescent mostly in lines, sometimes becoming glabrate; stipules ovate-lanceolate, cuspidate, persistent or caducous; petioles 1.5–5 cm. long, striate, pubescent; stipels 5 mm. long or more, often persisting; leaflets 5–11 cm. long, 2.5–5 cm. wide, lanceolate, lanceolate-ovate, or ovate, acuminate, slightly rugose or scabrous with few scattered hairs and becoming glabrate above, much lighter and appressed-pubescent or villous beneath, the terminal leaflet usually much larger than the lateral ones; panicles spreading flowers numerous, showy, about 1 cm. long on slender spreading uncinate-pubescent pedicels; bracts 5–10 mm. long, ovate or ovate-lanceolate, striate, ciliate, caducous; calyx 3 mm. long, the lobes attenuate, the upper one 2-toothed, the others somewhat longer; corolla lilac-purple, showy; legume 4–6-jointed, 3.5–6 cm. long, uncinate-pubescent, straight or somewhat rounded and angled on the dorsal suture, deeply triangular on the ventral, or nearly equally sinuate above and below, the 8–10 mm. long, reticulated joints almost lozenge-shaped; stipe about the length of the calyx-lobes.

June–September.

A characteristic species with the habit, leaf-form and legume of *M. bracteosa* and the pubescence of *M. Canadensis* and appearing as if intermediate between the two. The type specimen is without mature fruit.

Original locality, Arkansas. Type in Herb. Columbia University.

DISTRIBUTION. Illinois (Mead); Missouri (Bush, without fruit)? Kansas (Carleton); Arkansas (Nuttall); Louisiana (Hale); Alabama (Rugel).

SYNONYMY. *Desmodium Canadense* var. *longifolium* T. & G. Fl. N. Am. 1: 365. 1838.

Desmodium longifolium Nutt.; T. & G. Fl. N. A. l. c. as synonym.

MEIBOMIA PSILOPHYLLA WRIGHTII (A. Gray).

Desmodium Wrightii A. Gray, Bost. Journ. Nat. Hist. **6**: 177. 1850.

Meibomia Wrightii Kuntze, Rev. Gen. Pl. 198. 1891.

This species is so close to *M. psilophylla* (Schlecht. Linnaea, **12**: 310. 1838) as to scarcely even merit varietal rank. It is, however, variable, and the North American form seems to have somewhat broader leaves and slightly larger loment-joints.

DISTRIBUTION: Texas, New Mexico and Mexico.

M. psilophylla (Schlecht.) occurs in South Mexico.

MEIBOMIA ANGUSTIFOLIA (H. B. K.) Kuntze, Rev. Gen. Pl. 187 1891.

Hedysarum angustifolium H. B. K. Nov. Gen. **6**: 517. 1823,

Desmodium angustifolium DC. Prodr. **2**: 328. 1825.

Desmodium gramineum A. Gray, Pl. Wright. **2**: 46. 1853.

Meibomia graminea Kuntze, Rev. Gen. Pl. 198. 1891.

Grass Notes.

BY F. LAMSON-SCRIBNER.

(PLATE 266.)

JOUVEA STRAMINEA Fourn.

In Vol. **17**: No. 9, of the BULLETIN I figured and described a grass collected on the sandy seacoasts ot Lower California by Dr. Palmer, referring it with a sign of doubt to *Jouvea straminea* Fourn. The genus *Jouvea* was based upon female plants alone; and, while the characters presented by Palmer's specimens, which include both male and female plants, accorded in the main with the description given by Fournier, there were some differences in the details, which gave a doubt to the identification. Fournier did not recognize the male plants which were in the same collection (Liebmann 479 and 480) that contained the specimens upon which the genus was founded. He mistook these, as others had done before him, for species of *Distichlis* and referred them to

Brizopyrum pungens (Rupr.), under which name they were distributed. Last year Dr. Palmer collected the same grass in the vicinity of Acapulco, which he discovered in 1890 on the seashore in Lower California, and also another species which proves to be the true *Jouvea straminea* of Fournier, as determined by a comparison with the type. What I believe to be the male plants of the same species were also found, and from material gathered it has been possible to certainly identify Fournier's species, to ascertain that the grass of Palmer's earlier collection represents a distinct species of the same genus and also to determine with reasonable certainty that the male plants of the latter are the *Brizopyrum pilosum* of Presl.

From a study of the material now in hand, it appears to me that Fournier and others have heretofore misunderstood the structure of the female inflorescence. What has been described as a terminal, cylindrical and acute spike appears to me to be a 2 to 4-flowered spikelet with a remarkably developed rachilla in which the florets are embedded, the whole simulating in some degree the spikes of *Monerma* or *Lepturus*. These spikelets are lateral, sessile and articulated with the main axis, from which they readily separate at maturity. They are subtended by and partly enclosed within the leaf-sheath, from whose axil they originate, and there is a strong and well developed prophyllon on the rachis of the spikelet, above which is the articulation. This position suggests that what we here term a spikelet may be only a modified branch (but spikelets of the more familiar type are in reality modified branches), and the articulation of this with its own axis and the peculiar structure of the female flowers does, I think, warrant the use of the designation here given. These spikelets are without empty glumes, unless the leaf subtending them be regarded as a glume. In the staminate spikelets also the empty glumes are often entirely wanting, although occasionally we find one, and more rarely two, present. The glume which covers the female flower, called "*gluma exterior*" by Fournier, is really a flowering glume with its edge grown firmly to the rachilla for about one-half its length in *Jouvea straminea*, the upper portion being free, but the edges so extended and grown together as to form a closed cavity, having a small aperture only at the apex, through which the stigma protrudes. In *Jouvea pilosa* this glume is grown to the rachis or rachilla for nearly its entire length, the free portion being a short narrow tube as illustrated on page 228, Bull. Torr. Club, Vol. 17: and in *fig. n, pl. 106*. This glume is very firm and rigid, the texture of the dorsal portion being like that of the axis which bears it. It immediately subtends the pistil, which in *Jouvea pilosa* has no palea, but which in *Jouvea straminea* has a very delicate, hyaline, 2-keeled palea between it and the main axis. In many of the specimens examined there was above this palea a second pistil, imperfectly developed, enclosed within a sac of delicate texture, but otherwise formed like the sac which encloses the perfectly developed flower. This second and imperfectly formed pistil is raised above the other on a very short stalk, and the details of the structure here described are shown in *fig. e, pl. 266*. The presence and position of the second pistil in the cavity containing the female flower certainly suggests the idea that the organ here designated as a spikelet is really a branch bearing two or four 1 to 2-flowered female spikelets, which are subtended by and enclosed within a single glume, or entire and leafless blade-sheath.

JOUVEA STRAMINEA Fourn. Bull. Soc. Bot. Belg. 15: 475. Not Scribner. Liebmann, no. 738.

Found by Dr. Palmer (no. 443) in February, 1895, growing in large masses at the edge of a low damp place in a garden near the river bank at Acapulco. The plant produces long runners. There is a little uncertainty as to the staminate plants of the true *Jouvea straminea*. Dr. Palmer assures me, however, that the staminate specimens which he gathered were collected in the same locality as the female plants and were found growing with them. The staminate plants are more slender, with rather longer and less rigid leaves than those which are undoubtedly the male plants of *Jouvea pilosa*. There is little difference, however, to be noted between the spikelets of the two.

JOUVEA PILOSA n. n.

Jouvea straminea Scribn. not Fourn. *Rachidospermum Mexicanum* Vasey. Bot. Gaz. 15: 110. *Uniola pungens* Rupr. in Bull. Acad. Roy. Brux. 9: excluding the synonym. *Brizopyrum pilosum*

Presl, Rel. Haenk. 1: 280. Presl's species was founded upon the male plant. This species is represented in the National Herbarium as follows: Liebmann 480 (Santa Cruz) ♂; E. Palmer 124 (La Paz, 1890) ♂, ♀; Xantus 121 (Cape San Lucas) ♂; Brandegee 42 (San José del Cabo, 1890) ♂, ♀; Palmer 1384 (Manzanillo, 1894) ♀; Liebmann 479 (St. Augustine, 1842) ♂.

Jouvea straminea Fourn. is readily distinguished from *Jouvea pilosa* by its more slender habit, less rigid leaves, less crowded in-

Upper part of the culm of Jouvea straminea. m, a, and a′ the main axis s, s′, Lateral borne spikelets.

florescence, more slender and porportionately much longer spikelets. In *J. pilosa* the glumes are grown to the axis for almost their entire length, and there are no paleas or rudimentary pistils of a second flower within the floral cavities.

ANDROPOGON FLORIDANUS n. sp.

Culms smooth, stout, 4 to 6 feet high, or 2 to 3 feet high and more slender; sheaths scabrous, the lowermost slightly compressed, loose, and much exceeding the internodes, the upper shorter than the internodes and terete; ligule very short, ciliolate, auricled; leaf-blade 10 to 24 inches long, 3 to 5 lines wide, scabrous beneath, minutely strigose-pubescent above, at least near the base, very acute. Panicle 12 to 30 inches long, very much branched, branches ascending. Racemes 1 to 2 inches long, slender, in 2's, rarely in 3's or 4's, finally exserted, peduncle bearded at the apex; rachis slender, 8–10 jointed, the joints shorter than the sessile spikelet, bearded, the hairs near the summit of each joint 3 lines long. Primary spikelet wanting, the pedicel exceeding the sessile spikelet in length, and bearded with hairs equalling those of the joints of the rachis. Sessile spikelet 2 lines long, lanceolate-acute, with a few short hairs on the callus; first glume bicarinate, smooth and somewhat depressed on the back and nerveless between the keels, which are minutely aculeolate-scabrous above, glabrous below; second glume boat-shaped, rather broadly lanceolate, very acute, 1-nerved, scabrous on the keel above, ciliate on the hyaline margins; third glume about as long as the second, lanceolate or oblong, hyaline, ciliate on the margins; the fourth or flowering glume lanceolate, about as long as the third, margins ciliate, terminating in a slender awn, which is 5 to 6 lines long; palea hyaline, about 1 line in length. Spathe about 2 to 3 inches long, narrow, and closely enveloping the slender peduncles of the finally exerted racemes. Awn slightly twisted near the base, the column included within the glumes.

A stout grass of the low pine barrens, with elongated leaves and rather narrow, elongated, much-branched panicle of silky-bearded racemes. G. V. Nash, 1572, August, 1894.

ANDROPOGON ELLIOTTII GLAUCESCENS n. var.

Glaucous throughout, less branched than in the species, and the somewhat stouter racemes more densely silky-bearded.

High pine lands in the vicinity of Eustis, Lake county, Fla., G. V. Nash, 473.

Andropogon Elliottii laxiflorus n. var.

Lower sheaths, especially those of the innovations, more or less densely clothed with fine soft hairs; culms densely silky-bearded just below the nodes; upper sheaths not approximate and inflated as in the species, but remote and close; racemes 2 to 3 inches long, the joints equalling or exceeding the spikelets.

Florida, Nash, no. 1738. 1894.

Panicum (Digitaria) gracillimum n. sp.

A slender perennial 2 to 3 feet high, with very narrow elongated leaves and small spikelets, racemose along the main axis and the slender branches. Culms smooth, with one or two joints near the base; sheaths very long, striate, silky-villous below, otherwise smooth; ligule membranous, 1 to 2 lines long, fimbriate, decurrent, pubescent on the back; leaf-blade 6 inches to a foot long or more, 1 ½ lines wide, those of the intra-vaginal innovations much narrower, smooth beneath, long and rather densely pilose-hairy near the base above; otherwise minutely scabrous. Inflorescence 15 inches long, the raceme-like branches 7 to 9 inches, main axis, branches, and pedicels scabrous. Spikelets irregularly scattered along the branches and main axis, two to four together, on slender appressed pedicels which equal or exceed the spikelets in length; pedicels pubescent at the base. Spikelets 1 line long, oblong-lanceolate, acute; empty glumes, two, the first broadly obtuse, one-fourth as long as the spikelet, scarious, 3-nerved, smooth, the second 5–to 7-nerved, a little shorter than the third glume, obtuse; third glume rigid, subcoriaceous, very dark-brown, finely striate and minutely apiculate, closely enveloping the palea, which is of similar texture.

Described from No. 1192 Nash, collected on high pine land in the vicinity of Eustis, Lake county, Florida, July, 1894.

Explanation of Plate 266.

Fig. a. A portion of the ♂ spikelet.

Fig. b. A single floret with a portion of the rachilla of the same.

Fig. c. A ♀ spikelet partly enclosed within the sheath of the subtending leaf.

Fig. d. Lower part of the female spikelet including one floret, the upper part of which is free from the rachilla (d′).

Fig. e. A longitudinal section through a portion of d showing the base of the outside of the flowering glume (e′), the prophyllum (h) to the branch which supports the pistil and a glume (i) which encloses a second but imperfectly formed pistil. This is raised a little above the fully developed pistil, the plumose stigmas of which protrude from the small opening at the apex of the floret.

New or noteworthy American Grasses.—IV.

By Geo. V. Nash.

Panicum consanguineum Kunth, Enum. Pl. 1: 106. 1833.

Panicum villosum Ell. Bot. S. C. & Ga. 1: 124. 1817. Not Lamarck, 1791.

Dr. John K. Small collected in Georgia, in 1895, a *Panicum* which well accords with the description given by Elliott of his *P. villosum;* in fact, it agrees so closely that I have little hesitation in referring it to that species, especially in view of the fact that it comes from a section of the country with the flora of which Mr. Elliott was familiar. Dr. Small secured the early and simple state of this grass in the Ocmulgee River swamp, below Macon, in May; the later and much-branched form was collected by him at Darien Junction, McIntosh county, in June.

The name *villosum* had been previously applied by Lamarck to an entirely different plant, so Elliott's name becomes a homonym. The oldest available name, so far as I have been able to ascertain, is the *P. consanguineum* of Kunth, who founded his species on the *P. villosum* of Elliott. A number of different forms have been referred from time to time by various authors to this species, but I have hitherto seen none that so perfectly answers to Elliott's description as does this plant.

A description of Dr. Small's plant is appended :

Culms at first erect and simple; later decumbent or nearly prostrate and branching at every node, forming large spreading clumps. In the early and simple state the whole plant, excepting the glabrous basal leaves and panicles, is strongly villous; in the late and much-branched stage the culm leaves are often glabrous; nodes barbed; sheaths shorter than the internodes, even on the branches; ligule a dense ring of long white hairs; basal leaves spreading, lanceolate to ovate-lanceolate, 2.5–6 cm. long, 7–12 mm. wide; culm leaves linear-lanceolate, erect, stiff, particularly in the branched state, the primary ones somewhat narrowed into a rounded base, 6–12 cm. long, 4–7 mm. wide, the leaves on the branches 3–7 cm. long, 3–5 mm. broad, rounded or truncate, but not narrowed at the base; panicles glabrous, the primary ones exserted, ovate in outline, 5–6 cm. long, the branches not numerous, ascending, 2.5 cm. long or less, flexuous, bearing 2–6 spikelets, the secondary panicles much smaller, concealed among the leaves, their branches shorter and erect with fewer spikelets; spikelets obovate, 2.5 mm. long; first scale whitish, nearly orbicular, about one-quarter as long as the spikelet which it clasps at the base, glabrous, one-nerved; second and third scales of equal length, broadly oval, green and membranous, 7-nerved, strongly papillose-pubescent; fourth scale broadly oval or approaching orbicular, apiculate, abruptly narrowed at the base, striate, white and chartaceous, about 2.25 mm. long; palet chartaceous, slightly shorter than the fourth scale.

PANICUM ERECTIFOLIUM nom. nov.

Panicum sphaerocarpon var. *Floridanum* Vasey, Bull. U. S. Dept. Agric. Bot. Div. 8: 33. 1889. Not *P. Floridanum* Trin.

Glabrous. Culms 4–6 dm. tall, erect, stiff, simple or sparingly branched, leafy; sheaths loose, often ciliate on the margins, the basal ones crowded and overlapping, those at the middle of the culm about one-half as long as the internodes, the uppermost sheath usually elongated; ligule a ring of short hairs; leaves ciliate toward the base, the basal ones spreading, ovate-lanceolate, 1.5–4 cm. long, the next succeeding erect, lanceolate, acuminate, 9–11-nerved, longer and gradually reduced in size toward the summit of the culm, the lower 7–14 cm., the uppermost 2.5–6 cm. long, panicle finally long-exserted, ovate to oblong in outline, 7–12 cm. long, its branches ascending, much divided, the lower ones 3–7 cm. long; spikelets numerous, purplish, shorter than their pedicels, oval, obtuse, about 1.5 mm. long; first scale membranous, one-quarter as long as the spikelet or less, ovate or triangular, 1-nerved; second and third scales of equal length, membranous, more or less pubescent, 7-nerved; fourth scale yellowish white, chartaceous, broadly oval, about 1.5 mm. long; palet chartaceous, about as long as the fourth scale.

This grass appears to be confined to Florida, and does not occur plentifully. It was found in some abundance by the writer in an old muck bed near Eustis, Lake Co., in 1894, No. 1012. The plant collected by A. H. Curtiss, No. 3599, and distributed as *P. microcarpon*, belongs here.

Its affinity is with *P. sphaerocarpon* Ell., but it is distinguished from that species by its longer and erect leaves, the smaller spikelets and the more southern range.

PANICUM VILLOSISSIMUM n. sp.

Whole plant densely villous. Culms 3–6 dm. tall, erect or ascending; nodes barbed; sheaths about one-half as long as the internodes; ligule a ring of long hairs; leaves linear-lanceolate, 5–10 cm. long, 4–9 mm. wide, erect, somewhat narrowed toward the rounded base, yellowish green, 7–11-nerved; panicle long-exserted, broadly ovate in outline, 6–10 cm. in length, its branches spreading or ascending, somewhat flexuous, the lower ones 3–6 cm. long; spikelets shorter than their pedicels, elliptic, 2.5 mm. long, about 1.25 mm. broad, obtuse or acutish, purplish; first scale membranous, ovate, acute, 1-nerved, one-third to one-half as long as the spikelet; second and third scales equal in length, membranous, 7-nerved, strongly papillose-villous; fourth scale chartaceous, yellowish white, elliptic, slightly exceeding 2 mm. in length, 1.25 mm. broad, acutish, somewhat striate; palet chartaceous, about as long as the fourth scale.

A distinct and well-marked species. Collected by Dr. John K. Small in the Ocmulgee River swamp, below Macon, May 18–24, 1895. Only the early and more simple state was secured. The later and much-branched condition is probably very similar to many other forms of the dichotomum group.

PANICUM WEBBERIANUM n. sp.

Whole plant, with the exception of the lowermost sheaths and the ciliate margins of the upper ones, glabrous, the culms, sheaths and leaves often purple. Culms 2–4 dm. tall, erect or ascending, rigid, more or less branched, forming moderate-sized clumps; sheaths loose, shorter than the internodes; ligule very short, minutely ciliate; leaves lanceolate, 4.5–9 cm. long, 7–14 mm. wide, somewhat narrowed toward the rounded or subcordate sparsely ciliate base, usually erect, smooth or sometimes a little roughened, 7–11-nerved; panicle finally long-exserted, ovate in outline, 6–9 cm. long, its branches widely spreading, rarely ascending or reflexed, more or less flexuous, the lower ones 2-3 cm. long, the ultimate divisions of the longer branches generally spreading; spikelets equalling or longer than their pedicels, elliptic or obovate, 2.5 mm. long; first scale nearly hyaline, broader than long, rounded at the apex, about one-quarter the length of the spikelet, which it clasps at the base; second and third scales of equal length, green and membranous, 7-nerved, minutely pubescent, the latter enclosing a small narrow palet about one-half as long as the scale; fourth scale yellowish white, chartaceous, oval, about 2 mm. long, 1.3 mm. broad, minutely pubescent at the obtuse apex, striate-punctate, enclosing a palet of equal length and similar texture and a perfect flower.

Collected by the writer on the edge of a clay pit in the low pine land at Eustis, Lake Co., Florida, May 16–31, 1894, No. 781. This has somewhat the appearance of the *P. demissum* of Trinius, particularly as to the panicle, but the leaves and spikelets are considerably larger, and the whole plant more robust.

Named in honor of Mr. H. J. Webber, of Eustis, Florida.

PANICUM VIRGATUM BREVIRAMOSUM n. var.

Glabrous throughout. Culms 1 metre tall or less, erect, slender, strict, purplish at or near the nodes; sheaths shorter than the internodes; ligule a ring of long hairs; leaves narrowly linear, 1.5–3 dm. long, 3–7 mm. wide, long-acuminate, usually narrowed toward the base, erect, strict, smooth beneath, a little roughened above; panicle oblong, 9–13 cm. long, 3–5 cm. wide, its branches ascending, the lower ones 5 cm. long or less; spikelets numerous, slightly less than 3 mm. long, purplish; first scale about one-half as long as the spikelet, acute or obtuse, 5–7-nerved; second and third scales equal in length, acute, 7-nerved, the intervals between the nerves of the former gradually decreasing in width, the interval between the midnerve and first lateral nerve of the third scale much wider than the intervals between the other nerves, palet empty, hyaline, shorter than the scale; fourth scale elliptic, 2.25 mm. long, obtuse, chartaceous, whitish, enclosing a palet of similar texture and a perfect flower.

Collected by Dr. Small in clay soil in the pine lands about Augusta, Georgia, where it was common, June 27–July 1, 1895. The culms occur singly or two or three together, not forming large clumps as does the nothern form; the thick scaly rootstocks, usually so manifest in the type, are almost entirely wanting in this form. The spikelets are smaller, hardly 3 mm. long, and the branches of the panicle much shorter than in any form hitherto observed. These differences, together with its more southern range, would seem to warrant its separation as a variety.

CHLORIS TEXENSIS n. sp.

Smooth and glabrous, light green. Culms 3–6 dm. tall, flattened at the base; sheaths compressed, those at the base of the culm short and crowded, the uppermost one elongated; leaves 2.5–15 cm. long, 2–6 mm. wide, smooth beneath, scabrous above and on the margins, obtuse; inflorescence usually exserted; spikes 5–8, 10–18 cm. long, pilose at the base; rachis triangular, scabrous on the angles, flexuous; spikelets about 4 mm. long, exclusive of the awns; empty scales narrowly lanceolate, acuminate, 1-nerved, scabrous on the keels, the first about two-thirds as long as the second which about equals the third scale; third scale slightly less than 4 mm. long, lanceolate, 3-nerved, ciliate on the margins toward the apex, the rough awn 6–8 mm. long, inserted just below the apex, the keel sometimes sparingly pubescent, scabrous toward the summit; fourth scale 2–3 mm. long, lanceolate, the acute apex about even with the summit of the third scale, the scabrous awn 4–5 mm. long, inserted just below the apex.

Collected in Texas by both Thurow and G. C. Nealley.

Related to *C. verticillata* Nutt., but abundantly distinct The generally longer and narrower leaves, the spikelets more appressed to the rachis, the narrower and differently shaped third and fourth scales readily separate it from that species. In *C. verticillata* the third scale is 2.5 mm. long or less, and the fourth scale not over 2 mm. long, obovate or obovate-cuneate, truncate or obliquely so at the apex.

A new Achimenes from Bolivia.

ACHIMENES HEPPIELLOIDES Fritsch, sp. n. Caulis ruber, breviter hispidus. Folia magna, inferiora longe petiolata, ovata, subacuminata, crenato-serrata, pilis brevissimis dense tecta, subtus pallidiora. Flores in axillis foliorum superiorum multo minorum solitarii, longe pedicellati. Pedicelli pilis articulatis hispidi. Calycis laciniae lineares, corollae tubo multo breviores. Corollae coccineae tubus elongato-cylindricus, paulo ampliatus; limbus brevissimus. Antherae breves, cohaerentes. Ovarium omnino inferum. Stylus valde elongatus, pubescens. Stigma stomatomorphum.

Species corollae forma, imprimis lobis brevissimis inter Achimenis species insignis, Heppiellam revocans, sed antheris cohaerentibus ovarioque omnino infero ab illo genere diversum.

Specimen unique. Collected by Miguel Bang, the special locality not stated. H. H. RUSBY.

Botanical Notes.

Vienna Exchange Office for Cryptogams.—J. Brunnthaler, IV., Wiedner Hauptstrasse, 91, Vienna, Austria.

A circular has just been received, which is printed in German, French and English (?) setting forth the rules and regulations of this office, which proposes to negotiate sales and exchanges of all the cryptogams of the world for the benefit of its members, reserving 25% of the specimens for the trouble. The members are requested to send in their lists of desiderata, and duplicates, before the 15th of September, and the valuation of European specimens will be made at the office. Foreign specimens must be valued by the sender. All postage is charged to the members' account. The surplus remaining will be sold at prices specified in the annual catalogue. E. G. B.

Sisymbrium altissimum L.—For first record of this plant in Canada (1885) and its subsequent wide distribution, see Macoun Cat. Can. Plants, **2**: 305 and J. M. Macoun, Contr. Can. Bot. 3: 146. At Indian Head, Assiniboia, Prof. Macoun called the attention of the residents to this weed and advised the adoption of measures to exterminate it. Nothing was done, however, and at that place in 1895, 1,200 acres of it were plowed under. It is the worst "tumble weed" in the Canadian Northwest.

J. W. MACOUN.

Melanthium latifolium longipedicellatum.—On the 24th of July, 1892, I collected at White Sulphur Springs, Va., on a steep wooded slope bordering a mountain stream, a specimen in full flower bearing all the general characters of *Melanthium latifolium* Desr. The plant was over three feet tall, and the inflorescence about one foot long. It has a half dozen lower leaves, each 12 to 15 inches long, and but 6″ to 10″ wide in the widest parts. The pedicels of the flowers in the upper half of the inflorescence are fully 12″ long; and in the lower half from 6″ to 10″. Other herbarium specimens examined show flowering pedicels from 2″ to 7″ long, and fruiting pedicels not exceeding 8″; while the broadest lower leaves vary from 12″ to 28″ broad, though in one specimen but 7″.

Only a single specimen of this plant was found by me in a hurried and limited search, and no fruit was seen. This may possibly be only an extreme form of *M. latifolium;* or it may prove to be a distinct species. It seems to me to be at least a distinct variety. Its narrow leaves and very long pedicels give it a strikingly distinct appearance; and from the latter characteristic feature, I call it, provisionally, var. *longipedicellatum.*

ADDISON BROWN.

APRIL 10, 1896.

Rubus montanus Porter. Since the specific name of this *Rubus*, published in the BULLETIN, 21: 120, is antedated by that of Ortman, it must needs be replaced by another, and I can find no better one than *Allegheniensis.* The species ranges from the mountains of New York southward and is everywhere known and recognized among the people as the *Mountain Blackberry.* It differs from *R. villosus* in being less robust and tall, but especially in the character of the fruit, which is smaller, scarcely fleshy and possessed of a peculiar spicy flavor, from ⅓ to 1 inch or more in length and often oblong and tapering toward the end in the manner of the little finger.

THOS. C. PORTER.

Dr. Chapman's Collections.—Mr. George W. Vanderbilt has purchased the large herbarium of southern plants, collected and arranged by Dr. Chapman. It will serve as a nucleus for the scientific collections in connection with the arboretum and systematically managed forest at Biltmore, N. C.

Reviews.

Plant-breeding. L. H. Bailey. pp. 290, 20 cuts. Cloth, $1.00. Macmillan & Co., New York. 1895.

Taken in its entirety this is certainly an excellent little work. It is written in a popular style and is especially adapted to students and teachers of horticulture.

From the author's discussion of variation we would gather that he is a devout Darwinian. Some of his statements are misleading, or to state it more clearly, unscientific. For example, to speak of "Fortuitous Variation," or to state that the "inherent plasticity of organisms" permits the variation of organisms "without any immediate inciting cause," is certainly unscientific. Likewise the statement "that very many—certainly more than half—of the organisms which are born are wholly useless in the struggle for life and very soon perish." The very fact that an organism exists is evidence that it cannot be "useless."

In the main the author's opinions are sound and up to date. Many of his conclusions are based upon personal experiments. The subject-matter is well arranged. All, whether laymen or scientists, will find this book both interesting and instructive.

A. S.

Contributions from the U. S. National Herbarium, Volume III.

During the past few months four numbers of this important publication of the U. S. Department of Agriculture, Division of Botany, have been issued. The first of these is:

"No. 3, issued September 14, 1895. Flora of the Sand Hills of Nebraska, by P. A. Rydberg."

This number is of more than ordinary importance, as the collector himself has given us the result of his work and observations in the field. Introductory to the "Catalogue of Species" there are fifteen pages devoted to a discussion of the character and resources of the country. Here we find that the sand hills, like the sand dunes of the coast, are of a changeable and migratory nature, and if it were not for certain grasses which bind the sand together the wind would be continually changing the face of the country, and the ever-drifting sand would give very little chance for vegetation to thrive.

The region fails naturally into five divisions, each of which is described, and the characteristic plants noted. Examples of the weeds, native trees and shrubs and native forage plants, are listed. From an agricultural point of view the sand hills country does not amount to much. It is shown that at one time it was covered with a forest, and suggestions are made as to how they can be reforested. *Pinus ponderosa* and *Pinus divaricata* are mentioned as species most likely to flourish.

In the "Catalogue of Species" about six hundred are enumerated, only one of which is new. This is *Carduus Plattensis*, represented by a rather indifferent plate, instead of the fine ones usually found in these publications.

"No. 4, issued November 23, 1895. Report on a Collection of Plants made by J. H. Sandberg and assistants in Northern Idaho in the year 1392, by John M. Holzinger."

Taking into consideration the equipment of this expedition, and the means at its command we would expect much valuable information as the results of the five months work for which it was commissioned. On the contrary, the specimens themselves are about all the department has to show for its outlay.

Instead of a discussion of the geographical features of this interesting country, its resources, the distribution of species and other information which it is especially designed to bring out in these publications, there is a bare list of camping places, and a statement of how long the party staid at each camp. Even this meagre summary is not correct. It is stated that "the second camp was located in the neighborhood of Lake Waha, some twenty miles south of Camp 1. The party remained in that vicinity from May 20 to May 28, collecting the plants numbered 194 to 263. The Lake Waha region and Wiessner's Peak were the principal localities visited from this camp."

Now Lake Waha and Wiessner's Peak are separated by at least 75 miles of pretty rough country, and without the aid of a substantial pair of wings no member of the party could have gone there and returned in eight days. Wiessner's Peak, at the head of navigation on the St. Joseph river, 30 miles from Harrison, was visited from Camp 8, located at Farmington Landing, on Lake Coeur d'Alene, opposite Harrison, by the assistants of the expedition.

The two plates are excellent, but on page 212 a new species is described under the name of *Cardamine Leibergii*, while the accompanying plate bears the name *Cardamine Sandbergii*. The same lack of care is evidenced in at least one other instance. On page 223 we find "*Rosa* sp.," followed by a short description. In the index of species, page 281, this plant, No. 572, bears the name of *Rosa Sandbergii* Holzinger." If this can be considered as publication, *Rosa MacDougali* Holzinger, published in the February *Botanical Gazette* becomes a synonym.

Whoever is responsible for the notes concerning habitat, etc., of the species collected, often shows complete ignorance of the subject. The expression "Valley of Lake Waha" is frequently used. Lake Waha, situated well up among the Craig Mountains, is not provided with a valley. It is simply a depression surrounded by steep slopes. It is fed by a mountain stream, and has a subterranean outlet. The following are a few instances of erroneous data:

Ranunculus glaberrimus is credited as "common on moist ground, island in Clearwater river near Upper Ferry, above Lewiston." The plant to which the above name is applied does not occur on the low, sandy islands, but is occasionally met with in the pasture land near the summit of the plateau, and on the grassy slopes, growing in stiff black soil.

Actaea spicata rubra is stated to be "common in woods at 900 meters altitude, Craig mountains, valley of Lake Waha." It is by no means common, and was found in the cañon of the Sweetwater, beyond Lake Waha.

Trifolium longipes latifolium was not at all "frequent on grassy slopes, Craig mountains." It was collected in an open place on the west side of the lake, and only a few plants were found in a very circumscribed area.

Under *Spiraea betulifolia* Pall. it is said that "No. 539 is not typical. It has the corymb somewhat elongated, as in *P. salicifolia*, and may be a hybrid." It most certainly is an entirely different plant from No. 299, and in the living state has nothing in common with that plant. If it is a hybrid it is a rather one-sided one, for *Spiraea Douglasii Menziesii* was the only other one collected at that point.

Crataegus tomentosa is reported as growing in "copses, frequent, Craig mountains." A single tree was found in a little meadow below the outlet of the lake. It grew along a fence, and was not in a copse.

Under *Amelanchier alnifolia* two numbers are given. No. 26 is probably that species, but No. 53, which is reported from "copses near Upper Ferry, Clearwater river above Lewiston," is a distinct plant in appearance, habit and habitat. Instead of growing in copses, it is the only shrub found on the upper exposed slopes on the right bank of the Clearwater above Camp 1. It usually occurs as a solitary bush on the edge of the plateau. No. 26 does occur in copses along the tributaries of the Clearwater, but at much lower elevations.

A very curious statement is made under *Aster Sibiricus*: "On precipitous ledges of granite, subalpine, near the south end of Lake Pend d'Oreille." How this little plant only can be subalpine, while *Parnassia fimbriata*, *Hedysarum flavescens*, *Eriogonum ovalifolium* and *Carex capillaris*, which grew in company with it at an elevation of about 2500 feet, are not subalpine, is quite mysterious.

Verbena bracteosa is supposed to be "frequent on rocky hillsides, valley of Clearwater river." It was collected at one place, in low sandy ground, on the right bank of the river, opposite the upper island above Camp 1.

Eriogonum flavum is reported as growing "in exposed crevices, Packsaddle Peak." It was collected on a granite outcrop, about 2,000 feet below the summit of Packsaddle and on another ridge where it found a foothold in the scanty covering of soil which here and there clothed the large area of flat rock.

Under *Polygonum imbricatum*, we find "June 16 (No. 411)." The writer collected that number, and knows for a certainty that it should be *Polygonum polygaloides*. No. 403, which is not mentioned except in the index as "blank," is probably *P. Watsoni* (*P. imbricatum*).

A map of the region traversed would be a very fitting help to a better understanding of the report.

It is to be regretted that the criticism of this work should be adverse, but the fact remains that much of the attempted information is utterly worthless and misleading, as will be seen from the few notes recorded above.

"No. 5, issued December 14, 1895. Report on Mexican Umbelliferæ, mostly from the State of Oaxaca, recently collected by

C. G. Pringle and E. W. Wilson, by John M. Coulter and J. N. Rose. Descriptions on Plants, mostly new, from Mexico and the United States, by J. N. Rose."

Mexico, which has yielded so many new and rare species brought to light by the untiring work of Mr. Pringle, now gives us four new genera and twenty-seven new species of Umbelliferæ. Fifteen species had previously been reported from Oaxaca, as against forty-two in this late collection. They were collected at seven stations, the altitudes varying from 6000 to 11400 feet. Geographical notes are given about each station, and the altitude at which each species was collected is noted. This latter feature is especially commendable. Altitudinal distribution is an important factor in plant life, yet it has up to the present time received scant attention.

The second part, in addition to Mr. Rose's work, contains desriptions of Malvaceæ by Mr E. G. Baker, and of Cucurbitaceæ by Prof. A. Cogniaux.

Mr. Rose gives an illustration and a history of *Ligusticum verticillatum*, a long lost and puzzling plant, described by Hooker as *Angelica verticillata.*

A new genus *Thurovia* is established, named after the collecttor, Mr. F. W. Thurow, of Hockley, Texas. This curious little plant is said to be common northwest of Houston. Another nice piece of work is the disentangling of two species of *Tradescantia*, *T. brevifolia* and *T. leiandra*, which for a number of years have been sadly confused. The number is profusely illustrated, containing twelve plates.

"No. 6, issued January 15, 1896. Botany of Yukutat Bay, Alaska, by Frederick Vernon Coville, with a Field Report by Frederick Funston."

This number, nine pages of which are taken up by the field report, yields much welcome information concerning this far northern part of our country. As few persons have any idea of the labor and hardships which a professional collector experiences even within the pale of civilization, to them Mr. Funston's sum total of 3,000 specimens and 164 species may seem a small number for over three months' work. However, when we take into consideration the difficulties under which he labored, the result is very good.

Of the 107 days spent in the field, 83 were rainy, and ten cords of wood were consumed in keeping up fires to extract the moisture from his dryers.

The report shows that the flora of Yakutat Bay is divided between two zones, one extending from sea level to timber line, the other from timber line to the perpetual snow line. The general character of the flora is circumpolar.

The remarks concerning the distribution of certain species, and others whose fruits are used as food by the natives, are quite interesting. Five of the latter are enumerated: *Viburnum pauciflorum*, *Vaccinium ovalifolium*, *Rubus spectabilis* and *Fragaria Chiloensis*. These are mixed with seal oil and devoured with great gusto by the Indians. The bulbs of *Fritillaria Kamschatensis* and the leaf-stalks of *Heracleum lanatum* are also eaten.

Only one new plant is described, *Juncus falcatus Alaskensis*, but full notes are given under nearly all of the species enumerated. A. A. HELLER.

Musci americae septentrionali exsiccati. Notes sur quelques espéces distribuées dans cette collection par F. Renauld et J. Cardot. Bull. Herb. Boiss. 4: 1–19. 1896.

This is an enlarged and extended copy of the notes distributed in 1894 to the subscribers to the sets of their exsiccatae, including the numbers from 1–250. Most of the changes have already been recorded, either in these manuscript notes or in the check list published by the same authors in 1893. The following, however, are new: *Hypnum micans* Sw. is transferred from *Raphidostegium* to *Isopterygium*; No. 132, distributed as *Hypnum fluitans*, is referred to the var. *Jeanbernati* Ren.; *Grimmia pachyphylla* Leiberg has been changed to *G. Leibergii* Paris, Index Bryologicus, there being already a *G. pachyphylla* C. M. from Tierra del Fuego; *Dicranella Howeii* is reduced to a form of *D. varia*; *Dicranum Mariae* Holz. ined. is compared with *D. strictum* and *D. rhabdocarpum*: *D. fuscescens* var. *Eatoni*, is described and compared with var. *flexicaule; Fissidens falcatulus* is said to be too close to *F. exiguus* Sull.; *F. pauperculus* Howe is said to agree with descriptions of *F. Arnoldi; Bryum sanguilentum* is raduced to a subspecies of *B. capillare; Camptothecium lutescens* is said to include both *Hypnum fulgescens* Mitt. and *Homalothecium pseudosericeum* C. M.;

Hypnum orbicularicordatum Ren. & Card. sp. nov. is described as differing from *H. cordifolium.* No. 216, *Barbula fragilis*, was sent to them by Mr. J. M. Holzinger, named *B. tortuosa* var. *dicranoides.* The mistake is credited to me. The facts are these: Mr. Holzinger sent me some specimens of this moss named by him "*Timmia winonensis* n. sp. ined." I suggested that it was very close to *Barbula tortuosa*, but did not agree exactly with specimens of my own collecting in the Adirondacks, of which I sent him a duplicate, suggesting that it might be the var. *dicranoides* (Ferg.) described by Braithwaite. I did not compare them, nor did I send them to M. Cardot; therefore Mr. Holzinger must be held responsible for any mistakes in the matter. E. G. B.

New or less known Species of Pleurocarpous Mosses from North America and Europe. N. C. Kindberg, Rev. Bryol. 22: 81-88. 1895.

Thirty-two species are described, of which all but six are North American, and twenty-two will be found listed in Kindberg's check-list, the other four having been discovered since that list was published. Several varieties are raised to specific rank. The descriptions are brief and mostly comparative. The following is the list of species described: *Antitrichia gigantea*, *Clasmatodon rupestris*, *Thamnium micro-alopecurum*, *Pleuroziopsis alaskana*, *Isothecium brachycladon*, *I. Howei*, *I. obtusatulum*, *Leskea Cardoti*, *Amblystegium pseudo-confervoides*, *Eurhynchium pseudo-velutinoides*, *E. acutifolium*, *E. subcæspitosum*, *E. Macounii*, *Hypnum molluscoides*, *H. pseudo-complexum*, *Camptothecium aureolum*, *C. leucodontoides*, *Brachythecium cavernosum*, *B. calcareum*, *B. subintricatum*, *Hypnum subsecundum*, *H. microreptile*, *H. reptiliforme*, *H. filiforme*, *H. subcomplexum* and *Fontinalis gigantea.* Many of these are founded on very slight differences, as the names imply. E. G. B.

New or less known Species of Acrocarpous Mosses from North America and Europe. N. C. Kindberg. Rev. Bryol. 23: 17-23. 1896.

Twenty-six species are described, all but three of which are based on American specimens sent to him by Prof. Macoun. All but one are said to be new species or have new names, the worst illustration of this being *Orthotrichum lyellioides* Kindb. n. sp., which is founded, as far as we can determine, on *O. papillosum* Hpe., thus adding another synonym to the six already perpetrated by European bryologists for the varieties of this much-abused American species. We note three *new species* (?) from eastern localities, all of which are cited with his usual clearness and succinctness, *Drummondia canadensis*, *Weisia pusilla* and *Grimmia Austini.* He also founds a new genus to include *Mnium lucidum* and *M. simplex* in the following words:

"The both species are very differing from the other ones of *Mnium* that they are consisting at least a subgenus (or rather a proper genus), to which I propose the name *Roellia* to the honor of Dr. J. Roell." E. G. B.

Ueber die Brutkorper der Georgia pellucida und der Laubmoose ueberhaupt. C. Correns. Ber. Deutsch. Bot. Gesell. 13: 420–442. *pl. 33.* 1895.

The author proves conclusively that the habit of reproducing asexually is not confined to the leafy moss-plant, but is also resorted to by the protonema, which forms irregular masses of gemmae, differing from the regular cup-shaped ones which are so characteristic of this genus. He disagrees with previous writers in attributing the gemmae to modified antheridia, claims that they originate from the paraphyses, and states that the green globose terminal cell of the paraphyses in *Funaria,* is a step in this direction. He places the *Georgiaceae* between the *Andreaeceae* and the *Bryineae*, as a well-marked and distinct group. He also studied the gemmae in *Webera annotina*, *Orthotrichum Lyelli*, *O. obtusifoliun*, *Encalypta streptocarpa* and *Zygodon viridissimus.* E. G. B.

Revue des Travaux publiés sur les Muscinées depuis le ier Janvier 1889 jusq'au ier Janvier 1895. L. Géneau de Lamaliere. Rev. Gen. Bot. 8: 40–48. Ja. 1896. To be continued.

This series of papers is to include only the mosses of France, it seems, though the author does not say so. He proposes to review the works in the following order, first those treating of geographic distribution; second, the descriptive works; third, those on anatomy, and lastly, those on the physiology of the Mosses. He solicits contributions from authors. E. G. B.

Proceedings of the Club.

TUESDAY EVENING, MARCH 10, 1895.

In the absence of the President and both Vice-Presidents, Dr. Schneider occupied the chair, and there were 25 persons present.

Miss Josephine E. Tilden, University of Minnesota, Minneapolis, Minn., was elected a corresponding member. Miss Constance Lily Rothschild, Mr. Frederick Ehrenberg and Mr. Thomas P. Gilman were elected active members.

Mrs. Britton reported that the Instruction Committee had published its prospectus for the summer courses of instruction, which would commence on March 19th.

Mr. Theodore G. White read his announced paper, "The North American Species of the Genus *Vicia*," illustrated by a full suite of specimens. The paper was discussed by Dr. Britton, Dr. Schneider and others.

Mr. Geo. V. Nash read his announced paper on "New Florida Plants," richly illustrated by specimens. The paper was discussed by Dr. Britton, Dr. Small and others.

Mrs. Britton reported having seen *Tussilago Farfara* in full bloom already this season on Staten Island.

Dr. Britton spoke of the purchase for the New York Botanical Garden of Mr. J. B. Ellis' collection of fungi, with a large part of his library. The collection contains two or three thousand types, nearly all published sets of exsiccatae and a great number of unique specimens.

WEDNESDAY EVENING, MARCH 25TH, 1896.

Vice-President ALLEN in the chair, and 39 persons present.

Mr. W. A. Bastedo was appointed to act as Secretary during the absence of Dr. Rusby in South America.

Dr. J. S. Boynton and Mrs. Amos Rogers were elected active members.

Under the head of new business, Dr. Britton reminded the Club of the summer outings, and moved that a Field Committee be appointed by the chair. Carried. The Vice-President then appointed Dr. Britton as chairman of the committee, the other members of the committee to be selected by him.

Dr. Britton exhibited the fourth fascicle of Messrs. Collins, Holden & Setchell's "Phycotheca Boreali-Americana," and spoke of the value of this work.

Dr. Britton also called attention to a sedge, *Remiria maritima*, recently found at Lake Worth, Florida, but having a wide distribution in tropical maritime regions.

The announced paper of the evening was then read by Miss Alexandrina Taylor, entitled "A Comparative Study of the Superficial Periderm in a number of species of *Salix*." This was accompanied by diagrams illustrating the work. In the superficial periderm of these genus there are many variations from that selected as the type by Sanio, and the object of this study was to see if, by examining a greater number of species, one might not be found which might more justly be called the type of the genus. The paper was commented upon by Dr. Britton and Dr. Allen.

Index to recent Literature relating to American Botany.

Britton, E. G. How I found *Schizaea pusilla*. Linn. Fern Bull. **4**: 17. Ap. 1896.

Brooks, H. Prehistoric Botany. The Forester, **2**: 18–20. 1 Mr. 1896.

Burbridge, F. W. The Chilian Bellflowers. Garden, **49**: 174. 7 Mr. 1896.

With illustrations of *Lapageria alba*.

Burgess, T. J. W. Notes on the Study of Botany. Ott. Nat. **9**: 241–262. Mr. 1896.

Clendenin, I. *Lasioplodia* E. & E. n. gen. Bot. Gaz. **21**: 92. *pl. 5*. 18 F. 1896.

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KUHNISTERA GATTINGERI HELLER.

SISYRINCHIUM GRAMINOIDES BICKNELL.

SISYRINCHIUM ATLANTICUM BICKNELL

SISYRINCHIUM ANGUSTIFOLIUM MILL.

JOUVEA STRAMINEA FOURN.

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BULLETIN

OF THE

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AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

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THE TORREY BOTANICAL CLUB.

The Club-meets regularly at Columbia University, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1896, now payable, to Mr. Henry Ogden, Treasurer, 11 Pine St., New York City.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., May 30, 1896. No. 5.

OEnothera and its Segregates.

By John K. Small.

The year 1835 marks a great crisis in the history of the genus *OEnothera* of Linnaeus. Edouard Spach then divided the genus into about a dozen, taking his characters from the flower and fruit The results of his observations were published in the Annales des Sciences Naturelles,* Histoire Naturelle des Végétaux,† and in his Monographia Onagrearum published in Nouvelles Annales du Muséum,‡ the last named work containing a complete exposition of his conclusions. Although Spach's work was considered good and reliable, his generic lines were not generally accepted, but were used to divide the composite genus *OEnothera* into sections.

Spach, however, was not the first to see that *OEnothera* contained many generic types. In 1763 Adanson published *Onagra*, Rafinesque established *Meriolix* in 1818, in the same year Link separated *Chamissonia* (not *Chamissoa* H.B.K.), and later several genera were proposed by Nuttall.

Between 1835 and the present time authors have at one time or another eliminated one or two genera from *OEnothera*, but it was not until 1893, when Rud. Raimann prepared the Onagraceae for Engler and Prantl's Natürlichen Pflanzenfamilien,§ that any systematic or logical subdivision of the genus into several genera

*(II.) 4: 163–168.

†4: 347–379.

‡(III.) 4: 321–407.

§3: Abt. 7. 199–223.

appeared. Raimann's conclusions are based on Spach's work, but he has presented them in a much more satisfactory manner than was indicated by the earlier author.

The committee which prepared the List of Pteridophyta and Spermatophyta of Northeastern North America,* adopted Raimann's interpretation, and it was suggested by Dr. Britton that I make an examination of the material in the Herbarium of Columbia University to ascertain to what extent the characters hitherto assigned for generic lines held. The study has been interesting both from a generic and a specific standpoint in exposing the strong tendency to mass, and to maintain composite species and genera where clear and constant characters exist both in habit and in the more minute morphology.

The following pages contain the results of these observations on the North American species.

I will be glad to receive additional material, either specimens or seeds, for examination. Proposing to present a monograph of this group at an early day.

Key to the Genera.

Flowers regular (stamens equal in length.)
- Stigma deeply four-cleft, its segments linear.
  - Ovules and seeds horizontal, inserted in two or rarely in several rows, prism.tic-angled. — 1. ONAGRA.
  - Ovules and seeds ascending, not angled.
    - Buds erect; flowers yellow; ovules and seeds in one row. — 2. OENOTHERA.
    - Buds drooping; flowers pink; ovules and seeds in two rows. — 3. ANOGRA.
- Stigma entire or rarely four-toothed.
  - Ovaries and capsules sessile or nearly so, subglobose or elongated.
    - Calyx-tube longer than the ovary.
      - Stigma capitate; calyx-tube slender, usually adherent to the style. — 10. TARAXIA.
      - Stigma disk-like; calyx-tube funnelform. — 11. GALPINSIA.
    - Calyx-tube shorter than the ovary.
      - Stigma disk-like, slightly four-toothed; calyx-tube broadly funnelform, sometimes twice shorter than the ovary. — 12. MERIOLIX.
      - Stigma capitate; calyx-tube campanulate or somewhat funnelform, many times shorter than the ovary.

* Mem. Torr. Club, 5.

Capsules incompletely four-celled; calyx-tube with a lobed disk in its throat. 13. EULOBUS.

Capsules with complete septa; calyx-tube naked at the throat. 14. SPHAEROSTIGMA.

Ovaries and capsules long stalked, more or less club-shaped. 15. CHYLISMA.

Flowers irregular (the alternate stamens longer).

Ovules and seeds numerous, not tuberculate, clustered on slender funiculi; capsules club-shaped.

Flowess yellow 4. KNEIFFIA.

Flowers red, purple or white. 5. HARTMANNIA.

Ovules and seeds few, sessile, in one or two rows.

Plants normally acaulescent.

Capsules obtusely or retusely four-angled; seeds with a deep furrow along the raphe. 6. PACHYLOPHUS.

Capsules sharply four-angled; seeds with a tubercle at one end. 7. LAVAUXIA.

Plants caulescent.

Stems diffuse and wiry; leaves 1–2 cm. long; capsules sharply four-angled. 8. GAURELLA.

Stems not diffuse, stout; leaves 4–15 cm. long or longer; capsules broadly winged. 9. MEGAPTERIUM.

1. ONAGRA Adans. Fam. Pl. 2: 85. 1763.

Plants annual or biennial.

Flowers small; petals 2–4 mm. broad. 1. *O. cruciata.*

Flowers large; petals one or several centimeters broad.

Calyx-tubes slender, 2.5–5 cm. long.

Stems decumbent; pubescence rather dense, short and appressed. 2. *O. depressa.*

Stems erect or nearly so.

Pubescence villous-hispid, strigose or soft and appressed; species ranging east of the Rocky Mountains.

Capsules 2–2.5 cm. long, abruptly narrowed at the apex 3. *O. biennis.*

Capsules 3–4 cm. long, gradually narrowed from near the base. 4. *O. Oakesiana.*

Pubescence hirsute or canescent-hirsute; species ranging west of the Rocky Mountains. 5. *O. Hookeri.*

Calyx-tubes stout, 6–13 cm. long

Leaves distantly toothed, minutely ciliate. 6. *O. Jamesii.*

Leaves entire, with short bristle-like cilia. 7. *O. macroceles.*

Plants perennial. 8. *O. arguta.*

1. ONAGRA CRUCIATA (Nutt).

OEnothera cruciata Nutt.; Ser. in DC. Prodr. 3: 47. as synonym. 1828.

OEnothera biennis var. *cruciata* T. & G. Fl. N. A. 1: 492. 1840.
Onagra biennis cruciata Britton, Mem. Torr. Club, 5: 233. 1894.
Vermont and Massachusetts.

2. ONAGRA DEPRESSA (Greene).

OEnothera depressa Greene, Pitt. 2: 216. 1891.
Rocky Mountains of Montana.

3. ONAGRA BIENNIS (L.) Scop.

OEnothera biennis L. Sp. Pl. 346. 1753.
OEnothera muricata L. Syst. Ed. 12, 263. 1767.
OEnothera angustifolia Mill. Dict. Gard. Ed. 8, no. 2. 1768.
OEnothera glabra Mill. Gard. Dict. Ed. 8, no. 3. 1768.
Onagra biennis Scop. Fl. Carn. Ed. 2, 1: 269. 1772.
OEnothera graveolens Gilib. Fl. Lituan. 2: 168. 1781.
Onagra parviflora Moench, Meth. 675. 1794.
Onagra muricata Moench, Meth. 675. 1794.
OEnothera gauroides Hornem. Hort. Hafn. 1: 362. 1813.
OEnothera pubescens Nees in Neuwied, Reise N. A. 2: 435.
Onagra Europaea Spach, Hist. Veg. 4: 359. 1835.
Onagra communis Spach, Hist. Veg. 4: 359. 1835.
Onagra chrysantha Spach, Hist. Veg. 4: 362. 1835.
Onagra vulgaris Spach, Nouv. Ann. Mus. Par. 4: 353. 1835.
OEnothera biennis var. *vulgaris* T. & G. Fl. N. A. 1: 492. 1840.
OEnothera biennis var. *muricata* T. & G. Fl. N. A. 1: 492. 1840.
OEnothera biennis var. *canescens* T. & G. Fl. N. A. 1: 492. 1840.
? *OEnothera Jepsonii* Greene, Fl. Francis. 211. 1891.

Throughout the United States, east of the Rocky Mountains, ranging from sea-level to about 650 meters on various mountains.

The geographic range of *O. biennis* is not as extensive as has been supposed. The species proper ranges westward only to the Mississippi River. In the area from the Mississippi River to the Rocky Mountains it is represented by a closely related form clothed with strigose pubescence; this form might be separated as a variety or even a species. As far as I can learn, it has not been found west of the Rocky Mountains. Prof. Greene described *OEnothera Jepsonii** from California, but later

* Fl. Francis. 211.

referred it to *O. biennis*,* a doubtful disposition unless the plant is introduced. I have not seen specimens of this form.

3a. ONAGRA BIENNIS GRANDIFLORA (Ait.) Lindl.

OEnothera grandiflora Ait. Hort. Kew. 2: 2. 1789.

OEnothera suaveolens Desf. Tab. 169. 1804.

OEnothera biennis var. *grandiflora* Lindl. Bot. Reg. 19. *pl. 1604.* 1833.

OEnothera Lamarkiana Ser. in DC. Prodr. 3: 47. 1828.

Range the same as the species, more common in the Southeast; introduced in the vicinity of San Francisco according to Prof. Greene.

4. ONAGRA OAKESIANA (A. Gray) Britton.

OEnothera biennis var. *Oakesiana* A. Gray, Man. Ed. 5, 178. 1867.

OEnothera Oakesiana Robbins; A. Gray, Man. Ed. 5, 178. As synonym. 1867.

Onagra Oakesiana Britton, Mem. Torr. Club, 5: 233. 1894.

Shores of the St. Lawrence, west to the Great Lake region, south to New York and Nebraska.

5. ONAGRA HOOKERI (T. & G.).

OEnothera Hookeri T. & G. Fl. N. A. 1: 493. 1840.

OEnothera biennis Torr. Emory Rep. 140. 1848. Not L.

? *OEnothera odorata* H. & A. Bot. Beech. Voy. 343. 1841.

OEnothera biennis var. *hirsutissima* A. Gray, Pl. Fendl. 43. 1848.

Western slopes of the Rocky Mountains, west to the Pacific; at 1800 meters in Utah.

It seems remarkable that this excellent species could be confounded with *O. biennis*. Its gross characters are so strong that a scrap or even a leaf is sufficient to separate it from related species. It does not range east of the Rocky Mountains and is the western homologue of the eastern *O. biennis*.

6. ONAGRA JAMESII (T. & G).

OEnothera Jamesii T. & G. Fl. N. A. 1: 493. 1840.

Southern Utah south to eastern Texas and eastern Arizona.

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* Man. Bot. Bay Reg. 131.

7. Onagra macrosceles (A. Gray).

OEnothera macrosceles A. Gray, Pl. Fendl. 43. 1848.

Northern Mexico.

8. Onagra arguta (Greene).

OEnothera arguta Greene, Fl. Francis, 212. 1891.

Southern California, from Monterey southward. I have not seen specimens of this plant.

2. OENOTHERA L. Sp. Pl. 340. 1753.

Flowers axillary.
- Plants clothed with dense appressed or ascending pubescence.
  - Flowers 2–3 cm. broad; species of the Atlantic Coast. 1. *O. humifusa*
  - Flowers 7–9 cm. broad; species of the Western Gulf Coast. 2. *O. Drummondii.*
- Plants glabrous or rarely clothed with spreading hairs. 3. *O. laciniata.*

Flowers in terminal leafy bracted spikes.
- Spike few-flowered, loose; bracts ovate; calyx villous. 4. *O. heterophylla.*
- Spike many-flowered, dense; bracts narrow; calyx silky. 5. *O. rhombipetala.*

1. OEnothera humifusa Nutt.

OEnothera humifusa Nutt. Gen. 1: 245. 1818.

OEnothera sinuata var. *humifusa* T. & G. Fl. N. A. 1: 494. 1840.

Drifting sand along the coast from New Jersey to Florida; ranges but little above sea-level.

2. OEnothera Drummondii Hook.

OEnothera Drummondii Hook. Bot. Mag. *pl. 3361.* 1835.

? *OEnothera sinuata* var. *humifusa* A. Gray, Proc. Am. Acad. 5: 158. 1862.

Coast of Texas; ranges only a few meters above sea-level.

3. OEnothera laciniata Hill.

OEnothera laciniata Hill, Syst. Veg. 12: 64. 1767.

OEnothera sinuata L. Mant. 2: 228. 1771.

OEnothera repanda Medic. Act. Acad. Theod. Palat. 3: 198. *pl. 8.* 1775.

Onagra sinuata Moench, Meth. 676. 1794.

OEnothera prostrata Ruiz & Pavon, Fl. Per. 3: 79. *pl. 315.* 1802.

OEnothera minima Pursh, Fl. Am. Sept. 262. *pl. 15.* 1814.

OEnothera sinuata var. *minima* Nutt. Gen. **1**: 245. 1818.

? *OEnothera longiflora* Scheele; S. Wats. Proc. Am. Acad. **8**: 618 1873. Not Jacq.

New Jersey south to Florida, to Texas and Nebraska, also in central and northern South America.

3a. OENOTHERA LACINIATA MEXICANA (Spach).

OEnothera Mexicana Spach, Nouv. Ann. Mus. Par. **4**: 347. 1835.

OEnothera sinuata var *hirsuta* T. & G. Fl. N. A. **1**: 494. 1840.

Nebraska to Texas and Mexico.

3b. OENOTHERA LACINIATA OCCIDENTALIS.

OEnothera sinuata var. *grandiflora* S. Wats. Proc. Am. Acad. **8**: 581. 1873. Not *OE. grandiflora* Ait. 1789.

?*OEnothera longiflora* Scheele; S. Wats. Proc. Am. Acad. **8**: 618. 1873.

Missouri to Kansas, south to Texas.

4. OENOTHERA HETEROPHYLLA Spach.

OEnothera heterophylla Spach, Nouv. Ann. Mus. Par. **4**: 348. 1835.

OEnothera bifrons Don, Sweet, Brit. Fl. Gard. (II.) *pl. 386*, 1831–1838.

OEnothera rhombipetala Engelm. & Gray, Bost. Journ. Nat. Hist **5**: 216. 1847.

OEnothera Leona Buckley, Proc. Acad. Phila. **1861**: 163. 1861.

Florida to Texas.

5. OENOTHERA RHOMBIPETALA Nutt.

OEnothera rhombipetala Nutt.; T. & G. Fl. N. A. **1**: 493. 1840.

OEnothera Darlingtonii Pickering; S. Wats. Proc. Am. Acad. **8**: 612. 1873.

Minnesota and Wisconsin, to Illinois, Nebraska and Indian Territory.

4. ANOGRA Spach, Ann. Sci. Nat. (II.) **4**: 164. 1835.

Burmannia Spach, Hist. Veg. **4**: 351. 1835. Not DC. 1833.

Tips of the calyx-segments not free in the bud.
  Capsules divergent or reflexed.
    Valves of the capsules not winged at the base. 1. *A. deltoidea.*
    Valves of the capsules winged at the base. 2. *A. xylocarpa.*

Capsules more or less ascending.
Seeds narrow, smooth, sharply pointed. 3. *A. trichocalyx.*
Seeds ovoid, minutely ribbed and pitted, rather blunt. 4. *A. albicaulis.*
Tips of the calyx-segments free in the bud.
Throat of the calyx-tube villous within. 5. *A. coronopifolia.*
Throat of the calyx-tube glabrous within.
Calyx glabrous or rarely appressed pubescent.
Stem several centimeters long; leaves long-petioled. 6. *A simplex.*
Stem elongated; leaves short-petioled or sessile. 7. *A. pallida.*
Calyx villous.
Lower leaves oblanceolate or spatulate in outline. 8. *A. Californica.*
Lower leaves lanceolate or oblong in outline. 9. *A. Neo-Mexicana.*

1. ANOGRA DELTOIDEA (Torr & Frem.).

OEnothera deltoidea Torr. & Frem., Frem. Rep. 315. 1845.
Utah to California and Arizona.

2. ANOGRA XYLOCARPA (Coville).

OEnothera xylocarpa Coville, Cont. Nat. Herb. 4: 105. 1892.
Tulare County, California.

3. ANOGRA TRICHOCALYX (Nutt.).

OEnothera trichocalyx Nutt; T. & G. Fl. N. A. 1: 494. 1840.
Wyoming to California and New Mexico; ascends to 1950 meters in California.

4. ANOGRA ALBICAULIS (Pursh) Britton.

OEnothera albicaulis Pursh, Fl. Am. Sept. 733. 1814.
OEnothera pinnatifida Nutt. Gen. 1: 245. 1818.
OEnothera Purshiana Steud. Nom. 2: 207. 1841.
OEnothera Purshii Don, Gard. Dict. 2: 688. 1832.
Burmannia pinnatifida Spach, Hist. Veg. 4: 353. 1835.
Anogra pinnatifida Spach, Nouv. Ann. Mus. Par. 4: 341. 1835.
OEnothera coronopifolia A. Gray, Pl. Wright. 2: 56. 1853.
Anogra albicaulis Britton, Mem. Torr. Club, 5: 234. 1894.
South Dakota to the Rocky Mountains south to Indian Territory, New Mexico and Sonora, ascending to 1100 meters in the Black Hills.

5. ANOGRA CORONIPOFOLIA (T. & G.) Britton.

OEnothera coronipofolia T. & G. Fl. N. A. 1: 245. 1840.

OEnothera pinnatifida James, Bot. Long's Exp. 2: 154. 1825. Not Nutt. 1818.

South Dakota to Wyoming, south to Kansas, Utah and New Mexico.

6. ANOGRA SIMPLEX.

OEnothera ambigua S. Wats. Proc. Am. Acad. 14: 293. 1879. Not Spreng, 1825.

OEnothera albicaulis var. *decumbens* S. Wats. Proc. Am. Acad. 14: 293. 1879, as synonym. Not *OE. decumbens* Dougl.

Southern Utah and Northern Arizona.

7. ANOGRA PALLIDA (Lindl.) Britton.

OEnothera albicaulis Nutt. Fras. Cat. Name only. 1813.

OEnothera pallida Lindl. Bot. Reg. 14: *pl. 1142.* 1828.

OEnothera Nuttallii Sweet, Hort. Brit. Ed. 2, 199. 1830.

Baumannia Nuttalliana Spach, Hist. Veg. 4: 352. 1835.

Anogra Nuttalliana Spach, Nouv. Ann. Mus. Par. 4: 339, 1835.

Baumannia Douglasiana Spach, Hist. Veg. 4: 352. 1835.

Anogra Douglasiana Spach, Nouv. Ann. Mus. Par. 4: 339, 1835.

OEnothera pinnatifida var. *integrifolia* A. Gray, Pl. Fendl. 44. 1848.

OEnothera albicaulis var. *Nuttallii* Engelm. Am. Journ. Sci. (II.) 34: 334. 1862.

OEnothera leptophylla Nutt.; S. Wats. Proc. Am. Acad. 8: 602. 1873.

British Columbia to Washington and Minnesota south to Sonora; ascends to about about 1700 meters in the Black Hills.

7a. ANOGRA PALLIDA LATIFOLIA (Rydberg).

OEnothera pallida var. *latifolia* Rydberg, Cont. Nat. Herb. 3: 159. 1895.

Nebraska and Colorado.

7b. ANOGRA PALLIDA RUNCINATA (Engelm.).

OEnothera albicaulis var. *runcinata* Engelm. Am. Journ. Sci. (II.), 34: 334. 1862.

OEnothera pinnatifida A. Gray, Pl. Fendl. 43. In part. 1848. Not Nutt. 1818.

Utah to Arizona and Texas.

7c. ANOGRA PALLIDA BREVIFOLIA (Engelm.).

OEnothera albicaulis var. *brevifolia* Engelm. Am. Journ. Sci. (II.) **34**: 335. 1862.

Sand hills south of El Paso, Texas.

7d. ANOGRA PALLIDA ENGELMANNI.

OEnothera albicaulis var. *trichocalyx* Engelm. Am. Journ. Sci. (II.), **34**: 335. 1862. Not *O. trichocalyx*. Nutt. 1840.

Las Vegas, New Mexico.

8. ANOGRA CALIFORNICA (S. Wats.).

OEnothera albicaulis var. *Californica* S. Wats. Proc. Am. Acad. **8**: 582. 1873.

OEnothera Californica S. Wats. Bot. Calif. **1**: 223. 1876.

Central California to southern Utah and southward; ascends to 1900 meters in the San Bernardino Mountains.

9. ANOGRA NEO-MEXICANA n. sp.

OEnothera albicaulis var. A. Gray, Pl. Wright. **2**: 56. 1853. Annual or perennial, stout, hispid-villous, dark green. Stem erect, 6–7 dm. tall, flexuous, somewhat branched, clothed with a pale papery bark; leaves oblong or lanceolate, 4–8 cm. long, obtuse or acute, sinuate-toothed or somewhat pinnatifid, puberulent, with some hispid-villous hairs on the mid-rib and lateral nerves, rather abruptly narrowed into a slender petiole which is less than one centimeter long; flowers few at the ends of the branches, 5–6 cm. broad; calyx hispid-villous, its tube stoutish, 4–4.5 cm. long; nearly thrice longer than the ovary, its segments nearly linear, one-half as long as the tube, the tips free in the bud; petals broadly obdeltoid, 1.8 cm. long, 2 cm. broad, somewhat emarginate, narrowed into a broad claw; filaments about one-half as long as the petals; anthers 1–1.2 cm. long; style slender, longer than the petals; capsule nearly cylindric, 2–2.5 cm. long, somewhat narrowed at the base and the apex, hispid-villous; seeds "oblong and perfectly smooth."

New Mexico. Wright, no. 1068.

A perfectly distinct species, related to *A. pallida*, but easily separated by its foliage and hispid-villous calyx.

4. KNEIFFIA Spach, Hist. Veg. 4: 373. 1835.

Stem-leaves linear-filiform; capsule 4-angled or slightly winged. 1. *K. linifolia*.
Stem-leaves never approaching filiform; capsules winged.

Capsules more or less club-shaped.	
Capsules pubescent.	
Stems decumbent, spreading; pedicels shorter than the body of the capsules.	2. *K. Alleni.*
Stems erect or nearly so, not spreading.	
Pedicels longer than the body of the capsules.	
Body of the capsules subglobose; leaves numerous.	3. *K. subglobosa.*
Body of the capsules obovoid, leaves few.	4. *K. longipedicellata.*
Pedicels shorter than the body of the capsules.	
Capsules on slender pedicels, with thin wings.	5. *K. linearis.*
Capsules on stout pedicels (sometimes nearly sessile) with thick wings.	6. *K. Spachiana.*
Capsules glabrous or glabrate.	7. *K. pumila.*
Capsules oblong or nearly so.	
Plants not glaucous; capsules less than 1 cm. long.	8. *K. fruticosa.*
Plants somewhat glaucous; capsules 1 cm. long.	9. *K. glauca.*

1. Kneiffia linifolia (Nutt.) Spach.

OEnothera linifolia Nutt. Journ. Acad. Phila. 2: 120. 1821.

Kneiffia linifolia Spach, Nouv. Ann. Mus. Par. 4: 368. 1835.

Kansas and Illinois to Texas and Georgia; ascends only a few meters above sea-level.

2. Kneiffia Alleni (Britton).

OEnothera fruticosa var. *humifusa* Allen, Bull. Torr. Club, 1: 3. 1870. Not *OE. humifusa* Nutt. 1818.

Kneiffia linearis Alleni Britton, Mem. Torr. Club, 5: 235. 1894.

Eastern end of Long Island, at sea-level.

This local form must be separated from the species with which it has been associated on account of its habit, flowers and capsule.

3. Kneiffia subglobosa n. sp.

Perennial, slender, puberulent, dull green, producing numerous stolons. Stem erect, 2–3 dm. tall, much branched, strict or slightly flexuous, red; basal leaves spatulate, 4–10 cm. long, obtuse or acutish, undulately toothed, gradually narrowed into a short petiole; stem leaves linear or nearly so, 2–7 cm. long, entire or distantly toothed, narrowed into a short petiole or sessile, slightly revolute; flowers in terminal racemes which are more or less corymbosely arranged, yellow, about 3 cm. broad; calyx villous or silky, its tube slender, 1 cm. long, about twice as long as the ovary, its segments linear, about as long as the tube and less pubescent, the tips free in the bud; petals obovate, 1.5 cm long, notched at the apex; filaments nearly one half as long as the petals;

style slender, two-thirds as long as the petals; stigmas filiform, 3–4 mm. long; capsule at length subglobose, or globose-obovoid, 6–7 mm. long, on a stalk which exceeds the body, the angles strongly winged, the faces strongly ridged; seeds very irregular, minutely papillose, black, 1 mm. long.

North Carolina and Georgia.

Most closely related to *K. Alleni* and part of Torrey and Gray's var. *β*. It differs especially in its erect habit, very different basal leaves and larger flowers.

4. KNEIFFIA LONGIPEDICELLATA n. sp.

Annual, slender, bright green, more or less puberulent, stem erect or assurgent, 4–7 dm. tall, red, slender, simple or sparingly branched above; basal-leaves spatulate or obovate-spatulate, 4–6 cm. long; stem-leaves few, linear-lanceolate, 3–9 cm. long, obtuse or acutish, entire, often somewhat undulate, narrowed into a short petiole; flowers yellow, subtended by leaf-like bracts in terminal racemes which are sometimes corymbosely arranged; calyx hirsute, its tube slender, 1-1.5 cm. long, its segments linear, longer than the tube, the tips free in the bud; petals obovate, 2 cm. long, many-nerved, emarginate, stamens less than one half as long as the petals; styles slender, two-thirds as long as the petals; capsule narrowly obovoid, 1 cm. long, its angles winged, its faces ridged, on pedicels longer than the body; seeds irregularly oblong, .8 mm. long, brown, minutely papillose.

West Virginia to North Carolina and Florida.

Between *K. subglobosa* and *K. linearis*. It differs from the former in its sparsely leafy, usually nearly simple stem, the hirsute calyx, the larger flowers and the narrowly obovoid capsules. It can easily be separated from *K. linearis* by its pedicel, which exceeds the body of the capsule.

5. KNEIFFIA LINEARIS (Michx.) Spach.

OEnothera linearis Michx. Fl. Bor. Am. 1: 225. 1803.

?OEnothera media Link, Enum. Hort. Berol. 1: 377. 1821. acc. to S. Wats.

OEnothera riparia Nutt. Gen. 1: 247. 1818.

?OEnagra Linkiana Spach, Nouv. Ann. Mus. Par. 4: 354. 1835.

OEnothera fruticosa var. *linearifolia* Hook. Bot. Mag. *pl. 3545.* 1837.

Kneiffia linearis Spach, Hist. Veg. 4: 376. 1835.

Kneiffiia angustifolia Spach, Nouv. Ann. Mus. Par. 4: 368. 1835.

?*Kneiffiia maculata* Spach, Hist. Veg. 4: 375. 1835.

OEnothera fruticosa var. *linearis* S. Wats. Proc. Am. Acad. 8: 584. 1873.

Connecticut to Tennessee, south to Georgia.

6. KNEIFFIA SPACHIANA (T. & G.).

OEnothera Spachiana T. & G. Fl. N. A. 1: 498. 1840.

Blennoderma Drummondii Spach, Nouv. Ann. Mus. Par. 4: 408. 1835.

OEnothera Drummondii Walp. Rep. 2: 85. 1843. Not Hook.

OEnothera uncinata Scheele, Linnaea, 21: 578. 1848.

Texas and Louisiana; ascends only a few feet above sea-level.

7. KNEIFFIA PUMILA (L.) Spach.

OEnothera pumila L. Sp. Pl. Ed. 2, 493. 1762.

OEnothera pusilla Michx. Fl. Bor. Am. 1: 225. 1803.

OEnothera chrysantha Michx. Fl. Bor. Am. 1: 225. 1803.

OEnothera gracilis Schrad.; F. & M. Ind. Sem. Hort. Petrop. 2: 44. 1835.

OEnothera riparia Lehm.; Hook. Fl. Bor. Am. 1: 212. 1830, not Nutt.

Kneiffia pumila Spach, Hist. Veg. 4: 377. 1835.

Kneiffia chrysantha Spach, Hist. Veg. 4: 377. 1835.

Nova Scotia to the Saskatchewan south to Georgia.

8. KNEIFFIA FRUTICOSA (L.) Raimann.

OEnothera fruticosa L. Sp. Pl. 346. 1753.

OEnothera mollissima Walt. Fl. Car. 129. 1788.

OEnothera hybrida Michx. Fl. Bor. Am. 1: 225. 1803.

OEnothera tetragona Roth, Cat. Bot. 2: 39. 1825.

OEnothera Canadensis Goldie, Edinb. Phil. Journ. 6: 325. 1822.

OEnothera incana Nutt. Gen. 1: 247. 1818.

OEnothera serotina Don; Sweet, Brit. Fl. Gard. 2: *pl. 184* 1825–1827.

Kneiffia suffruticosa Spach, Nouv. Ann. Mus. Par. 4: 365. 1835.

OEnothera fruticosa var. *differta* Millsp. Fl. W. Va. 366. 1892.

Kneiffia fruticosa Raimann, in Engl. & Prantl. Nat. Pfl. Fam. 3: Abt. 7, 214. 1893.

Nova Scotia to Missouri and southward.

8a. Kneiffia fruticosa Pilosella (Raf.) Britton.

OEnothera Pilosella Raf. Ann. Nat. 15. 1820.

? OEnothera fruticosa var. *ambigua* Nutt. Gen. 1: 247. 1818.

? OEnothera ambigua Spreng. Syst. 2: 229. 1825.

Kneiffia floribunda Spach, Nouv. Ann. Mus. Par. 4: 366. 1835.

OEnothera fruticosa var. *hirsuta* Nutt.; T. & G. Fl. N. A. 1: 496. 1840.

Kneiffia fruticosa Pilosella Britton, Mem. Torr. Club, 5: 234. 1894.

9. Kneiffia glauca (Michx.) Spach.

OEnothera glauca Michx. Fl. Bor. Am. 1: 224. 1803.

Kneiffia glauca Spach, Hist. Veg. 4: 374. 1835

OEnothara Fraseri Pursh, Fl. Am. Sept. 734. 1814.

OEnothera glauca var. *Fraseri* T. & G. Fl. N. A. 1: 497. 1840.

OEnothera fruticosa var. *Fraseri* Hook. Bot. Mag. *pl. 3548*. 1837.

Kneiffia Fraseri Spach, Hist. Veg. 4: 375. 1835.

Virginia and Kentucky, south to Georgia and Alabama, ascends to 1600 meters on Roan. Mt., Tenn.

5. HARTMANNIA Spach, Hist. Veg. 4: 370. 1835.

[Xylopleurum Spach, Hist. Veg. 4: 378. 1835.]

Plants canescent (except some forms of *H. rosea parviflora*).
 Calyx-tube shorter than the ovary; capsule club-shaped. 1. *H. rosea.*
 Calyx-tube longer than the ovary; capsule oblong or elliptic. 2. *H. speciosa.*
Plants more or less villous. 3. *H. tetraptera.*

1. Hartmannia rosea (Ait.) Don.

OEnothera rosea Ait. Hort. Kew. 2: 3. 1789.

OEnothera rubra Cav. Ic. 4: 68. *pl. 400.* 1797.

OEnothera purpurea Lam. Encycl. 4: 554. 1797.

Hartmannia rosea Don, in Sweet, Hort. Brit. Ed. 3, 236. 1.839.

Hartmannia gauroides Spach, Hist. Veg. 4: 371. 1835.

Xylopleurum roseum Raimann, in Engl. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 214. 1893.

Texas to New Mexico and southward; also in western South America.

1a. Hartmannia rosea parvifolia (Coult.).

OEnothera rosea var. *parvifolia* Coult. Cont. Nat. Herb. 2: 186. 1891.

Texas and northern Mexico.

2. Hartmannia speciosa (Nutt.).

OEnothera speciosa Nutt. Journ. Acad. Phila. 2: 119. 1821.

Xylopleurum hirsutum Spach, Nouv. Ann. Mus. Par. 4: 370. 1835.

Xylopleurum Nuttallii Spach, Nouv. Ann. Mus. Par. 4: 371. 1835.

Xylopleurum Drummondii Spach, Nouv. Ann. Mus. Par. 4: 371. 1835.

Xylopleurum obtusifolium Spach, Nouv. Ann. Mus. Par. 4: 372. 1835.

OEnothera Spachii Dietr. Syn. 2: 1289. 1840.

OEnothera obtusifolia Dietr. Syn. 2: 1289. 1840.

OEnothera Drummondii Schnitzlein, Ic. *pl. 265. f. 1.*

Xylopleurum speciosum Raimann, in Eng. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 214. 1893.

Missouri to Kansas, south to Texas and Mexico; introduced into fields around Charleston, S. C.

3. Hartmannia tetraptera (Cav.).

OEnothera tetraptera Cav. Ic. 3: 40. *pl. 279.* 1794.

Texas, Mexico, Central America and northern South America.

6. PACHYLOPHUS Spach, Hist. Veg. 4: 365. 1835.

Pachylophus caespitosa (Nutt.) Raimann.

OEnothera caespitosa Nutt. Fras. Cat. 1813.

OEnothera scapigera Pursh, Fl. Am. Sept. 263. 1814.

Pachylophus Nuttallii Spach, Hist. Veg. 4: 365. 1835.

Pachylophus Nuttalliana Spach, Nouv. Ann. Mus. Par. 4: 356. 1835.

OEnothera montana Nutt.; T. & G. Fl. N. A. 1: 500. 1840.

OEnothera marginata Nutt.; Hook. & Arn. Bot. Beech. 342. 1841.

OEnothera eximia A. Gray, Pl. Fendl. 45. 1848.

Pachylophis caespitosa Raimann, in Eng. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 215. 1893.

Dakota to Idaho, south to California, New Mexico and Senora.

7. LAVAUXIA Spach, Hist. Veg. 4: 366. 1835.

Tips of the calyx-segments not free in the bud. 1. *L. primiveris.*
Tips of the calyx-segments free in the bud.
 Leaves thinnish, very conspicuously pinnatifid. 2. *L. triloba.*
 Leaves thick, entire or sparingly pinnatifid near the base.
  Capsule ovoid or elliptic; testa of the seed thickened. 3. *L. brachycarpa.*
  Capsule attenuate at the apex; testa of the seed not thickened. 4. *L. Wrightii.*

1. LAVAUXIA PRIMIVERIS (A. Gray).

OEnothera primiveris A. Gray, Pl. Wright. 2: 58. 1853.

Texas and New Mexico.

2. LAVAUXIA TRILOBA (Nutt.) Spach.

OEnothera triloba Nutt. Journ. Acad. Phila. 2: 118. 1821.

OEnothera rhizocarpa Spreng. Syst. 2: 239. 1825.

Lavauxia triloba Spach, Hist. Veg. 4: 367. 1835.

Lavauxia Nuttalliana Spach, Nouv. Ann. Mus. Par. 4: 358. 1835.

OEnothera Roemeriana Scheele, Linnaea, 22: 154. 1849.

OEnothera clandestina Nutt.; S. Wats. Proc. Am. Acad. 8: 615. 1873.

Saskatchewan to Texas, California and Sonora.

2a. LAVAUXIA TRILOBA WATSONI Britton.

OEnothera triloba (?) var. *parviflora* S. Wats. Proc. Am. Acad. 12: 251. 1876. Not *O. parviflora* L.

Lavauxia triloba Watsoni Britton, Mem. Torr. Club, 5: 235. 1894.

Kansas and Nebraska.

3. LAVAUXIA BRACHYCARPA (A. Gray) Britton.

OEnothera brachycarpa A. Gray, Pl. Wright. 1: 70. 1852.

OEnothera marginata var. *purpurea* S. Wats. Bot. King's Rep. 5: 108. 1871.

Lavauxia brachycarpa Britton, Mem. Torr. Club, 5: 235. 1894.

Western Texas and New Mexico, probably in Nevada and Montana.

4. Lavauxia Wrightii (A. Gray).

OEnothera Wrightii A. Gray, Pl. Wright. 2: 57. 1853.

New Mexico.

8. GAURELLA.

Perennial herbs low, wiry, diffuse, canescent or strigilose. Stems at length branched throughout and spreading, leafy, clothed with a longitudinally wrinkled bark; leaves small, linear-lanceolate or lanceolate, nearly entire or distantly toothed, narrowed into a very short petiole; flowers axillary, white or rose-colored, spotted or striped with red; calyx purplish, its tube cylindric, slightly dilated at the throat, twice as long as the ovary, its segments slightly longer than the tube; their tips not free in the bud; petals obovate, truncate or emarginate; filaments filiform-subulate; anthers linear; ovary sessile, 4-angled; style stoutish, enlarged at the top; stigmas filiform; capsule ovoid-pyramidal, sessile, attenuate into a slender curved beak, the angles keeled, the faces swollen; seeds obovoid, angled, pointed at the base; delicately striate.

A perfectly distinct genus, with no very close affinity to related groups. It differs from *Megapterium*, with which it has been associated, in habit, foliage, inflorescence and fruit.

✓1. Gaurella guttulata (Geyer).

OEnothera canescens Torr. & Frem., Frem. Rep. 315. 1845. Not *OE. biennis* var. *canescens* T. & G. 1840.

OEnothera guttulata Geyer; Hook. Lond. Journ. Bot. 6: 222. 1847.

Megapterium canescens Britton, Mem. Torr. Club, 5: 235. 1894.

Wyoming to Kansas and New Mexico.

9. MEGAPTERIUM Spach, Hist. Veg. 4: 363. 1835.

Leaves entire or nearly so.	
Capsule (with wings) oblong, 2–3 cm. long.	1. *M. Fremontii.*
Capsule (with wings) suborbicular, 5–6 cm. long.	2. *M. Missouriense.*
Leaves pinnatifid.	3. *M. dissectum.*

1. Megapterium Fremontii (S. Wats.) Britton.

OEnothera Fremontii S. Wats. Proc. Am. Acad. 8: 587. 1873.

Megapterium Fremontii Britton, Mem. Torr. Club, 5: 286. 1893.

Kansas to Texas.

2. Megapterium Missouriense (Sims) Spach.

OEnothera Missouriensis Sims, Bot. Mag. *pl. 1592.* 1814.

OEnothera macroparpa Pursh, Fl. Am. Sept. ~~374~~. 1814. 734

OEnothera alata Nutt. Gen. 1: 248. 1818.

Megapterium Missouriense Spach, Hist. Veg. 4: 364. 1835.

Megapterium Nuttallianum Spach, Hist. Veg. 4: 363. 1835.

OEnothera Drummondii Hook. Lond. Journ. Bot. 6: 221. 1847.

OEnothera Missouriensis var. *latifolia* A. Gray, Bost. Journ. Nat. 6 Hist. ~~5~~: 188. 1856.

OEnothera Missouriensis var. *incana* A. Gray, Bost. Journ. Nat. 6 Hist. ~~5~~: 189. 1856.

Nebraska to Texas.

3. Megapterium dissectum (A. Gray).

OEnothera dissecta A. Gray, Proc. Am. Acad. 17: 356. 1882.

OEnothera Havardi S. Wats. Proc. Am. Acad. 20: 366. 1885.

Western Texas and northern Mexico.

10. TARAXIA Nutt.; Raimann in Engl. and Prantl, Nat. Pfl. Fam. 3: Abt. 7, 216. 1893.

Leaves not pinnatifid.
- Plants hirsute.
  - Plants acaulescent. — 1. *T. graciliflora.*
  - Plants producing several short branches. — 2. *T. Palmeri.*
- Plants glabrous or glabrate; leaves lanceolate or linear.
  - Leaves lanceolate; calyx-segments linear-lanceolate. — 3. *T. heteranthera.*
  - Leaves ovate; calyx-segments lanceolate. — 4. *T. ovata.*

Leaves pinnatifid.
- Sparingly pubescent; calyx-tube longer than the segments; seeds minutely pitted in rows. — 5. *T. breviflora.*
- Densely pubescent; calyx-tube several times longer than the segments; seeds conspicuously pitted. — 6. *T. longiflora.*

1. Taraxia graciliflora (H. & A.) Raimann.

OEnothera graciliflora H. & A. Bot. Beech. Voy. 341. 1841.

Taraxia graciliflora Raimann, in Engl. & Prantl, Nat. Pfl. Fam. 3: abt. 7, 217. 1893.

California except the extreme north; apparently also in Colorado.

2. Taraxia Palmeri (S. Wats.).

OEnothera Palmeri S. Wats. Proc. Am. Acad. 12: 251. 1877.

Valleys, Arizona and southern California.

3. TARAXIA HETERANTHA (Nutt.).

OEnothera heterantha Nutt. Journ. Acad. Phila. 7: 22. 1834.

Jussiaea subacaulis Pursh, Fl. Am. Sept. 304. 1814.

OEnothera triloba Hook. Lond. Journ. Bot. 6: 223. 1847. Not Nutt. 1821.

Idaho and Oregon to Utah and Nevada; at about 2200 meters in Utah.

3a. TARAXIA HETERANTHA TARAXACIFOLIA (S. Wats.).

OEnothera heterantha var. *taraxacifolia* S. Wats. Proc. Am. Acad. 8: 589. 1873.

On the Sierra Nevada.

4. TARAXIA OVATA (Nutt.).

OEnothera ovata Nutt.; T. & G. Fl. N. A. 1: 507. 1840.

California from San Francisco to Monterey.

5. TARAXIA BREVIFLORA (T. & G.) Nutt.

OEnothera breviflora T. & G. Fl. N. A. 1: 506. 1840.

OEnothera Nuttallii Torr. & Frem., Frem. Rep. 89. 1845.

Taraxia breviflora Nutt.; T. & G. Fl. N. A. 1: 506. 1840.

Northwest Territory to Colorado and Utah, where it ascends to about 2800 meters.

6. TARAXIA LONGIFLORA Nutt.

OEnothera Nuttallii T. & G. Fl. N. A. 1: 506. 1840. Not Sweet. 1830.

OEnothera tanacetifolia T. & G. Pacif. R. R. Rep. 2: 121. *pl. 4*, 1854.

Taraxia longiflora Nutt.; T. & G. Fl. N. A. 1: 506. As synonym. 1840.

Washington to Nevada and California.

11. GALPINSIA Britton, Mem. Torr. Club, 5: 263. 1894.

[SALPINGIA Raimann in Engl. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 217. 1893. Not *Salpinga* DC.]

Free tips of the calyx-segments about 3 mm. long. 1. *G. Hartwegii.*

Free tips of the calyx-segments less than 2 mm. long.

Plants hispid; calyx-tube much longer than the ovary. 2. *G. Greggii.*

Plants puberulent; calyx-tube slightly longer than the ovary. 3. *G. tubicula.*

1. GALPINSIA HARTWEGI (Benth.) Britton.

OEnothera Hartwegi Benth. Pl. Hartw. 5. 1839.

OEnothera lavandulaefolia T & G. Fl. N. A. 1: 501. 1840.

OEnothera Hartwegi var. *lavandulaefolia* S. Wats. Proc. Am. Acad. **8**: 590. 1873.

Salpingia Hartwegi Raimann, in Engl. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 217. 1893.

Galpinsia Hartwegi Britton, Mem. Torr. Club, **5**: 236. 1894.

Kansas to Colorado and Mexico.

1*a*. GALPINSIA HARTWEGI FENDLERI (A. Gray).

OEnothera Fendleri A. Gray, Pl. Fendl. 45. 1848.

OEnothera Hartwegi var. *Fendleri* A. Gray, Pl. Wright. **2**: 56. 1853.

Nebraska to Indian Territory, Texas and New Mexico.

2. GALPINSIA GREGGII (A. Gray).

OEnothera Greggii A. Gray, Pl. Fendl. 46. 1848.

OEnothera Lampsana Buckl. Proc. Acad. Phila. **1861**: 454. 1861.

OEnothera Hartwegi var. A. Gray, Proc. Acad. Phila. **1862**: 163. 1862.

New Mexico and northern Mexico.

3. GALPINSIA TUBICULA (A. Gray).

OEnothera tubicula A. Gray, Pl. Wright. 1: 71. 1852.

OEnothera tubicula var. *demissa* A. Gray, Pl. Wright. 1: 71, 1852.

Northwestern Texas and New Mexico.

12. MERIOLIX Raf. Am. Month. Mag. **4**: 192. 1881.

[CALYLOPHIS Spach, Hist. Veg. **4**: 350. 1835.]

1. MERIOLIX SERRULATA (Nutt.) Walp.

OEnothera serrulata Nutt. Gen. 1: 246. 1818.

Calylophis Nuttallii Spach, Hist. Veg. **4**: 350, 1835.

OEnothera fruticosa A. Gray, Pl. Fendl. 44. 1848.

OEnothera leucocarpa Comien; Lehm. in Hook. Fl. Bor. Am. 1: 210. 1833.

OEnothera serrulata var. *Douglassi* T. & G. Fl. Bor. Am. 1: 502. 1840.

OEnothera serrulata var. *Drummondii* T. & G. Fl. N. A. 1: 502. 1840.

Calylophis Drummondiana Spach, Nouv. Ann. Mus. Par. 4: 337. 1835.

? *Calylophis Berlandieri* Spach, Nouv. Ann. Mus. Par. 4: 337. 1835.

Meriolix serrulata Walp. Repert. 2: 79. 1843.

Meriolix Berlandieri Walp. Repert. 2: 79. 1843.

OEnothera spinulosa var. *Drummondii* Engelm. Pl. Upp. Miss. 192. Acc. to S. Wats.

Saskatchewan to Missouri, Texas and Arizona.

1a. Meriolix serrulata spinulosa (T. & G.).

OEnothera serrulata Nutt. Journ. Acad. Phila. 2: 120. 1821.

OEnothera serrulata var. *spinulosa* T. & G. Fl. N. A. 1: 502. 1840.

Saskatchewan to Missouri and Texas.

1b. Meriolix serrulata pinifolia (Engelm.).

OEnothera serrulata var. *pinifolia* Engelm. Bost. Jour. Nat. Hist. 5: 189. 1856.

? *OEnothera capillifolia* Scheele, Linnaea, 21: 576. 1848.

Texas.

13. EULOBUS Nutt.; T. & G. Fl. N. A. 1: 514. 1840.

1. Eulobus Californicus Nutt.; T. & G. Fl. N. A. 1: 515. 1840.

Eulobus Californicus Nutt.; T. & G. Fl. N. A. 1: 515. 1840.

OEnothera Californica Greene, Pitt. 1: 290. 1889, not S. Wats. 1876.

OEnothera leptocarpa Greene, Pitt. 1: 302. 1889.

Southern California.

14. SPHAEROSTIGMA F. & M. Ind. Sem. Hort. Petrop. 2: 49. 1835.

[Chamissonia Link, Jahrb. der Gewächsk. 186. 1818. Not *Chamissoa* H. B. K.]

[AGASSIZIA Spach, Hist. Veg. 4: 346. 1835.]

[HOLOSTIGMA Spach, Nouv. Ann. Mus. Per. 4: 21. 1835.]

Flowers yellow, turning red or green.
Capsules fusiform, straight.
Seeds cylindric-oblong. 1. *S. aldinum.*
Seeds clavate. 2. *S. Hilgardi.*
Capsules linear, somewhat curved.
Plants puberulent or hirsute.
Capsules scarcely beaked. 3. *S. contortum.*
Capsules with a slender beak. 4. *S. campestre.*
Plants viscid-glandular. 5. *S. chamaenerioides.*
Capsules linear or linear-fusiform, more or less contorted.
Flowers less than 1 cm. broad.
Lower stem-leaves linear or nearly so; species maritime. 6. *S. micranthum.*
Lower stem-leaves ovate; species not maritime. 7. *S. hirtellum.*
Flowers more than 1 cm. broad.
Plant glabrous and lustrous. 8. *S. nitidum.*
Plants pubescent and dull.
Stems woody; leaves sessile. 9. *S. viridescens.*
Stems herbaceous; lower stem-leaves petioled.
Calyx canescent. 10. *S. spirale.*
Calyx hirsute.
Capsule with a very short beak. 11. *S. Bistorta.*
Capsule with a long slender beak. 12. *S. Veitchianum.*
Flowers white or rose-colored; capsules terete or nearly so.
Plants glabrous (inflorescence glabrate); capsules enlarged at the base. 13. *S. decorticans*
Plants pubescent or glandular.
Capsules enlarged at the base, viscid-glandular. 14. *S. Boothii.*
Capsules scarcely enlarged at the base.
Plants more or less villous. 15. *S. Utahense.*
Plants more or less puberulent.
Leaves linear or nearly so. 16. *S. refractum.*
Leaves spatulate, elliptic or lanceolate. 17. *S. alyssoides.*

1. SPHAEROSTIGMA ANDINUM (Nutt.) Walp.

OEnothera andina Nutt.; T. & G. Fl. N. A. 1: 512. 1840.

Sphaerostigma andinum Walp. Repert. 2: 79. 1843.

Washington to Montana, south to Nevada and Utah; at 1800 meters in Utah and Nevada.

2. SPHAEROSTIGMA HILGARDI (Greene).

OEnothera Hilgardi Greene, Bull. Torr. Club, 10: 41. 1883.

Washington and Oregon.

3. SPHAEROSTIGMA CONTORTUM (Dougl.) Walp.

OEnothera contorta Dougl.; Lehm. in Hook. Fl. Bor. Am. **1**: 214. 1833.

OEnothera strigulosa T. & G. Fl. N. A. **1**: 512. 1840.

OEnothera parvula Nutt.; T. & G. Fl. N. A. **1**: 511. 1840.

Sphaerostigma contortum Walp. Repert. **2**: 78. 1843.

Sphaerostigma parvulum Walp. Repert. **2**: 78. 1843.

Sphaerostigma strigulosum F. & M. Ind. Sem. Hort. Petrop. **2**: 22. 1835.

Washington to Nevada, Arizona and southern California, where it ascends to 1850 meters.

3a. SPHAEROSTIGMA CONTORTUM PUBENS (S. Wats.).

OEnothera strigulosa var. *pubens* S. Wats. Proc. Am. Acad. **8**: 594. 1873.

OEnothera contorta pubens Coville, Cont. Nat. Herb. **4**: 104. 1893.

Vancouver Island to Nevada, Arizona and Southern California, ascends to 1500–1700 metres in Nevada and California.

3b. SPHAEROSTIGMA CONTORTUM GREENEI.

OEnothera strigulosa var. *epilobioides* Greene, Fl. Francis, 216. 1891. Not *OE. epilobioides* Nutt. 1840.

Away from the seaboard, from Oregon to San Diego, Cal.

4. SPHAEROSTIGMA CAMPESTRE (Greene).

OEnothera dentata S. Wats. Bot. Calif. **1**: 226. 1876. Not Cav. Ic. **4**: 67. *pl.* 398. 1797.

OEnothera campestris Greene, Fl. Francis, 216. 1891.

From the Valley of the Sacramento to southern California, where it ascends to 1700 meters.

4a. SPHAEROSTIGMA CAMPESTRE MINOR.

OEnothera strigulosa Benth. Pl. Hartw. 310. 1849.

OEnothera dentata var. *cruciata* S. Wats. Proc. Am. Acad. **8**: 594. 1873. Not *OE. cruciata* Nutt. 1828.

5. SPHAEROSTIGMA CHAMAENERIOIDES (A. Gray).

OEnothera chamaenerioides A. Gray, Pl. Wright **2**: 58. 1853.

Southern Utah to Texas and southern California.

6. SPHAEROSTIGMA MICRANTHUM (Hornem.) Walp.

OEnothera micrantha Hornem. "Hort. Hafn." 1807.

OEnothera dentata Ser. in DC. Prodr. 3: 46. In part. 1821, not Cav.

OEnothera hirta Link, Enum. 1: 378. 1821.

Sphaerostigma hirta F. & M. Ind. Sem. Hort. Petrop. 2: 22. 1835.

Holostigma micrantha Spach, Nouv. Ann. Mus. Par. 4: 334. 1835.

Sphaerostigma micranthum Walp. Repert. 2: 77. 1843.

OEnothera asperifolia Nutt.; S. Wats. Proc. Am. Acad. 8: 680. 1873.

OEnothera cheiranthifolia Torr. Pacif. R. R. Rep. 4: 87. 1857.

OEnothera strigulosa Torr. Pacif. R. R. Rep. 4: 87. 1857.

OEnothera bistorta A. Gray, Proc. Bost. Soc. Nat. Hist. 7: 146. 1859.

From the valley of the Sacramento south to Lower California,

7. SPHAEROSTIGMA HIRTELLUM (Greene).

OEnothera hirtella Greene, Fl. Francis. 215. 1891.

Mountains, from Lake county, California, southward.

8. SPHAEROSTIGMA NITIDUM (Greene).

OEnothera nitida Greene, Pitt. 1: 70. 1887.

Vicinity of Monterey Bay, California and on the Island of San Miguel.

9. SPHAEROSTIGMA VIRIDESCENS (Lehm.) Walp.

OEnothera viridescens Lehm. in Hook. Fl. Bor. Am. 1: 214. 1833.

Sphaerostigma viridescens Walp. Repert 2: 77. 1843.

Along the coast from Monterey Bay to San Diego.

10. SPHAEROSTIGMA SPIRALE (Lehm.) Walp.

OEnothera spiralis Lehm. in Hook. Fl. Bor. Am. 1: 213. 1833.

Along or near the coast from San Francisco southward.

11. SPHAEROSTIGMA BISTORTA (Nutt.) Walp.

OEnothera bistorta Nutt.; T. & G. Fl. N. A. 1: 508. 1840.

?*Holostigma Bottae* Spach, Nouv. Ann. Mus. Par. 4: 335. 1835.

Sphaerostigma bistortum Walp. Repert. **2**: 77. 1843.

OEnothera cheiranthifolia A. Gray. Ives, Rep. 12. 18.

Southern California.

12. SPHAEROSTIGMA VEITCHIANUM (Hook).

OEnothera bistorta (?) var. *Veitchiana* Hook. Bot. Mag. *pl. 5078*.

OEnothera graciliflora Torr. Pacif. R. R. Rep. **4**: 87. 1857.

Southern California to Lower California.

13. SPHAEROSTIGMA DECORTICANS (H. & A.).

Gaura decorticans H. & A. Bot. Beech. Voy. 343. 1840.

OEnothera gauraeflora T. &. G. Fl. N. A. **1**: 510. 1840.

Sphaerostigma gauraeflorum Walp. Repert. **2**: 78. 1843.

OEnothera Nevadensis Kellogg, Proc. Calif. Acad. **2**: 224. *pl. 70*. 1863.

Southern Utah to Arizona and California; ascends to 2100 meters in California.

14. SPHAEROSTIGMA BOOTHII (Dougl.) Walp.

OEnothera Boothii Dougl.; Lehm. in Hook. Fl. Bor. Am. **1**: 213. 1833.

OEnothera pygmaea Dougl.; Lehm. in Hook. Fl. Bor. Am. **1**: 213. 1833.

OEnothera lithospermoides Nutt.; S. Wats. Proc. Am. Acad. **8**: 604. 1873.

Sphaerostigma Boothii Walp. Repert. **2**: 77. 1843.

Washington to California and Nevada; occurs at about 1000–1100 meters in Nevada.

15. SPHAEROSTIGMA UTAHENSE n. sp.

Annual, low, pale-green, villous. Stem erect, 2–10 cm. tall, simple or branched at the base or above, the branches ascending; leaves varying from spatulate to ovate, 1–2.5 cm. long, densely villous, obtuse or acutish, entire or obscurely toothed, narrowed into slender petioles; flowers yellow, 8–12 mm. broad, in loose terminal spikes; buds ovoid, 5 mm. long; calyx-tube very slender, 7–9 mm. long, shorter than the ovary, abruptly dilated at the throat; calyx-segments ovate or lanceolate, nearly twice shorter than the tube, involute, acutish; petals obovate, 3–5 mm. long, delicately nerved, crisped at the apex; style slender, exceeding the stamens; capsules nearly filiform, about 1.5 cm. long, villous, spirally twisted near the base, slightly glandular; seeds oblong, 13 mm. long, pale, very minutely striate.

A species of low habit, related to *S. gauraeflorum*, *S. Boothii* and *S. refractum*, striking on account of its dense villous pubescence.

Specimens were collected on May 3, 1850, by Capt. Stansbury, at "Great Salt Lake, growing in loose sand on the 'storm line' of the shore," and by M. E. Jones, in June, 1880; these were distributed as *OEnothera Boothii* Dougl.

16. SPHAEROSTIGMA REFRACTUM (S. Wats.).

OEnothera refracta S. Wats. Proc. Am. Acad. **17**: 373. 1882.

Southern Utah and northern Arizona.

17. SPHAEROSTIGMA ALYSSOIDES (H. & A.) Walp.

OEnothera alyssoides H. & A. Bot. Beech. Voy. 340. 1840.

Sphaerostigma alyssoides Walp. Repert. **2**: 78. 1843.

Idaho and Oregon, south to Nevada, Utah and southern California; at 1100 meters in Nevada and California.

17a. SPHAEROSTIGMA ALYSSOIDES MINUTIFLORUM (S. Wats.).

OEnothera alyssoides var. *minutiflora* S. Wats. Proc. Am. Acad. **8**: 591. 1873.

Northern Nevada and Utah.

17b. SPHAEROSTIGMA ALYSSOIDES MACROPHYLLA.

OEnothera alyssoides var. *villosa* S. Wats. Proc. Am. Acad. **8**: 591. 1873. Not *OE. villosa* Thunb. 1794–1800.

Nevada and Utah.

OEnothera rutila Davidson, is said to belong to the genus SPHAEROSTIGMA, but I have not seen specimens.

15. CHYLISMA Nutt.; Raimann in Engl. & Prantl, Nat. Pfl. Fam. 3: Abt. 7, 217. 1893.

Flowers axillary, subtended by leaves. . . . 1. *C. pterosperma.*
Flowers in terminal racemes, usually subtended by bracts.
  Plants caulescent.
    Leaves simple.
      Leaves cordate; capsules short-pedicelled. . . . 2. *C. cardiophylla.*
      Leaves narrowed at the base; capsules long-pedicelled.

Plants villous; blade of leaf closely toothed. 3. *C. heterochroma.*
Plants hirsute; blade of leaf distantly toothed. 4. *C. Parryi.*
Leaves compound. 5. *C. multijuga.*
Plants scapose.
Tips of the calyx-segments not free. 6. *C. scapoidea.*
Tips of the calyx-segments free. 7. *C. brevipes.*

1. CHYLISMA PTEROSPERMA (S. Wats.).

OEnothera pterosperma S. Wats. Bot. King, Rep. 5: 112. *pl. 14.* 1871.

Northwestern Nevada and Utah; occurs at about 1280 meters in Nevada.

2. CHYLISMA CARDIOPHYLLA (Torr.).

OEnothera cardiophylla Torr. Pacif. R. R. Rep. 5: 360. 1856.

Southern California to Arizona and Lower California; ascends to 700 meters in California.

3. CHYLISMA HETEROCHROMA (S. Wats.).

OEnothera heterochroma S. Wats. Proc. Am. Acad. 17: 373. 1882.

Western Nevada.

4. CHYLISMA PARRYI (S. Wats.).

OEnothera Parryi S. Wats. Parry, Am. Nat. 9: 20. 1877.

Southern Utah and northern Arizona.

5. CHYLISMA MULTIJUGA (S. Wats.).

OEnothera multijuga S. Wats. Proc. Am. Acad. 8: 595. 1873.

Southern Utah.

6. CHYLISMA SCAPOIDEA (Nutt.).

OEnothera scapoidea Nutt.; T. & G. Fl. N. A. 1: 506. 1840.

Wyoming and Idaho to Utah and southern California; occurs at about 1280 meters in Utah.

6a. CHYLISMA SCAPOIDEA CRUCIFORMIS (Kellogg).

OEnothera clavaeformis T. & G. Pacif. R. R. Rep. 2: 121. 1856.

OEnothera cruciformis Kellogg, Proc. Cal. Acad. 2: 227. 1863.

OEnothera scapoidea var. *clavaeformis* S. Wats. Bot. King's Rep. 5: 109. 1871.

OEnothera scapoidea var. *purpurascens* S. Wats. Proc. Am. Acad. 8: 595. 1873.

Eastern slope of the Sierra from Oregon to Nevada and southern California; at 400 meters in California.

6b. CHYLISMA SCAPOIDEA CLAVAEFORMIS (Torr.).

OEnothera clavaeformis Torr. Frem. Rep. 314. 1845.

OEnothera scapoidea var. *aurantiaca* S. Wats. Proc. Am. Acad. 8: 595. 1873.

Southern California and Arizona.

7. CHYLISMA BREVIPES (A. Gray).

OEnothera brevipes A. Gray, Pacif. R. R. Rep. 4: 87. 1857.

OEnothera clavaeformis Torr. Bot. Mex. Bound. Surv. 66. In part. 1859.

Southern California and Arizona.

Salix candida Willd, and its Hybrids.*

W. W. ROWLEE AND K. M. WIEGAND.

(PLATE 267.)

Within a radius of twenty miles of Ithaca, New York, there is but a single station for *Salix candida*. This is a swamp, formerly a sphagnous bog, called "Fleming Meadow," two miles south of the city. The swamp is a little higher, possibly fifteen feet, than Cayuga lake. An attempt was made some years ago to drain this and a neighboring bog and thereby to render them suitable for cultivation. The springs of water pouring in thwarted this attempt, and after they had been thoroughly cleared of bushes the attempt to utilize them was abandoned and they were allowed to become wild again.

Salix candida persisted along the margins of the ditches during the attempt to drain the bog. These have filled up and the soil has become again very wet. The willow has now spread somewhat from the ditches. Other willows grow in the bog. *Salix cordata* is more abundant than any other. *S. rostrata* and *S. dis-*

* We have received from the authors photographs illustrating the variation in buds described in this paper. They are willing to send similar photographs to anyone interested enough to pay the cost of printing and mailing—25 cents each. There are three photographs 5x8 inches, and 6 branches, natural size, represented in each.—ED.

color also grow there. *Salix sericea* grows in the immediate vicinity, but has not been detected in the bog. Stations for *S. petiolaris* are known not far from the bog, and it is highly probable that both the species last mentioned grew in the bog before vegetation was disturbed by settlements.

In the spring of 1894 several forms of *Salix candida* were brought into the laboratory, one of which was so unusual in its appearance that specimens were sent to Mr. Bebb. These specimens were from the plant labeled No. 20. Of it in a letter he said, "just at a glance, without a careful examination of minute characters I should take your smoother form to be a hybrid, *Salix candida* × *S. petiolaris*. In addition to the differences from pure *candida* which you mention, you will observe that the aments are borne on slender and more distinctly leafy peduncles. I imagine too that they are more loosely flowered. The capsules are too old to afford a good view of the style (without soaking up, for which I have not the time at present), but I fancy it is shorter than pure *candida*. The leaves have a different outline, being more pointed at base, and exhibit (even in your carefully dried specimens) a slight tendency to blacken, and the margin is less distinctly revolute. It would not be well to rest a decision on the scant material before me, but I have very little doubt that if you carefully study the forms in the locality from which this specimen was obtained, in flower, fruit and mature foliage, you will find convincing proof of hybridity."

Subsequent studies of these specimens during the same summer convinced us that there was a very interesting series of forms in the bog, and in the spring of 1895 a systematic study of them was undertaken. The opportunity for observing the forms is especially favorable, since the whole bog comprises not more than two acres, and the plants in question were all upon one corner of this area. Each individual which promised any appreciable variation from typical forms, as well as a number of apparently typical forms, was given a number and marked with a tag. At the same time a map of the locality was made as a check and as a matter of convenience in finding our plants. Observations were made at frequent intervals, and specimens were taken at three periods during the season: First, at anthesis (April 30); second, when the capsules were mature (May 17); third, when the leaves were mature (July 13). Specimens of the buds and branches were also taken in March, 1896.

The preliminary comparison of material from each individual, and our conclusions, together with a complete set of our plants, were ready to be sent to Mr. Bebb for his final revision, when the sad news of his death reached us.

The results of our work fulfil Mr. Bebb's prophecy and even more than fulfil it. A whole season's study of No. 20 confirms his provisional diagnosis of it.

There is a specimen from a pistillate plant in the Cornell University Herbarium named by Mr. Bebb, *Salix candida* × *S. petiolaris*, and on the label is printed, "Originally from Hascoll's Swamp, near Flint, Michigan, where it was discovered by Daniel Clarke, M. D., in 1872, the locality soon after being obliterated. Should it be deemed advisable hereafter to treat supposed hybrids as quasi-species after the manner of Andersson, Kerner and others, I very much wish that this beautiful Willow should be called *S. Clarkei*, to commemorate the name of a botanist who has done more than anyone else to give an impetus to the study of hybrid willows in this country." With the specimens are drawings and detailed notes which, so far as the writers know, Mr. Bebb never published.

Our plant differs decidedly from Mr. Bebb's in general appearance. The leaves are larger, much more densely tomentose below, and lighter green above; the capsules are much more densely tomentose at maturity (there is no young material with Mr. Bebb's specimen) and the tomentum is creamy white, whereas in his specimen it is silky and gray. The young catkins in our specimen have that glistening white appearance so characteristic of *S. petiolaris*. A superficial comparison of his plant with ours would lead one to believe them quite different, but closer examination shows that they agree quite closely as to essential characters. The winter buds, which are of much importance in diagnosing willows, indicate too that this is intermediate between *S. candida* and *S. petiolaris*.

It is a significant indication of the accuracy of Mr. Bebb's judgment regarding willows that what he anticipated for this specimen in style and capsule characters should prove so true.

There proved to be some other equally interesting forms in the same swamp. They are our nos. 21, 23, 28 and 84. Everything seems to point to these being hybrids between *Salix candida* and *S. cordata.*

No. 21 at time of flowering might easily be mistaken for pure *Salix cordata.* It is a staminate plant and has the large catkins and general aspect of *S. cordata.* The catkins are "sessile" as in *S. candida.* The young leaves are comparatively smooth, but even in age retain the "candida" characteristics very decidedly. The venation of the leaf resembles that of *S. candida* more than it does that of *S. cordata.* The leaves are lanceolate-acuminate as in *S. cordata.* The petioles are twice the length of the small stipules. The gall which is so abundant upon *S. cordata* in this region is abundant also upon this plant.

No. 23 is a pistillate plant. The capsules in the mature catkin (collected May 17) are acute and still bear the rather long style. They are sparsely tomentose and green and the sutures upon their sides are conspicuous. The leaves when young are densely-tomentose on both sides, the mature ones are whitened below and very veiny, those upon the lower part of the shoot being very sparingly tomentose, tapering nearly equally both ways and acute at both ends. The petioles are not longer than the stipules. The stipules are rather large, obliquely, very broadly ovate, acute and revolute. The winter buds are ovate, acutish, but rounded at the apex, divergent and only slightly flattened. The whole plant seems to be intermediate between its supposed parents.

No. 28 also a pistillate plant, is closely related to *S. cordata.* If it were not for the rugose, slightly revolute inconspicuously toothed, and somewhat tomentose leaves, the long styles and sparingly tomentose capsules, it would be at once so considered. The capsule becomes green and nearly smooth at maturity, but retains somewhat the form of the "candida" capsule. The form of the leaves and stipules, the leafy peduncled catkins, and the size of the plant are all suggestive ot *S. cordata.* The winter buds also resemble those of the pistillate plants of *S. cordata*

No. 84 is also a pistillate plant. It bears a close resemblance to *S. candida.* In fact during our first visits to the swamp we took this plant to belong unquestionably to that species and did not give it a number. The appearance of the mature capsule led us to take specimens May 17th, and the leaves and buds confirm our surmise that this too is an errant form. A peculiar fact is that the plant resembles strongly *S. candida* in its floral and fruiting characters, while it resembles just as strongly *S. cordata* in its leaf and stem characters. The capsule is densely tomentose and the tomentum is in texture and color like that upon the capsules of *S. candida*. Older leaves are nearly smooth and are rugose above, whitened and silky below, the younger ones are covered with scattered white tomentum both above and below. The youngest leaves on the shoot which were still unrolled July 13th, are densely white-tomentose. The mature leaves are rounded at the base, with lanceolate-acuminate outline, and have revolute and very obscurely dentate margins. The stipules are obliquely ovate, broad and toothed, prominently veiny below and longer than the petioles.

No. 90 is another individual which is evidently intermediate between *S. candida* and *S. cordata*. Only the mature leaves and buds are available for study. These are sufficient to show that *S. candida* has some influence in this plant, although at time of flowering the plant was thought to be *S. cordata*. Another season's observations are necessary to determine the place no. 90 should have.

It seems very certain that these individuals are hybrids between *S. candida* and *S. cordata*. The isolation of the former species in this region and the very pronounced characteristics which it possesses makes it a comparatively easy matter to detect a relationship between the forms here described and the typical *S. candida*.

The other element in the mixture is not so constant and well defined. Mr. Bebb in his Notes upon N. A. Willows (Bot. Gaz. 16: 104, 1891), says, "No American willow has a wider distribution than this (*S. cordata*). * * * * None other presents more the appearance of a 'congeries of species in the making.' * * * * Of all our willows, (it is) the one which hybridizes most freely with others, and this implies that even where actual hybridity cannot be proven, it is more or less effected by association with other willows in different portions of this wide area of distribution."

Of the inconstancy of *S. cordata*, Glatfelter (Trans. Acad. Sci. St. Louis, 7: 139, Jan. 4, 1896) states that of 184 specimens of supposed *S. cordata* which he collected at random near St. Louis, "13 were rejected as hybrid *sericea* and *cordata* either fully identified or probable." He also dwells upon the great variability of *S. cordata* and discredits Mr. Bebb's species *Salix Missouriensis*.

Professor Dudley spent much time studying willows about Ithaca. His conclusions (Cayuga Flora, p. 87), verified by Mr. Bebb, were that hybrids between *S. cordata* and related species were not infrequent. It has been a matter of some surprise that Professor Dudley or some other of the many students who have done field work about Ithaca did not discover these plants before. It hardly seems possible that they could have been passed over year after. It seems more probable that they have sprung up within the last ten years, perhaps immediately after the attempt to reclaim the swamp was abandoned.

Salix cordata as it grows about Ithaca is an exceedingly variable plant. It presents several forms and grows along the creeks and in low grounds everywhere.

The winter buds promise to aid much in the determination of species of willows *Salix cordata* and *S. candida* have very different buds. In the former they are large and flattened upon the side next to the branch and appressed. They are acute, the apex frequently reaching the base of the next bud above. They are dull and frequently hairy. In the latter the buds are short, rounded at the apex and decidedly spreading. They are polished and shining. The hybrids all have buds intermediate between the two species; they are more divergent, shorter, and more blunt than those of *S. cordata*, and vary from smooth to hairy.

Not until the winter buds came into consideration did the question of the parentage of our hybrids seem satisfactorily solved. Plate 267 illustrates forms of buds of *Salix candida* and *S. cordata*, and also the buds of the hybrids. The buds of the hybrid plants have the gradually contracted upper portion of *S. cordata*, but are inclined to be blunt. They are not always strictly intermediate between the two parents, but sometimes approach more nearly to one parent or the other. This variation is correlated with the relation of the hybrid to the parents as shown by other characters.

It should be noted, too, in this connection that several species show marked sexual variations in the buds and branches. The staminate plants generally have larger and stouter buds and coarser branches. No willow that has come to our attention presents so conspicuous sexual variation as *S. cordata.* The variation relates not only to the size of the bud, but also to the form.

It is highly desirable to prove experimentally that hybridization may take place between these willows, and that as an effect of such hybridization individuals will be produced like our forms. These experiments we propose to undertake. It does not seem desirable to await the result, since European willows, as well as American, are inclined to hybridize freely beyond a doubt, and our observations published may encourage others to report observations upon similar forms.

A detailed description may assist in identifying these forms when found in other places.

Salix candida Flügge × *S. petiolaris* Smith.

Catkins, at anthesis, 2 cm. long, at the time of dehiscence of capsule 4–5 cm., upon slender pedicels which bear two or three foliaceous bracts. The bracts not enlarging as the capsules mature. Catkins rather closely flowered at anthesis, moderately loosely flowered at maturity. Capsules, at anthesis, elliptic-lanceolate, 1 ½ mm. long, style 1 mm., smooth and purple, capsule densely white tomentose, stigmas conspicuously two branched, the apices of the branches two lobed. Pedicels ½ mm., about equalled by the slightly clavate gland, surpassed by the black scales; at maturity lanceolate, 6–7 mm. long and creamy whitish and tomentose, pedicels not longer than at anthesis, the looser character of the catkin being due to the elongation of the main axis.

Leaves narrowly elliptical, tapering very gradually to an acute base and apex, obscurely toothed and scarcely revolute, smooth and light green above, finely tomentose and very white and veiny beneath, petioles 1 cm. long, twice the length of small lance-subulate, revolute stipules. Young leaves showing a decided tendency to blackening in drying.

A shrub two or three feet high diffusely spreading, the young part of the shoots pruinose tomentose, becoming, in age, brown and polished. Buds ovate oblong, blunt, slightly compressed, bud scales chestnut or darker, nearly smooth.

Salix candida Flügge × *S. cordata* Muhlenberg.

Staminate plant. Catkins at anthesis 3 cm. long, stout cylindrical, bracts at base small or none. Scales obovate-spatulate, dark at tip, hair long and crisp.

Leaves 8–10 cm. long, narrowed elliptical, tapering each way from the middle, rounded at base, rugose and very prominently veined, serrulate, light green and mostly smooth above, whitened and somewhat woolly beneath; petioles 8–10 mm. long, slender, stipules ovate, semi-cordate inconspicuously veined ¼–⅓ length of the petiole. Shoot pale chestnut, often hoary. Buds ovate-lanceolate, rather blunt, stout and but slightly flattened. Numerous spherical galls formed of distorted leaves.

Pistillate plant. Catkins at anthesis 2 cm. long, leafy bracted at base. Capsule ½ mm. slender more or less tomentose, styles long or short. At maturity 2½–4 cm., more densely flowered and narrower than in *S. candida.* Capsule in the forms near *S. cordata*, ovate-lanceolate, tapering gradually to the short style, not obtuse, 3–4 mm., long, sutures glabrous and prominent. In forms near *S. candida*, the capsules are larger, 5–8 mm., more obtuse at apex, densely tomentose, sutures not prominent. Style slender, 1–1½ mm., more obtuse at apex, style more slender. Pedicel shorter, not twice the length of the gland scarcely over ½ mm. long.

Leaves large lanceolate, mostly rounded at base, 10–15 cm. long, 1½–2 cm. broad, narrowing to an acuminate apex, somewhat rugose, strongly veined, primary veins nearly horizontal, margins subentire, upper surface becoming glabrous, lower, whitish from nearly glabrous to tomentose. Petioles short, 3–5 mm., stout, stipules longer than the petioles, ovate to broadly ovate, subcordate, veiny, serrate, subacute and revolute.

Shoots long, light chestnut, slender, often tomentose, buds small, ovate, blunt, varying from narrow to broad, more or less compressed, divaricate or appressed.

CORNELL UNIVERSITY.

Explanation of Plate 267.

PLATE I. 1. Leaf of *S. candida* × *S. cordata.* 2. Of *S. candida* × *S. petiolaris.* 3. Of *S. candida.* 4–17. Winter buds collected in March. 4, 5. *S. cordata* (staminate). 6, 7. *S. cordata* (pistillate). 8, 9. *S. candida* × *S. petiolaris* (pistillate). 10, 11. *S. candida* (staminate). 12, 13. *S. candida* (pistillate). 14, 15. *S. candida* × *S. cordata* (pistillate). 16, 17. *S. candida* × *S. cordata* (staminate).

Observations on Antidromy.

BY GEORGE MACLOSKIE.

It was stated in the BULLETIN of September and November, 1895, that every species of flowering plant, including Gymnosperms, appears to have two castes of individuals, which are two reversed counterparts of each other, as our right and left hands are. This 'antidromic' diversity is evidently a primitive character, and seems to pervade the whole organization of the plant; so that when it is masked or disturbed by secondary changes in one part we may detect it in others. Thus in *Berberis* and in *Cardamine* you may find it difficult to determine the antidromic phyllotaxy, but the order of flowers in the racemes is manifestly antidromic. The opposite leaves of *Acer* render it difficult to trace the right course of the spiral, but here the anthotaxy assists, and also in the seedling we are guided by the position of the first pair of foliage-leaves relatively to the cotyledons, in some individuals crossing somewhat to the right, in others somewhat to the left, when the same orientation is maintained. Whether we do or do not know the real significancy, the facts themselves are too definite to be any longer overlooked; and my present contribution is designed to add some new observations which must be taken account of as part of the data.

Erythronium is a good illustration of the unexpected way in which the evidence may come up. Hold the plant with the outer or sheathing leaf towards you, then some of the plants have the solitary flower nodding over to your right, and others have it nodding to your left. Spring-beauty (*Claytonia Virginica*) carries the same system further, and also introduces an additional factor. Hold a specimen with the two fleshy leaves next you, and note that the lowest flower arises to your right side from the peduncle, the bract arising towards your left side; another specimen held in the same way has the first flower on your left side, and order of bracts and subsequent flowers antidromic as compared with the first specimen. A new point in this is that the same tuber may have half a dozen plants, which are half and half of each caste according to some definite law. Thus the derivatives of the same tuber appear to be relatively antidromic, like the embryos produced by seeds from opposite sides of the same carpel. In my first paper I referred to *Iris* and to *Richardia* as having antidromic plants from the same rootstock; and now I find this to be the general system. Thus the skunk cabbage (*Symplocarpus foetidus*), of the same order as *Richardia*, has the spathes of a single plant always of the same kind; but nearly always the same clump has plants differing in the order of phyllotaxy and in the form of the spathes. In *Helonias* (of Liliaceae) the thick rootstock bifurcates so as to have two arms like the letter Y; and if you hold it with the branches of the Y towards you, the plant or plants borne on the branch next your right hand are evolved counter-clockwise (*i. e.*, with dextrorse phyllotaxy), whilst the plant or plants borne on the branch next your left hand are evolved clock-wise or sinistrorsely. This is as was noted in *Iris*, which belongs to a different order of plants. The two or three flowers along one arm being of the same caste remind us of the seeds borne on one valve of a bean-pod being alike to each other and being the antidromes of those on the opposite valve. In *Podophyllum* the examination is more troublesome, but so far as I can determine the result is the same. If we hold the plant with the smaller of the peltate leaves next us, then the uppermost of the sub-leaves (niederblätter) at the base of the stalk is next us, its tip towards our right and the other sub-leaves following in definite order in one plant, and all these relations reversed in another plant. In one plant thus held, the flower starting from the fork of its stalk turns to my right hand and in another to my left hand; the flower to my right has its most prominent sepal and its placenta distad-dextrad, and in the other plant these parts are distad-sinistrad. This diversity can be observed in very young plants starting from the ground. (In one specimen I found two flowers turning right and left respectively.) Now the underground stem sometimes bifurcates, one of its branches bearing one or more plants which are the antidromes of those borne by the other branch. In the same clump of *Carex* we find different individuals with antidromic phyllotaxy and antidromic order of evolution of flower-spikes. Perhaps these observations may cast some light upon the curious case of *Liquidambar* where the same tree may have antidromic branches; whilst some definite law seems to hold in them all.

The case of *Viola* may be cited because of its difficulty. The leafy stemmed Violets baffle us because of the angle of divergence being nearly that of a semicircle; the rosettes of the stemless species are not easily resolved, but in some cases, as *V. lanceolata*, etc., they seem to be antidromic. The flower on each peduncle being solitary, we can get no aid from the anthotaxy. The spur of the flowers furnishes a landmark, but whether this is antidromic or only of recent origin I have not been able to prove. If you hold a violet-flower with the spur towards you, in some cases the spur will protrude to your right of the pedicel, in other cases it will protrude towards your left.

This distinctive peculiarity cannot arise from the direct influence of sunlight, as it is shown by the very young flower-bud. I have not succeeded in correlating it with antidromic phyllotaxy; but generally all the flowers of one plant appear to be of the same caste, and the flowers of different plants from the same rootstock appear to differ. But the case is complex; thus a fleshy rootstock of *V. pedata* had four fleshy branches, each of them bearing a number of plants; branch 1 and 2 had each three flowers, two of them with spur to right, one with spur to left, and phyllotaxy dextrose; branch 3 was in all respects the converse of the others, and branch 4 was small and bore no flowers. Possibly the quasi-antidromy of these may be of the same character as in *Hibiscus*, where the same branch may have flowers twisted in contrary directions; this explanation may apply also to the cases reported to me by my friend, Arthur K. Harrison, of Lebanon Springs, N. Y., about the catkins of birches and *Ostrya*, of which he writes: "Whenever they occur in pairs it is the rule for one to be dextral and the other sinistral, the whorl in each rolling outward from the axis as viewed from the upper (inner) side of the branch; where there are three or more aments the central (end) one whorls sometimes one way, sometimes the other, depending, I think, upon which side of the branch they originate from," and he thinks the same rule applies to all species bearing terminal clustered catkins.

In my paper of November last I referred tentatively to some facts that seem to introduce the Ferns into the realm of antidromy. This view is confirmed by observations on the vernation of Cinnamon-Osmund. The fronds, in starting in the center of the plant, arise clockwise in some plants and counter-clockwise in others. I think that *Isoetes* affords similar evidence; but I have not been able to satisfy myself on this point.

The rootstock of the yellow waterlily (*Nuphar*) shows in its leaf-scars the order of development of the leaves to be distinctly antidromic as between two segments borne by the same stock; in the specimen before me the leaf-scars on the mother stock and on the right arm of the Y-like rootstock are arrranged in sinistrorse order, whilst those on the left arm are dextrorse. The following extract from a letter sent by my young friend, Professor Francis E. Lloyd, of Pacific University, Oregon, is very interesting, as it gives a connecting link between the antidromy of *Liquidambar* and that of rootstocks,—"I find that *Acer circinatum*, a plant o very singular habit, shows antidromy as between branch and branch in dichotomy. I am not sure of any observations. The plant is a shrub or small tree, and branches dichotomously with great regularity and the two branches of the Y twist to the right and left respectively." This is precisely as in the rhizome of *Helonias*. Professor Lloyd promises to report his observations; and I hope he will extend them to other plants on the Pacific coast.

PRINCETON COLLEGE, May 19, 1896.

New Species of Fungi from Mississippi.

BY S. M. TRACY AND F. S. EARLE.

In the BULLETIN for May, 1895, the writers described a number of new species of parasitic fungi, nearly all of which had been collected in Mississippi. During the past year we have identified a number of additional species, which are described here. Type specimens of all are in the herbaria of the authors, and of nearly all in the herbaria of the Department of Agriculture, Rutgers College, and Columbia and Harvard Universities.

CERCOSPORA CORNICOLA n. sp.

Epiphyllous, on irregular brown deadened spots without a definite border, 5–10 mm. Hyphae densely clustured from a nodular base, very short, continuous, somewhat flexuous, olivaceous, 11–15 by 3–4 μ; conidia slender, thread-like, somewhat curved, mostly continuous, hyaline or light olivaceous, 60–70 by 2–3 μ.

On languishing leaves of *Cornus florida;* Ocean Springs, Miss., September 29, 1895.

CERCOSPORA GLOTIDIICOLA n. sp.

Forming greenish black definite areas. Hyphae in small fasciculate clusters from a nodular base, 1–2-septate near the base, fuliginous, somewhat flexuous or geniculate, 50–70 by 5–6 μ; conidia slender, clavate, hyaline, faintly 2–5-septate, 70–80 by 2–4 μ.

On ripening legumes of *Glotidium Floridanum* with *Macrosporium Floridanum.* Ocean Springs, Miss., September 25, 1895.

CERCOSPORA MINIMA n. sp.

Epiphyllous, on brown irregular indeterminate areas. Hyphae densely caespitose, very short, continuous, flexed and irregular, olivaceous, about 10–15 by 4 μ; conidia thread-like, hyaline, faintly septate, 40–60 by 2 μ.

On *Pyrus communis*, Biloxi, Miss., September 2, 1895.

CERCOSPORA MYRICAE n. sp.

Epiphyllous, on dark brown indeterminate areas. Hyphae densely caespitose from a common nodular base, flexuous, 1–2-septate, light fuscous, 30–40 by 3–4 μ; conidia narrowly clavate, faintly several septate, hyaline, 100–125 by 3 μ, occasionally 175 μ long.

On *Myrica cerifera* var. *media*, Ocean Springs, Miss., September 15, 1895, and March 7, 1896.

CERCOSPORA SEPTATISSIMA n. sp.

Amphigenous, at first forming dark olivaceous angular areas bounded by the veins, at length widely effused; hyphae densely caespitose, irregularly bent and flexed, dark fuscous, distinctly many-septate, 40–60 by 5–6 μ, the septa usually only 4–6 μ apart; conidia slender, clavate, faintly septate, hyaline, 50–60 by 3–5 μ.

On *Verbena Caroliniana*, Columbus, Miss., October 12, 1895.

CERCOSPORA STYLISMAE n. sp.

Amphigenous, spots 2–3 mm. wide, white, surrounded by a dark raised border; hyphae in small slightly divergent clusters, nearly straight, fuscous-olivaceous, uniseptate near the base, 40–50 by 5–6 μ; conidia clavate, hyaline, faintly 3–5-septate, 50–70 by 4–5 μ.

On *Stylisma humistrata*, Columbus, Miss., October 16, 1895.

GLADISPORIUM XYRIDIS n. sp.

Blackening the persistent withering petals. Mycelial threads effused, slender, not nodular, branching, occasionally septate, fuliginous, 3–4 μ in diameter; conidia oval or somewhat fusiform, lighter colored than the mycelium, at length uniseptate, 7–10 by 4–5 μ.

On *Xyris fimbriata*, Ocean Springs, Miss., September 29, 1895

GLONIUM MACROSPORIUM n. sp.

Perithecia scattered, black, carbonaceous, broadly oval, obtuse' indistinctly longitudinally striate, lips closely connivent, about 1 mm. long; asci cylindrical, thin-walled, 8-spored, paraphysate, about 200 by 35–40 μ; sporidia very long, cylindrical, slightly curved, obtuse, unequally uniseptate, somewhat constricted, hyaline or at length slightly tinted, 60–70 by 12–15 μ.

On dead twigs of *Persea palustris*, Ocean Springs, Miss., May 26, 1895.*

The spores are twice as large as in any described species of *Glonium*. It approaches *Tryblidium* in its occasionally tinted spores, and there is one species, *T. turgidulum* P. & H. with spores even slightly larger than these.

HELMINTHOSPORIUM GENICULATUM n. sp.

Blackening the spikelets. Hyphae thinly effused, flexuous, nodular, septate, dark fuscous, 100–125 by 4–5 μ; conidia obtuse-fusiform, usually 4-septate, fuscous, central cell darker, apical cells lighter and nearly hyaline, usually abruptly geniculate on the enlarged central cell, 35–40 by 8–10 μ.

On *Eragrostis rachitricha* grown from imported seed, Starkville, Miss., October, 1894.

LEMBOSIA OLEAE n. sp.

Hypophyllous, spots none; perithecia scattered, large, flexuous and often branched or compound, about 400 by 80–100 μ; subiculum abundant, of long slender fuscous branching matted threads, 100 or more by 2–2.5 μ; sporidia unequally uniseptate, the shorter cell narrower, hyaline (but evidently immature), 12–15 by 4 μ.

On leaves of *Olea Americana*, Ocean Springs, Miss., February 4, 1894, and September 19, 1895.

LEMBOSIA ANDROMEDAE n. sp.

Hypophyllous, without definite spots; perithecia scattered or gregarious, linear and occasionally flexed, seldom branched, 250–400 by 50–90 μ; subiculm copious, of loosely interwoven and anastomosing fuscous threads, 25–40 by 2–3 μ; spores unequally

* Also found at Auburn, Ala., on various dead twigs. February, 1886.

uniseptate, oval or biconic, hyaline (perhaps immature), 8–9 by 2.5–3 μ.

On leaves and stems of *Andromeda nitida*, Ocean Springs, Miss., May 26, 1895.

This resembles *L. Oleae* in its hypophyllous growth, lack of spots or evident mycelium, and in its elongated stipitate asci, but it averages smaller and narrower, and has a less abundant and very different appearing subiculum. The two species seem to form a natural section or subgenus quite different from the other species, which are epiphyllous on more or less distinct spots, and with broadly oval or orbicular asci.

LEMBOSIA CLIFTONIAE n. sp.

Epiphyllous, on small irregularly rounded whitened areas 1–2 mm. in diameter; perithecia small, oval or linear-oval, usually straight and simple, rather thick and dense, 100–150 by 40–70 μ; subiculum very scanty or almost wanting, of few dark colored nodular flexuous threads, 15–25 by 2–3 μ; asci obovate, 20–25 by 10–15 μ; sporidia oval or biconic, about equally uniseptate, light fuligenous, 9–11 by 4–5 μ.

On living leaves of *Cliftonia ligustrina*, Ocean Springs, Miss., September 14, 1895.

LEMBOSIA ILICIS n. sp.

Epiphyllous, on ash-colored spots 3–5 mm. in diameter; perithecia usually linear and simple, rarely branched, 200–300 by 70–80 μ; subiculum of numerous slender fuscous threads, 15–20 by 2–3 μ; asci oval or oblong, not sipitate, 20–25 by 10–12 μ; sporidia elliptical, about equally uniseptate, slightly constricted, becoming olivaceous, 8–10 by 2.5–3 μ.

On living leaves of *Ilex glabra*, Ocean Springs, Miss., August 25, 1895.

The microscopic characters are much as in *L. angustiformis* T. & E. on *Ilex coriacea*, but the sporidia are even smaller and more delicate, the stellate blisters so characteristic of *L. angustiformis* are wholly wanting, and the gross appearance on the leaf is quite different.

LEMBOSIA RUGISPORA n. sp.

Epiphyllous, on irregularly rounded, dark brown spots covered with a radiating mycelium; spots 1–3 mm. in diameter; perithecia often stellately compound, or variously branched, about 400 by 100 μ when simple; subiculum rather scanty, of two kinds of threads, one pale, multiseptate, about 3–3.5 μ thick, the other darker, mostly continuous, frequently anastomosing, 2.75–3 μ, the darker threads bear occasionally erect sessile 4–8 septate dark fuscous clavate conidia, 30–45 by 7–8 μ; they also bear occasional sessile orbicular one-celled dark opake bodies (hyphopodia?) 5–6 μ in diameter; asci oval, 25–35 by 20–25 μ, sporidia large, oval, about equally uniseptate, at length dark fuscous, 15–20 by 8–10 μ. When fully matured and freed from the ascus the surface of the sporidia is seen to be prominently roughened by small wart-like projections.

On living leaves of *Persea palustris*, Ocean Springs, Miss., May 26, 1895.

LOPHODERMIUM CYRILLICOLUM n. sp.

Amphigenous, on irregular brown sub-arid red-bordered spots; perithecia innate, depressed and finally collapsing, broadly oval, lips connivent, 1–1.5 mm.; asci cylindric-clavate, about 65–75 by 10 μ; paraphyses very numerous, thread-like, exceeding the asci, tips not recurved; sporidia filiform, nearly equalling the ascus, straight and parallel with it.

On living leaves of *Cryilla racemiflora*, Ocean Springs, Miss., November, 1894.

PESTALOZZIA UNISETA n. sp.

Acervuli scattered, erumpent, oval or elliptical, opening by an irregular elongated fissure, 50–100 by 100–200 μ; conidia elliptical, often somewhat curved, 5-septate, the four medial cells dark fuscous, terminal cells hyaline, 25–30 by 7–8 μ; arista single, hyaline, 8–10 μ long, abruptly bent at a sharp angle with the spore; stipe very short, bent to the same side as the arista.

On bark of "Prof. Gulley" grape, Starkville, Miss., March 16. 1896.

SCOLECOTRICHUM EUPHORBIAE n. sp.

Hypophyllous, forming prominent olivaceous tufts; spots none; hyphae very numerous, in large tangled clusters, long and flexuous, olivaceous, occasionally septate, marked for more than half their length by scars left by the pleurogenous conidia, 225–275 by 4–5 μ; conidia oval or obovate, with a distinct scar at the base, hyaline, minutely granular, continuous or at length faintly uniseptate, not constricted, 20–25 by 7–8 μ.

On *Euphorbia Preslii*, Starkville, Miss., Sept. 27, 1895. Also from Auburn, Ala., September, 1892 (Duggar).

This is placed here with considerable doubt, as the hyphae are quite different from those of any described species of *Scoleco-*

trichum, though the conidia appear to be typical. It is perhaps generically distinct, but rather than establish a new genus in this already overcrowded and confused group, we write it as above.

TILLETIA CORONA Scrib.

This striking smut was first observed by Scribner on *Homalocenchrus oryzoides* and *H. Virginicus* near Washington, D. C., in 1886, and specimens collected by him were distributed by Ellis under the above name in N. A. F., as No. 1896. It has since been collected by Waite in Illinois and Missouri on *Homalocenchrus*, on *Panicum virgatum* in Illinois, and by the writers in Mississippi on *Homalocenchrus lenticularis* and *H. Virginicus* at Columbus, on *H. lenticularis* at Bairds, and on *Panicum sanguinale* at Starkville. Specimens on *Panicum virgatum* in the herbarium of the Division of Vegetable Pathology at Washington bear the unpublished herbarium name *T. pulcherrima* Ell. and Gal., but they seem identical with the forms on the other hosts. As no description of this species has been published, we make the following, drawn from an examination of all the above mentioned material.

TILLETIA CORONA Scrib.

Infesting the ovaries, transforming them into black curved horn-shaped masses sometimes 1 cm. in length, the outer covering firm in texture, showing traces of the cellular structure of the ovary; spores large, spherical, 22–26 μ, dark fuscous and densely opake when mature, but covered with a hyaline envelope 2 μ or more in thickness, the surface of the dark central mass covered by minute but deep alveolations, this structure being obscured by the opacity of the mature spore, when the thin alveolar walls can be seen only at the periphery, where they appear like numerous spinous projections reaching almost through the hyaline envelope. The remains of the fruiting hyphae often persist on the younger spores as a false pedicel.

On various grasses, Mississippi, Illinois, Missouri and Washington, D. C.

Several other species of *Tilletia* have similar large spores with a hyaline outer covering, but in the others the spores are less dark and opake, and the alveolar reticulations are much larger and more easily recognized. These species form a natural group quite distinct from the other *Tilletias*, and might well be considered as constituting a distinct genus.

USTILAGO SPOROBOLI n. sp.

Infesting the ovaries, forming a hard greenish compact mass 2–3 mm. in diameter; spores dark fuscous, oval or subglobose; epispore thickly covered with broadly conical tuberculations, 12 to 12 by 15 μ.

On *Sporobolus junceus*, Columbus, Miss., October 12, 1895.

Usually but few infested ovaries occur on a plant, and the panicle retains its normal form.

WINTERIA LOBATA n. sp.

Hypophyllous, superficial; perithecia scattered, turbinate, collapsing to patellate, and becoming variously ridged and lobed on the thick margins, thin, fragile, not distinctly cellular, black externally and greenish blue within, 300–400 μ; asci numerous, thin-walled, ovate, short-pedicellate, about 35 by 15 μ, involved in the thread-like gelatinous greenish paraphyses; sporidia hyaline, narrowly elliptical, acute, faintly 3-septate.

On living leaves of *Ilex coriacea*, Ocean Springs, Miss., February 16, 1894, and August 20, 1895.

The February specimens seem slightly immature, so that the characters of the sporidia are made out with difficulty, and the August specimens appear to be entirely sterile. The same fungus has been detected with specimens of *Asterina peliculosa* on the same host collected in Florida by Th. Holm, and in Georgia by M. B. Waite.

ZIGNOELLA MAGNOLIEAE n. sp. (Subgenus Trematostoma).

On whitened areas, thickly scattered and sometimes confluent, hemispheric, base slightly sunk in the matrix, rounded above, not papillate, finally opening by a large round ostiolum, black, carbonaceous, surface roughened, about ½ mm. in diameter; asci narrowly elliptical, long-stipitate, 130–150 by 12–15 μ; paraphyses filiform, abundant, exceeding the asci; sporidia hyaline, elliptical, ends rounded, 4-guttate, finally 3-septate, not constricted, 22–24 by 5–6 μ.

On bark of dead *Magnolia glauca*, Ocean Springs, Miss., March 7, 1896.

Jasione montana in New England.

In the summer of 1894 a fragment of a plant was handed to me by Mr. J. T. Smith, who collected it the year previous (July, 1893), while wheeling along the old West road on Conanicut Island, R. I., where, as he said, it grew in "great profusion." The specimen was so fragmentary that little attempt was made to determine its name, but it was laid aside with the data to await future collections or information.

Early in July, 1895, a complete plant of the same was sent from Conanicut Park by Mrs. H. R. Teel, with a request for its name. It proved to be the European Sheeps's-bit (*Jasione montana* L.). Early in August (1895) I visited the island and walked the whole length of the West road, from the north end of the island to the village of Jamestown. From observations on this walk, and from information furnished by Mrs. Teel, who has resided on the island for more than a dozen summers, I learned that the plants have been growing for at least five years, at a station about 1 ¼ miles southwest of the Conanicut Park Hotel, where, at the time of my visit, it gave a decided blue tinge to several acres of fields and sandy roadsides. The field where it was most abundent showed signs of having once been cultivated, but not very recently.

It is reported to grow sparingly on the East road about a mile from the above mentioned station, and the specimen sent by Mrs. Teel was from the East road about one-fourth mile south of the hotel. Specimens have also been collected by A. Green, Esq., Mrs. S. O. Metcalf and others, at the West road station. Mr. Greenman of the Gray Herbarium writes that it was reported to them from Reading, Mass., in 1891 by Mr. W. H. Manning. The last mentioned botanist informs me that a few plants only were noticed, growing with *Filago minima*, between rows of young nursery stock imported from France, but he believes it did not appear the next year. He has an idea that it is growing on the Boston Back Bay Fens, but is not sure. According to Prof. Britton it has been collected on ballast grounds on New York Island, as shown by specimens in Columbia University Herbarium.

Perhaps some readers of the BULLETIN can add to this record. If so, the writer would be pleased to hear from them. Can anyone give any definite information in regard to the Boston Back Bay locality?

The plant, as it occurs in Rhode Island, is 1½–2 ft. high, sometimes scarcely branched, but usually much branched either below or above; with solitary naked pedunculate involucrate head-like clusters of blue flowers, ½–¾ of an inch in diameter. Flowers pedicellate; calyx-lobes and the divisions of the deeply parted corolla linear; anthers united; ovary and fruit 2-celled; ovules and seeds numerous.

J. FRANKLIN COLLINS.

BROWN UNIVERSITY HERBARIUM, PROVIDENCE.

Botanical Notes.

The second annual meeting of the Botanical Society of America will be held in Buffalo, N. Y., on Friday and Saturday, August 21 and 22, 1896. The Council will meet at 1:30 p. m. on Friday, and the Society will be called to order at 3 p. m., by the retiring president, Dr. William Trelease, Director of the Missouri Botanical Garden. The President-elect, Dr. Charles E. Bessey, Professor of Botany in the University of Nebraska, will then take the chair. The afternoon session will be devoted to business. At the evening session the retiring President will deliver a public address on "Botanical Opportunity." The sessions for the reading of papers will be held on Saturday at 10 a. m. and 2 p. m. The Botanical Society of America is affiliated with the American Association for the Advancement of Science, whose sessions this year begin on Monday, August 24th, in Buffalo.

C. R. BARNES, *Secretary*.

Reviews.

The Structure and Development of the Mosses and Ferns (Archegoniatae). By Douglas Houghton Campbell. 544 pp. 8vo. Price $4.00. Macmillan & Co. 1895.

This book has been welcomed by all students of the Mosses and Ferns and has everywhere been received with gratitude. From the fact that it gives us in a compact form and clear style the most recent results of foreign investigation into the life-history and embryogeny of these plants, with a complete index to the literature from which these results have been obtained, it is invaluable; and its worth is further enhanced by the original investigations which Dr. Campbell has made upon some of our native species. We welcome these with peculiar pleasure, and have only ourselves to blame, if from a systematic standpoint we can see where it might have been bettered. The chapter on the Bryineae is peculiarly interesting to us, for the light thrown by morphological investigations into several mooted questions of classification is particularly welcome at this time. There is great divergence of opinion among recent monographers, as to the systematic position of the cleistocarpous mosses. Braithwaite scatters them among the higher families of mosses, and Limpricht recognizes fifteen genera, including some species which are very doubtful, such as *Physcomitrella Hampei* Limpr. Dr. Campbell gives us the comparisons between *Ephemerum*, *Phascum* and *Pleuridium* with *Funaria*, and the results are very interesting, but we venture to suggest that there are two American mosses which would better represent perhaps the two extremes, *Micromitrium megalosporum* Aust. and *Bruchia longicollis* Eaton. The morphology of the stem and leaves in *Fissidens*, *Bryoziphium*, *Schistostega* and *Leucobryum* are also particularly instructive from a systematic standpoint, as well as the conclusions reached with regard to the place which *Archidium* and *Buxbaumia* should hold as the extremes of differentiation in the sporophyte. We are pleased to see that *Archidium Ravenelii* Aust. has been figured by Dr. Campbell, and agree with him that the question as to whether the cleistocarpous mosses are rudimentary or degenerate forms is a difficult one to decide; yet we feel a personal bias toward the opinion that they are primitive forms.

E. G. B.

Wild Flowers of the North-Eastern States, being three hundred and eight individuals common to the northeastern United States, drawn and described from life. Ellen Miller and Margaret Christine Whiting. Cloth, 4to, pp. 622, plates 308. G. P. Putnam's Sons, New York, 1895.

This is the latest of the many recent attempts to popularize and render easy the study, or rather the naming, of plants. The work makes no pretense of being scientific, and the authors state that the collection of flowers represented on its pages was gathered together "with the hope of making their acquaintance more easy to non-scientific folk than the much condensed manuals of our flora are able to do."

The family sequence is that of Gray's Manual, as is also the nomenclature and terminology, in regard to which the authors ingeniously remark: "The choice of botanical terms has been intentionally confined to those which long usage has so wrought into common speech that they have practically ceased to belong to strictly scientific nomenclature."

The figures are sketchy, but are perfectly true to nature, are entirely lacking in stiffness or conventionality, and give in every instance an excellent general idea of the plant's appearance in the field. The descriptions are simple; they include both the botanical and popular names, and many little notes and hints which never find place in a scientific work. The exceedingly popular style of the text which prevails throughout may be judged from the following extract under "*Hypericum maculatum*, Lesser St. John's Wort. * * * This little plant's habits are in marked contrast to its larger brother John, for it is as tidy in rolling up into tiny bundles its faded petals as the other is careless of appearances."

Taken all in all, the book will always be useful for assistance in determining the names of the plants which are figured, and it is a matter for regret that the work has not been carried any further. It compares more than favorably with most other works of its kind.

A. H.

Notes on the ninth Edition of the London Catalogue of British Plants. G. Claridge Druce. Annals of Scottish Natural History, 1896: 38–53.

Our attention has been called to this interesting paper by the learned editor of the "Journal of Botany" in the February issue of his now happily enlarged organ. Mr. Druce's review of the "London Catalogue" is critical and valuable, including matters of typography, classification, generic limitations, capitalization of specific names, citation and nomenclature. He points out that a large number of generic and specific names adopted in the Catalogue are antedated by others, and calls for the abandonment of the newer ones. We quote a few sentences, in order to show that Mr. Druce is sound on principles of nomenclature:

"The names adopted for many plants differ from those given in the preceding Catalogue; but the change is in almost all cases caused by following the only safe guide, *i. e.*, the law of priority of nomenclature."

"Many of the names given in the Catalogue do not follow the law of priority. It would be well to carry out this law as far as possible."

"In the Catalogue brackets are used to enclose the names of some authorities for varietal names. They appear to be used when a writer has described as a species a plant to which is now given only varietal rank, or when a writer has placed it as a variety of a species which then bore a different name from the one now employed."

"In the preface, as already alluded to, a statement is made that pre-Linnaean authorities for genera are not cited. It would have been better to have made the statement more precise, and to have stated that the date whence the citation, either of species or genera, should commence, is the year 1753, when the 'Species Plantarum' was published—the first work in which the binomial system of nomenclature was consistently adopted. As it is, in the present Catalogue the names of several authors which are cited are, strictly speaking, pre-Linnaean; that is, they published the genera to which their names are attached before the issue of the 'Species Plantarum.' By citing authors before the date 1753 (and after the first edition of the 'Genera Plantarum' in 1737) a host of genera are brought into competition with existing names, a danger which it would be well to avoid. Also the date 1753 received the assent of the late Alphonse de Candolle when the writer suggested it to him shortly after the publication of Kuntze's 'Revisio Generum Plantarum,' with its vast number of changes of plant names. Moreover, this date has been recommended by the Berlin committee of botanists, as well as by the conference of botanists which met at Genoa; and it is adopted by the majority of botanists in Europe and America."

"To one method of citation used in the Catalogue the writer must raise a protest, as it seriously threatens to hinder that uniformity of nomenclature which can be obtained only by adopting the law of priority. Mr. Hanbury himself, in his arrangement of the Hieracia, consistently and correctly uses the Linnaean names of *Hieracium alpinum* and *H. Murorum* in a more restricted sense than did Linnaeus."

"But, unfortunately, another practice, which is, I think, to be strongly deprecated, has been followed in some cases, which consists in giving up the older name, which, according to the rule of priority, should be adopted for a more recent one, because the species as first described is now considered to be made up of more than one species." N. L. B.

Flora of Nebraska, part 21, Rosales. Per Axel Rydberg. Edited by the members of the Botanical Seminar of the University of Nebraska. Lincoln, 1895 (issued December 30). $1.00.

This is a very welcome addition to local botany and is the second part issued of this excellent work.

After discussing certain points concerning the morphology and terminology of different parts of the flower, the author takes up the order of Calyciflora, beginning with the family Rosaceae. Schemes of the relationships of the higher groups are inserted and keys to all the groups from the suborders to species are given. The idea in the treatment of the families and species is segregation, thus avoiding much confusion. In place of Leguminosae we find Caesalpinaceae, Mimosaceae and Papilionaceae, while the Grossulariaceae are taken out of Saxifragaceae.

Psoralea collina, Kuhnistera candida diffusa, Lathyrus ornatus flavescens, L. ornatus incanus and Ribes aureum chrysoccum are described as new. The nomenclature is based on the most advanced and practical ideas. An excellent feature of the work is the numerous original plates which contain figures showing the diagnostic characters of the several tribes. All the Nebraska species of *Astragalus* are figured. J. K. S.

The Potomac Formation. Lester F. Ward. 15th Ann. Rept. U. S. Geol. Surv. 1893–94 [Washington, 1895], 307–397. *pl. 2–4* and illust. in text.

The value of this contribution will be appreciated by the geologist more than by the botanist, but the botanist will find it of interest for the reason that palaeobotany plays such an important part in it throughout. The flora of the Potomac Formation is represented in part by the most ancient dicotyledonous angiosperms of which we have any knowledge—archaic types, in which the outlines of subsequent modern genera are foreshadowed. The following new species are figured: *Scleropteris Vernonensis*, *Zamia Washingtoniana*, *Casuarina Covillei*, *Sagittaria Victor-Masoni*, *Antholithus Gaudium-Rosae*, *Populus Potomacensis*, *P. auriculata* and *Celastrophyllum Hunteri*.

As a demonstration of the value of palaeobotany in determining the stratigraphic relations of beds this contribution is a masterpiece and its appearance will be welcomed by all workers in the geology and palaeontology of the central plain region.

A. H.

Proceedings of the Club.

TUESDAY EVENING, APRIL 9TH, 1896.

President Brown in the chair and thirty members present.

Miss Fanny A. Mulford and Mr. Charles W. Mulford were elected active members.

Dr. Schneider read his announced paper, "The Uses of Lichens," giving an instructive account of the past and present uses of these plants in medicine and the arts.

The next paper was that of Mr. P. A. Rydberg entitled "Preliminary notes on a Revision of the North American Species of *Potentilla* and related Genera." This was accompanied by numerous specimens and drawings and elicited remarks from the President and Mrs. Britton.

Mrs. Britton then read a paper, "Notes on Mexican Mosses," giving a short historical account of the various collections of mosses which have been made in Mexico and in comparing the number of genera and species common to Mexico and the United States. Numerous specimens were exhibited.

WEDNESDAY EVENING, APRIL 29TH, 1896.

President Brown in the chair and sixty-four persons present.

Dr. Britton announced his associates on the Field Committee as Messrs. Fay and Stottler. He reported eighteen persons present at the Field meeting of April 25th, at Prince's Bay, S. I.

Major Timothy E. Wilcox, of Fort Schuyler, N. Y., then read his paper, "Botanizing in Arizona," describing many of the little known plants of that Territory, and ascribing to some of them quite new economic values. Lantern slides from original photographs were shown.

Mr. Cornelius Van Brunt rapidly exhibited a number of colored lantern slides of plants growing in the city parks, accompanying them with short descriptions and anecdotes. Most of these slides had never been exhibited before. In response to a request, he described how Mrs. Van Brunt had colored these slides entirely by hand, by the use of aniline pigments, the ordinary gelatine plates being used for the photographs.

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HYBRIDS OF SALIX CANDIDA.

Contributions from the Herbarium of Columbia College.

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VOLUME I.

No. 4. A List of Plants Collected by Miss Mary B. Croft at San Diego, Texas. By N. L. Britton and H. H. Rusby (1887), ... 25 cents.

No. 5. New or Noteworthy North American Phanerogams. By N. L. Britton (1888), ... 25 cents.

No. 6. An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1886–1887. By N. L. Britton. (Twenty-three parts published; not yet completed.)

No. 7. The Genus *Hicoria* of Rafinesque. By N. L. Britton (1888), . . 25 cents.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., June 30, 1896. No. 6.

A preliminary Revision of the North American Isotheciaceae.

By A. J. Grout.

During the past winter a critical study of this family of mosses has been made at the Herbarium of Columbia University. Wishing to obtain more material illustrating the distribution of the species, a brief summary is here presented, giving the distribution, so far as can be determined, from material at hand. Persons having specimens from outside the range here indicated will confer a great favor by sending them to me at the Herbarium of Columbia University. If duplicates can also be sent, a suitable return will be made for them. I am already greatly indebted to several persons for aid in my work, for which acknowledgments will be made in the final publication.

ISOTHECIACEAE Spruce, Ann. and Mag. Nat. Hist. (II.) **3**: 285. 1849.

Gametophyte generally large, never minute. Primary stems creeping, radiculose. Paraphyllia lacking (except in *Climacium*). Leaves smooth, often plicate or concave; median leaf-cells linear, alar cells quadrate (except in *Holmgrenia*).

Sporophyte. Seta smooth, twisted. Calyptra cucullate. Operculum conic to conic-rostrate. Columella persistent. Capsule erect, straight, not conspicuously contracted under the mouth when dry. Peristome double, well developed; teeth lanceolate, articulate. Segments of endostome linear to lanceolate, attached to a narrow basal membrane, free, or adherent to the teeth in two species of *Pylaisiella*; cilia rudimentary or wanting. Spores roughened.

Distinguished from the Brachytheciaceae by the straight erect capsule, absence of cilia, short basal membrane, capsule not contracted under the mouth when dry.

Homalothecium and certain species of *Brachythecium* (notably *B. acuminatum*) have the capsule characters of this family, but their other characters show their relationship to be with the Brachytheciaceae.

Key to the Genera.

Leaves veined, vein single, extending to the middle of the leaf or beyond.
4. CLIMACIUM.
Leaves veinless or the veins short and double.
Alar cells not quadrate. 3. HOLMGRENIA (*Orthothecium*).
Alar cells quadrate.
Complanate foliate (except *E. repens* and *E. seductrix*) with very large persistent annulus (except *E. Drummondii*).
1. ENTODON (*Cylindrothecium*).
Leaves more or less falcate-secund especially at the tips of branches; annulus narrow. 2. PYLAISIELLA (*Pylaisia*).

1. ENTODON. C. Muell. Linnaea, 18: 704. 1844. Also Bot. Zeit. 1894: 740.

[CYLINDROTHECIUM Br. & Sch. Bry. Eur. fasc. 46 and 47. *pl. 464, 465.* 1851.]

Leaves obtuse, quadrate; alar cells of 2 or 3 layers. 7. *E. orthocarpus.*
Leaves acute or acuminate, quadrate, alar cells of one layer.
Leaves gradually narrowly acuminate; segments of endostome adhering to the teeth. 8. *E. brevisetus.*
Leaves acute to apiculate; segments free.
Teeth conspicuously hyaline margined. 6. *E. repens.*
Teeth not conspicuously hyaline margined.
Annulus apparently none; seta yellow. 5. *E. Drummondii.*
Annulus of narrow small cells; seta red. 2. *E. seductrix.*
Annulus large, of large cells.
Teeth uniformly papillose-roughened. 3. *E. compressus.*
Teeth conspicuously striolate above; leaves serrate.
4. *E. Sullivantii.*
Teeth not conspicuously striolate; leaves nearly entire.
1. *E. cladorrhizans.*

1. ENTODON CLADORRHIZANS (Hedw.) C. Muell. Linnaea, 18: 707. 1844.

Cylindrothecium cladorrhizans Schimp. Syn. Ed. 1: 514. 1860.
Entodon Transylvanicus Demet. Hedwigia, 23: 81. 1884.
Entodon minutipes Kindb. Can. Rec. Sci. 1894: 21. 1894.

Not uncommon in North America east of the Mississippi; Minnesota (Holzinger), Iowa (A. S. Hitchcock and Miss McGee).

Limpricht, in Rab. Krypt. Fl. 4: part 3: 30, separates *E. Schleicheri* of Europe from *E. cladorrhizans* and also cites *E. cladorrhizans* as European. That the two species are distinct can hardly be doubted, if the peristomal teeth be compared. *E. acicularis* C. Muell. and Kindb. in Macoun, Cat. Can. Pl. part 6, 176, [Macoun's 816 (in part) and 170,] is only a peculiar form of *E. cladorrhizans*. It may possibly prove to be a good variety. It is characterized by having a peculiar brownish green color, the tips of branches lighter; very short turgid branches which are largest in the middle and at the largest part bear leaves as large as the stem leaves; capsule and seta much shorter and teeth more perforate than is typical. *E. Transylvanicus* Demeter and *E. minutipes* Kindb. are said by Limpricht, l. c. to be identical, and only slightly divergent forms of *E. cladorrhizans*. I have been unable to see specimens ot either.

2. ENTODON SEDUCTRIX (Hedw.) C. Muell. Linnaea, 19: 214. 1847.

Neckera seductrix Hedw. Spec. Musc. 208. *pl. 47. f. 8–13.* 1801.

Pterigynandrum Carolinianum Brid. Musc. Recent. Suppl. 1: 132. 1803.

Cylindrothecium seductrix Sull. in A. Gray, Man. Ed. 2: 664. 1856.

A very variable species and appropriately named, found only in the eastern United States. Common in the Appalachian region from Canada to the Gulf; less frequent northward and not reported far west of the Mississippi. I have seen no specimens from northern New England or eastern Canada.

Dallas, Texas, (J. Ball), Missouri, Kansas, Wisconsin, Minnesota, Ontario.

2a. E. SEDUCTRIX LANCEOLATUS n. var.

Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering gradually to the serrate acute apex. On rotton wood, Hanging Rock, Wabash Co., Ill., April 3, 1890. (J. Schneck.)

2b. E. SEDUCTRIX MINUS Aust. Mss. in herb.

Entire plant much reduced, dirty green; leaves, seta and capsule shorter than in type. Capsule 1.5–2 mm. long, its length about 3 times its diameter.

Ohio, Sullivant. Sand hill near Augusta, Ga., J. D. Smith, Feb. 2, 1877. A portion of no. 388 of Sull. and Lesq. Musc. Bor. Am., in Columbia Herb., issued as *Cylindrothecium compressum* Br. and Sch. is this variety.

2c. E. SEDUCTRIX DEMETRII (Ren. & Card.).

Entodon Demetrii Ren. & Card. Rev. Bry. **20**: 14. 1893.

Stems irregularly divided and branched, strongly complanate-foliate, slender, having almost exactly the facies of *E. compressus*; leaves ovate, gradually acute, very entire. Peristomal teeth often irregularly perforate.

On stones at top of well, Emma, Saline Co., Mo., Rev. C. H. Demetrio.

3. ENTODON COMPRESSUS (Hedw.) C. Muell. Linnaea, **18**: 707. 1844.

Leskea compressa Hedw. Spec. Musc. 232. *pl. 56. f. 1–7.* 1801.

Cylindrothecium compressum Br. & Sch. Bry. Eur. fasc. 46 and 47. 1851.

Rhode Island, New Jersey, Ohio, Illinois, Kansas, Nebraska, Missouri. Rare.

4. ENTODON SULLIVANTII C. Muell. Can. Rec. Sci. **1894**: 21. 1894.

Neckera Sullivantii C. Muell. Syn. Musc. **2**: 65. 1851.

Cylindrothecium Sullivantii Sull. in A. Gray, Man. Ed. **2**: 664. 1856.

North Carolina (Gray and Sullivant), Tennessee (Lesquereux), South Carolina. Very rare.

5. ENTODON DRUMMONDII (Br. & Sch.) Jaeger & Sauerb. Ber. St. Gall. Nat. Gesell. 1876–77: 282.

Cylindrothecium Drummondii Br. & Sch. Bry. Eur. fasc. 46 and 47. 1851.

Southern U. S., east of the Mississippi, north to Tennessee and North Carolina. Northern Mexico (Pringle).

6. ENTODON REPENS (Brid.).

Pterigynandrum repens Brid. Musc. Recent. Suppl. 1: 131. 1806.

Platygyrium repens Br. & Sch. Bry. Eur. fasc. 46 and 47. *pl. 458.* 1851.

Cylindrothecium repens De Not. Epil. 214. 1869.

North America, east of the Rocky Mountains. Common.

6a. ENTODON REPENS ORTHACLADOS (Kindb.).

Platygyrium repens orthoclados Kindb. in Macoun, Cat. Can. Pl. 6: 172. 1892.

Platygyrium repens sciuroides Limpr. Rab. Krypt. Fl. 4: part 3, 7. 1896.

Platygyrium repens ramulis elongatis Bry. Eur. *pl. 458. f. 3.*

Branches much larger and longer than in the species, leaves larger, loosely imbricate, shortly bicostate.

Ontario, Macoun Canadian Mosses, no. 259.

7. ENTODON ORTHOCARPUS (La Pyl.) Lindb. Musc. Scand. 39. 1829.

Hypnum Schreberi orthocarpum Brid. Bry. Univ. 2: 422. 1827.

Hypnum orthocarpum La Pylaie; Brid. Bry. Univ. 2: 422. 1827.

Cylindrothecium concinnum Schimp. Syn. 515. 1860.

Colorado, Brandegee. Although collected but once and in a sterile state, Brandegee's specimens are undoubtedly this species.

8. ENTODON BREVISETUS (Hook. & Wils.) Jaeger & Sauerb. Ber. St. Gall. Nat. Gesell. 1876–77: 291.

Neckera breviseta Hook. & Wils. Lond. Jour. Bot. 4: 419. *pl. 24. f. a.* 1842.

Cylindrothecium brevisetum Br. & Sch. Bry. Eur. fasc. 46–47. 1851.

New Jersey, Virginia, Pennsylvania, Ohio, Missouri, Canaan Forks, New Brunswick (J. Moser). Rare.

ENTODON MACOUNII C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 177. 1892.

Authentic specimens from type locality in Herb. Macoun are not referable to *Entodon* at all, but are one of the complanate-foliate Hypneae. Capsules are needed to classify them. There are no quadrate alar cells and the cells at the angles are so little enlarged as to be scarcely noticeable.

ENTODON (?) EXPALLENS C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 177. 1892.

This species belongs to the same group as *E. Macounii.*

ENTODON SUBFLACEUS C. Muell. & Kindb. Can. Rec. Sci. 1894: 21.

I have been unable to examine any specimens of this species, as Prof. Macoun has none in his herbarium.

CYLINDROTHECIUM FLORIDANUM Duby, Regensb. Flora, 58: 284, is probably not related to *Entodon,* as the horizontal capsules described are not in accordance with the characters of the genus. We have not been able to obtain a specimen of it, as the type cannot be found in the Duby nor the Boissier herbaria at Geneva.

2. PYLAISIELLA Kindb. Can. Rec. Sci. 1894: 21.

[PYLAISIA Br. & Sch. Bry. Eur. fasc. 46–47. 1851. Not Desv. 1814.]

The generic name *Pylaisia* was first used by Desvaux in 1814 to designate a new genus named in honor of De La Pylaie. The specimen upon which his genus was founded is stated to be nothing more than a depauperate form of *Hypnum denticulatum* L.

In 1851 Bruch and Schimper took up the name for a new genus founded on *Hypnum polyanthos* Schreb, thus publishing a homonym.

DeNotaris in 1869 extended the genus *Pylaisia* by including *Orthothecium* of the Bryol. Eur., and in this extended form it was degraded by Lindberg in 1879 to a sub-genus of *Stereodon* of Mitten. The name *Pylaisiella* proposed by Kindberg for two species of the genus, viz.: *P. velutina* and *P. subdenticulata*, is very appropriate, as it will preserve the name of De La Pylaie.

Segments of the endostome entirely free from the teeth.	
Operculum conic; cilia present, rudimentary.	1. *P. polyantha.*
Operculum short, rostrate; cilia lacking.	2. *P. subdenticulata.*
Segments partially or wholly adherent to the teeth:	
Partially adherent; spores 18–24 μ.	3. *P. intricata.*
Wholly adherent; spores 25–30 μ.	4. *P. velutina.*

1. Pylaisiella polyantha (Schreb.).

Hypnum polyanthos Schreb. Spicil. Flor. Lips. 97. 1771.

Pylaisia polyantha Br. & Sch. Bry. Eur. fasc. 46 and 47. *pl. 455.* 1851.

Stereodon polyanthos Mitt. Journ. Linn. Soc. **8**: 40. 1865.

Pylaisia heteromalla Br. & Sch. Lond. Jour. Bot. **2**: 669. 1843.

Hypnum polyanthum pallidifolium C. Muell. Syn. **2**: 337. 1851.

Pylaisia Ontariense C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 174. 1892.

Canada and northwestern United States (Macoun); Kakabeka Falls, Ont. (Mrs. Britton); Saskatchewan and Rocky Mountains (Bourgeau); Santa Fé (Fendler); White Mountains (James); Montana (R. S. Williams); Pike's Peak, Colo. (S. L. Clarke); Minnesota (F. F. Wood). Apparently widely distributed in Canada and along the northern border of the United States in mountainous regions, but rather infrequent and local.

The typical American form of this species is quite variable in leaf characters, even on the same plant, but it differs constantly from European specimens in that the leaves are shorter, more abruptly acuminate and more broadly ovate-lanceolate. The length of the leaf of the European form averages 1.5 mm.; that of the American 1 mm., though I have found one plant whose leaves measured 1.4 mm. The length of the acumination of the perichaetial leaves is also very variable. It may be that our forms of this and the next species are but two varieties of the European *P. polyantha.* The American *polyantha* answers very closely to the description of *P. polyantha brevifolia* Lindb. & Aruell, Musc. Asiaebor. 152. 1890. I have seen the type specimens of *P. heteromalla* from Schimper's herbarium and not only are they *P. polyantha*, but

Schimper himself indicated clearly on his labels that he did not consider it a good species; Drummond's no. 222, on which this species was founded, is evidently somewhat mixed, as the Columbia Herbarium specimen is *P. intricata.*

1a. PYLAISIELLA POLYANTHA JAMESII (Sull.) E. G. Britton.

Pylaisia Jamesii Sull. & Lesq. Musc. Bor. Am. Ed. 2. 383. 1865.

Pylaisia subdenticulata obscura Lesq. & James, Mosses N. A. 309. 1884.

Gametophyte smaller than the type; leaves shorter, broadly ovate-lanceolate, shortly bicostate; length of leaf-cells 4–6 times their diameter; quadrate alar cells numerous; perichaetial leaves shorter, abruptly acuminate.

Sporophyte with shorter subulate-lanceolate peristomal teeth, which are also shorter than the segments.

On the ground and roots of trees. Chelsea, Mass. (James.)

This variety has the appearance of *P. subdenticulata* because of its reduced size, otherwise it has the characters of American *polyantha*, such as conic operculum and rudimentary cilia.

1b. PYLAISIELLA POLYANTHA PSEUDO-PLATYGYRIA (Kindb.).

Pylaisia pseudo-platygyrium Kindb.; Macoun, Cat. Can. Pl. 6: 173. 1892.

Pylaisia filari-acuminata Kindb. l. c. 174.

Leaves narrowly long-acuminate; upper branch leaves distantly serrate-dentate along sides of acumination; inner perichaetial leaves often long-acuminate, serrate-dentate along the acumination; cilia 1 or 2, better developed than in the type.

Type locality, shores of Lake Nipigon, Ontario. Also found on the west side of the Columbia River, at Revelstoke, B. C.

On decayed trunks and on "logs subject to inundation."

Exsiccata: Macoun, Can. Musc. 626. (*Pylaisia filari-acuminata.*)

2. PYLAISIELLA SUBDENTICULATA (Schimp.) Kindb. Can. Rec. Sci. 1894: 22.

Pylaisia subdenticulata Schimp. Bry. Eur. fasc. 46 and 47. 1851.

Pylaisia denticulata Sull. in A. Gray, Man. Ed. 2, 62. 1856.

New York and New Jersey (Austin); Maryland (Holzinger); Ohio (H. J. Biddlecome); Athens, Ill. (Hall). Very close to *P.*

polyantha, but distinguished by the reduced size, rostrate operculum and absence of cilia.

3. PYLAISIELLA INTRICATA (Hedw.).

Pterigynandrum intricatum Hedw. Spec. Musc. 85. *pl. 18.* 1801.
Pylaisia intricata Schimp. Bry. Eur. fasc. 46 and 47. 1851.
Hypnum intricatum C. Muell. Syn. **2**: 338. 1851.
Stereodan intricatus Lindb. Musc. Asiae-bor. **2**: 151. 1890.
Pylaisia Selwinii Kindb. Ott. Nat. **2**: 156. 1889.

Common in the northeastern United States and eastern Canada, Kansas, Missouri, Misisssippi, Georgia (Ravenal), Florida (Chapman).

This species is easily distisguished by its curved branches, numerous quadrate alar cells and partially adherent segments. It varies a great deal in length of leaves and in length of leaf-cells, length and color of capsule and size of spores. Authentic specimens of *Pylaisia Seliwinii* Kindb. show that it is merely a form of this species growing in exposed dry places. The plants are darker and the leaves more strongly recurved than usual.

4. PYLAISIELLA VELUTINA (Schimp.) Kindb. Can. Rec. Sci. **1894**: 21.

Pylaisia velutina Schimp. Bry. Eur. fasc. 46 and 47. 1851.

New Brunswick, and Mt. Desert, Maine, south to North Carolina, west to Ohio and Indiana.

Distinguished from *P. intricata* by the entirely adherent segments, narrower leaves with fewer quadrate alar cells, and larger spores.

Pylaisia revolutifolia Kindb. in Herb. Macoun, from Leamington, Ont., August 4, 1892, and Pelee Point, Ont., is *Entodon repens.*

3. HOLMGRENIA Lindb. Öfv. Vet.-Ak. Förh. **1862**: 605. 1863.

[ORTHOTHECIUM Br. & Sch. Bry. Eur. fasc. 48. 1851. Not Schott. & Endl. Melet. Bot. 31. 1832.]

Gametophyte large (5–10 cm. high); leaves strongly plicate	1. *H. chrysea.*
Gametophyte small (2 cm. high); leaves not plicate.	2. *H. stricta.*

1. HOLMGRENIA CHRYSEA (Schwaegr.) Lindb. Öfv. Vet.-Ak. Förh. 1862: 605. 1863.

Hypnum chryseum Schwaegr. Schulte's Reise auf. d. Glockner, 2: 364. 1804.

Orthothecium chryseum Br. & Sch. Bry. Eur. fasc. 48. *pl. 461.* 1851.

Very rare. Rocky Mountains (Macoun, Drummond); Saskatchawan (E. Bourgeau).

2. HOLMGRENIA STRICTA Lorentz, Moos Stud. 122. *pl. 5.* 1864.

Stereodon rubellus Mitt. Journ. Linn. Soc. 8: 40. 1865.

Orthothecium rubellum Kindb. Laubm. Schwed. u. Norw. 46. 1883.

Orthothecium intricatum var. *rubellum* Husnot, Musc. Gall. 173. 1893.

Davis Strait (Taylor). In several sets of Drummond's mosses no. 73, from the Rocky Mountains (distributed as *Catoscopium nigritum*), there is no trace of this species. Dr. Mitten kindly sent a portion of the Davis Strait plant and indicates that *Holmgrenia rufescens* (Dicks.) Lindb. has not yet been found in North America. In a letter dated April 21, 1896, he says: "I have looked through all my specimens of *Orthothecium rufescens* and find no trace of any North American examples. All Taylor sent me are in with *O. chryseum*, as are the 221 of Drummond in both my sets. I suppose I must have mistaken one of Taylor's to be the first named."

4. CLIMACIUM Web. & Mohr, Iter Suec. 96. 1804.

Capsules 3–4 times and median leaf-cells 10 times as long as broad.
1. *C. dendroides.*

Capsules 5–6 times and median leaf-cells 2–7 times as long as broad.
2. *C. Americanum.*

1. CLIMACIUM DENDROIDES Web. & Mohr, Iter Suec. 96. 1804.

The northern and western species. New Brunswick to St. Paul Island, Behring sea, south to New Jersey, Colorado and California. Not represented from Pennsylvania or the North Central States.

1a. CLIMACIUM DENDROIDES OREGONENSE Ren. & Card. Bot. Gaz. 15: 59. 1890.

Type from Oregon, Willamette R. (L. F. Henderson). A specimen from Sauvie's Island, Oregon (C. G. Pringle no. 510), is probably referable to this variety, as the leaves are almost entire, although broader instead of narrower than in the type.

2. CLIMACIUM AMERICANUM Brid. Musc. Suppl. part 2, 45. 1812.

The southern and eastern species, ranging from Canada to North Carolina and probably south to the Gulf; west to Minnesota, Iowa, Illinois and Missouri.

2a. CLIMACIUM AMERICANUM KINDBERGII Ren. & Card. Bot. Gaz. 15: 1890.

C. Americanum fluitans Aust. Musc. App. 49. no. 289. Name only. 1870.

Varying greatly in appearance. Leaves characterized by oblong-hexagonal areolation and lack of auricles. The dendroid form, which is found especially in southern swamps, has often been mistaken for *C. dendroides*. Has the range of the type and extends to the Gulf. The Columbia Herbarium specimens of Sull. & Lesq. Musc. Bor. Am. Ed. 2, no. 42, and Drummond's Musc. Am. (Southern States), 120, are this variety.

CLIMACIUM RUTHENICUM Lindb. is not a *Climacium*. Its affinities are uncertain, but is not one of the Isotheciaceae.

HOMALOTHECIUM Br. & Sch. Bry. Eur. fasc. 46 and 47. 1851.

This genus is so closely allied to *Camptothecium* that it is clearly a violation of natural relationships to put it in another family. The nearly erect and symmetric capsule and the incomplete peristome are the only characters associating *Homalothecium* with the Isotheciaceae.

ISOTHECIUM Brid. Bryol. Univ. 2: 355. *pl. 10.* 1827.

Schimper, Synopsis, Ed. 2; 662, separates *Isothecium myosuroides* (L.) Brid. from the genus of which *I. myurum* (Pollich) Brid. remains the type. *I. myosuroides* clearly belongs to the Brachytheciaceae and all our American species are closely allied to it. Thus we have no American species of *Isothecium*.

Revision of the Genus Asimina in North America.

BY GEO. V. NASH.

The genus *Asimina* was founded by Adanson * in 1763. Catesby's † figure, on which Linnaeus ‡ based his *Annona triloba*, is cited by Adanson, thus leaving no doubt as to the type of the genus. In 1803, Michaux § gave the name of *Orchidocarpum* to this group of plants, probably from the resemblance of the young carpels to the tuberous roots of many members of the Orchidaceae. Torrey and Gray ‖ merged *Asimina* in *Uvaria*, to which it cannot be referred, the difference in size of the outer and inner petals readily separating it from that genus. This was the view later held by Dr. Gray, as set forth in the Botanical Gazette,** where the characters, maintaining *Asimina* as distinct from *Uvaria* and worthy of generic rank, are indicated.

The genus is restricted to North America, with a possible extension into Mexico, if the three or four imperfectly known species occurring there prove to belong to this genus, a question about which there is considerable doubt. The forms from the West Indies, placed here by Grisebach,†† would seem to belong elsewhere, the uniform size of the outer and inner petals excluding them from *Asimina*.

In North America the genus *Asimina* is mainly confined to the southeastern parts of the United States, one species only, *A. triloba*, occurring as far north as southern New York and Michigan, and extending to the west, along the Gulf, as far as eastern Texas. This appears to be the only one that occurs any great distance beyond the general range of the genus, with the possible exception of *A. parviflora*, which, according to Dr. Chapman, in his Flora of the Southern States, occurs in North Carolina. I have

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* Fam. Pl. 2: 365.
† Nat. Hist. 2: 85. *pl. 85.*
‡ Sp. Pl. 537. 1753.
§ Fl. Bor. Am. 1: 329.
‖ Fl. N. A. 1: 45. 1838.
** 11: 161–2. 1886.
†† Cat. Pl. Cub. 3. 1866.

seen no specimens authenticating this, however; in fact, Georgia is the most northern state from which I have seen specimens of this species. The remainder of the genus is confined to Georgia, Florida and Alabama.

Asimina, as here understood, comprises seven species, one of which, though quite common in herbaria, has remained undescribed up to the present time, owing to its early and wrong identification with the *A. grandiflora* of Dunal,* which was based on the *Annona grandiflora* of Bartram.† These excellent figures, and the description accompanying that of Dunal, make it difficult to understand why such a mistake should have occurred. This matter will be discussed later, in its proper place.

A large number of specimens, contained in the herbarium of Columbia University, has been examined. In addition to these, the material in the National Herbarium and that in the herbarium of Prof. Lester F. Ward, at Washington, have been kindly loaned for examination. The study of this material has seemed to warrant the following disposition of the species.

Key to the Species.

Flowers borne in the axils of the deciduous leaves of the preceding year, hence appearing before or with the leaves.
- Leaves thin, not reticulated; a solitary purple flower in the axil.
  - Mature outer petals 2 cm. long or larger, more than twice the length of the sepals; a small tree 3–12 metres high. 1. *A. triloba.*
  - Mature outer petals 1 cm. long or smaller, less than twice as long as the sepals; a small shrub 15 dm. high or less. 2. *A. parviflora.*
- Leaves thick, leathery and reticulated when old; 1 or 2 yellowish white flowers and often a branchlet arising from the same axil.
  - Young leaves sparingly tomentose above and soon glabrous, tomentose beneath; mature outer petals 2.5–4 cm. long. 3. *A. reticulata.*
  - Young leaves densely tomentose on both sides; mature outer petals 4–5 cm. long. 4. *A. speciosa.*

Flowers terminal, or borne in the axils of the leaves of the season, hence appearing after the leaves.
- Flowers terminal, sessile or nearly so; leaves short and broad, obovate to oval. 5. *A. obovata.*
- Flowers axillary and long-peduncled, rarely single and terminal in No. 7; leaves long and narrow, oblanceolate to oblong.

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* Monog. Anon. *pl. 11.* 1817.

† Travels, *pl. 2.* 1791.

Mature outer petals 3 cm. long or less, changing color, becoming deep black-purple at the time of falling. 6. *A. pygmaea.*

Mature outer petals 3.5 cm. long or more, not changing color, remaining yellowish white at the time of falling. 7. *A. angustifolia*

1. Asimina triloba (L.) Dunal, Monog. Anon. 83. 1817.

Anonna triloba L. Sp. Pl. 537. 1753.

Orchidocarpum arietinum Michx. Fl. Bor. Am. 1: 329. 1803.

Porcelia triloba Pers. Syn. 2: 95. 1807.

Uvaria triloba Torr. & Gr. Fl. N. A. 1: 45. 1838.

A small tree, 3–12 metres tall, the bark of the mature branchlets reddish brown or sometimes gray. Branchlets and leaves when young, peduncles, exterior surface of the sepals and young petals tomentose with reddish brown hairs; mature leaves obovate or obovate-cuneate, 10–30 cm. long, 4–11 cm. wide, abruptly acuminate at the apex, usually acute, but sometimes rounded at the base, thin, glabrous above, the midrib and primary nerves, which are prominent on the lower surface, usually more or less pubescent; petioles 1 cm. long or less, glabrous or sparingly pubescent; flowers in the axils of the deciduous leaves of the preceding year, on peduncles 8–15 mm. long, which are often recurved; sepals from ovate to orbicular-ovate, 8–12 mm. long; petals at first greenish, later purple and conspicuously veined, the outer ones nearly orbicular, 2–2.5 cm. long, more than twice the length of the sepals; fruit 7–15 cm. long, 2.5–4 cm. thick, oblong, cylindric, when full grown at first hard, green and glaucous, later turning yellow, and when fully ripe becoming soft and edible and brown or almost black in color; seeds brown, oblong, 2–2.5 cm. long, 1–1.5 cm. broad, compressed, obtuse at the apex and usually obliquely truncate at the hilum.

Rich and moist soil from western New York and Pennsylvania to southern Michigan and Kansas, south to middle Florida and eastern Texas.

A large number of specimens of this, the most frequent and widely distributed species, were examined, but it is so well known that a detailed list is not necessary.

2. Asimina parviflora (Michx.) Dunal, Monog. Anon 82. *pl. 9.* 1817.

Orchidocarpum parviflorum Michx. Fl. Bor. Am. 1: 329. 1803.

Porcelia parviflora Pers. Syn. 2: 95. 1807.

Uvaria parviflora Torr. & Gr. Fl. N. A. 1: 45. 1838.

A small shrub 15 dm. tall or less, with gray to reddish bark. Branchlets, young leaves, particularly the lower surface, peduncles, and the outside of the young sepals and petals tomentose with bright reddish brown hairs; mature leaves 6–17 cm. long, 3–9 cm. wide, obovate to oblong-obovate, acute at the apex, narrowed at the base, thin, glabrous above, usually more or less tomentose beneath, especially on the midrib and veins; petioles tomentose, 6 mm. long or less; flowers solitary from the axils of the deciduous leaves of the preceding year, on peduncles 5 mm. long or less; sepals ovate, 5–7 mm. long; mature outer petals ovate to broadly oval, 7–10 mm. long, less than twice the length of the sepals; fruit, not fully mature, oblong, about 3 cm. long, sparingly pubescent.

In the low and middle country from North Carolina (according to Dr. Chapman) to Florida, west to Alabama.

Specimens examined:

Georgia: Small, Gwinnett Co., July 20, 1893; Stone Mountain, May 1–18, 1895.

Florida: Curtiss, nos. 85, 4201 and 4545, all from the vicinity of Jacksonville.

Canby, Hibernia, March, 1869.

J. D. Smith, no. 27, Clay Co., March 10, 1883.

Rugel, near Tallahassee, April, 1843.

Chapman, no data.

Le Conte, no data.

Alabama: Buckley, April and June.

Winchell, no data.

3. Asimina reticulata Shuttlw.; Chapm. Fl. S. St. 603. 1884.

Asimina cuneata Shuttlw.; A. Gray, Bot. Gaz. 11: 163. 1886.

A small shrub 5–10 dm. tall, with bark of a grayish brown to brown color, the branchlets, lower surface of the young leaves, peduncles and the exterior surface of the sepals and young petals densely tomentose with reddish brown hairs. Young leaves somewhat tomentose above, soon glabrous; mature leaves narrowly oblong, inclining to narrowly obovate or oblanceolate, 2.5–9 cm. long, .5–2 cm. broad, thick and leathery, glabrous, reticulated, the midrib and nerves prominent beneath; petioles 1–2 mm. long; flowers on peduncles 5–8 mm. long, from the axils of the deciduous leaves of the preceding year, sometimes accompanied by a branchlet; sepals ovate, 5–7 mm. long; mature outer petals oval to obovate, 2.5–4 cm. long, 1.2–1.5 cm. broad, much exceeding the inner ones and about five times the length of the sepals, pubescent on the outside, particularly toward the base; immature fruit obovate, nearly glabrous.

Pine barrens of Peninsular Florida.

Specimens examined:

Garber, Tampa, May, 1876.

Lester F. & Rosamond Ward, Tampa, February 27, 1891.

Nash, Tampa, no. 2477, August, 1895.

Hubbard, March 1, 1883, no locality.

Simpson, 1880, no locality, but probably in the vicinity of Manatee.

Webber, no. 148, Mt. Dora, Lake Co., March, 1894.

Palmer, no. 6, Fort Capron, Indian River, 1874.

Bates, Merritt's Island, Indian River, March and April, 1889.

4. ASIMINA SPECIOSA.

Orchidocarpum grandiflorum Michx. Fl. Bor. Am. 1: 330. 1803.?

Porcelia grandiflora Pers. Syn. 2: 95. 1807.?

Uvaria obovata Torr. & Gr. Fl. N. A. 1: 45. 1838.

Asimina grandiflora A. Gray, Bot. Gaz. 11: 163. 1886. Not Dunal. 1817.

A small shrub, 6–12 dm. tall, with gray smooth bark. Branchlets, as well as the peduncles and both surfaces of the young leaves, densely tomentose with yellowish or tawny hairs; mature leaves oblong, narrowly obovate or obovate, 7–14 cm. long, 2.5–7 cm. broad, thick and leathery, reticulated, tomentose on both sides, sparingly so above; petioles 3–7 mm. long, densely tomentose; flowers, sometimes accompanied with a branchlet, from the axils of the deciduous leaves of the preceding year, on peduncles 7–18 mm. long; sepals ovate, 6–8 mm. long, tomentose; mature outer petals oval to obovate, 4–5 cm. long, 2.5–3.5 cm. broad, much exceeding the inner ones, and about six times as long as the sepals, pubescent, particularly on the outside near the base; immature fruit glabrous.

This plant has been referred to the *A. grandiflora* Dunal, which was based on *Annona grandiflora* Bartram. It is not that plant, as is plainly indicated by a reference to the excellent figures of Bartram* and of Dunal† where the flowers are shown as terminating

* Travels *pl. 2.* 1791.

† Monog. Anon. *pl. 11.* 1817.

the branchlets. The description of Dunal,* moreover, calls for a plant with sub-sessile flowers and the branchlets and the lower surface of the leaves "rufo-pubescentibus," characters certainly not to be found in *A. speciosa*, the flowers of which are lateral, from the axils of the deciduous leaves of the preceding year, and the pubescence merely yellowish white or tawny. The long peduncles also serve well to distinguish this from the true *A. grandiflora* Dunal, which is described in this revision under the name *A. obovata*.

Sandy pine barrens, southeastern Georgia and East Florida.

Specimens examined:

Georgia: Small, Trader's Hill, Charlton Co., June 12–15, 1895.

Florida: Curtiss, nos. 86, 4,200 and 4,588, and a specimen with no number collected in 1875, all from the vicinity of Jacksonville.

Reynolds, March–May, 1871.

Chapman, East Florida, 1871.

Canby, Hibernia, March, 1869.

Palmer, no. 4, Fort Capron, Indian River, 1874.

5. ASIMINA OBOVATA (Willd.).

Annona grandiflora Bartr. Trav. 18. *pl. 2.* 1791. Not Lamarck. 1786.

Annona obovata Willd. Sp. Pl. 2: 1269. 1800.

A shrub or small tree, 1.5–2 metres tall, with grayish brown bark. Branchlets, petioles and the lower surface of the leaves, especially the midrib and nerves, tomentose with bright reddish brown hairs; leaves 4–10 cm. long, 2–5 cm. broad, narrowly obovate to obovate, or the smaller ones often oval, glabrous above, on petioles 3–5 mm. in length; flowers sessile or nearly so, terminating the branchlets; sepals ovate or oval, 10–12 mm. long, tomentose when young, later glabrate; petals yellowish white, glabrous, mature outer ones obovate, 5–6 cm. long; fruit not seen.

Pine lands in eastern and central peninsular Florida.

Specimens examined:

Nash, no. 178, Eustis, Lake Co., March 1894.

Hulst, DeLand, March, 1891.

Bates, Merritt's Island, Indian River, March and April, 1889.

The earlier publication by Lamarck of an *Annona grandiflora* †

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* l. c. 84.

† Encycl. 2: 126. 1786.

invalidates the use of this name by Dunal, so that given by Willdenow is here taken up, being the oldest one available.

6. Asimina pygmaea (Bartr.) A. Gray.

Annona pygmaea Bartr. Trav. 18. *pl. 1.* 1791.

Asimina pygmaea A Gray, Bot. Gaz. 11: 164. 1886. Not Dunal, 1817.

A small plant, 2–4 dm. tall. Stems simple, or rarely somewhat branched, arcuate, often nearly prostrate, 2–several from the same root, somewhat shrubby below, reddish, glabrous at the base, often tomentose at and near the summit; young leaves more or less tomentose, especially beneath; mature leaves often erect, thereby appearing as if secund, oblong, oblanceolate, or spatulate-obovate, 5–15 cm. long, 1–4 cm. broad, rounded, obtuse or acutish at the apex, acute at the base, glabrous, reticulated, the midrib and principal nerves very prominent beneath, sessile, or on petioles 8 mm. long or less; flowers solitary in the axils, on slender glabrous, or somewhat tomentose, often recurved peduncles 1–1.5 cm. long; sepals ovate, 7–10 mm. long, tomentose when young, glabrate when old; petals greenish and slightly pubescent externally when young, becoming dull black-purple and glabrous at the time of falling, the mature outer ones narrowly obovate, 2–3 cm. long, 8–12 mm. broad; fruit not seen.

Pine lands in eastern and peninsular Florida.

Specimens examined:

Curtiss, nos. 87, 4202 and 4742, all from the vicinity of Jacksonville.

Nash, nos. 359 and 1919, in the vicinity of Eustis, Lake Co.

Palmer, no. 7, Fort Capron, Indian River, 1874.

Burroughs, no data.

Powell, 1872.

7. Asimina angustifolia A. Gray, Bot. Gaz. 11: 163. 1886.

Orchidocarpum pygmaeum Michx. Fl. Bor. Am. 1: 330. 1803.

Porcelia pygmaea Pers. Syn. 2: 95. 1807. ?

Asimina pygmaea Dunal, Monog. Anon. 84. *pl. 10.* 1817.

Uvaria pygmaea Torr. & Gr. Fl. N. A. 1: 45. 1838.

A small shrub, 4–6 cm. tall. Stems several from the same root, erect or reclining, much branched, glabrous excepting at the summit, the old bark gray, the young bark reddish; leaves very variable, 5–20 cm. long, 1–3 cm. broad, linear to oblong-linear or oblanceolate, acute or obtuse at the apex, acute at the base, glabrous, reticulated, the midrib prominent beneath, sessile, or on petitoles 7 mm. long or less; flowers solitary in the axils of the leaves, or rarely terminating the branches, on slender glabrous or sparingly pubescent peduncles 1–2 cm. long; sepals ovate, nearly glabrous, 1–1.5 cm. long; mature outer petals oblong-obovate to obovate, 3.5–6 cm. long, 2–3 cm. wide, yellowish white, even at the time of falling; fruit, probably not fully grown, cylindric-oblong, about 3 cm. in length.

Pine lands in Georgia and north Florida.

Specimens examined:

Georgia: Small, Albany, Dougherty Co., July, 1895; Bainbridge, Decatur Co., June, 1895; Albany, Dougherty Co., May 24–28, 1895.

Florida: Chapman, Apalachicola.
Curtiss, no. 87 *, Gainesville.
Nash, no. 2153, Lake City, Columbia Co., July 11–19, 1895.
Leavenworth, vicinity of Fort King and Fort Drane.
Alexander, Gadsden Co.
Rugel, between Tallahassee and St. Mark's, May and June, 1843.

The leaves of this plant are most variable in shape. In a specimen collected by Dr. Chapmam at Apalachicola, preserved in the herbarium of Columbia University, they are from 5–8 cm. long and from 1–2 cm. wide. This matches the figure given by Dunal of his *A. pygmaea,** having the short straight ascending branches and the petals obovate and about 3 cm. long, just as there represented. In the extreme of variation, represented by Curtiss, no. 87 *, and Nash, no. 2153, the leaves are 8–20 cm. long, and only 5–15 mm. wide; the petals narrowly obovate and 5–6 cm. long. There are numerous plants connecting these two extremes; indeed, leaves nearly representing the two forms were noticed on the same plant by the writer during the past summer.

Another form of this plant has a flower terminating the branches and no flowers in the axils of the leaves. This is probably but a variation, and it seems best to refer it to this species. Dr. Small's plant, collected at Albany, Georgia, in May, 1895,

* Monog. Anon. *pl. 10.* 1817.

well represents this form; as does also a specimen secured by Dr. Baldwin in the same State. This last is the type of the variety of *Uvaria pygmaea* mentioned by Torrey and Gray in their Flora of North America.*

The Development of the Antheridium of Targionia hypophylla.†

BY EFFIE B. MCFADDEN.

(PLATE 268).

One of the most characteristic of our Californian liverworts is *Targionia hypophylla*, a species common in southwestern Europe, but which has not been described from the eastern United States.‡ The specimens studied were collected mostly in October and November on the slopes of sandy banks in the vicinity of Stanford University.

Targionia is our sole representative of the family Targionieae, which includes the genus *Cyathodium*. *Targionia* is perennial, becoming completely dried up at the end of the rainy season, and remaining so until the rains set in again, when it begins at once to grow actively. The structure of the thallus is similar to that of the typical Marchantiaceae, except that the branching is not usually dichotomous, but instead is largely due to lateral adventitious branches growing from the ventral surface. The antheridial shoots are of this character and may be easily recognized by their flattened oval form, small size and wavy outline.

The antheridia arise in acropetal succession from single superficial cells of the dorsal segment of the apical cell, so that in a vertical longitudinal section of a young plant, nearly all stages of development may be seen. The first division of the primary cell is a transverse one, separating the antheridium proper from the stalk-cell. (Fig. 2.) This is followed by at least two similar walls, but the number varies considerably, four being the greatest number

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*1: 45. 1838.

† This study was suggested by Dr. Douglas Houghton Campbell, of Leland Stanford Junior University, and was prepared under his direction.

‡ Underwood's Hepaticae in Gray's Manual, sixth edition, 1889.

found. The second series of divisions are vertical and are formed only in the middle segments and divide each into the quadrants of a circle as seen in cross section. (Fig. 7, b.) The separation of the sperm-cells is brought about by a series of periclinal walls by means of which four central cells in each segment are separated from as many peripheral ones. (Fig. 7, b, c.) The upper and lower segments do not seem to take any part in the formation of sperm-cells, the upper usually being prolonged into a beak, while the lower one forms the base of the antheridium.

The lower of the two divisions of the antheridial mother-cell divides usually by three transverse walls to form a stalk. This stalk may be a single row of cells, or a vertical division may take place, making a double row. (Fig. 6, b.)

The contents of the central cells become much denser than those of the outer ones. The former begin to divide actively, the walls being formed at right angles, thus making a large number of nearly cubical sperm-cells.

From the time the antheridium first becomes recognizable, there is a rapid growth of the cells immediately surrounding it. These grow up about the antheridium, which thus becomes sunk in a deep cavity whose walls are extended into a tubular neck, projecting above the general level of the thallus, and through which the spermatozoids escape.

The wall-cells of the antheridium are very large and distinct, and fill the whole cavity between the body of the antheridium and the wall of the cavity. (Fig. 6, a.)

The complete development of the spermatozoids was not followed, but there was nothing to indicate any variation from what has already been described in other liverworts. The nucleus shows the usual flattened form, after the last division of the central cells, and the sperm-cells remain in pairs. The full grown spermatozoid shows one and one-half complete coils; the two cilia are longer than the body, and the vesicle is plainly evident.

Explanation of Plate 268.

Fig. 1. Male plant with antheridial branches; $\times$ 3.

Fig. 2. Vertical longitudinal section; apical cell; two very young antheridia $\times$ 400.

Figs. 3, 4, 5. Successive stages in the development of the antheridium; $\times$ 400.

Fig. 6, a. Full grown antheridium; $\times$ 300; b. stalk showing three rows of cells; $\times$ 400.

Fig. 7. Three cross sections from the upper part of an antheridium; a. toward the apex; b. c. lower down; $\times$ 400.

Fig. 8. Cross sections from the lower part of an antheridium, d. being the lowest segment; $\times$ 400.

Fig. 9. Cross section of a full grown antheridium near the center; $\times$ 400.

Fig. 10. a. Full grown spermatozoid; b. sperm-cell with nearly developed spermatozoid.

Notes on Potentilla.—I.

BY P. A. RYDBERG.

The author has been studying the genus *Potentilla* for some time. The plan is to prepare a revision of the North American Potentilleae and have it published as Volume 2 of the Memoirs from the Department of Botany of Columbia College. It is planned to contain, if possible, full size illustrations of all native species of *Potentilla*, *Horkelia*, *Ivesia*, etc. The best way the author knows of, to secure the coöperation of other botanists is to publish some of the results already obtained. He will regard it as a great favor to be permitted to look over and name any collection of North American species, and will be very thankful for any information, suggestion or criticism that may be given.

It will be seen from the following that my opinion as to the limitation of the species differs widely from those expressed in our manuals and from Dr. Watson's revision of *Potentilla* in the Proceedings of the American Academy of Arts and Sciences, **8**: 549–573. They agree, however, very closely with those held by the late Dr. Christian Lehmann, of Hamburg. This eminent botanist after having studied the genus about forty years, having published several papers on it from time to time, among others a monograph in 1820, and having prepared the text for the genus *Potentilla* in Hooker's Flora Boreali-Americana, issued in 1856 his "Revisio Potentillarum," a quarto of 250 pages and 64 plates. This book, which always will remain as one of our standard works, will serve as the basis of my revision.

In the *glandulosa* group, Dr. Watson includes only two species, viz., *P. arguta* and *P. glandulosa.* Lehmann acknowledged five American species. Of these five, *P. brevifolia* Nutt., must be excluded as the style is not basal. For my part, I think the group contains at least seven or eight species. The additional species were not known to Lehmann, except *P. glutinosa* Nutt., which he included as a variety under *P. fissa* Nutt.

The group is characterized by an erect habit, more or less glandular pubescence, pinnate leaves with rounded or rhomboidal, coasely toothed leaflets, obovate or orbicular, not emarginate petals, very flat anthers, and a nearly basal style, this last character, as far as I know, not being found elsewhere in the genus. In all except one, the style is also fusiform, *i. e.*, swollen near the middle and tapering to both ends. The species belonging to the group are:

POTENTILLA ARGUTA Pursh, Fl. Am. Sept. 736. 1814.

Geum agrimonioides Pursh, Fl. Am. Sept. 351. 1814. Not *Potentilla agrimonioides* Bieb.

This is the only eastern species of the group, extending from New Brunswick to District of Columbia, westward to the foothills of the Rocky Mountains, from Colorado, as far north as Fort Simpson on the Mackenzie River. It differs from the rest by its pubescence, which is coarser, densely hirsute and glandular, by its dense and strict cyme, and its white flowers. Dr. Watson mentions that in the Rocky Mountain region, there is found a form of *P. arguta* with bright yellow flowers. This is probably a mistake, and the specimens referred to belong to the next species.

POTENTILLA GLUTINOSA Nutt; Torr. & Gray, Fl. N. Am. 1: 446. 1838. As a synonym under

P. fissa major Torr. & Gray, *l. c.* Not *P. verna major* Wahl.

P. arguta Nutt. Journ. Acad. Phil. 7: 21. 1834. Not Pursh, 1814.

P. valida Greene, Pittonia, 3: 20. 1896.

It most resembles *P. arguta* in habit, is fully as stout and as pubescent, but the pubescence is finer, the longer hairs villous rather than hirsute. The cyme is open in age, rather flat-topped, the pedicels longer, the sepals thinner and more acute, and the petals larger, much exceeding the calyx, and bright yellow. It ranges from Vancouver Island and British Columbia to Idaho and Oregon. A specimen also belonging here, without doubt, but less pubescent, has been collected in Utah by Marcus E. Jones. Fendler's no. 197, from Santa Fé Creek, New Mexico, which was included in *P. fissa major* by Lehmann, resembles the typical form except that the petals are smaller, scarcely exceeding the sepals.

POTENTILLA FISSA Nutt.; Torr. & Gray, Fl. N. Am. 1: 446. 1838.

P. glandulosa Am. Auth., not Lindley.

P. scopulorum Greene, Erythea, 1: 4. 1893.

The flowers resemble much those of the preceding, the petals being bright yellow, very large, orbicular, very concave, and much exceeding the ovate-lanceolate long-acuminate sepals; but the habit is very different. *P. fissa* is a low plant, seldom exceeding 2 dm. high, very bushy, with a narrow and few-flowered cyme; also often with some flowers in the axils of the leaves. The leaves most resemble those of the next, but the leaflets are generally more rounded and with stronger veins. The type specimens of *P. scopulorum* are less glandular than the original of *P. fissa*, but very glandular specimens have been collected even in Colorado. *P. fissa* occurs in the higher Rockies. It is common in Colorado, rare in Wyoming, Idaho and Montana.

POTENTILLA GLANDULOSA Lindl. Bot. Reg. 19: *pl. 1583*. 1833.

Resembles *P. glutinosa* in the open many-flowered cyme and general habit, but is a much more slender plant. It resembles *P. fissa* in the leaves, the long sepals and the shorter glandular pubescence, which is sometimes rather sparse. It differs from both by its petals, which are obovate, flat and about equal the sepals. Next to *P. arguta*, it is the most common and has the widest range of the group. It extends from British Columbia and Alberta to the Black Hills of South Dakota and the foot hills of New Mexico and California.

Suksdorf has collected a plant in West Klickitat Co., Wash., which agrees perfectly with *P. glandulosa*, except that the petals are very small, obovate-spatulate and white.

P. Hanseni Greene, Pittonia 3: 20, should perhaps be regarded as a mountain variety of *P. glandulosa* rather than a distinct species. It differs only in its more slender habit, a slightly denser pubescence, somewhat shorter sepals and a more contracted and few-flowered cyme, a modification perhaps due to the higher altitude. Intermediate forms are not rare. It is common in the higher Sierras of California, Nevada and Arizona.

POTENTILLA LACTEA Greene, Pittonia 3 : 20. 1896.

P. glandulosa lactea Greene, Fl. Frans. 65. 1891.

I can not pronounce on this, as I have not seen specimens The description points toward *P. glandulosa*, except in the color of the petals, which are described as white.

POTENTILLA WRANGELLIANA Fish. & All. Anim. Bot. Ind. Sem. Hort. Bot. Petrop. 1840: 54; Ann. Sci. Nat. (II.) 16: 57. 1841.

P. rupestris Presl, Epim. Bot. 198. 1849. Not L.

P. glandulosa Am. Auth., as Brewer & Wats. Bot. Cal. 1 : 178, and Greene, Fl. Frans. 65, mainly.

This species most resembles *P. glandulosa*, but differs by the larger, more decidedly double-serrate leaflets, the more leafy cyme, which is dichotomously branched, with a short-pedicelled flower in the forks, but principally by the sepals, which are more veiny, oval (not ovate-lanceolate), and abruptly contracted into a small point, almost mucronate. The common form is inclined to become glabrate. Lindley's figure of *P. glandulosa incisa* in Bot. Reg. 23: *pl. 1973*, resembles this species as to the leaves, but the cyme and the sepals are those of *P. glandulosa*. *P. Wrangelliana* is common in California and Oregon, extending into Washington.

P. Oregana Nutt. Mss., is a form of this species, but the stem is glandular and very pubescent with long villous hairs. Torrey and Gray, Fl. N. Am. 1: 446, place it as a synonym of *P. glandulosa*, but its habit and sepals show a close relationship with *P. Wrangelliana*.

POTENTILLA REFLEXA Greene, Pittonia 3:19. 1896.

P. glandulosa reflexa Greene, Fl. Frans. 65. 1891.

This somewhat resembles *P. glandulosa*. The principal difference given by Prof. Greene is that petals and sepals are reflexed in anthesis. As far as I know the species, the following characters may be added: thicker, darker leaves with broader and shorter teeth, a more slender stem which is inclined to be tinged with red, and a fruiting calyx scarcely larger than that of the next species. According to Prof. Greene, it is common in dry open pine woods of the foot hills of the Sierra Nevada. I have seen specimens from only two collections, viz., Coville & Funston, no. 1355, from Big Tree Cañon, Southern California, 1891; and Mrs. R. M. Austin, Modoc Co., Calif., 1895.

POTENTILLA RHOMBOIDEA n. sp.

P. glandulosa var. *Nevadensis* Wats. Bot. Calif. 1: 178, in part. 1876. Not *P. Nevadensis* Boiss.

Stem low and slender, about 2 dm. high, simple, about 3-leaved, not striate, nearly glabrous or glandular above, with very short hairs. Stipules small, 2–4 mm., ovate and subentire. Basal leaves many, short-petioled, about 3-paired, smooth or beset with a few scattered hairs. Leaflets rhombic-ovate, mostly acute, serrate with acute teeth, the largest ones 1 ½ cm., seldom 2 cm. long. Stem leaves about 3, similar, the lowest pinnate with about 2 pairs, short-petioled, the other two generally 3-foliolate and subsessile. Flowers few in open cymes, about 1 cm. in diameter. Calyx glandular with very short hairs, sometimes also with a few long hairs; sepals about 8 mm. long in fruit. Bractlets linear-oblong, obtuse or acutish, half the length of the broadly ovate slightly mucronate sepals. Petals yellow, obovate, a little exceeding the sepals. Stamens 15–20. Style nearly basal, filiform, long and slender, in fruit about twice as long as the smooth achene.

It somewhat resembles depauperate *P. glandulosa*, but differs by its longer filiform style, which is not fusiform, by the pubescence which could be called glandular-pruinose, when present, with a few scattered straight hairs on the calyx and the leaves, and by the small fruiting calyx. It reminds us also of *P. brevifolia*, but in the latter the style is not basal and the petals emarginate.

P. rhomboidea is apparently a rare plant. The following specimens have been seen by me:

Nevada, S. Watson; *Montana*, S. Watson, no. 114; *Washington*, W. V. Suksdorf (Mt. Paddo), 1885; *Oregon*, Thomas Howell (Deer Creek Mts.), no. 1128, 1887.

To this group belong also *P. geoides* Bieb. of Tauria, *P. rupestris* L. of Europe and northern Asia, and *P. macrocalyx* Huet du Pav. of the Pyrenees.

Appendages to the Petioles of Liriodendra.

BY ARTHUR HOLLICK.

(PLATES 269, 270.)

In a paper read some time ago before the Club and published in the BULLETIN* attention was called to certain wing-like appendages on the petioles of fossil leaves considered to be allied to the living *Liriodendron Tulipifera* L. Referring to the theory advanced by Professor Lester F. Ward in regard to stipular appendages to the petioles of *Platanus*,† that they may represent former basal lobes of the leaf, which have become detached, forming first basilar appendages, then wings to the petioles, and finally stipules, I suggested that we might have a similar example in the case of *Liriodendron*. In other words, that the stipules of the living species had been derived from the wing-like appendages, which in turn had been previously derived from basal leaf lobes.

Since then a series of leaf forms of *Liriodendron* was sent to me by Mr. Edward W. Berry, of Passaic, N. J. They were collected from saplings, seedlings and new shoots from old stumps, and many of them are exceedingly interesting and significant. In the specimen to which I wish to call special attention the blade of the leaf is abnormally broad at the top and narrow at the base. The petiole is short and has broadly winged margins, which extend from the base of the petiole and connect with the base of the leaf blade. On one side there is a sharp sinus where they join, on the other merely a contraction. The nervation of each extends into the other. The question to decide is whether we have stipules adnate to the petiole and leaf blade, or portions of the leaf blade which are acting the part of stipular appendages.

The abnormal shape of the leaf is also significent, suggesting at once the fossil genus *Liriophyllum*, in which at least one species (*L. populoides* Lesq.) is known to possess winged petioles.

On plate 269, for purposes of comparison with our specimen, I have introduced a figure of this species and one which shows

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*Bull. Torr. Bot. Club, **21** : 467–471. *pl. 220, 221.* 1894.

†Proc. U. S. Nat. Mus. **11** : 39–42. *pl. 17–22.* 1888. Am. Nat. **24** : 797. 810. *pl. 28.* 1890.

the winged petiole of *Liriodendron alatum* Newb. Also a representation of a large sized stipule from a young shoot, in order to show its nervation.

On plate 270 another abnormal leaf is shown, with imperfectly formed basal lobes, the nervation of which, especially that of the one on the left-hand side, is so strikingly similar to that of the stipule as to attract attention at once. On this plate are also figures of young leaves showing normal position and arrangement of the stipules.

The figures and descriptions are submitted without further comment, largely in the hope that it may induce observers to collect and study abnormal specimens, which often give us a starting point for some important morphological investigation.

Description of Plates.

PLATE 269

Fig. 1. Abnormal leaf of *Liriodendron Tulipifera* L., showing winged appendages to the petiole, from Passaic, N. J.

Fig. 2. *Liriophyllum populoides* Lesq. (Bull. Torrey Bot. Club, *plate 221*, in part.)

Fig. 3. Winged petiole of *Liriodendron alatum* Newb. (Bull. Torrey Bot. Club, *plate 220*, in part.)

Fig. 4. Large stipule of *Liriodendron Tulipifera* L., showing nervation, from Passaic, N. J.

PLATE 270.

Fig. 1. Abnormal leaf ot *Liriodendron Tulipfera* L., showing imperfect basal lobes, from Passaic, N. J.

Figs. 2, 3. Young leaves of *Liriodendron Tulipifera* L., showing normal arrangement and position of stipules, from Passaic, N. J.

Description of a supposed new Species of Fossil Wood from Montana.

BY F. H. KNOWLTON.

(PLATE 271.)

For some time the United States Geological Survey has had in preparation a Study Series of Rocks for general educational purposes, which is to contain a series of typical rocks of this country, and in 1891 I was requested to collect for this a set of 250 specimens of silicified wood. This Study Series is to be accompanied by a descriptive pamphlet in which the characters, especially the microscopic ones, will be fully set forth. The fossil wood illustrates well the replacement of organic structure by silica, and in preparing the figures and descriptions for the Study Series it was found that it represented an apparently undescribed species of tree, and it has been thought desirable to publish a proper diagnosis in advance of the distribution of the specimens.

This silicified wood was collected in September, 1891, in the Upper Galletin Basin, Montana, just outside of the Yellowstone National Park. The trunk which afforded the specimens was an upright one, about eight feet in height and four feet in diameter, and, as subsequent study has shown, was admirably preserved. As the drawings show, its structure can be made out with almost as much satisfaction as though still living.

The matrix in which the trunk was standing is the characteristic volcanic deposit of the region. It appears to be very similar to, if not indeed identical with, that of the well known Fossil Forest on the Lamar River in the Yellowstone National Park. Its geological age is therefore regarded as probably Miocene.

PITYOXYLON PEALEI n. sp.

Annual ring very pronounced, 2–10 mm. broad; cells of summer wood large, thin-walled; cells of fall wood thick, much compressed; cells of summer wood with a single series of large scattered punctations; medullary rays in a single series of two to about twenty long cells, marked radially with one to three small bordered pits in the width of each wood cell; resin tubes rather numerous, of large size.

Cross Section.—This section (Fig. 1) shows the late fall and early spring wood. The contrast in the size and thickness of the walls makes a very clearly demarked ring. This ring of growth was very broad, being in some cases fully 10 mm. The medullary rays show in this section also as long, slender cells.

Radial Section.—The fine state of preservation is well shown in this section (Figs. 2–4). The cells of the spring and summer wood are very broad and marked with a single series of large scattered bordered pits. The medullary rays are also prominent in this section. They are composed of very long cells, each of which is marked with usually two or three small oblong or nearly circular bordered pits the width of each wood cell.

Tangential Section.—This section (Figs. 5, 6) shows the medullary rays to be arranged in a single series of from two to occasionally twenty superimposed cells. The resin tubes, occurring in the midst of a medullary ray (Fig. 6, enlarged 300) are quite numerous. They are of the usual character.

As far as could be made out, there are no pits or markings on the tangential walls of the wood cells.

I take pleasure in naming this supposed new species of fossil pine in honor of Dr. A. C. Peale, whose party I accompanied when it was obtained, and who has done so much, in connection with the Hayden and later geological surveys, to elucidate the geology of our Western States.

U. S. GEOLOGICAL SURVEY.

Botanical Notes.

Reseda lutea moving Inland.—In passing through a meadow to-day, a mile or so out of the city upon high ground, my eye was attracted by several greenish lemon colored sprays of a mignonette. By turning to Volume I., Part 1, of the Synoptical Flora, the find is seen to agree with *Reseda lutea* L., which is "sparingly naturalized from Europe" and localized as "Nantucket, Mass. and in ballast ground." The meadow where the specimens were found to-day is neither, and it becomes a new and interesting locality for a rare plant collected but twice before in New Jersey, so far as can be determined, and then on ballast. It is not in Gray's Field Book or Wood's Florist. BYRON D. HALSTED.

RUTGERS COLLEGE, May 25, 1896.

ASCLEPIAS ARENICOLA n. n. *Asclepias aceratoides* Nash. Bull. Torr. Club, 22: 154. 1895. Not M. A. Curtis, Am. Journ. Sci. (II.) 7: 407. 1849.

The name which I gave to this new and interesting plant, collected in 1894, had, unknown to me, been previously applied by Curtis to an entirely different member of the genus. It becomes necessary, therefore, to rename the Florida form, and the above is suggested, being descriptive of its habitat. It occurs only in the hottest and driest sand, and is confined to and is the only member of this genus found in the "scrub," a tract peculiar to peninsular Florida. This so-called "scrub" is hotter in summer and, so I have been informed, colder in winter than any of the surrounding territory, and is the home of some of the most characteristic plants of that part of Florida. GEO. V. NASH.

Two New Serials.—The first number of the "Bulletin of the New York Botanical Garden," containing the act of incorporation, lists of members of the corporation, officers and managers for 1896, provisions for patrons, fellows and annual members, list of patrons, constitution and by-laws, report of the Secretary for 1895, report of the Treasurer for 1895, agreement with Columbia University, an account of recent progress, and an outline map of the site, was distributed to members on April 15th, 1896, and has subsequently been sent to a large number of institutions, journals and societies.

The first number of "Bulletin du Laboratoire de botanique générale de l' université de Genève," edited by Dr. John Briquet Director of the Botanical Garden of Geneva, was also issued on, April 15th, 1896. It contains morphological and anatomical papers by MM. Briquet, Hochreutiner and Tswett, and "Études de biologie florale dans les Alpes occidentales," with three plates, by Briquet.

The Herbarium oj Columbia University, and the Herbarium of the New York Botanical Garden.—Botanists and collectors are hereby advised, that specimens, books or pamphlets intended for the Columbia University collections, should be addressed either to Dr. Lucien M. Underwood, Professor of Botany, or to Dr. John K. Small, Curator of the Herbarium. Material intended for the collections of the New York Botanical Garden, should be addressed to Dr. N. L. Britton, Director-in-Chief. All material addressed to Dr. Britton will hereafter be deposited in the collections of the Garden. His address will remain at Columbia University, until further notice.

The agreement entered into between the University and the Garden provides for the deposit of the Columbia collections and botanical library with the Botanical Garden, but the transfer will not take place until the Garden's museum building is completed. Plans for this building have now been drawn. The two collections will be kept on the same floor, but will be treated as distinct.

N. L. BRITTON.

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Small, John K. Studies in the Botany of the southeastern United States.—V. Bull. Torr. Bot. Club, 23: 125–130. 30 Ap. 1896.
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A new stem blight is noted and a new *Fusarium*, *F. acuminatum* E. & E.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., June 30, 1896. No. 6.

A preliminary Revision of the North American Isotheciaceae.

BY A. J. GROUT.

During the past winter a critical study of this family of mosses has been made at the Herbarium of Columbia University. Wishing to obtain more material illustrating the distribution of the species, a brief summary is here presented, giving the distribution, so far as can be determined, from material at hand. Persons having specimens from outside the range here indicated will confer a great favor by sending them to me at the Herbarium of Columbia University. If duplicates can also be sent, a suitable return will be made for them. I am already greatly indebted to several persons for aid in my work, for which acknowledgments will be made in the final publication.

ISOTHECIACEAE Spruce, Ann. and Mag. Nat. Hist. (II.) **3**: 285. 1849.

Gametophyte generally large, never minute. Primary stems creeping, radiculose. Paraphyllia lacking (except in *Climacium*). Leaves smooth, often plicate or concave; median leaf-cells linear, alar cells quadrate (except in *Holmgrenia*).

Sporophyte. Seta smooth, twisted. Calyptra cucullate. Operculum conic to conic-rostrate. Columella persistent. Capsule erect, straight, not conspicuously contracted under the mouth when dry. Peristome double, well developed; teeth lanceolate, articulate. Segments of endostome linear to lanceolate, attached

DEVELOPMENT OF THE ANTHERIDIUM IN TARGIONIA HYPOPHYLLA.

APPENDAGES TO THE PETIOLES OF LIRIODENDRON.

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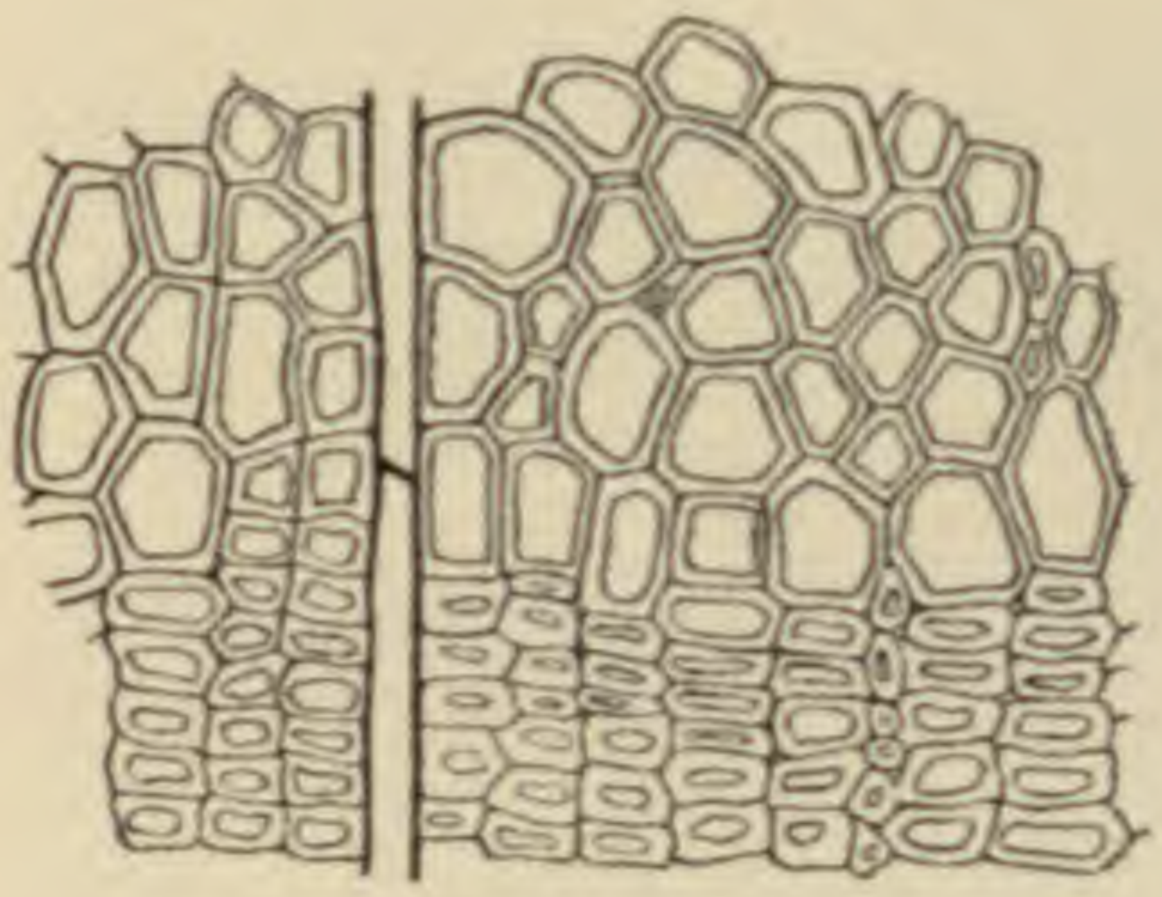

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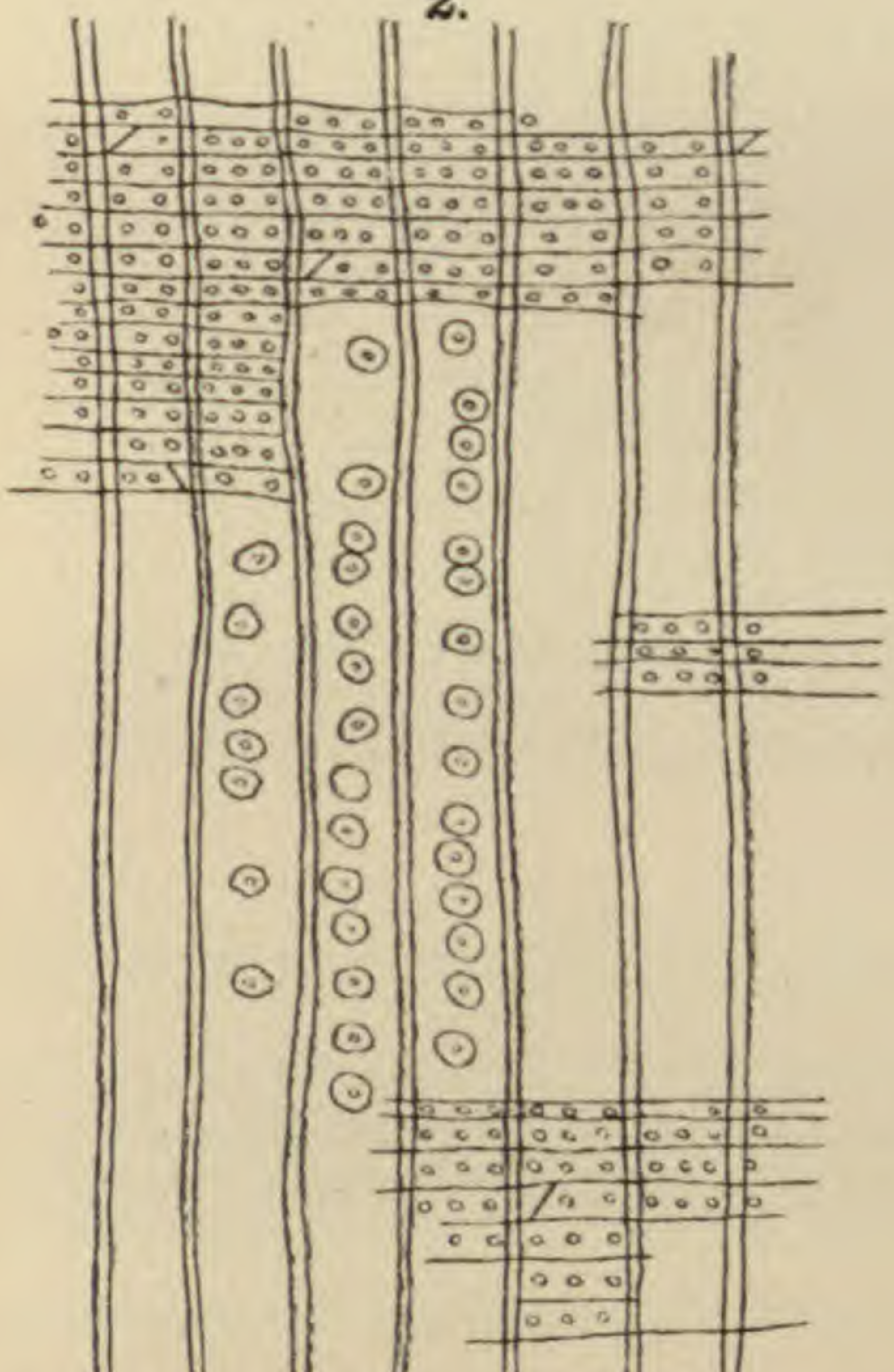

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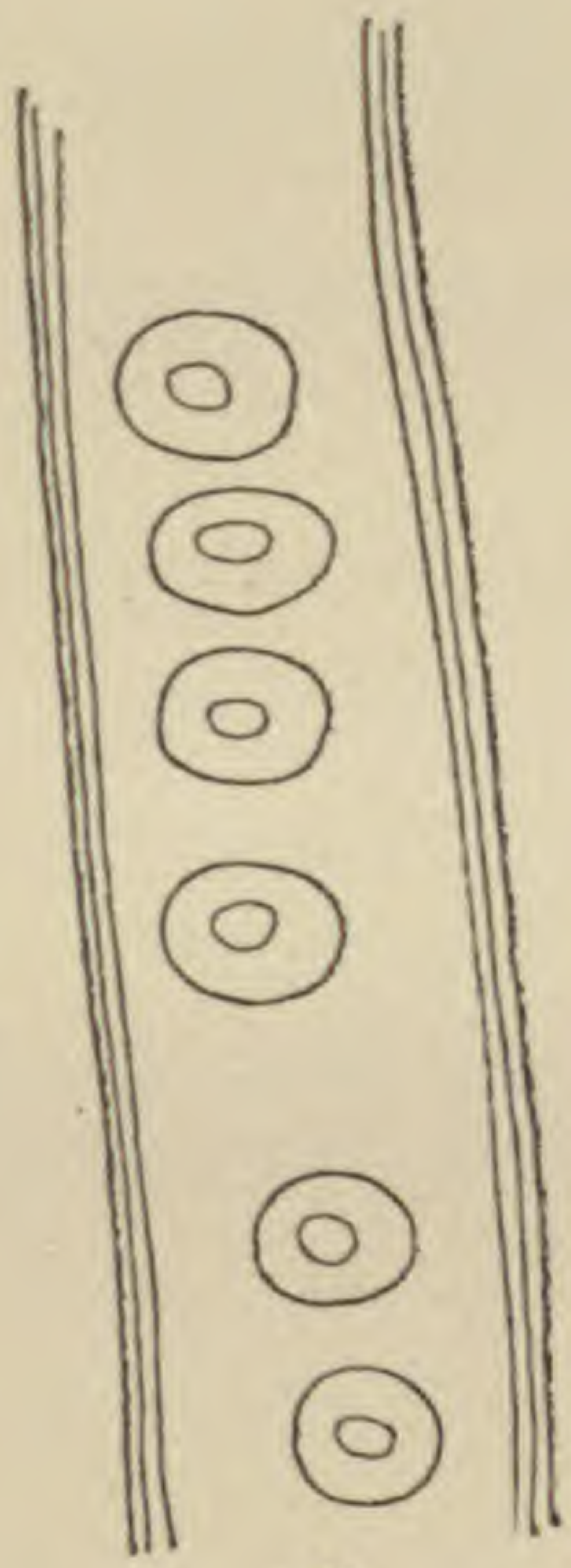

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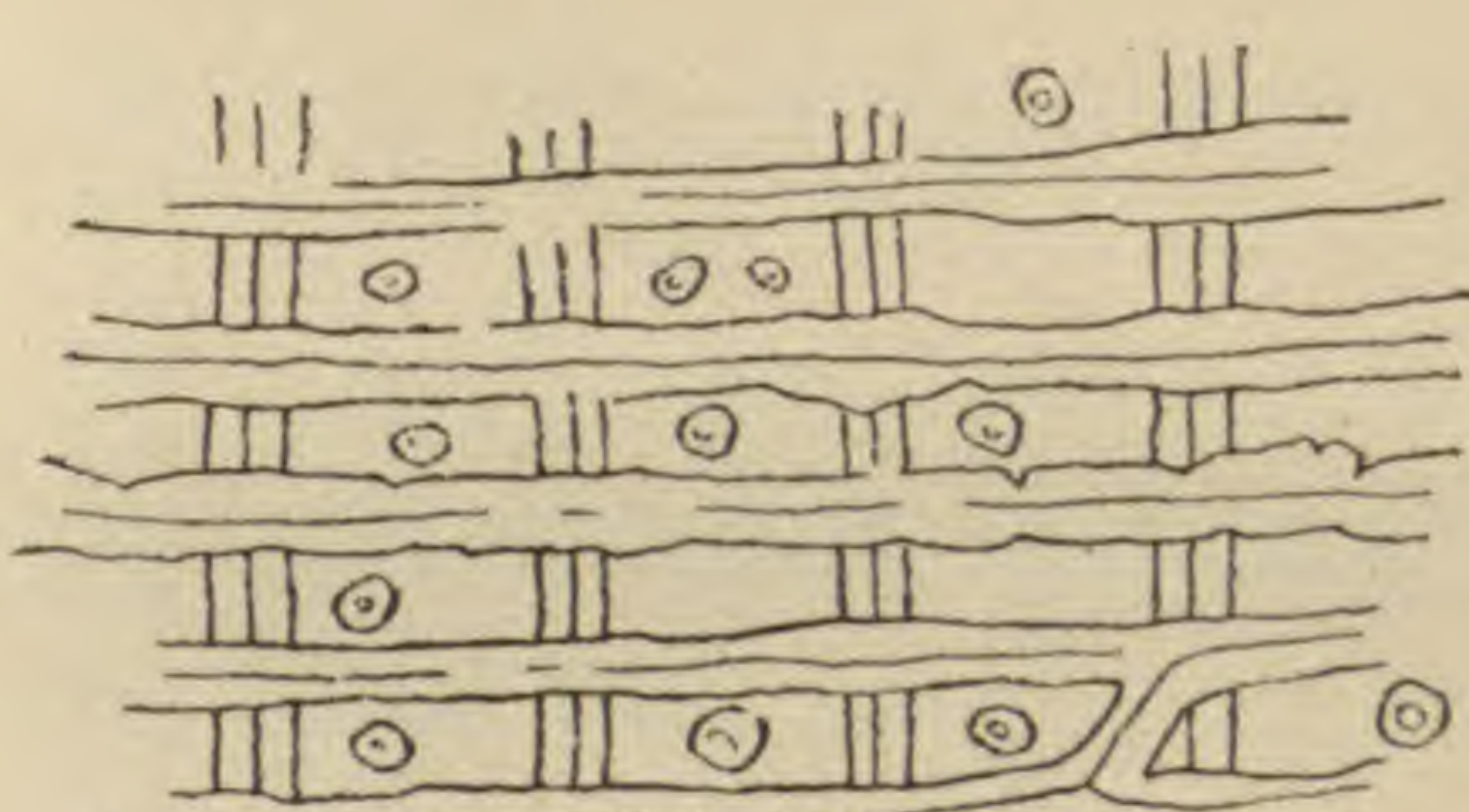

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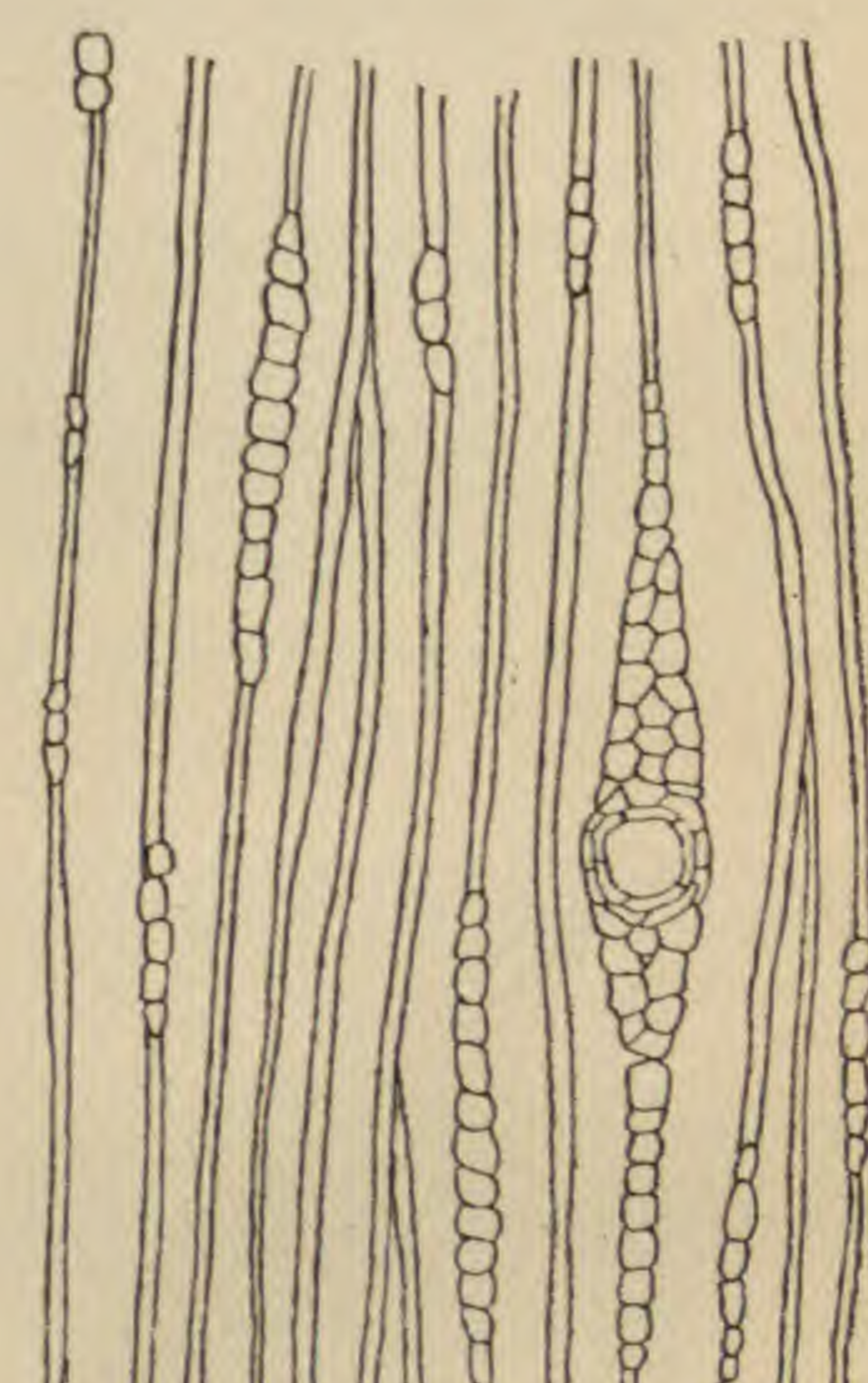

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VOL. 23. JULY, 1896. No. 7.

BULLETIN

OF THE

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A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., July 20, 1896. No. 7.

Notes on Potentilla.—II.

BY P. A. RYDBERG.

Another very natural group is that which clusters around *P. rivalis*. Watson acknowledged only three species, viz.; *P. supina*, *P. rivalis* and *P. Norvegica*. Lehmann has ten species, of which six are American. To these six should be added *P. Nicolletii* (*P. supina Nicolletii* Wats.), which is a fairly good species and also another, near *P. millegrana*, described in this paper.

The characters of the group are: an annual or biennial root, a terminal style which is curved above and considerably thickened near the base, small flowers, in which the petals seldom exceed the sepals, 5–20 stamens and small anthers whose two lobes are nearly spherical.

POTENTILLA PARADOXA Nutt.; Torr. & Gray, Fl. N. Am. 1: 437. 1838.

P. supina Michx. Fl. Bor. Am. 1: 304. 1803. Not L.

It has been regarded as a form of the European *P. supina*, and we still find it under that name in our manuals, notwithstanding the fact that the principal distinction has been known since the time of Nuttall. It resembles *P. supina* in the leaves, which are pinnate with several pairs of leaflets, but differs from it not only by the swollen corky attachment of the achene, but also in the stouter and more upright habit, the larger and coarser leaflets and a truly cymose inflorescence. It ranges from New York to Montana and New Mexico.

POTENTILLA NICOLLETII (Wats.) Sheld. Bull. Geol. and Nat. Hist Surv. Minn. 7: 16. 1894.

P. supina Nicolletii Wats. Proc. Am. Acad. 8: 553. 1873.

This is much nearer the European *P. supina*, having the same prostrate habit, small leaflets and falsely racemose inflorescence, but the achenes are of the same structure as in *P. paradoxa*. Only the basal leaves have several more or less distant pairs of leaflets; the lower stem-leaves have generally two approximate pairs, and the rest are ternate. It is a rather rare plant. The following specimens have been examined:

Minnesota: C. A. Geyer (Nicollet's Exped.), no. 361, 1838 (type); *Missouri*: B. F. Bush, 1893; *Iowa*: Hitchcock.

POTENTILLA RIVALIS Nutt.; Torr. & Gray, Fl. N. Am. 1: 437. 1838.

This differs from the preceding by its upright habit, cymose inflorescence, small petals which are scarcely half as long as the sepals, and achenes without any swelling on the inner side. The leaves are generally pinnate with two pairs of approximate leaflets, except the upper ones, which are ternate. Occasionally, especially in depauperate specimens, all the leaves are ternate, when it is very difficult to separate it from the next. The range is from Oregon and Montana to Mexico. All specimens named *P. rivalis* I have seen from the prairie States, except one from the stock-yards of Chicago, belong to the following species:

POTENTILLA MILLEGRANA Engelm.; Lehmann, Ind. Sem. Hort. Bot. Hamb. 1849: Add. 11. 1849.

This, as well as *P. pentandra*, have been regarded as varieties of the preceding. I think it is better, however, to consider them species. In *P. millegrana* all the leaves are, as a rule, ternate. The plant is much branched, with divergent branches and in the typical form spreading. This habit and the smaller, nearly white achenes separate it from forms of *P. rivalis* with ternate leaves. The plant is generally also more glabrate. It has a wide range, but is not a common plant. It extends from Illinois to New Mexico, California and Washington.

POTENTILLA LATERIFLORA n. sp.

P. millegrana lateriflora Engelm. Mss. in herbarium.

Annual or biennial; stems often several from the root, 3–5 dm. high, terete, finely and rather densely glandular-pubescent, often tinged with red or purple, simpler than in related species and with erect branches. Stipules small, ovate or oblong, entire or toothed. Leaves all ternate, the lower on petioles 2–10 cm. long, more or less hairy; leaflets broadly obovate, coarsely crenate, 2–4 cm. long and 1–3 cm. wide. Flowers small, about 5 mm. in diameter, on pedicels 5–15 mm. long from the axils of upper leaves, making the branches resemble leafy racemes. Calyx glandular-pubescent in fruit, about ½ cm. in diameter. Bractlets ovate-lanceolate or oblong, acute, a little shorter than the ovate, acute sepals. Petals yellow, obovate-cuneate, sometimes slightly emarginate, shorter than the sepals. Stamens about 10; pistils very numerous; style terminal, thickened and glandular at the base; ripe achenes whitish, smooth.

It most resembles *P. millegrana* and generally bears that name in our herbaria. Sometimes it is labelled *P. Norvegica*, which it resembles in the form of the leaf and general habit, but is a much more slender plant and has much smaller petals and fruiting calyx. From *P. millegrana* it differs in the simpler and erect stems, erect branching, falsely racemose inflorescence, broader and more hairy leaflets, and more glandular stems. Most specimens of what has been regarded as *P. rivalis millegrana* from the Pacific States belong to this species. It ranges from California and British Columbia to Assiniboia and Arizona. The following specimens have been examined:

Utah: Henry Engelmann (Simpson's Exp.), 1859.

Arizona: Edw. Palmer, no. 143, 1877; E. O. Wooton, 1892.

Nevada: Watson (King's Exp.), no. 324, 1867, in part, viz.: specimens from Unionville.

California: Coville & Funston, no. 1763, 1891: Wilkes' Expedition, no. 1647; J. G. Lemmon, no. 85, 1875; S. B. Parish, no. 3153, 1894; M. E. Jones, no. 2700, 1881.

Oregon: J. H. Bartholf, no. 29, 1875; T. J. Howell, 1881.

Idaho: A. Isabel Mulford, 1892.

Montana: Mrs. Moore, 1894; P. A. Rydberg, 1895.

British Columbia: John Macoun, 1889.

Assiniboia: John Macoun, no. 10482. 1895.

POTENTILLA MONSPELIENSIS L. Sp. Pl. 499. 1753.

P. Norvegica L. Sp. Pl. 499. 1753.
P. hirsuta Michx. Fl. Bor. Am. 1: 303. 1803.
P. Norvegica and *P. Norvegica hirsuta* Am. auth.

This is the stoutest of the group. It differs from the related species with ternate leaves in the size of the petals and the fruiting calyx. The former about equal the sepals in length and the latter often becomes 1 cm. in diameter. It is also more coarsely hirsute. It extends from Labrador to the District of Columbia westward across the continent.

The European form has generally a finer pubescence and oblong rather than obovate leaflets. It is occasionally met with in the East.

Potentilla Labradorica Lehmann, Ind. Sem. Hort. Bot. Hamb. 1849, Add. 12, has generally been included in *P. Monspeliensis.* From Lehmann's description it seems quite distinct, differing in being very low, 1–3-flowered, nearly glabrous, with leaves resembling those of *P. nana*, large stipules and larger flowers. I have not seen specimens.

POTENTILLA PENTANDRA Engelm; Torr. & Gray, Fl. N. Am. 1: 447. 1838.

P. pentandra is characterized by its leaves, which are digitately 5-foliolate or 3-foliolate, with the lateral leaflets cleft to near the base, by the exceeding numerous small flowers in a somewhat flat-topped cyme, by exceedingly small petals and generally only five stamens. It is often as stout as *P. Monspeliensis* and more bushy. Its range is from Missouri and Iowa to North Dakota and Arkansas.

The group *Multifidae* are perennials and have pinnate leaves with 2–7 pairs of deeply incised or pinnatifid leaflets, which are more or less white-tomentose beneath and greener above. All American species have a short terminal style, which in all except *P. pinnatifida* is thickened and glandular near the base. All except *P. Pennsylvanica* are spreading or ascending, with several stems from the perennial root.

POTENTILLA PENNSYLVANICA L. Mant. 1: 76. 1767.

P. Missourica Schrad. Linnaea, **8**: Litb. 26. 1833.

There is some doubt whether this or the next is the true *P. Pennsylvanica* L. The description of the leaves seems to indicate rather the next species. The form represented by *P. Missourica* has been cultivated in Europe under the name of *P. Pennsylvanica.* The same form was also figured by Jacquin, in his Hort. Vind. **2**: *pl. 189*, under that name. Dr. Lehmann held that Jacquin's figure represented the typical Linnaean species. Torrey and Gray, in Fl. N. Am., regarded *P. Missourica* as a synonym of the typical *P. Pennsylvanica.* I have therefore accepted that name for this very variable species.

P. Pennsylvanica is generally erect, 4–8 dm. high and more or less woolly tomentose. The leaves are truly pinnate, with 3–7 pairs of leaflets, which in the typical form are grayish tomentose beneath and nearly glabrous above, with broad oblong divisions and scarcely revolute margins.

The typical *P. Pennsylvanica* is a comparatively rare plant, ranging in British America from Hudson Bay to the Rockies, and in these extends southward to Colorado.

POTENTILLA PENNSYLVANICA BIPINNATIFIDA (Dougl.) Torr. & Fl. N. Am. 1: 438. 1838.

Potentilla bipinnatifida Dougl.; Hook. Fl. Bor. Am. 1: 188. 1830.

Segments linear, but their margins scarcely revolute; leaves white-tomentose beneath, more or less silky above.

It is more common than the species and of nearly the same range, but extends into Upper Michigan and Minnesota.

POTENTILLA PENNSYLVANICA STRIGOSA Pursh, Fl. Am. Sept. 356. 1814.

Stem with spreading hairs; segments narrow and with more or less revolute margins.

This is the most common form of *P. Pennsylvanica* found in the same range as the species, but also extending over the plains to Kansas and New Mexico. Also in northern Asia.

POTENTILLA PENNSYLVANICA ARACHNOIDEA Lehm. Nov. Stirp. Pug. 9: 41. 1851.

Plant in every part smaller; segments short; stem arachnoid-pubescent. Colorado, Utah and New Mexico.

POTENTILLA PENNSYLVANICA GLABRATA Wats. Proc. Am. Acad. 7: 554. 1872.

Low, stem puberulent or glabrate; leaves nearly glabrate and the sepals more distinctly veined. Perhaps distinct. Nevada, Montana and Assiniboia, in the higher mountains.

POTENTILLA LITORALIS.

Stem decumbent or ascending, 2–4 dm. long, simple, slightly appressed silky strigose. Lower stipules lanceolate, scarious and brown, the upper ovate, green, more or less toothed. Leaves pinnate, of two approximate pairs of leaflets, the lower pair the smaller, or subdigitately 5-foliolate, grayish tomentose and veiny beneath, nearly smooth above. Leaflets obovate, divided to near the mid-rib into linear oblong obtuse divisions. Calyx strigose and slightly tomentose, in fruit about 8 mm. in diameter. Bractlets lanceolate-oblong, nearly equalling the ovate triangular sepals. Petals obovate, cuneate, truncate or slightly emarginate, about equalling the calyx; stamens 20–25; style short, terminal, thickened and glandular at the base; achenes smooth.

A near relative of *P. Pennsylvanica*, but differs in the ascending or spreading stem, the sparser pubescence, the leaves, which have fewer and approximate leaflets, often almost digitate, and the sepals which are more distinctly ribbed. *P. litoralis* is principally a beach plant, or at least growing near the coast, while *P. Pennsylvania* is an inland plain or mountain plant. The following specimens belong to *P. litoralis*:

New Hampshire: Oakes & Robbins (Isle of Shoals), W. M. Canby. *Maine:* Wm. Boott (Cape Elizabeth), M. L. Fernald. *Newfoundland:* Waghorne, no. 8, 1895. *Quebec:* J. A. Allen, 1881 (Shores of St. Lawrence). *Labrador:* J. A. Allen, 1882.

POTENTILLA MULTIFIDA L. Sp. Pl. 496. 1753.

This is a species which somewhat resembles *P. Pennsylvanica bipinnatifida*, but the plant is spreading or ascending, the leaves of only 2–3 pairs, their segments nearly filiform with revolute margins, the stipules long-acuminate, scarious and brown, the sepals narrower and the style not thickened and glandular at the base. It is not rare in northern and alpine Europe and Asia, but I have seen only the following specimens from America.

Great Slave Lake: Miss E. Taylor, 1892. *Hudson Bay*: R. Bell, 1880.

POTENTILLA PULCHELLA R. Br. Ross' Voy. Ed. 2, 2: 193.

P. pulchella is generally a very small plant, tufted with many spreading items from the perennial root. The stems are generally less than 1 dm. long, but in one specimen seen fully 3 dm. The leaves have only two pairs of leaflets, and the terminal leaflet is generally sessile. It is generally quite hairy with long and yellowish white hairs. In general habit and flowers it comes near *P. Vahliana*, which has been mistaken for it; but the latter has always only 3 leaflets. Spitzbergen, Greenland, arctic coast of America, and Wrangle Island, off the coast of eastern Siberia.

POTENTILLA SOMMERFELTII Lehm. Del. Ind. Sem. Hamb. 1849: 6. 1849.

Closely resembles *P. pulchella*, but is still smaller and differs in the smaller flowers, the lack of the long hairs, and the stalked terminal leaflet. It is a native of Spitzbergen and Greenland, but one specimen at least has been collected on the American Continent. It was sent to Dr. Torrey from Dr. Hooker, but the collector's name does not appear on the label.

A neglected Species of Oxalis and its Relatives.

By JOHN K. SMALL.

The problem of drawing satisfactory lines between several species of *Oxalis* belonging to the group of which *O. corniculata* may be taken as the type, has apparently never been solved. Several forms of *Oxalis* exist in eastern North America, whose dispositions in our systematic works many botanists have not been able to understand satisfactorily. The plants referred to in this particular case are close relatives of *Oxalis corniculata* L., and have usually been regarded by authors as forms or varieties of that species, but as often happens, the "forms" or "varieties" possess excellent specific characters which for one reason or another have been overlooked.

A study of the material in the herbaria of Mr. Eugene P. Bicknell and Columbia University, together with field observations during several seasons, have led me to the following conclusions;

There are two perfectly distinct species, native in eastern North America, which have been indiscriminately referred to the names *Oxalis corniculata* or *O. stricta*. *Oxalis corniculata* is thought to be a native of southern Europe or tropical America and appears to be circumtropical. It is introduced to some extent into temperate regions, and we know it as a common weed in some of our southern cities; normally it is a prostrate and creeping plant, commonly wiry and very characteristic in habit, quite distinct from its two native eastern North American relatives with which we are at present concerned.

Linnaeus defines* *O. corniculata* and *O. stricta*, giving as characters for the former; "caule ramoso diffuso, pedunculis umbelliferis, Hort. Cliff. 175" and Trifolium luteum minus repens etjam procumbens, Moris. hist. 2, p. 183, f. 2. t. 17. f. 2." For *O. stricta* he gives, "caule ramoso erecto, pedunculis umbelliferis, Gron. Virg. 161," and "Trifolium . . . corniculatum luteum majus rectum . . . , Moris. hist. 2, p. 184, f. 2. t. 17. f. 3." We notice that Linnaeus describes the habit of the two species as dissimilar, while the character of the inflorescence is recorded as the same in both, namely, "pedunculis umbelliferis."

What strikes one most forcibly in the case of our two eastern species is the great difference in the general habit of the plants and their more minute morphology; the lower stout and pale plant with umbel-like inflorescence, large columnar abruptly pointed pods and strigose pedicels is closely related to *Oxalis corniculata* although abundantly distinct. Its characters pointed to the Linnaean *O. stricta*, but to make sure, specimens of both the eastern American forms were sent to Mr. Edmund Baker, who kindly compared them with the originals in the herbarium of the British Museum of Natural History and reported that the plant

* Sp. Pl. 435.

with umbel-like inflorescence matched the original of *Oxalis stricta.*

This disposes of one species, but there now remains the plant which has posed as *Oxalis corniculata*, as a state of *O. corniculata*, as a variety of *O. corniculata* and as *O. stricta;* it is tall and slender in habit and of a bright green color, with cymose inflorescence, smaller and more gradually narrowed capsules and villous pedicels. I cannot find an available published name for this species, and the only indication that it was noticed many years ago is the figure 4, on plate CCXXI, of Dillenius' Hortus Elthamensis, the rest of the plate clearly being *Oxalis stricta.* This species may be designated *Oxalis cymosa.* I append a description of our two common species:

Oxalis stricta L. Sp. Pl. 435. 1753.

Annual, caulescent, normally low, stout, fleshy, pale-green, glabrous below, or more or less strigose. Stem simple and erect or usually branched at the base, the branches spreading, decumbent or ascending, 1–4 dm. long, rather fleshy, usually green; leaves 1.5–3.5 cm. in diameter, on petioles 3–9 cm. long; stipules a narrow scarious dilatation of the base of the petiole; leaflets broader than long, thick and fleshy, acutely notched at the apex, the cellular structure very prominent under a lens; inflorescence axillary, umbellate; peduncles rather stout, 4–15 cm. long; petioles 1–2.5 cm. long, strigilose, at length deflexed, subtended by linear-subulate bracts; flowers yellow, fragrant; sepals linear or lanceolate, about 5 mm. long, many-nerved, ciliolate, erect or ascending; petals somewhat spatulate, about 1 cm. long, many-nerved, more or less inequilateral, undulate, commonly reddish at the base, sometimes slightly emarginate at the apex; capsule columnar, 1.5–3 cm. long, abruptly narrowed at the apex; seeds obovoid or elliptic, about 1 mm. long, brown, angled, marked with interrupted transverse ridges, the base rather acute.

New England to Dakota and Colorado, south to the Gulf of Mexico.

Oxalis cymosa n. sp.

Annual, caulescent, normally tall, slender, rather wiry, bright-green, glabrous or somewhat villous. Stem simple at the base, more or less branched above, 1–7 dm. tall, erect or assurgent, rarely decumbent at the base, at length woody, somewhat grooved, reddish or brownish; leaves 1–5 cm. to usually 3 or 4 cm. in diameter, on slender petioles 3–7 cm. long; stipules almost wanting;

leaflets broader than long, acutely notched at the apex, usually thinnish, the cellular structure not prominent under a lens; inflorescence axillary, cymose; peduncles wiry or filiform, 5–10 cm. long; pedicels 5–8 mm. long, villous, erect or ascending, subtended by linear-lanceolate bracts; flowers yellow; sepals lanceolate or narrowly elliptic, 4–5 mm. long, obtuse or acutish, erect or at length spreading; petals obovate or somewhat spatulate, 7–9 mm. long, many-nerved, obtuse or emarginate at the apex; capsule columnar, 1–1.5 cm. long, gradually narrowed to the apex; seeds obovoid-oblong, 1.2 mm. long, marked with prominent continuous ridges.

Ontario to the Lake Superior region and Nebraska, south to the Gulf of Mexico. Flowers somewhat earlier than *O. stricta*.

There is another relative of *Oxalis corniculata* occurring in our campestrian territory that appears to need study. I have examined the plant in the field and in the herbarium during several years and am convinced that it is specifically distinct from all other forms.

Rafinesque apparently found this form many years ago and described it in his New Flora,* and Prof. Trelease has described† it as a probable variety of *Oxalis corniculata*. The following is a description of the species as I now know it.

OXALIS MACRANTHA (Trel.).

? *Oxalis caespitosa* Raf. New. Fl. 2: 27. 1836. Not A. St. Hill.

Oxalis corniculata var. ? *macrantha* Trel. Mem. Bost. Soc. Nat. Hist. 4: 88. 1888.

Usually perennial by horizontal rootstocks, stoutish or hirsute. Stems erect or assurgent, sometimes loosely tufted, 1–3 dm. tall, often becoming woody at the base, commonly leafy throughout, sometimes densely hirsute; leaves 1 cm. or usually 2–3 cm. broad, more or less silky-pilose; petioles filiform, 3–9 cm. long, pubescent like the stem; leaflets ciliate, sharply notched at the apex; peduncles filiform, exceeding the petioles; flowers bright yellow or golden, 2–2.5 cm. broad, 2–5 umbel-like at the ends of the peduncles; pedicels 1–2 cm. long, about as long as the flowers, subtended by linear-subulate bracts; sepals ovate or oblong, 6 mm. long, obtuse, minutely pubescent, 6–12 nerved, nearly erect, the tips sometimes spreading, petals nearly 1.5 cm. long, slightly notched at the apex; ovary glabrous or nearly so; styles villous;

* New Fl. 2:27. 1836,

† Mem. Bost. Soc. Nat. Hist. 4: 88. 1888.

capsule columnar, 12 mm. long, abruptly narrowed into and tipped by the long (4–5 mm.) styles; seeds obovoid, 3-angled, 1.5 mm. long, marked with low broken transverse ridges.

Missouri to Georgia, Florida and Texas; ascends to only a few meters above sea-level.

Fossil Diatomaceae from Nebraska, and their Relation to modern Species.*

By C. J. Elmore.

Until very recently, fossil diatoms were scarcely known in Nebraska. In November, 1895, Dr. Barbour, professor of geology in the University of Nebraska, received some remarkably pure diatomaceous earth from Wheeler county. A little later he received some equally pure material from Mullen; and since that time a second deposit consisting of diatomaceous limestone has been found at Mullen, and a deposit of pure diatomaceous earth at Thedford. Some diatomaceous earth, largely calcareous, had been collected in Greeley county in 1887 by Mr. Russell and left with Dr. Bessey, but none of the species of diatoms that it contained had been identified.

Very little is known of these deposits. Dr. Barbour has not yet visited them, and the information that can be obtained from the collectors, who, in some cases at least, are the owners of the land on which the deposits occur, is very limited. Possibly the pure diatom deposits are of a sufficient extent to be valuable for commercial purposes, but this is somewhat doubtful.

The pure diatom deposit at Mullen consists of three layers. The middle layer contains practically nothing but diatom valves, while the top and bottom layers are mixed with considerable foreign matter. In the top layer six species were found that were not found in the middle layer, three of which are known in Nebraska only as fossil. In the lower layer only three species were found which were not found in the middle layer, all of which are common among modern Nebraska diatoms. It seems a little strange that the species in the lower layer should resemble mod-

* Read before Nebraska Academy of Sciences, January 3, 1896.

ern Nebraska species more closely than those in the top layer do. The species in all of these deposits show such a general resemblance to each other that it is likely that all the deposits were formed under the same conditions.

In these deposits 73 distinct species were identified, besides a number of so-called varieties not enumerated separately. Fifty-nine of these, according to De Toni Syll. Alg., are exclusively fresh-water species, 11 are fresh or submarine, 1 fresh or marine, 1 marine, and 1 submarine or marine. The last species, however, is found in Nebraska in fresh water. Only 28 of the species, according to De Toni, l. c., are known as fossil, leaving 45 species that have not been found before as fossil. A deposit in New Jersey, however, discovered by Dr. A. M. Edwards since the publication of the Sylloge Algarum, shows many of the same species that are found in these deposits. There is a striking similarity between the species found in these deposits and those now found living in Nebraska. Fifty-two of the 73 species are known to be living within the State; and considering that only a comparatively small number of the living diatoms of Nebraska are known, it is likely that nearly all of the fossil species are now to be found living in the region.

A comparison of these fossil diatoms with modern ones has led me to the conclusion that the term *variety* cannot be properly used in dealing with diatoms. The forms classed as varieties may be divided into two classes: (1) Conditions of some species, and (2) closely related species. Diatoms vary so greatly in form and size between one auxospore stage and the next that the same species may occur in many forms, all of which are but stages in the life-history of the organism. Many of these different conditions have been described as species, and have been reduced to the rank of varieties by later writers who saw more or less clearly their true relationship. But such conditions are not varieties any more than the prothallium of a fern or the protonema of a moss are varieties of the plants to which they belong. The other forms which are classed as varieties are merely closely related species. These fossil diatoms show the same species and the same variations from the species that modern ones do. If these variations are only temporary and return to the original form by the formation of auxospores they come under the first class. If they do not return to the original form, but have remained distinct from it since Tertiary times, they have certainly earned their title to the name *species*, and should not be classed as varieties. Evolution in diatoms since their first appearance as such is not easy to trace; in fact, there appears to have been none. Unless we can find in them evidence of continued evolution, we cannot consistently recognize varieties among them.

The following is a list of the species identified in these deposits:*

Abbreviations used in the list. (The data as to habitat, etc., are taken from De Toni, l. c.)

Fr. A freshwater species.

Mar. A marine species.

Subm. A submarine species.

Foss. A species known elsewhere as fossil.

Neb. A species that has been found living in Nebraska.

M. Found in the middle layer of the Mullen deposit.

M 1. Found in the top layer of the Mullen deposit.

M 2. Found in the bottom layer of the Mullen deposit.

L. Found in diatomaceous limestone at Mullen.

G. Found in Greeley county deposit.

W. Found in Wheeler county deposit.

T. Found in Thedford deposit.

Amphora ovalis Kuetz. Fr. Neb. Very rare. Probably the form represented by var. *gracilis* (Ehr.) in M. L.

Coconeis placentula Ehr. Fr. and Mar. Foss. Neb. T. M. W.

Cymatopleura elliptica (Bréb.) W. Sm. Fr. and subm. Neb. Only a fragment found. M2.

Cymatopleura solea (Bréb.) W. Sm. Fr. Neb. Not common. M2.

Cymbella cistula (Hempr.) Kirchn. Fr. Neb. Common, and quite variable. M. W. L. G.

Cymbella cuspidata Kuetz. Fr. Foss. Neb. Common. Some specimens measure 98 μ long. W. M. T.

* I am indebted to Prof. C. S. Boyer for examining my slides and for other suggestions.

Cymbella cymbiformis (Kuetz.) Bréb. Fr. Neb. Common. M. W. L. In the limestone at Mullen a form occurs like var. *parva* (W. Sm.). V.H.

Cymbella gastroides Kuetz. Fr. Foss. Neb. Common. M. T. G.

Cymbella inaequalis (Ehr.) Fr. Foss. Neb. Common. M. T.

Cymbella lanceolata (Ehr.) Kirchn. Fr. Common. M. L. G.

Cymbella levis Naeg. Fr. Rare. M.

Cystopleura gibba (Ehr.) Kuntze. Fr. and subm. Foss. Neb. Rather common. T. M. W. L. The form called var *ventricosa* (Ehr.) Grun. also occurs.

Cystopleura ocellata (Ehr.). Kuntze. Fr. Foss. Rather common. M1.

Cystopleura turgida (Ehr.). Kuntze. Fr. and subm. Neb. Quite common, as are also var. *vertagus* (Kuetz.) Grun. and var. *Westermanii* (Ehr.) Grun. M. W. L; var. *Westermanii* is cited (De Toni, Syll. Alg. 2: 778) as fossil.

Cystopleura Zebra (Ehr.) Kuntze. Fr. and subm. Foss. Neb. Not very commom. M. W. L.

Encyonema caespitosum Kuetz. Fr. Neb. Rare. M.

Eunotia Arcus Ehr. Fr. Foss. Common. G. M.

Eunotia Diodon Ehr. Fr. Foss. Rare. M.

Eunotia formica Ehr. Fr. Rather common. G. A form reaching 225 μ in length resembling var. *elongata* Grun. occurs rather common at Mullen.

Eunotia lunaris (Ehr.) Grun. Fr. Neb. Common. M. L.

Fragilaria construens (Ehr.) Grun. Fr. Foss. Neb. Rather common. M. T. W. The form represented by var. *venter* Grun. is much more common, being the most common one in the Weller Co. deposits.

Fragilaria elliptica Schum. Fr. Common. W. M.

Gomphonema acuminatum Ehr. Fr. Foss. Neb. Not common M. Common G.

Gomphonema constrictum Ehr. Fr. Foss. Neb. Rather common. W. M.

Gomphonema gracile Ehr. Fr. Neb. Common. M. L. G.

Gomphonema herculaneum Ehr. Fr. Rare. M.

Gomphonema intricatum Kuetz. Fr. Neb. Common. G.

Gomphonema montanum subclavatum Grun. Fr. Neb. Rather common. W.

Gomphonema parvulum (Kuetz.) Rabenh. Fr. Neb. Not very common. M. T.

Gomphonema Turris Ehr. Fr. Neb. Common. M.

Gomphonema Vibrio Ehr. Fr. Foss. Rare. M. Common. G.

Hantzschia Amphioxys (Ehr.) Grun. Fr. and subm. Neb. Common. W. M. Var. *major* Grun. Mi.

Melosira distans (Ehr.) Kuetz. Fr. Foss. Neb. Very common. M. L. G. W.

Meridion circulare (Grev.) Ag. The specimens evidently belong to *Meridion constrictum* Ralfs, but that is probably only a form of *M. circulare*. Fr. Foss. Neb. Rare. M.

Navicula ambigua Ehr. Fr. Neb. The specimens are all in "resting" condition, described by Van Heurck (Syn. 100) as forma *craticula*. No specimens in normal condition were found. L.

Navicula bacilliformis Grun. Fr. Neb. Rare. M. L.

Navlicula cuspidata Kuetz. Fr. Neb. This species occurs both in normal and "resting" condition. Not very common. W. M. L.

Navicula dicephala Ehr. Fr. Foss. Neb. Rare. M.

Navicula elliptica Kuetz. Fr. and subm. Foss. Neb. Rather common. M. Mi.

Navicula Gigas (Ehr.) Kuetz. Fr. Not common. M.

Navicula Hungarica Grun. Fr. and subm. Rare. L.

Navicula Iridis Ehr. Fr. Neb. Varieties *affinis* (Ehr.) V. H., *amphigomphus* (Ehr.) V. H., and *amphirhynchus* (Ehr.) De Toni occur with the species. The specimens of the type are all rather small. W. M. L. T. Var. *amphigomphus* is the only form that De Toni, l. c., cites as fossil.

Navicula Legumen Ehr. Fr. Neb. Rare. Mi.

Navicula limosa Kuetz. Fr. Neb. The specimens vary from the type, being as long as 95 μ, and scarcely inflated at the apices. Common. G.

Navicula nobilis (Ehr.) Kuetz. Fr. Foss. Rather common. M.

Navicnla oblonga Kuetz. Fr. Foss. Neb. Rather common. M. T.

Navicula parva (Ehr.). Fr. Neb. Not very common. M.

Navicula placentula (Ehr.) Kuetz. Fr. and subm. Foss. Found with var. *tumida* (W.Sm.). This species shows all variations from globose-capitate to slightly attenuate-rostrate. The specimens are larger than those described by De Toni (Syll. Alg. 2: 55) and have coarser striations. The globose-capitate forms seem not to be described, but they evidently belong to the same species as the attenuate forms. Common. L. M.

Navicula pupula Kuetz. Fr. Neb. Not very common. W. M.

Navicula radiosa Kuetz. Fr. Foss. Neb. Var. *acuta* (W.Sm.) Grun., is found with the type, from which it scarcely differs. Rather common. M2. L.

Navicula rostrata Ehr. Fr. Foss. Neb. Not very common. W. *Navicula sphaerophora* Kuetz, appears to be merely a form of *Navicula rostrata*. M.

Navicula serians (Bréb.) Kuetz. Fr. Foss. Neb. Rare. L.

Navicula trinodis inflata Schultze, occurs, but is rare. Fr. Neb. M.

Navicula viaidus (Nitz.) Kuetz. Fr. Foss. Neb. Not very common. M. L. G.

Navicula viridula Slesvicensis (Grun.) V. H. Fr. and subm. Neb. Rare. M.

Nitzschia amphibia Grun., and *Nitzschia Frauenfeldii* Grun., which seems to be merely a form of the former. Fr. Neb. M. G. L.

Nitzschia obtusa W. Sm. Fr. Common. L.

Nitzschia sinuata (W. Sm.) Grun. Fr. Not very common. L.

Nitzschia spectabilis (Ehr.) Ralfs. Subm. and Mar. Foss. Found in Nebraska in fresh water. Rare. L.

Nitzschia subtilis (Kuetz.) Grun. The form represented by var. *paleacea* Grun., occurs, but is rare. Fr. and subm. Neb. M. L.

Nitzschia vermicularis (Kuetz.) Hantzsch. Fr. Neb. Not common. M2.

Opephora pacifica (Grun.) Petit. Marine. This is the only species found in any of these deposits that has formerly been known as exclusively marine. Rather common. M. T.

Stauroneis anceps Ehr. Fr. and subm. Neb. Not very common. L.

Stauroneis minutissima Lagerst. Fr. Rare. M.

Stauroneis Phoenicenteron Kuetz. Fr. Neb. Rather common. G. M. L.

Suriraya spiralis Kuetz. Fr. Rare. M.

Suriraya splendida (Ehr.) Kuetz. Fr. and subm. Neb. Rare. M1.

Synedra capitata Ehr. Fr. Foss. Neb. Rather common. W. M. L. T. The form represented by *Synedra ulna longissima* (W. Sm.) Brun, seems rather to belong to this species. Not very common. M. W.

Synedra radians Kuetz. Fr. Rare. M.

Synedra tenuissima (Kuetz.) Fr. Neb. Rare. M.

Synedra ulna (Nitz.) Ehr. Fr. Foss. Neb. The forms called var. *amphirhynchus* (Ehr.) Grun. and var. *oxyrhynchus* (Kuetz.) V. H., occur, but not common. M. L.

Tabellaria fenestrata Kuetz. Fr. Very common. M.

Tetracyclus lacustris Ralfs. Fr. Foss. Rare. G.

Notes upon Maine Plants.

BY F. L. HARVEY.

The following plants found in Maine and not in Fernald's catalogue or supplement may be of interest to botanists. New localities for a few are added.

Geranium molle L. Common in the lawns on the college ground. Noticed for two seasons; apparently spontaneous.

Anthemis tinctoria L. This was found in Brewer, in 1887, by Rev. Mr. Merrill, and we have it from Mr. C. H. Gould, collected at N. Bridgton, where it was abundant in fields.

Hypochaeris glabra L. Has been found on the college grounds occasionally. We think Mr. Fernald found it in 1890 and it has been detected since. It should not be forgotten.

Lobelia leptostachys A. DC. We have a fine specimen of the species collected in an old field at Brownfield, Me., by Geo. Haley, probably brought in from the West in grass or clover seed. It possibly may gain a foothold.

Lythrum alatum Pursh. Collected at Bradford, Me., along the roadside by Mr. F. P. Briggs, is as worthy of record as *Silene dichotoma* and other plants recently introduced in Maine, and listed before sufficient time has elapsed to decide their spontaneity.

Mentha gentilis Smith. Jackman, August, 1895 (Harvey & Knight). This is given in Gray's Flora as a variety under *M. sativa.*

Polygonum lapathifolium nodosum (Pers.) Small. Jackman, August, 1895 (F. L. Harvey & O. W. Knight). Growing in a potato field.

Cyperus esculentus L. Is found on sandy shores of the Penobscot river about Orono. We believe it has not been reported from the Penobscot Valley.

Carex sterilis excelsior Bailey. Coast of Maine, 1893 (Harvey). Our specimens were determined by Professor Bailey. Professor Bailey regards this form as *C. stellulata, C. echinata* and *C. sterilis.* Boott var. β. (BULLETIN, November, 1893, p. 424). As these are not mentioned in Fernald's lists, we presume this form has not been recorded.

Festuca ovina pseudovina Hackel. Was collected in fields about Orono in 1892, by Mr. F. P. Briggs. The specimens were determined by Vasey, and are undoubtedly correct.

Agrostis canina alpina Oakes. Collected on Mt. Ktaadn in 1892 by F. P. Briggs, and determined by Dr. Vasey.

New Melastomaceae collected by Miguel Bang in Bolivia.

BY A. COGNIAUX.

TIBOUCHINA TETRAPETALA Cogn. sp. n. (sect. Pseudopterolepis).

Ramis petiolis pedunculis foliisque supra setis subadpressis breviter denseque vestitis; foliis parvis, rigidis, breviter petiolatis, ovato-oblongis, apice obtusiusculis, basi rotundatis, margine subintegerrimis, 5-nerviis, subtus brevissime denseque hirtellis; cymis brevibus, plurifloris, subcongestis; floribus 4-meris, satis parvis, sessilibus vel subsessilibus; calyce setulis arcte adpressis longiusculis eglandulosis dense vestito, tubo campanulato-oblongo, lobis triangulari-subulatis tubo satis brevioribus; staminibus satis inaequalibus, omnibus connectivo basi breviter producto.

Rami satis graciles, obscure tetragoni, ferruginei satis ramulosi. Petiolus robustiusculus, 2–5 mm. longus. Folia patula vel subreflexa, supra intense viridia, subtus cinerea, 2–3.5 cm. longa, 1–1.5 cm. lata. Calyx viridi-cinereus, tubo 5 mm. longo, lobis erecto-patulis 3–4 mm. longis. Petala purpurascentia, anguste obovata, margine vix ciliata, circiter 1 cm. longa. Staminum filamenta glaberrima, 4 vel 6 mm. longa: antherae subrectae, 4 vel 5 mm. longae, connectivo infra loculus 1 vel 1.5 mm. longi producto. Stylus filiformis, 13–15 mm. longus.—(No. 2425.)

Cette espèce ressemble beaucoup au *T. Brittoniana* Cogn., dont elle diffère par ses fleurs tétramères, sessiles ou subsessiles, et non pentamères, assez longuement pedicellées, par sou calice á soies plus longues, etc.; elle doit se placer près du *T. parviflora* Cogn.

DIOLENA BOLIVIENSIS Cogn. sp. nov. Caule superne petiolis pedunculisque longiuscule subadpresse denseque setulosis; foliis in eodem jugo valde disparibus, breviter petiolatis, late oblongis, basi valde inaequalibus obtusisque, margine minute denticulatis, supra sparsissime longeque setulosis, subtus ad nervos densiuscule adpresse longeque setosis caeteris glabris, majoribus 7-plinerviis longiuscule acuminatus, minoribus 5-plinerviis breviter acuminatis; racemis terminalibus vel subterminalibus, submultifloris; floribus breviter pedicellatis.

Caulis ascendens, simplex, obtuse tetragonus, satis robustus, superne purpureo-violaceus, 2 dm. longus. Petiolus 2–4 mm. vel 1–3 cm. longus. Folia tenuiter membranacea, intense viridia; marjora 12–18 cm. longa, 4.5–6 cm. lata; minora 3–4.5 cm. longa, 11–17 mm. lata. Pedunculus communis 4–6 cm. longus; pedicelli erecto-patuli, 3 mm. longi. Calyx late obconicus, furfuraceo-puberulus, superne subsparse breviterque setulosus, 3 mm. longus. Petala alba, glabra, apice subrotundata, 8–9 mm. longa. Staminum filamenta 3 vel 3.5 mm. longa; antherae leviter arcuatae, majores 1.5 mm. longae, appendicibus erectis, capillaribus, 2 mm. longis. Stylus robustiusculus, apice uncinatus, 4–5 mm. longis. (No. 2574.)

MICONIA UNDATA Triana, var. ROBUSTA Cogn. var. nov. Tota robustior. Rami juniores satis compressi. Petiolus robustus, 2–3 cm. longus. Folia ut in var. *Boliviensis*, sed majora, basi breviore attenuata. Flores satis majores; calyx 2.5–3 mm. longus; petala 2 mm. longa. (No. 2343).

MICONIA CYANOCARPA Naud. var. HIRSUTA Cogn. var. nov. Rami petioli pedunculique setis patulis elongatis densiuscule hirsuti. Folia membranacea, usque 15 cm. longa et 8 cm. lata. (No. 2387).

MICONIA BRITTONII Cogn. var. GLABRATA Cogn. var. nov. Rami petiolique demum glabrati. Folia supra brevissime sparseque strigillosa, subtus ad nervos nervulosoque brevissime sparseque setulosa, caeteris glabra. Calyx leviter furfuraceus vix hirtellus. (No. 2627).

MICONIA LASIOCALYX Cogn. sp. nov. (sect. *Amblyarrhena*). Ramis obtuse tetragonis, junioribus petiolis pedunculis foliisque subtus ad nervos brevissime denseque puberulis fere furfuraceis; foliis ovato-oblongis, breviuscule acuminatis, basi rotundatis, margine obscure denticulatis, breviter 7-plinerviis, supra brevissime subsparse adpresseque setulosis, subtus pilis brevissimis simplicibusque densiuscule puberulis; floribus 5-meris, sessilibus; calyce breviter denseque hirtello, dentibus brevissimis; antheris oblongis, apice biporosis; stigmate peltato.

Rami satis graciles, juniores cinereo-fusci. Petiolus satis gracilis, 2–3.5 cm. longus. Folia membranacea, subtus viridi-cinerea, 15–19 cm. longa, 6.5–8 cm. lata. Paniculae pyramidatae, circiter 1 dm. longae, ramis divaricatis. Calycis tubus campanulato-ovoideus, cinereus, 3 mm. longus. Petala late obovata, apice subtruncata, 1 mm. longa. Antherae 1 mm. longae. Stylus 3 mm. longus. Affinis *M. Costaricensis* Cogn. (No. 2344).

MICONIA VALIDA Cogn. sp. nov. (sect. *Cremanium*); ramis obtuse tetragonis, ad nodos non dilatatis vix compressis, junioribus petiolis foliisque subtus ad nervos pilis plumosis crispulis brevissimis dense tomentosis; foliis tenuiter membranaceis, ovato-oblongis, breviter acuminatis, basi rotundatis vel vix emarginatis, integerrimis, 5-nerviis, supra primum leviter furfuraceo-hirtellis praecipue ad nervos demum glabratis, subtus brevissime et densiuscule stellato-puberulis; floribus minutissimis, 5-meris, sessilibus; calyx ovoideo-campanulato, glabrato, distincte 5-dentato; antheris apice biporosis; stigmate peltato.

Rami robusti, cinereo-fulvi. Petiolus robustiusculus, 3–4 cm. longus. Folia supra laete viridia, subtus viridi-cinerea, 18–23 cm. longa, 8–11 cm. lata. Paniculae late pyramidatae, multiflorae, 7–8 cm. longae, ramis patulis, gracilibus, densiuscule breviterque hirtellis. Calyx fuscescens, 1.5 mm. longus. Petala suborbiculari-ovata, obtusa, leviter furfuracea, 0.6–0.7 mm. longa. Antherae vix 0.5 mm. longae. Stylus 2 mm. longus.—Species *M. plethoricae* Naud. proxima. (No. 2630.)

What is meant by Stem and Leaf.

BY EMILY L. GREGORY.

The difference between these two plant organs appears so evident that few persons would hesitate if asked to explain it. To the botanist, however, the subject is not so simple. This is illustrated by the following paragraph which occurs in a recent number of the *School Review*: "It is unfortunate from a morphological standpoint that these organs of the Bryophyta should be called stems and leaves * * * this terminology being handed down from a time when the true homologies of the sporophyte and gametophyte parts were not well known."

It would seem from this paragraph that, while the ordinary observer would not hesitate to describe the organs of the moss-plant as stem and leaf corresponding to those of higher plants, the morphologist would give a different interpretation to their meaning, and even carry this so far as to prefer that other names be given them.

This opinion, expressed by the author of the above paragraph, is shared by many morphologists of the present day, and especially by one of our leading botanists, Professor Goebel. He says in an article published several years ago in the third volume of Schenk's General Botany, in speaking of the development of the higher from the lower, from thallus to the stem and leaf. "The attainment of a higher form in the different plant-groups has taken place in a similar or analogous manner, though it is an independent process in each plant group." He then compares the parts or members of *Caulerpa*, which resemble stem and leaf, with similar members in certain forms in the higher groups of plants, with certain of the Phaeophyceae, Florideae, and with the liverworts, ferns and phanerogams. Of these again he says, "We cannot say that these members are homologous, for example, liverworts and ferns are undoubtedly nearly related, but the vegetative form of the foliose liverwort is not the homologue of the leafy stem of the fern, but of the other generation, which has the form of a thallus; that is, the attainment of a stem and leaf in the asexual generation of the fern plant may have come about entirely independent of any inherited tendency or connection with the liverwort, simply by a series of changes from a thallus up to a stem and leaf, just as we have seen in the sexual generation of the liverwort. Here there is a gradual adaptation of the plant to its surroundings, till from a thallus form comes finally that of stem and leaf. The endeavor to find out how the different organs or members of the higher plants have originated must not take the starting point that the different groups of plants form a continuous series from low to high, but, on the contrary, must start with the assumption that the origin of different organs must be sought separately in each large group of plants. For this reason it is very difficult to give a definition of leaf which will hold for every group, as the leaf of the liverwort is analogous to that of the fern and not homologous."

It is difficult to harmonize these statements of Goebel, for, on the one hand, he says the attainment of stem and leaf is an independent process in each large group of plants ; on the other, that it is difficult to give a definition of a leaf which will hold for every group, because these organs are not homologues throughout the different groups but only analogues. If their attainment has come about independently in each group, why does he expect to find them homologues, or what has the question of homology to do with the conception of stem and leaf?

The writer of the present article was puzzling over this question in the laboratory of Professor Schwendener in the summer of 1894, and on asking him to explain it received the following explanation of his idea of stem and leaf. He first said that he did not share Professor Goebel's opinion regarding the idea of stem and leaf, for he saw no connection whatever with the question of homology. He then explained about as follows :

Suppose we examine a system consisting of main stem and branches or shoots : We find first a main stem which we may name I. On this arises another which may be called II. It is somewhat different from the first, smaller and less complex ; this number II bears on it another which we may call III, and so on. There is no need so far for another name ; this might be a branched thallus or a branched stem, the branches being the same in general character as the first or main branch, only they diminish in rank according to their distance from the main stem, so numbers do just as well as words to describe them. But when we come to the little outgrowths that appear on these branches then we find the need of another word or name. They differ from the stem, but are all of the same grade or rank, whether they are found on number I or II, or any other rank of stem. They generally arise from the point of vegetation in acropetalous order and are lateral appendages of the mother organ. The stem must first be present, then comes the leaf. For this formation we must have a name, as we cannot consider it a stem of any grade or rank.

This may be still farther illustrated by the examination of a plant like *Nitella* or *Chara*. Here the main branch sends off side-branches which in turn develop other side-branches, but these differ in rank, the higher the number, or the farther its distance from the main stem, the smaller the branch. There is no difference in principle but only in rank, so there is no need for term leaf here. There is but one idea, the repetition of the main stem, but on a smaller scale.

This makes the idea of leaf and stem a fixed one which holds through all the different groups of plants. The fact that the *Blasia* thallus is not homologous with the leafy fern stem has nothing whatever to do with the idea of the leaf. This is entirely independent of phylogenetic considerations, has to do simply with the ontogenetic facts, consists either of stem and leaf, or thallus. According to Professor Schwendener also, the transition forms are not so distinct as Goebel makes them. As soon as a leaf-like organ appears, the mother organ is to be named stem; so in *Marchantia*, that which is ordinarily called thallus is really stem, as it is that member from which another member unlike itself originates.

This conception of the relation between leaf and stem not only obviates the difficulty to which Goebel refers in defining the word leaf, but agrees perfectly with the manner in which it is supposed to originate. Those who accept this view, therefore, find no inconsistency in retaining the word cormophyte, neither in the use of the terms stem and leaf as applied to the organs of the moss plant.

NEW YORK, June 1, 1896.

Botanical Notes.

CASSIA PROBOSCIDEA n. sp. Cassia sectioni Oncolobio pertinens, erecta, herbacea (?), glabra vel leviter glanduloso-pubescens. Foliola 4–5-juga, ovata, anguste acuta, marginibus ciliata, 1.5–3 cm. longa. Petiola basiglandulosa, glandulis hemisphericis, sessilibus.

Racemi terminales, pauciflori. Flores flavi, petalis oblongis, longitudine 1 cm. Antheri perfecti 6, duobus superioribus majoribus, filamentis quam alteris longioribus. Staminodia 3. Legumen glabrum, coriaceum, conspicuiter rostratum, cylindricum vel leviter compressum. Semina transversa, oblonga. Cotyledones plani.

Collected by J. F. Waby at Hastings, Barbadoes, April–June, 1895. (No. 24.) Type in the United States National Herbarium.

The basal petiolar gland and cylindrical pod containing seeds parallel to the dissepiments fix the position of this Cassia in Vogel's section Oncolobium, under which Bentham enumerates in his revision ten species.*

The plant is unique, however, in the possession of a pod tapering abruptly into a narrow proboscis-like beak, which occupies about one third of its total length. The pods of *Cassia Manzanilloana* Rose, from Mexico, exhibit a slight tendency to become rostrate; but the beak is never obviously developed. Mature seeds from the type specimen have been planted in the greenhouse, in the hope that the plant may be successfully cultivated and distributed.

CHARLES LOUIS POLLARD.

WASHINGTON, D. C.

Euphorbia Nicaensis. A few days ago I visited the locality for this rare spurge, which was discovered near Vestal, N. Y., by Mr. C. F. Millspaugh in 1885. The plant is apparently increasing and grows luxuriantly, some stems being four feet in height.

On the day I saw it the plant was in full blossom, and looked at first glance like a field of Golden Rod nearly ready to bloom. It is found in greatest profusion about a lock of the abandoned New York and Pennsylvania Canal, and from thence has spread to the roadside and adjacent fields.

In the majority of the plants the floral leaves are greenish or yellowish green, but in some individuals this varies to deep yellow. In these the floral leaves are usually larger than in the others. Plants that are completely sterile, with floral leaves and no flowers, are also common.

The sixth edition of Gray's Manual gives Binghamton, N. Y., as the only station for the plant, but I understand it has since

* Trans. Linn. Soc. London, 27: 530-535. 1871.

been found along the Susquehanna river at Athens, Pa., perhaps derived from the Vestal locality and carried there by the stream.

WILLARD N. CLUTE.

BINGHAMTON, N. Y.

Sisymbrium altissimum L. The Tumble Mustard has entered Michigan. The writer found over one hundred plants of this dreaded weed at Benton Harbor, Mich., June 13, 1896.

C. F. WHEELER.

Reseda lutea. We notice a reference in the June BULLETIN to *Reseda lutea* L., having been found in New Jersey.

In July of 1894 we collected specimens of this plant in meadows at East Windsor, Ct., on what could not have been ballast ground.

C. H. BISSELL.

Reseda lutea was collected by Miss Powers at Baldwins, Long Island, in 1895, and has been reported to me from Michigan, by Mr. S. H. Camp.

N. L. B.

Erythea. The editor of the "Journal of Botany," in referring (June issue, p. 280) to the part of Professor Greene's "Pittonia" recently distributed, makes a statement concerning "Erythea" which is about as accurate as his recently printed tabulation of the dates of publication of the BULLETIN during 1895. He says "Erythea, of which Prof. Greene was the moving spirit, seems to have come to an end, no number having appeared since December last." As the journal has been issued every month, this statement can only be understood by realizing that a restricted or insular notion as to the significance of "to appear" pervades the mind of the learned editor.

Reviews.

The Characeae of America. By Dr. T. F. Allen. Part 2, fascicle III. April, 1896.

This contains descriptions and illustrations of ten species of *Nitella*, two of which are new, *N. Leibergi* and *N. transilis.* The other species figured and described are *N. mucronata, N. capitellata, N.*

gracilis, *N. tenuissima*, *N. pygmaea*, *N. minuta*, *N. intermedia* and *N. Asagraeana*. The text is full of interesting quotations and notes, several of which ought to encourage the collection of rare or undescribed species in many familiar Eastern localities, notably Green Pond, New Jersey, and Nantucket, Mass. We note in the case of *N. Leibergi* the careful record made by the collector of the time and place of collection, but regret that this is not as exactly given in several other cases where it would be of great value. The illustrations are as handsomely lithographed, as Dr. Allen's always are, but we regret a certain indistinctness and irregularity of lettering which mars several of the plates. E. G. B.

The Bamboo Garden. By A. B. Freeman Mitford; illustrated by Alfred Parsons. Macmillan & Co., New York, 1896.

This is a work that will be welcomed by all plant lovers. It is a new departure in the way of ornamental gardening. Up to the last few years no one thought of introducing the bamboos into outdoor gardens; they were looked upon as belonging to the tropics, but the author has proved the possibility of making many varieties do duty as hardy plants.

The work is written for the more favored portion of the British Islands; there is no reason why it may not be just as useful in this country. On Staten Island several varieties have proved capable of resisting the cold of this latitude, and south of Washington many others would doubtless succeed if given a trial.

The author is an enthusiast and carries the reader along in a very pleasant way into believing as he does; he ridicules the attempts made of late years in copying a carpet, and other unnatural ways of planting for effect, advocates a return to the easy and graceful style of planting, and this he thinks can be helped by introducing the bamboo where available.

Altogether it is a very useful work, and will be much sought after as an authority on the subject, for he gives a list of more than fifty varieties of bamboos available for the temperate garden.

SAMUEL HENSHAW.

Monographie der Gattung Euphrasia. Dr. R. V. Wettstein. Pp. 316. *7 cuts. 14 pl. 4 maps.* Leipzig. 1896.

This exhaustive monograph touches on nearly every point of interest connected with the genus *Euphrasia.* After an introduction and detailed discussions of the nomenclature, morphology and physiology, and a conspectus of the species, the author describes the species, giving much detail in regard to the time of flowering, geographic distribution and specimens examined, all followed by copious critical notes. Eighty-seven species and twenty-one hybrids are enumerated.

The excellent series of plates is divided between the anatomy, morphology and photographs of all the species, many taken from original specimens. The maps serve to show the geographic distribution of some of the species and larger groups of the genus.

Dr. Wettstein has divided *Euphrasia officinalis*, as generally understood by American botanists, into *E. Americana* Wett., *E. latifolia* Pursh, and *E. Oakesii* Wett., thus giving us three American species in place of one. *E. Americana* is said to extend from the region of the St. Lawrence River and the Great Lakes through Labrador; *E. latifolia* occurs on the coasts of Labrador and Greenland, and extends through sub-arctic and arctic Europe to Asia; while *E. Oakesii* is known from a single collection from the White Mountains, New Hampshire (not California as indicated by the author). We hope that Dr. Wettstein's interpretation of the American representation of the genus is more trustworthy than his geography. J. K. S.

Lehrbuch der Ökologischen Pflanzengeographie. Eine Einführung in die Kenntniss der Pflanzenvereine. By Dr. Eugen Warming. German edition by Dr. Emil Knoblauch. 8vo., pp. 412. Berlin. 1896.

In the arrangement of the subject-matter this work is original. It is, however, very probable that Drude's and Grisebach's works on plant geography and distribution gave the impulse for producing it. It also seems evident that the author was strongly influenced by the numerous comparatively recent investigations on symbiosis, which no doubt suggested many of his ideas in regard to plant societies.

Warming introduces the subject with a consideration of the ecological factors concerned in plant distribution. These are divided into direct and indirect (Schoum). In the former are included the contour of the earth's surface, elevation, latitude, longitude, the effects of living and dead soil-coverings (grass, leaves), the activities of plants and animals in the soil, etc., etc. In the latter are included the influence of light, moisture, air currents, chemical composition of the soil.

In section 2 the author takes up the discussion of "Zusammenleben" and vegetable societies. For the time being I am unable to give a good English equivalent for the term Zusammenleben. By it the author wishes to indicate the interdependent relationships of plants and animals, whether organicaly united (parasitism, saprophytism, symbiotism, etc.) or merely in close proximity (such as plants and plants, animals and plants). The author's conceptions of symbiosis (in the broader sense) are somewhat original. Parasitism is considered to be the most intimate association. The form of symbiosis met with in lichens is designated as "Helotism," in which the alga is the slave. The term mutualism is made to apply to the occurrence of endotrophic and ectotrophic mycorhiza. Nothing original is added to the consideration of epiphytes and saprophytes. Lianas are included under Zusammenleben, since they were doubtless formed by their original dependence upon vegetable supports. Commensalism is used as equivalent to plant societies. According to the modifying factors the plant societies are divided into the following great groups: hydrophytes, xerophytes, halophytes and mesophytes. Each of these divisions is again subdivided. These subdivisions with their special modifying factors are quite fully discussed. On p. 125 it is stated that "pure water has a blue color," which seems to be an original idea.

The greater part of the work is devoted to the discussion of comparative vegetable morphology and physiology in connection with the modifying factors. It is a complete and well-arranged resumé of our knowledge on the subject. In conclusion there is given a brief discussion of plant struggles, weapons employed by plants in their struggles, origin of species, etc.

Considered in its entirety this is a most valuable recent contribution to the science of botany. It is a book which should be in the hands of every student. A. S.

Flora of West Virginia. By Charles Frederick Millspaugh and Lawrence William Nuttall. Field Columbian Museum, Publication 9. Botanical Series. Vol. 1: no. 2. Chicago. January, 1896.

The book before us is written in about the same style as the author's preliminary edition of 1892, but printed in much more handsome type. The introductory part is augmented by some paragraphs on the special features of the flora, the sylva, and a summary of the flora. The catalogue of species is enlarged by the intercalation of additions to the flora, new species and new varieties. A map of the State, and several illustrations are inserted, and a host index of the fungi and a list of local plant-names are appended. The authors are to be congratulated on their success in finding so many plants new to the region and new to science in such a circumscribed field. The number of plants of the present edition is recorded as 2,584 against the 1,645 of the preliminary edition. New species are described in the following genera: *Aspergillus*, *Botrytis*, *Verticillium*, *Fusicladium*, *Clasterosporium*, *Helminthosporium*, *Cercospora*, *Cylindrocolla*, *Phyllosticta*, *Sphaeronaema*, *Dothiopella*, *Cytispora*, *Sphaeropsis*, *Camarosporium*, *Septoria*, *Sacidium*, *Gloeosporium*, *Valsa*, *Diaporthe*, *Massaria*, *Trematosphaeria* and *Corticium*. A hybrid between *Betula lenta* and *B. lutea* is recorded.

We note several species whose occurrence in West Virginia we are inclined to doubt, for example *Dryopteris fragrans* and *D. Filix-mas*.

The nomenclature follows the most practical rules, but we notice a most unscientific case under *OEnothera* where that genus is divided, but only the nearest relatives of the true *OEnothera* are removed, while the more distinct members (*Kneiffia*) are left under *OEnothera*, because there is a later genus *Kneiffia*, which happens to be in use!

The present catalogue is a valuable addition to local botany, but we should like to see these local works that appear from time time, in a more useful form. Why not give generic and specific keys, and at least diagnostic descriptions? J. K. S.

The Lichen-flora of Chicago and Vicinity. By W. W. Calkins. Bulletin No. 1, Geological and Natural History Survey of the Chicago Academy of Sciences. April, 1896.

The author describes 125 species distributed among 28 genera as occurring in the vicinity of Chicago. The diagnoses are given in fairly good English. We are also pleased to note that no "new species" were "discovered." There is appended a fairly complete list of the publications on lichenology issued in North America previous to April 15, 1896

The paper is prefaced by a discussion of the habits and distribution of the lichens of the territory. In the discussion of "What are Lichens?" the author very clearly shows that he is somewhat behind the times. He mentions the Schwendener theory and wonders whether the theory will ever be accepted. It has been fully accepted, and is now fast giving way to a better one (Reinke's).

There is also an intróduction to the development and progress of Lichenology, which is, however, too brief to be of any practical value to the student of this special group. The same may be said of his mention of "the economic uses of lichens."

Proceedings of the Club.

Tuesday Evening, May 12th, 1896.

Mr. L. G. Fay in the chair and 12 persons present.

The Curator reported that Mr. Edward Berry has presented the Club with fifty fine specimens of plants from the country about Passaic, N. J., and other counties of the same State.

Mr. A. A. Tyler read his paper on "A Historical Review of the Study of Stipules." The author presented in a concise way the older opinions in regard to the morphology and modification of stipules. The paper was discussed by Dr. Britton and others. Subsequently Mr. Tyler made some further remarks on the origin and development of stipules.

The paper entitled "Appendages to the petioles of *Liriodendra*" by Mr. Arthur Hollick was read by title.

Wednesday Evening, May 27th, 1896.

Dr. A. Schneider in the chair and 15 persons present.

Mr. John J. Schoonoven was elected an active member.

Dr. John K. Small read a paper entitled "Notes on the Flora of Yadkin Valley, N. C.," exhibiting several new species, besides many other specimens. Remarks were made by Dr. Schneider, Mr. Rydberg and others, after which followed a discussion on the growth of plants in regions which for long periods at a time are devoid of rain.

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VOL. 23. AUGUST, 1896. No. 8.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

A MONTHLY JOURNAL OF BOTANY.

EDITED BY

NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

CONTENTS:

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THE TORREY BOTANICAL CLUB.

The Club meets regularly at Columbia University, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1896, now payable, to Mr. Henry Ogden, Treasurer, 11 Pine St., New York City.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., August 20, 1896. No. 8.

Studies in the Botany of the southeastern United States.—VI.

BY JOHN K. SMALL.

RIBES CURVATA n. sp.

Perennial, glabrate, bright green, armed with subulate spines, which are about 4–6 mm. long. Stem diffusely branched throughout, 6–8 dm. long, clothed with a loose papery exfoliating bark; branches purplish; branchlets reddish, wiry, like the branches recurved, or conspicuously drooping; leaves suborbicular, 1–2 cm. in diameter, three-lobed, the lobes toothed, the terminal lobe often mucronate; petioles slender, as long as or shorter than the blade of the leaf, usually somewhat villous; flowers small but conspicuous, solitary; peduncles 7–8 mm. long; pedicels twisted, nearly as long as the peduncles, subtended by two 3-lobed ciliate bractlets; calyx-tube papillose; calyx-segments linear or linear-spatulate, 6 mm. long, whitish, reflexed and recurved, strongly nerved toward the middle, the edges hyaline, obtuse, one usually notched at the apex; petals oblong, 1.5 mm. long, white, obtuse, with lateral teeth and one or two nerves; stamens conspicuous, 7 mm. long, erect; filaments villous; anthers red; style somewhat shorter than the filaments, villous; berry globose, 6–8 mm. in diameter, crowned by the persistent stamens.

A low, diffuse shrub, growing on the slopes of Stone Mountain, Georgia; found in flower during the first two weeks of May, and in fruit in the first week of July, 1895.

CUPHEA PROCUMBENS Cav. Ic. 4: 55. *pl. 380.* 1797.

Mr. A. M. Huger has sent me specimens of this showy *Cuphea* from naturalized plants found at Horse Cove, Macon county, North Carolina, altitude about 800 meters. The plant has escaped from gardens.

PERILLA FRUTESCENS (L.) Britton, Mem. Torr. Club, **5**: 277. 1894.

This garden plant is establishing itself along the roadsides in the foothills of the mountains of Georgia, notably between Toccoa Falls and Tallulah Falls.

THE NORTH AMERICAN SPECIES OF ILYSANTHES.

Field experience with *Ilysanthes* convinces me that the genus has never been correctly understood. The botanists of the early part of this century seem to have limited the species much better than later authors. Among the later botanists Dr. Chapman* has given us the most satisfactory interpretation of the genus, but he makes *I. gratioloides* a composite. Dr. Gray's treatment in the Synoptical Flora† is inferior in that it contains the composite species just mentioned, and reduces *I. saxicola*, a clearly distinct species, to a variety or state of *I. refracta.* The following seems to me to be the proper division of the genus:

Key to the Species.

Stems creeping, leafy throughout; leaves orbicular or orbicular-ovate, all sessile, rounded at the base.

- Leaves entire; upper lip of the corolla much shorter than the lower; capsule slender, much shorter than the calyx. 1. *I. grandiflora.*
- Leaves 3-toothed; upper lip of the corolla about equalling the lower; capsule stout, equalling or slightly exceeding the calyx. 2. *I. tridentata.*

Stems erect or ascending, not creeping; leaves more or less elongated, the lower ones usually narrowed at the base.

- Pedicels shorter than the leaves; calyx-segments commonly as long as or longer than the capsule. 3. *I. attenuata.*
- Pedicels longer than the leaves; calyx-segments shorter than the capsule.
  - Leaves slightly reduced above; pedicels ascending or spreading.
    - Upper leaves more or less clasping; capsules much longer than the calyx-segments. 4. *I. gratioloides.*
    - Upper leaves not at all clasping; capsules slightly longer than the calyx-segments. 5. *I. saxicola.*
  - Leaves reduced to narrow inconspicuous bracts above; pedicels reflexed. 6. *I. reflexa.*

1. ILYSANTHES GRANDIFLORA (Nutt.) Benth. in DC. Prodr. **10**: 418. 1846.

Lindernia grandiflora Nutt. Gen. **2**: 43. 1818.

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* Fl. S. States, 294.

† Syn. Fl. **2**: Pt. 1, 283.

Annual, slender, glabrous, somewhat fleshy, bright green. Stems decumbent and creeping, leafy throughout, 2–20 cm. long, simple or rarely branched; leaves suborbicular, .5–1 cm. in diameter, leathery, entire, usually obtuse, sessile, rounded at the base, more or less clasping; pedicels filiform, 2–4 cm. long, several times longer than the leaves; calyx-segments linear-lanceolate, 3 mm. long, acute, about as long as the capsule; corolla blue, slender, about 1 cm. long, its upper lip much shorter than the lower; capsule slender, narrowly oblong, or narrowly ovoid, 4.5–5 mm. long, acute or acuminate, much longer than the calyx.

Low wet places, eastern Georgia and Florida, March to October. Ascends only a few meters above sea level.

2. ILYSANTHES TRIDENTATA n. sp.

Ilysanthes grandiflora S. Wats. Proc. Am. Acad. **22**: 442. 1896. Not Benth. 1846.

Annual or biennial, fleshy, slender, glabrous. Branches erect or ascending from a rhizome-like creeping stem, simple or sparingly branched, leafy throughout; leaves orbicular-ovate, 4–6 mm. long, with two low teeth below the apex, rounded at the base, sessile or sometimes slightly clasping, rather densely punctate; pedicels filiform, 1.5–2 cm. long, ascending; calyx minutely glandular-puberulent, its segments linear, 2.5–3 mm. long, obtuse, more than twice shorter than the corolla; corolla stout, 10–12 mm. long, its upper lip very slightly crisped, nearly as long as the cleft and slightly involute lower one; capsule oblong-obovoid, 3–3.5 mm. long, obtuse, equalling or slightly longer than the calyx; seeds oblong or obovoid, angled, with a minute tubercle at the summit.

Rio Blanco, Jalisco, Mexico (Palmer, 46). June to October.

3. ILYSANTHES ATTENUATA (Muhl.).

Lindernia attenuata Muhl. Cat. 59. 1813.

Lindernia pyxidaria var. *major* Pursh, Fl. Am. Sept. 419. 1814.

Gratiola attenuata Spreng. Syst. **1**: 39. 1825.

Ilysanthes gratioloides curtipedicellata Bush, Bull. Torr. Club, **21**: 494. 1894.

Annual, low, fleshy, glabrous, dull-green. Stem erect or ascending, 1–5 dm. long, the branches often numerous, spreading; leaves oblong or ovate, sometimes oblanceolate, or obovate, 1–3 cm. long, thinnish, obtuse, distantly and shallowly serrate, five-nerved, gradually narrowed into a short petiole, or the upper ones nearly sessile; pedicels rather stout, shorter than the leaves; calyx-segments linear-subulate, as long as or longer than the capsules;

corolla 4–11 mm. long; capsule narrowly ovoid, about 4 mm. long; pointed, tipped by the persistent style; seeds oblong, slightly curved, .3–.4 mm. long, yellowish-brown, transversely wrinkled, with usually rounded ends.

Wet places, Ontario to Wisconsin and Missouri, south to the Gulf of Mexico. March to October. Ascends to about 670 meters in the mountains of Virginia.

My attention was first called to this plant by Mr. Bush's Missouri specimens (described as *I. gratioloides curtipedicellata*) and by some I collected in North Carolina. On taking up the subject I found no lack of material, there being twenty-two specimens in the Herbarium of Columbia University variously associated with twenty-five specimens of *I. gratioloides*, some even over the same label. *I. attenuata* can be distinguished from *I. gratioloides* at sight by its stouter and lax habit and short pedicels, while a closer examination will show the calyx-segments of the former as long as or longer than the capsule, whereas those of the latter are always much shorter than the capsule.

4. Ilysanthes gratioloides (L.) Benth. in DC. Prodr. **10**: 419. 1846.

Capraria gratioloides L. Sp. Pl. Ed. 2, 876. 1763.

Gratiola anagallidea Michx. Fl. Bor. Am. **1**: 5. 1803.

Lindernia dilitata anagallidea Muhl. Cat. 59. 1813.

Lindernia pyxidaria Pursh, Fl. Am. Sept. 419. 1814.

Ilysanthes riparia Raf. Ann. Nat. 13. 1820.

Gratiola dilatata Muhl.; Spreng. Syst. **1**: 39. 1825.

Ilysanthes attenuata Raf.; Benth. in DC. Prodr. **10**: 419. 1846. Not *L. attenuata* Muhl.

Ilysanthes dilitata Raf.; Benth. in DC. Prodr. **10**: 419. 1846.

Annal, low, wiry, glabrous, bright green. Stem erect, or at length decumbent, 1–2 dm. long, simple or diffusely branched from near the base; leaves ovate, or the lower oblong or obovate, somewhat leathery, .6–2 cm. long, obtuse or acute, entire or nearly so, indistinctly nerved, sessile, abruptly narrowed at the base (except some of the lower ones), obtuse or subcordate; pedicels wiry, much longer than the leaves; calyx-segments linear, shorter than the capsule; corolla 5–7 mm. long; capsule ovoid, 4–5 mm. long, rather blunt, tipped by the persistent style; seeds oblong, .2 mm. long, nearly straight, reddish, transversely wrinkled, with usually square ends.

Damp places, New England to Dakota, Nebraska and Texas, south to the Gulf of Mexico, across the southern boundary of the United States and on the Pacific coast; also in Cuba, and said to occur in Mexico. July to September. Ascends to 100 meters both in the Eastern and Pacific States.

Ilysanthes gratioloides has a more extensive geographic distribution than any other of our species. It ranges over the whole United States, except a part of the Rocky Mountain region, although further exploration may show its existence there. It is said to be native in South America and eastern Asia and to be naturalized in western Europe. I have not seen foreign specimens.

5. ILYSANTHES SAXICOLA (M. A. Curtis) Chapm. Fl. S. States, 290. 1860.

? *Lindernia monticola* Muhl. Cat. 59. Without description. 1813.

Lindernia saxicola M. A. Curtis; Am. Journ. Sci. **44**: 83. 1843.

Ilysanthes refracta var. *saxicola* A. Gray, Syn. Fl. N. A. **2**: pt. 1, 283. 1878.

Annual or sometimes biennial, glabrous, slender, but somewhat fleshy, bright green. Stems solitary or tufted, erect or assurgent, 2–20 cm. long, simple, or sparingly branched, especially above; leaves fleshy-leathery, 0.5–1.5 cm. long, the basal tufted, spatulate, obtuse, commonly very short-petioled, the upper ones ovate, lanceolate or narrowly elliptic, acutish, sessile, not clasping, slightly narrower than the lower; pedicels wiry, but rather stout, ascending or spreading, 1–1.5 cm. long, 3–4 times longer than the leaves; calyx-segments linear-lanceolate, acutish or obtuse, 2 mm. long, slightly shorter than the capsule; corolla pale blue, variegated, about 1 cm. long, its segments crisped; capsule ovoid, 3 mm. long, rather obtuse; seeds globose-oblong, 0.5 mm. long, pale.

Crevices in damp rocks, Tallulah Falls, Georgia, and on the Hiwassee River, North Carolina. At about 460 meters at Tallulah Falls, and probably at a little greater altitude in North Carolina.

6. ILYSANTHES REFRACTA (Ell.) Benth. in DC. Prodr. **10**: 419. 1846.

Lindernia refracta Ell. Bot. S. C. and Ga. **1**: 579. 1817.

Lindernia monticola Nutt. Add. 1818.

Annual or biennial, glabrous, very slender and wiry, bright green. Stems several together or densely tufted, erect or ascending, .8–3 dm. long, at length almost filiform, nearly naked, simple or sparingly branched and finally diffuse; leaves mostly basal, spatulate or obovate, 1–3 cm. long, obtuse, entire or undulate, sessile or narrowed into a short petiole; stem leaves reduced to narrow inconspicuous bracts, except a pair at the first or second node; pedicels filiform, at length reflexed, 2–4 cm. long; calyx-segments almost linear, 2–3 mm. long, acutish, twice shorter than the capsule; corolla 1–1.3 cm. long, its segments flat; capsule linear-oblong, about 4 mm. long, acute or acutish; seeds globose-oblong, .5 mm. long, orange, with a small tubercle at the end.

Mostly on wet rocks, North Carolina to Mississippi, south to Florida. Spring to Fall. Ascends to about 365 meters on Little Stone Mountain, Georgia.

GAYLUSSACIA URSINA (M. A. Curtis) T. & G.; A. Gray, Mem. Am. Acad. (II.) 3: 49. 1846.

Flowering specimens of this rare huckleberry were collected by Mr. A. M. Huger, in the mountains about Highlands, Macon county, North Carolina, June, 1895. The altitude was about 710 meters.

SOLIDAGO PURSHII Porter, Bull. Torr. Club, 21: 311. 1894.

"* * * Two remarkable southern stations * * *," namely McCalls Ferry, Pennsylvania, and Great Falls of the Potomac, are mentioned in the Synoptical Flora as localities for this northern *Solidago*.

In the latter part of August, 1894, I was surprised to find handsome specimens growing in crevices of the rocks at the bottom of the cañon at the falls of the Yadkin river, and at the Narrows some miles above the falls in middle North Carolina. The plants differ from specimens from the northern localities in their greater size and glabrous achenes. There is an abundant growth during the last part of August and the first weeks in September, but at other seasons hardly a vestige of the species can be found. The average height of the plants is about three feet; a few specimens attained a height of four feet. At these localities the species is more plentiful and attains a greater development than it does at the northern stations.

SOLIDAGO GRACILLIMA T. & G. Fl. N. A. 2: 215. 1841.

In September, 1894, I found this species on the summit of Little Stone Mountain, Georgia. Heretofore it has been known only from middle Florida, from collections by Dr. Chapman.

SOLIDAGO RADULA Nutt. Journ. Acad. Phila. 7: 102. 1834.

Found for the first time east of the Alleghenies on August 18th, 1891, by Mr. Heller and myself growing on dry hillsides, just west of the Falls mountains, Stanley county, North Carolina, and observed for several succeeding years. This is an interesting addition to the eastern flora.

HELIANTHUS OCCIDENTALIS Riddell, Suppl. Cat. Ohio Pl. 13. 1836.

This prairie species occurs in a meadow near Logansville, Georgia, about twenty-five miles east of Atlanta. This seems to be the first record of its occurrence east of the Blue Ridge.

Notes on Potentilla.—III.

BY P. A. RYDBERG.

With the exception of two species, viz., the white-flowered *P. tridentata* Soland., and the introduced *P. nemoralis* Nestl., all the North American perennial species with ternate leaves can be divided into two natural groups, viz., the *Niveae*, with leaves densely white-tomentose beneath, and the *Frigidae*, without tomentum. Both groups consist of plants generally less than 2 dm. high and often more or less caespitose. The style is terminal or nearly so, filiform but short, in all, except *P. flabellifolia*, not longer than the mature achenes. All the species are arctic or alpine.

To the *Niveae* belong the following:

POTENTILLA VILLOSA Pall.; Pursh, Fl. Am. Sept. 353. 1814.

P. fragiformis villosa Regel & Tiling, Fl. Ajan. 85.

Watson follows Regel & Tiling in placing *P. villosa* as a variety under *P. fragiformis*. The two resemble each other in one important character, viz., the broadly oval obtuse bractlets, which, as well as the calyx, enlarge considerably in fruit. *P. villosa* differs from *P. fragiformis*, however, in the leaves as well as in the flowers; those of the former are much thicker, densely silky above (rarely glabrate), and densely floccose and with prominent veins beneath. The flowers are about one-half larger than those of *fragiformis*. From all the species of the group it differs in the large 2-3 cm. wide flowers, stout habit, large leaves and broad bractlets. *P. villosa* is a native of Alaska and adjacent Asia, but is also found in the mountains of British Columbia, Vancouver Island and Washington.

POTENTILLA HOOKERIANA Lehm. Ind. Sem. Hort. Bot. Hamb. 1849: Add. 10. 1849.

Dr. Watson placed this with *P. Pennsylvanica* on account of the style. It is glandular, but scarcely thickened near the base, and not curved as in *P. Pennsylvanica.* In habit it comes nearest to *P. nivea*; and as the style is often glandular in *P. villosa* and sometimes in *P. nivea*, it is better to include *P. Hookeriana* in this group, with which it agrees in all other respects. It differs from *P. nivea* in the more deeply dissected leaves, the smaller flowers, the bractlets, which equal the sepals, and a slightly stricter habit. It is a very rare plant.

POTENTILLA NIVEA L. Sp. Pl. 499. 1753.

The common form of this species is fully as tall as either of the two preceding, but very slender. The flowers are only 15 mm. in diameter, the bractlets linear-oblong or lanceolate, shorter than the ovate-lanceolate sepals. The obcordate petals only a little exceed the sepals. The leaflets are 1-3 cm. long, oblong or obovate, with broad teeth. *P. nivea* is distributed throughout the arctic regions and in the higher mountains of the northern hemisphere. In America it ranges from Labrador to Alaska, extending in the Rockies as far south as Colorado.

P. nivea is very variable. The following varieties have been collected in America:

POTENTILLA NIVEA MACROPHYLLA Hook. Bot. Mag. 57: *pl. 2982.*

Leaflets very large and deeply incised; plant taller than the ordinary form.

POTENTILLA NIVEA QUINQUEFOLIA.

P. nivea pentaphylla Lehm. Nov. Stirp. Pug. 9: 69. 1851. Not *P. pentaphylla* Richt.

P. nivea dissecta Wats. Proc. Am. Acad. **8**: 559. 1873. Not *P. dissecta* Pursh, 1814.

Leaves quinate as well as ternate; leaflets deeply toothed, in the quinate leaves the lower ones often smaller.

POTENTILLA NIVEA UNIFLORA (Ledeb.).

Potentilla uniflora Ledeb. Mem. Acad. St. Petersb. 5: 543.

P. nivea Vahliana American authors, at least in part.

The true position of this plant is difficult to determine. It may be placed as a variety of *P. nivea* or of *P. Vahliana* or as a species intermediate between the two. Ledebour made it a variety of *P. villosa*, which it somewhat resembles as to the leaves. It has the caespitose habit, short nearly leafless stems, and short wedge-shaped leaves of *P. Vahliana*. Its flowers are nearly of the same size as those of that species, but the petals are obcordate, not reniform, and the sepals and bracts are those or *P. nivea*, depauperate forms of which grade into it. It is found in the arctic regions from Greenland to Alaska and adjacent Asia, but also in the Rocky Mountains of Colorado. Apparently all specimens labelled *P. nivea Vahliana* from the Rockies belong to *P. nivea uniflora*. It was evidently this form that Watson had in mind when he made the statement that *P. Vahliana* was a depauperate few-flowered form of *P. nivea*.

POTENTILLA VAHLIANA Lehm. Monog. 172. 1820.

P. hirsuta Vahl; Hornem. Fl. Dan. *pl. 1390*. Not Michx.

This is very low and matted, the large flowers a little exceeding the leaves. The petals are very broadly subreniform, *i. e.*, broader than long, and therefore overlap each other; the bractlets are broadly oval, obtuse and about equal the ovate sepals. The whole plant is covered with yellowish villous hairs besides the tomentum. Lehmann was in some doubt whether he should regard it as a variety of *P. nivea* or as a distinct species. He made it a species on the authority of Vahl, who knew the plant in its native haunts. Seeing only *P. nivea* and *P. Vahliana* nobody would hesitate in assigning specific rank to the latter. The trouble comes in when one is to draw the line between either and *P. uniflora*. Lehmann states that *P. Vahliana* was collected by Richardson in

Captain Franklin's journey. Specimens collected by Richardson and named *P. Vahliana* are in the Torrey Herbarium at Columbia, but these, it seems to me, rather belong to *P. uniflora.* There is, however, from the same collector one specimen, a very small one, indeed, which without any doubt belongs to *P. Vahliana,* but this is together with two specimens of *P. nana* under the name *P. nivea arctica.* Except this specimen and one from Herald Island, all specimens seen are from Greenland and the islands of Baffin Bay. They are generally labelled *P. pulchella.* The latter species is easily distinguished by its small flowers, the petals scarcely exceeding the sepals, and its deeply dissected leaves which are pinnate with two approximate pairs of leaflets.

The *Frigidae* differ from the *Niveae* principally in the lack of tomentum. They are all low, more or less caespitose, arctic or alpine plants. To this group belong the following:

POTENTILLA ROBBINSIANA Oakes; Torr. & Gray, Fl. N. Am. 1: 441. 1838, as a synonym under

P. minima Robbinsiana Torr. & Gray, *l. c.*

P. frigida American authors, not Vill.

Torrey and Gray placed this species as a variety under *P. minima* and Watson tranferred it to *P. frigida.* It very much resembles both of those European species. It comes nearest to *P. minima* in habit, but to *P. frigida* in pubescence. It differs from both in the small petals, which about equal the sepals, and in the bracts and the sepals, which are very narrow and subequal. In both *P. frigida* and *P. minima* the petals are longer than the sepals, and these much longer than the bractlets. The same characters that distinguish *P. Robbinsiana* from the two species mentioned distinguish it also from its American relatives. The range of *P. Robbinsiana* is very limited. It apparently is confined to the White Mountains of New Hampshire.

POTENTILLA ELEGANS Schlecht. & Cham. Linnæa, 2: 22. 1827.

This species, as far as I know, has not yet been collected in America, but is mentioned here because it is quite common across Behring Strait and may be found in Alaska. It resembles *P. Robbinsiana* in the sepals and bracts, but is a more delicate plant, the leaflets being only 3–5 mm. long and nearly glabrous.

POTENTILLA EMARGINATA Pursh, Fl. Am. Sept. 1: 353. 1814.

This species was described from specimens collected by Kohlmeister in Labrador. According to Lehmann (Hook. Fl. Bor. Am. 1: 194), *P. nana*, also, was collected by the same missionary. There is therefore a doubt which of the two is the original *P. emarginata*. The latter, as understood by Vahl, Lehmann and others, is a stouter plant than *P. nana*, has very narrow bracts, and leaves with acute teeth, of which the terminal is generally the largest. In both the flowering stems scarcely exceed the leaves. *P. emarginata* grows in Labrador, the Baffin Bay region, Greenland and Spitzbergen.

POTENTILLA NANA Willd. Mag. Gesell. Naturf. Fr. Berl. 7: 296. 1813.

Dr. Watson states that this is a depauperate form of *P. emarginata*. As understood by Lehmann, it is a plant much nearer related to *P. fragiformis*. The habit is caespitose, as in *P. emarginata*, but the teeth of the leaves are rounded and the terminal one generally smaller, and the bractlets are broadly elliptical and enlarge in fruit, as in *P. fragiformis*, from which it differs mainly in size, being in every respect smaller, and in the fact that the flowering stems scarcely exceed the leaves. A connecting link is formed by the Greenland *P. Friesiana*, which resembles *P. nana* in every respect, except that the flowering stems are elongated, as in *P. fragiformis*. Probably all three are but forms of one species. *P. nivea arctica*, at least as to Richardson's plant, must be included in *P. nana*. It ranges through arctic America from Labrador to Alaska, and is also found in eastern Siberia.

POTENTILLA FRAGIFORMIS Willd. Mag. Gesell. Naturf. Fr. Berl. 7: 294. 1813.

Differs from *P. nana* in being in every respect more robust and with stems 1–2 dm. high. It somewhat approaches *P. villosa* in habit, but lacks the tomentum and has much smaller flowers. It comes nearest the Caucasian and Siberian *P. gelida* Meyer, but differs in its hirsute pubescence. *P. fragiformis* is mainly Siberian, but has been collected on the Aleutian Islands.

POTENTILLA FLABELLIFOLIA Hook.; Torr. and Gray. Fl. N. Am. 1: 442. 1838.

P. gelida American authors, not Meyer.

This is near *P. gelida* and has generally been included therein, but differs in its much larger flowers, lighter foliage and a thicker creeping rootstock; it is best to regard it as at least a good variety. If the isolated range is taken in consideration, it is still better to regard it as a species. *P. flabellifolia* is found on the higher mountains of Oregon and Washington, while *P. gelida* grows in the Caucasus and eastern Siberia.

Near *Frigidae* is another group, which may be called *Brevifoliae*, consisting of only two species. It differs from the preceding group mainly in two characters, viz.: pinnately 3–5-foliolate leaves and a very long and slender style, which is fastened a short distance below the apex of the achene. Both species are low, less than 1½ dm. high, from a thickish branched rootstock.

POTENTILLA GRAYI Wats. Proc. Am. Acad. **8**: 560. 1873.

In this species the leaflets are only three, broadly obovate or nearly obicular. The habit of the plant reminds one somewhat o f *P. flabellifolia*, but the middle leaflet is considerably stalked, showing that the leaf is pinnate with only one pair, rather than ternate. As the style is of the same form and the same place of attachment as in *P. brevifolia*, it is better to let the two constitute a group by themselves, especially as the habit and flower is nearly the same. *P. Grayi* has been collected only in the mountains around the Yosemite valley, California.

POTENTILLA BREVIFOLIA Nutt.; Torr & Gray, Fl. N. Am. 1: 442.

This species has leaves with about two pairs of rounded 2–3-cleft and crenate leaflets, which are rather small, only ½–1 cm. long. Lehmann included it in the *Glandulosae* on account of the habit, which a little resembles that of the group mentioned, and the fact that the plant is somewhat glandular puberulent. As stated before, the style is very slender, filiform, not basal, but fastened near the apex; the anthers are not flat, and plainly divided into two lobes, and the petals are emarginate. It is confined to the alpine peaks of Oregon.

Contribution to the Myxogasters of Maine.

BY F. L. HARVEY.

The following list includes all the species of slime-moulds known by the writer to have been collected in Maine.

Species recorded by Saccardo, Massee and Lister are noted. We have had accesses to Sprague's lists; the collections in the Port. S. N. H. determined by Cooke and Berkeley, a list of Maine fungi collected by Rev. J. Blake, specimens in the Blake Herbarium of the Maine State College; and a list of specimens collected at Rangely and Bar Harbor by Dr. Rex. The specimens collected by the writer have all been examined by either Wingate, Peck, Ellis, Rex or Morgan, or carefully compared with authentic specimens. We will be glad to know of additional references or the names of past or present Maine collectors of these forms. The list is by no means exhaustive, as each year brings to light new and interesting forms. Dr. Rex said "your second sending contains an unusual number of interesting forms and suggests that there may yet be many treasures found."

We are under great obligations to the above named specialists, especially to Mr. Wingate, from whom came the original inspiration to study and collect these forms, and to Dr. Rex for many kind letters and the determinations of specimens, and since his death to Mr. Morgan for similar favors. We have followed the order of genera given in Lister's recent monograph.

MYXOMYCETES OF MAINE.

ORD. CERATIOMYXACEAE.

1. *Ceratiomyxa mucida* Schroet.=*Ceratium hydnoides* Alb. & Schw. Common on rotton wood. Orono; Greenfield (Harvey).

ORD. PHYSARACEAE.

2. *Badhamia hyalina* (Pers.) Berk. In Blake Herb. as *Physarum hyalinum* Pers. Cumberland (Blake).

3. *B. utricularis* (Bull.) Berk. Low ground on prostrate logs. Orono, Oct. (Harvey).

4. *B. macrocarpa* (Ces.) Rost. Common in low ground on logs. Orono, Oct. (Harvey).

5. *B. fasciculata* (Jungh.) Rost. On bark of dead gray birch on ground in a swamp. Orono (Harvey).

6. *Physarum Petersi Farlowii* Rost. (*P. globuliferum* Pers. according to Lister.) Under bark of a standing birch. Orono (Harvey).

7. *P. viride* Pers. Under this head we put *Tilmadoche viridis* and *T. mutabilis*, both from Rangely (Rex).

8. *P. didermoides*. Port. S. N. H. Coll. no. 55 as *Didymium congestum* B. & Br. (Fuller).

9. *P. cinereum* (Batsch) Pers. Rangely (Rex).

10. *P. contextum* Pers. Rangely (Rex). Orono (Harvey).

11. *P. sinuosum* (Bull.) Rost. Rangely (Rex). *P. bivalve* of Lister.

12. *P. penetrale* Rex. Rangely (Rex).

13. *P. leucophaeum* Fr. Rangely (Rex). Orono (Harvey). 1889. Lister makes this *P. nutans* var. *leucophaeum*. Rex says "specimens well marked with a large central vesicular granule of lime.

14. *P. nutans* Pers. Herb. Port. Soc'y, no. 32 (Fuller). Harrison (Blake). Rangely (Rex). Orono (Harvey). Our specimens are *Tilmadoche nutans* Rost.=*P. nutans* var. *genuinum* List.

15. *P. Ditmari* Rost. Rangely (Rex).=*P. virescens* Ditm.

16. *P. citrinellum* Pk. Greenfield, Oct., 1895 (Harvey).=*Craterium citrinellum* Lister.

17. *Fuligo septica* Gmelin. Rangely (Rex). Orono & Greenfield (Harvey). Specimens collected at Greenfield, September, 1895, were infested by the rare fungus *Hypomyces violaceus* (Fr.) Tul. The aethalia vary in color and size. The shades are brown, yellow and white. Some aethalia are nearly 3 in. across. We have found specimens 3 ft. from the ground on the side of living trees.

18. *Craterium leucocephalum* Ditm. Rangely (Rex). *Craterium citrinellum* Lister is recorded as *Physarum citrinellum* Pk. See this list No. 16.

19. *Leocarpus fragilis* (Dicks.) Rost. Herb. P. S. N. H. no. 21, as *Diderma vernicosum* Pers. (Fuller). Rangely (Rex). Orono, September to November (Harvey) = *L. vernicosus* Link, of Lister.

20. *Condrioderma testaceum* (Schr.) Rost. Rangely (Rex).

21. *C. Michelii* Rost. Rangely (Rex). These specimens were the sessile variety.

22. *C. aculeatum* Rex.=*C. Sauteri* Rost. Bar Harbor (Rex).

23. *Diachaea elegans* Fries. Herb. P. S. N. H. (Fuller). Rangely (Rex).

24. *D Thomasii* Rex. This is spoken of by Lister as having been collected by Prof. Thaxter at "*Killery*," U. S. A. Probably Kittery, Me., is meant.

ORD. DIDYMIACEAE.

25. *Didymium Clavus* Rost. Rangely (Rex).

26. *D. farinaceum* Schrad. Rangely (Rex). Orono (Harvey).

27. *D. microcarpon* Fr. Herb. P. S. N. H. as *D. nigripes* Fr. (Fuller). Cumberland (Blake). Bar Harbor and Rangely (Rex).

28. *D. Xanthopus* Fr. Wells (Blake).

29. *D. proximum* B. & C. Beech woods, Orono (Harvey).

30. *D. eximum* Pk. Orono (Harvey). The four preceding species are united by Lister as *D. nigripes* Fries, and varieties.

31. *D. effusum* Link. Rangely (Rex).

ORD. STEMONITACEAE.

32. *Stemonitis fusca* Roth. Otisfield (Blake). Rangely (Rex). Orono and Oldtown (Harvey).

33. *S. herbatica* Pk. On fallen trunks. Greenfield, Oct. (Harvey).

34. *S. ferruginea* Ehrenb. Rangely (Rex). Orono, Aug. (Harvey).

35. *S. Smithii* Macbride=*S. microspora* List. Greenfield, Sept 1895 (Harvey).

36. *Comatricha typhoides* Rost. Port. S. N. H. Coll., no. 94 (Fuller). Rangely (Rex). Orono (Harvey).

37. *C. obtusata* Preuss. Sprague's N. Eng. Myc., p. 318 (Morse), as *Stemonitis ovata* Pers. Bar Harbor (Rex). A single very fine cluster was found at Orono by my son, Bartle Harvey, upon a decaying spruce timber from a barn.

38. *C. longa irregularis* Lister. Our specimens were named by Rex as *C. irregularis* Rex. Greenfield, Oct. Other specimens collected at Oldtown, September, 1895, were submitted to Morgan, who named them *C. crypta* Schw.

39. *Lamproderma physarioides* Rost. Rangely (Rex). Greenfield, September, 1895 (Harvey).

40. *L. columbinum* (Pers.) Rost. Greenfield, October, 1894. On moss covering a log, in fine development (Harvey).

Regarding this form Mr. Morgan made the following note: "It corresponds exactly to what Rostafinski describes as *Lamproderma columbinum* (Pers.) Rost. Lister and Massee have made very bad work of this genus, so that the students in this country using their volumes can scarcely tell what to do with their specimens. I was influenced by Lister in this genus, but after the publication of his volume I am disposed to fall back on Rostafinski. Lister combines this species with *L. physaroides* A. and S. This I think is not correct. The old writers describe them as distinct, one with a silvery sheen and the other with a steel blue luster. Both have long stipes. I think Rostafinski is correct in allowing them to stand as two good and distinct species. It is more like *L. violaceum* Fr., having, however, a much larger stipe."

41. *L. violaceum* Rost. Greenfield, 1895 (Harvey).

42. *L. arcyrioides* (Somm.) Rost. Rangely (Rex). Lister puts this under *L. violaceum* Rost.

Ord. Amaurochaetaceae.

43. *Amaurochaete atra* Rost. Herb. P. N. S. H. as *Reticularia atra* Fr. Maine (Fuller).

Ord. Heterodermaceae.

44. *Lindbladia tubulina* Fries. Cumberland (Blake) as *Licea spermoides* B. & C.

45. *Cribraria intricata* Schrad. Rangely (Rex).

46. *C. tenella* Schrad. Bar Harbor (Rex).

47. *C. purpurea* Schrad. On decaying logs, Greenfield, Oct. (Harvey).

48. *Dictydium umbilicatum* Schrad. Rangely (Rex) as *D. cernuum* Pers.

Ord. Liceacea.

49. *Licea fragiformis* Fr. Cooke's Hand Book, 1: 408. Cumberland (Blake). This form is noted in Blake's list. It is not recorded by Saccardo or Lister, and we have not been able to trace the synonymy. It may be *Tubulina cylindrica* (Bull.) DC., as Saccardo records *L. fragiformis* Nees as a synonym of this species.

50. *L. minima* Fr. Sacc. 7: 405. Cumberland (Blake). The

specimens in the Blake Herb. bearing this name were mounted on a sheet without protection and are in bad shape. They were determined for Blake by Cooke and were probably correct. Saccardo questions whether this species belongs to the genus *Licea*, while Lister makes it a good species.

51. *Orcadella operculata* Wing. Proc. Phil. Acad. 1889: 280. Trunks of living red oaks, Me. (Wingate.)

ORD. TUBULINACEAE.

52. *Tubulina fragiformis* Pers. Very common on hemlock stumps and logs and other situations. Rangely (Rex). Orono, Greenfield, Oldtown, Jackman, Norcross, etc. (Harvey).

ORD. RETICULARIACEAE.

53. *Enteridium Rozeanum* Wing. On charred fallen trunks Chemo Pond, Bradley (Harvey).

ORD. TRICHIACEAE.

54. *Trichia fallax* Pers. As *T. clavata* Wig. in Port. N. H. Coll. no. 19, Fuller. Rangely (Rex.). Orono (Harvey).

55. *T. varia* Pers. Rangely (Rex.). Orono, 1889, Sept. Greenfield, Sept., 1895 (Harvey). Rex. says, "This is peculiar in the elongated sporangium, terminating in a hollow stipe, like *T. fallax*. I have never seen anything like it in *T. varia* before.

56. *T. varia sessilis* Rost. Cumberland (Blake). Orono (Harvey). Lister does not recognize this variety.

57. *T. chrysosperma* (Bull.) DC.=*T. favoginea* Pers. Herb. Port. S. N. H. Coll. no. 18 (Fuller) Rangely (Rex.), Greenfield, Sept., 1895 (Harvey).

58. *T. Jackii* Rost.=*T. persimilis* Karst. Greenfield (Harvey). Rex says of my specimens that they are "strongly marked."

59. *T. scabra* Rost. Rangely (Rex). Orono and Oldtown, September, 1895 (Harvey).

60. *T. inconspicua* Rost. Rangely (Rex). Orono (Harvey). Lister regards this as *T. contorta* Rost.

61. *T. contorta* Rost. Orono (Harvey). Rex says my specimens are good examples of this species.

62. *T. reniformis* Pk. Orono (Harvey). Rex says, "This is typical according to a specimen of the type sent me by Prof. Peck."

Later, Rex says this seems really to be a form of *T. contorta.* Lister includes it in the above species.

63. *T. abrupta* Cooke, Grev. 5 : 150. Cooke B. Myx. 256 (Portland). Lister refers this form to *T. persimilis* Karst.

64. *T. subfusca* Rex. Jackman (Harvey), Sept., 1895. Lister makes this var. *subfusca*, under *T. Botrytis.* Morgan says, "The stipe is much shorter than the type I have from Dr. Rex, and the elaters are remarkably branched."

65. *T. affinis* De Bary. Greenfield (Harvey), Sept., 1895.

66. *T. nana* Mass. Westbrook (?). According to Lister this is the same as *Hemiarcyria Wigandii* Rost., a form which we record under that genus from Orono.

67. *Oligonema nitens* Rost. Orono, Sept., 1889. Greenfield, 1893 (Harvey). Our specimens are finely developed.

68. *Hemiarcyria* (*Hemitrichia*) *rubiformis* (Pers.) Rost. Cumberland (Blake). Rangely (Rex). Orono (Harvey).

69. *H. clavata* (Pers.) Rost. Common on fallen trunks. Sept. to Nov. Rangely (Rev). Orono, Greenfield (Harvey).

70. *H. serpula* (Scop.) Rost. Bar Harbor (Rex).

71. *H. Wigandii* Rost. Orono, Oct., 1892 (Harvey). Rex says, "This has not been recorded from America before. It answers the description well, except that the spore and thread measurements are less." Lister refers *Trichia nana* Mass. which is reported from Westbrook, Me., to this species.

72. *H. leiocarpa* Rost. On vegetable debris. Portland (Bolles). Grev. 5 : 150.

73. *H. stipata* Schw. Orono, Oct. '90, Oldtown, Sept. '95 (Harvey). Rex says of the specimens collected in 1890, "That I have specimens in abundance of this species from several localities in this country, but yours has the most strongly marked capillitium. It is valuable for that reason." Lister refers this to *Arcyria stipata* Lister.

74. *H. plumosa* Morgan. On fallen trunks. Sept. 1895, Oldtown (Harvey). Lister makes no mention of this.

ORD ARCYRIACEAE.

75. *Arcyria punicea* Pers. Bar Harbor and Rangely (Rex). Orono and Oldtown (Harvey).

76. *A. cinerea* (Bull.) Schum (*A. albida* Pers). Rangely (Rex). Orono and Jackman (Harvey).

77. *A. adnata*, Batsch=*A. incarnata* Pers. Cumberland (Blake). Rangely (Rex). Orono and Oldtown (Harvey).

78. *A. nutans* (Bull.) Grev. Orono, Greenfield, Jackman (Harvey).

79. *A. aurantiaca* Rounk. On decayed pine boards. Orono, Oct., 92 (Harvey). Our specimens were determined by Dr. Rex. Lister says the description clearly refers to *A. ferruginea.*

80. *A. OErstedtii* Rost. Rangely (Rex).

81. *A. minor* Schw. Greenfield, 1895 (Harvey). Lister does not mention this.

82. *A. ferruginea* Saut. In low ground. In large masses several inches square, upon the under side of a decorticated log. Orono, Oct., 1893 (Harvey).

Dr. Rex makes the following note on this species: "This is an exceedingly interesting specimen to me, partly because it is the first American specimen I have seen, and partly from its variable thread sculpture. It is typical only in the central part of the capillitium. Both the basal and apical portions differ from my European types. Still I think it should be referred as above. I have compared it with authentic specimens of *A macrocarpa* Pk. Externally the resemblance is very great, but the capillitium is different, yet suggests your species in a few places. It seems to be one end of a series, of which *A. ferruginea* forms the other, and your specimens the central position. I should call your specimen an intermediate form between the above species, but referable rather to *A. ferruginea.*"

83. *Perichaena chrysosperma* Lister. This is reported from Rangely by Rex, as *Cornuvia Wrightii* Rost.

84. *P. depressa* Libert. Rangely (Rex.).

ORD. MARGARITACEAE.

85. *Dianema Harveyi* Rex. Our specimens are the type of this genus. They were obtained on decorticated poplar in a swamp near Orono, Sept., 1889. They have not been detected since the original gathering, though searched for carefully. The species may be regarded as rare.

ORD. LYCOGALACEAE.

86. *Lycogala miniatum* Pers.=*L. epidendrum* List. Very common. Cumberland (Blake). Rangely (Rex.). Orono (Harvey).

On a new Species of Scrophularia hitherto confounded with S. Marylandica.

BY EUGENE P. BICKNELL.

Two totally distinct species of *Scrophularia* are included under the name *Scrophularia Marylandica*, the common Figwort of the Eastern States. The true *S. Marylandica* is a late-flowering plant; beginning to bloom in the neighborhood of New York from the second to the fourth week of July, and continuing to bear flowers into late September or even October. The other species blooms in the spring and early summer—from about the middle of May until late June or early July. Its latest flowers are gone long before the earliest of *S. Marylandica* appear.*

It is not a little remarkable that this very noteworthy difference in the flowering-periods of these common plants should have remained so long undetected, and the fact readily explains why only a single species has been recognized; for, so close is the resemblance between these two figworts that, were their flowering periods identical, their distinctness would scarcely have been suspected. The case affords a striking illustration of extremely close general resemblance between species fundamentally distinct.

That I am not wrong in thus characterizing these plants will, I think, sufficiently appear from a comparison of their roots alone which exhibit notable differences both in morphology and in anatomical structure. It is to be especially remarked, also, that each plant has a characteristic odor distinctly different from that of the other.

It is a matter of curious interest now to recall the long-existing differences of opinion as to whether our *S. Marylandica*,

* Observations made the present season show that this general rule is not without exceptions. On July 7th, among an abundant growth of the early-flowering species on a shaded northern slope, three belated flowers were found; the same day some plants of *S. Marylandica* which had strayed from the woods into damp open ground showed their first flowers.

actually embracing two species, was or was not different from the European *S. nodosa.* Of the latter plant I have seen only two incomplete specimens, enough, however, to satisfy me that it is perfectly distinct from both of its East American relatives.

I have not overlooked that Pursh ascribed two species of *Scrophularia* to the Eastern States. There cannot be any doubt, however, that his *S. lanceolata* was merely a form of *S. Marylandica*, as authorities have ruled. At first glance the brief description of the former might seem to point to our early-flowering species, but a more careful reading does not allow this view. Not only is no one of the essential characters of this plant defined, but the flowering period given by Pursh—" Aug.–Sep."—is alone conclusive against his *S. lanceolata* being the same as our species which flowers in May and June. Moreover, Pursh's description perfectly accommodates certain narrow-leaved forms of true *S. Marylandica.*

As bearing on this point it may be noted that in the Herbarium of Columbia University is a sheet of true *S. Marylandica*, labeled in Dr. Torrey's hand " *S. lanceolata*, Pursh," followed by the full reference to Pursh's publication. Another sheet of Dr. Torrey's labeled *S. Marylandica* exhibits specimens of both our species.

For the new plant I propose the name *Scrophularia leporella* * in reference to the flower which bears a curious resemblance to a little rabbit sitting upright with ears erect. In the very similar flowers of *S. Marylandica* the same resemblance is seen, but is less striking.

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* Since this was written Mr. P. A. Rydberg has described a new *Scrophularia* from the Black Hills of South Dakota as *Scrophularia nodosa occidentalis.* (Cont. U. S. Nat. Herb. 3: 517.) Mr. Rydberg, who has seen specimens of my *S. leporella* declares that it is not the same as the Dakota plant, the types of which were large-flowered, and showed a peculiar basal cutting of the leaves something like that seen in *S. Californica.* Certain specimens of *Scrophularia* from Nebraska in the Columbia Herbarium, which Mr. Rydberg regards as referable to his *occidentalis* seem to show a close affinity to *leporella*, and are certainly nearer to it than to *Marylandica.* It is evident from this that the western plant should stand as *Scrophularia occidentalis.* It would be clearly illogical to maintain it as a variety of the European *nodosa*, and, if it should prove to be related varietally to one of our eastern species, that species would almost certainly be *S. leporella*, which would have to take the varietal designation.

SCROPHULARIA MARYLANDICA L.

Erect, mostly 5°–6° tall (3°–10°), large plants becoming widely candelabrate branched above, the branches sometimes reaching an expanse of 5°. Stem glabrous and shining, four-sided with rounded angles and deeply grooved or impressed sides, more or less acutely quadrangular above. Panicles terminal on stem and branches, often somewhat pyramidal, mostly about 1° long (6′–2°) and leafy at the base, glandulose above and in the cymes, the glandules purple, stalked or terminating minute hairs. Cymes racemose, numerous, rather close, widely spreading or ascending, varying from short and contracted to loose and open, 2′–5′ in length and breadth, the peduncles usually much shorter than the branches. Perfectly developed cymes are formed by the forking of the peduncle into two diverging, evenly zig-zag branches bearing at each angle a slender-pedicelled flower, a solitary longer-pedicelled flower rising from the angle of the fork. In many cases the structure is less regular, and more contracted cymes may be irregularly dichotomous. Cymes bracteolate throughout, the bracteoles subtending the pedicels mostly in opposite pairs, linear-subulate, spreading or recurved. Flowers few to many; on the lower cymes rarely less than 9–11 and frequently twice that number. Leaves slender-petioled, deep green, rather thin and veiny, glabrous above (with fine scattered hairs when young) minutely pubescent below (nearly glabrous to softly pubescent) often very large, reaching a length of 1° and a breadth of 6′, mostly ovate-lanceolate from a rounded or sub-cordate base, but varying greatly, from cordate-ovate and acute to lanceolate and acuminate with acute or narrowed base; uppermost leaves often narrowly lanceolate tapering to either end. The leaves vary also from regularly or irregularly serrate or dentate to coarsely doubly dentate-serrate or even sharply dentate lobed. Petioles long and slender, from ⅓ to ¾ the length of the blade, or longer in the lower leaves, becoming gradually shorter in the upper leaves, ciliate-pubescent along the upper side, sometimes glabrate; nodes of the stem between the petioles often ciliate-fringed. A fascicle of small leaves or a single pair, often quite rudimentary, occupies the axil of each cauline leaf; lowest leaves of the stem large and fully developed, on long petioles. Corolla ventricose-ovoid, puncticulate with pellucid glands, 3″–4″ long, 2″–2½″ wide, little contracted at the throat, the lobes short, the lateral pair and the upper lip usually slightly spreading, the lobes of the upper lip short and rounded; outside of tube green, appearing dull and finely cellular, the interior shining and with the upper lip mostly deep brownish purple; not infrequently the flower is nearly all greenish-yellow. Sterile stamen with its adnate filament deep purple, about ¾″ broad; style filiform, scarcely enlarged at base. Calyx-lobes orbicular to oblong, obtuse, scarcely margined. Flower-buds dull green before expanding. Capsule 2″–3″ long, about 2″ wide, short-ovoid or subglobose, mostly abruptly contracted or rounded to a slender mucronate point, often becoming black. Rarely the capsule is 3, 4 or 5-celled.

Woodland in rich soil, usually about rocky places, sometimes at the borders of thickets in low grounds.

Begins to flower at New York about the middle of July (July 7–28). In some seasons flowers are still to be found at the end of September.

Specimens have been examined from various localities from New York and Ohio to North Carolina, Tennessee and Kansas.

SCROPHULARIA LEPORELLA n. sp.

Lower than *S. Marylandica*, mostly 3°–4° tall (2°–7°), erect, but sometimes inclined from the weight of the fruiting panicle, commonly simple or nearly so, or developing a few ascending slender branches, rarely strongly branched. Stem throughout quadrangular with flat sides and acute margined angles, more or less glandular-puberulent especially when young, becoming glabrate below, viscid-glandular above and throughout the panicle; glandulosity finer and closer than in *Marylandica*, the smaller glandules pale. Panicle commonly longer and narrower than in *Marylandica*, 1°–3° in length, naked or with small leaves subtending the lowest cymes. Cymes commonly fewer-flowered and more contracted than in *Marylandica*, the branches and pedicels less slender and spreading, mostly under 2′ long and broad (1′–3′, rarely longer), ascending, frequently much separated, the branches often not longer than the peduncles, the bracteoles mostly not in pairs or finally recurved as in *Marylandica*, but solitary and somewhat appresed or incurved. Flowers of the cymes mostly 5–7, rarely more than 11, sometimes only 3 in each cyme throughout. Exceptionally, on strongly developed plants, the cyme may be as long-branched and many-flowered as in *Maiylandica*, presenting, however, a very distinct appearance from the more ascending branches and pedicels and longer more attenuate capsules. Leaves commonly smaller than in *Marylandica* (largest 10′ x 4′) thicker and less rugose, brighter green, glabrous both sides, somewhat shining below (when young with some minute glandular hairs on the veins above and below) varying from deltoid-ovate through ovate and oblong to lanceolate and narrowly lanceolate, truncate, cordate, rounded or tapering at the base, from finely and evenly to coarsely and irregularly dentate-serrate or sharply cut dentate, sometimes with acuminate and elongated spreading uncinate teeth. Petioles short, from 1/8 to 1/3 the length of the blade, stouter than in *Marylandica*, finely glandular-puberulent, on the upper side short-ciliate. Leaves of the axillary fascicles larger than in *Mary-*

landica, the fascicles sometimes developing into short sterile branches. Lower leaves of the stem reduced or rudimentary, early deciduous, the lowest reduced to appressed scaly bracts. Corolla longer and narrower than in *Marylandica*, more delicately veined but not glandular-puncticulate, more contracted at the throat 4″–5″ long, 2″ broad, the lobes longer than in *Marylandica*, especially the upper one, the two lateral lobes erect or slightly incurved, the lobes of the upper lip often narrowly oblong. Surface of the corolla-tube shining, greenish and purplish, the interior green and dull, the lobes varying from yellowish-green to dull purplish-red, or sometimes a bright pink-red; sterile stamen greenish-yellow, its lobe slightly more adherent than in *Marylandica* and mostly more abruptly dilated to the broadly truncate top which is ½″–1″ wide. Calyx-lobes broadly or narrowly ovate, obtuse or acute, slightly margined. Flower-buds shining, bright green with a purple spot at the top. Capsules ovoid-conic to elongated-conic or attenuate, passing into the thickened base of the style, 2″–5″ long, 1½″–3½″ wide, at maturity slightly compressed and impressed along the sutures, mostly brown, the surface often distinctly reticulate-veined. Seeds a little larger than those of *Marylandica* and darker, otherwise similar—irregularly oblong, often curved, strongly wrinkled striate and pitted. Roots fewer and simpler than in *Marylandica*, much stouter and longer, coalescing basally to form a large irregular woody structure which may be as much as six inches in longer diameter.

Wooded hillsides in rich soil, straying into open ground along roadsides where it sometimes becomes much branched and unusually stoutly developed.

Common near New York City. Dr. Britton finds it common on Staten Island. I have met with it within eight miles of the Connecticut line and in the Pocono region of eastern Pennsylvania. Its further distribution remains to be ascertained.

Begins to flower at New York from before the middle of May to the end of the month. Full sized fruit is already formed early in June, and by the end of the month only a few belated flowers, if any, remain.

Although this species occurs in much the same kind of situations as *S. Marylandica*, the two are rarely found growing together, or even inhabiting the same piece of woods. Near New York are various tracts of woodland inhabited exclusively by one or the other species; twice only have I found them growing together, apparently in accidental association in both cases.

Allusion has been made to differences in the root-structure of these two figworts. These differences are so distinctly marked, even to the unaided eye, that identification may safely rest on a mere glance at a fragment of the fresh root. In *Marylandica* the central cylinder is slender, occupying only about one-third of the diameter of the root; it is hence of about the thickness of the surrounding cortex, from which it is sharply distinguished by its greater whiteness, especially at its tough and lignified outer walls. Upon attempting to break the root the cortex is easily ruptured and peels off smoothly from the central cylinder which bends readily but refuses to break. In *leporella* the central cylinder is of softer texture and much larger, occupying the greater part of the interior of the root; its walls are not lignified, nor is it sharply marked off in color from the surrounding thin layer of cortex, which is not readily disengaged from it. The root is easily snapped in two, showing an even plane of fracture.

A comparison of the flowers of these plants shows a curious reversal of color characters between them. In *Marylandica* the surface of the corolla tube is green and dull, the interior shining and brownish-purple; in *leporella* the outside of the tube is purplish and shining, the interior green and dull. The color of the sterile stamen, deep purple in *Marylandica*, yellowish-green in *leporella* is absolutely constant, that is to say, a reference to hundreds of flowers of each species has discovered no exception. Even in flowers of *Marylandica* which are pale green nearly throughout, the sterile stamen remains purple; conversely, in the most highly colored flowers of *leporella* the green stamen is without the slightest purple tinge.

The early annual shoots of these plants show some interesting comparative differences. Before the end of April the stouter shoots of *leporella* are already a foot or more high, four or five times as tall as those of *Marylandica*. In the former the base of the shoot is leafless, often for several inches, and invested with broad, appressed, overlapping scales or bracts (modified petioles); these show a gradual transition into the small lower leaves. The early leaves have broad, flat petioles, sometimes nearly half an inch wide; the bases of the blades are mostly entire and sharply truncate. In *Marylandica* the lowest pair of leaves are large and fully developed, on long slender petioles which rise from nearly the extreme base of the shoot.

Reviews.

Plants of Monroe County, New York, and adjacent Territory.— Many catalogues of American local floras have been published. Among the regions most thoroughly explored is that of central and western New York. The number and character of the students who, first and last, have done field work within its limits would warrant this conclusion without taking into consideration their published results. Gray, Torrey, Vasey, Knieskern, Clinton, Sartwell, Paine, Wright, Day, Dudley and others have published papers, while many others have assisted in collecting information.

The recent publication, by the Rochester Academy of Science, of a catalogue of "Plants of Monroe County, New York, and Adjacent Territory,"* adds a large amount to our knowledge of the plants of this region. The catalogue is something more than a list, as may be seen by the table of contents.

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* Plants of Monroe County, New York, and Adjacent Territory. Published by the Rochester Academy of Science: 150 pages; large octavo, with two maps. Price, one dollar.

The work is made up of two main parts, the introduction and the catalogue proper. The plan of the whole work is similar to Professor Dudley's Cayuga Flora. There is lacking in it the evidence of painstaking research by the authors, so evident in every page of Professor Dudley's book. "The committee have collated all the lists of plants of this vicinity which they have been able to obtain, have examined the specimens in the herbarium of the Academy, and have used all available sources of information."

The list includes phanerogams and vascular acrogens. The unstable condition of botanical nomenclature apparently subjected the committee to some embarrassment. They used the old nomenclature in order to make the work "immediately useful to the schools of western New York," Gray's Manual being the standard text-book. By including the names of the new system in brackets wherever they differ from the old, it is hoped to make the publication up to date in botanical science, and at the same time available to the students in the high schools.

The tables in the introduction are interesting and suggestive. The number of species of flowering plants in the region is 1314, and consequently exceeds the number included in Professor Dudley's Catalogue as well as Mr. Day's "Plants of Buffalo." Some feeling is shown over the fact that Mr. Day reached far enough east to include the plants of Bergen Swamp. In the tables of comparison the Bergen plants are eliminated from the Buffalo list. An outsider might think this unjustifiable manipulation of the returns. It should be remembered, however, that Rochester and Buffalo are rival cities, and are not always on the most neighborly terms. The situation would be less amusing had not Rochester done very nearly the same thing herself for which she rebukes Buffalo. In including the plants of Wayne County and the region about Canandaigua Lake, about thirty-six plants were added to the list which have not been seen in Monroe County nor in the valley of the Genesee River.

However inconsistent it may be for Rochester to expunge from the Buffalo list its eastern extension, and at the same time to include an eastern extension of its own, every botanist will rejoice that the observations of Mr. Hankenson in Wayne County have been recorded. Monroe County is not a natural district, and the main issue is to include all the facts regarding the distribution of plants in that general region.

The committee gives its authority for each rare plant and thereby relieves itself, in part at least, of the responsibility for errors. It includes the lists of isolated amateur collectors without seeing their specimens or rediscovering their stations. Twelve or thirteen rare plants are included in the catalogue on the authority of the list of Rev. Lawrence Holzer, who collected about Rochester between 1862 and 1865. One plant, *Carex squarrosa*, the committee declines to give a number. Those included are *Nicotiana rustica* L., *Thymus Serpyllum* L., *Alnus serrulata* Willd., *Quercus ilicifolia* Wang., *Salix fragilis* L., *Allium vineale* L., *Trillium sessile*

L., *Carex monile* Tuckerm., *Muhlenbergia sobolifera* Trin., *Glyceria pallida* Trin., *Bromus racemosus* L., *Abies balsamea* Mill. Among these the species which arouses the greatest suspicion about Holzer's observations is the *Quercus*. Sargent avers (Silva of North America, 8: 156) that *Q. ilicifolia* "apparently does not reach central New York, nor cross the Alleghany mountains into the Mississippi basin." Other plants in Holzer's list belong to groups such that one who did not have access to verified specimens, might easily go astray in. In making up the lists peculiar to each of the three floras—Monroe Co., Buffalo and Cayuga—the committee spared no pains to swell the Monroe Co. list. A considerable percentage of them are plants of recent introduction, some of them are given no number in the list. But it would be unfair, perhaps uncharitable, to dwell upon the parts of the work in which the committee has emphasized the richness of their flora.

The historical sketches are welcome contributions to our too meager knowledge of local botanists. The maps are excellent; the sketches of localities are full of interesting matter. The remarks upon forest trees, which always form such a conspicuous feature in a flora, make one wish that more information had been collected and included. It is certain that Mr. Fuller could have put upon record much that those local botanists who succeed him would be glad to possess.

W. W. ROWLEE.

The Roentgen Rays and Botany.—It is reasonable to suppose that botanists, among other scientists, should devote some attention to the influence of Roentgen rays upon vegetable life. So far only minor reports have been published owing to the fact that sufficient time has not yet elapsed for the attainment of reliable results.

Schober* has published the preliminary results of his observations on the influence of the Roentgen rays upon the heliotropic curvatures of plants. He experimented upon the seedlings of *Avena sativa.* The seed was allowed to germinate in a dark chamber after which it was exposed (without being removed from the dark chamber) to the Roentgen rays for a period of one-half

* Schober, Alfred. Ein Versuch mit Röntgen'schen Strahlen auf Keimpflanzen. Ber. deutsch. bot. Ges. 14: 108–110. 1896.

hour. Upon examination it was found that the new rays had not induced any curvatures. A further exposure of one-half hour induced no curvatures. Afterwards the seedlings were exposed to one-sided diffuse sunlight, to determine whether any after effects would be manifest. It was found that the heliotropic curvatures took place promptly and proceeded normally. From these experiments the author concludes that the new rays differ from sun rays in that they do not cause growth curvatures. No observations were made as to whether the seedlings absorbed the Roentgen rays.

Recently Hintenberger* has published some interesting results in regard to the preparation of Roentgenograms of vegetable tissue. From some previous experiments made by K. Zahlbruckner and W. König it became apparent that certain tissues are very clearly outlined, especially the interior of the ovary. The author, with the assistance of Dr. A. Zahlbruckner, made a series of experiments testing the transmissibility of different flowers, buds and fruits to the Roentgen rays. From the Roentgenograms obtained it was found that not all ovaries gave the same clearness of outline. Seeds having a comparatively low percentage of water and a large number of air chambers and passages gave the best results, as for example beans and peas. Fleshy fruits transmit the new rays with difficulty. The interrupted water columns in the vessels of the stem of a species of *Nuphar* were outlined.

Further Roentgenogramic experiments with dried herbarium specimens, of seedlings, woody tissues, etc., are in progress. The author ventures the suggestion that vegetable tissue may perhaps be made more readily transmissible to the new rays by impregnation with various solutions, such as solutions of lead salts, etc. It is also his opinion that the sensitive plates can be made to respond more effectually to the influence of the Roentgen rays.

A. S.

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*Hintenberger, Hugo von. "Röntgenogramme" von Planzentheile. Separatabdruck aus der Photographischen Correspondenz. 1896.

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NATHANIEL LORD BRITTON,

AND OTHER MEMBERS OF THE CLUB.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

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Botanical Gardens.*

BY N. L. BRITTON.

ORIGIN AND DEVELOPMENT.

The cultivation of plants within small areas for their healing qualities by the monks of the middle ages appears to have been the beginning of the modern botanical garden, although these mediaeval gardens doubtless took their origin from others of greater antiquity. Botanical gardens were thus primarily formed for purely utilitarian purposes, although the aesthetic study of planting and of flowers must doubtless have appealed to their owners and visitors. Their function as aids in scientific teaching and research, the one which at present furnishes the dominating reason for their existence, did not develop much, if at all, before the 16th century, and prior to the middle of the 17th century a considerable number existed in Europe, in which this function was recognized to a greater or less degree, of which those at Bologna, Montpellier, Leyden, Paris and Upsala were, perhaps, the most noteworthy. The ornamental and decorative taste for planting had meanwhile been slowly gaining ground, as well as the desire to cultivate rare or unusual species, and during the 18th century attained a high degree of development. Many persons of wealth and influence fostered this taste and became, through the employment of men skilled in botany and horticulture, generous patrons of science.

* Vice-Presidential address befere Section G, American Association for the Advancement of Science, Buffalo, N. Y., August 24, 1896.

The world was searched for new and rare plants, which were brought home to Europe for cultivation, and many sumptuous volumes, describing and delineating them, were published, mainly through the same patronage. The older gardens were essentially private institutions, but as the rights of the people became more and more recognized, many existing establishments and an increasing number of newly founded ones became, to a greater or less extent, open to the public, either through an admittance fee or without charge. The four main elements of the modern botanical garden have thus been brought into it successively:

1. The utilitarian or economic.
2. The aesthetic.
3. The scientific or biologic.
4. The philanthropic.

These four elements have been given different degrees of prominence, depending mainly upon local conditions, some gardens being essentially aesthetic, some mainly scientific, while in our public parks we find the philanthropic function as the underlying feature, usually accompanied by more or less of the aesthetic and scientific.

The Economic Element.—In the broadest extension of this department of a botanical garden there might be included, to advantage, facilities for the display and investigation of all plants and their products directly or indirectly useful to man. This conception would include forestry, pharmacognosy, agriculture, pomology, pathology and organic chemistry, and in case the management regards bacteria as plants, bacteriology.

The display of the plants may be effected by growing such of them as will exist without protection in the locality in a plot, more or less individualized, commonly known as the Economic Garden, while those too tender for cultivation in the open are grown in the greenhouses, either in a separate house or section, or scattered through the several houses or sections, in the temperatures best adapted to their growth. The display of plant products, best accompanied by mounted specimens of the species yielding them, by photographs and by plates, is accomplished by the Economic Museum, where these are arranged in glass or glass-fronted cases, suitably classified and labeled. It is believed that the most useful results are obtained by arranging this museum by the products themselves, and thus not in biologic sequence, but by bringing together all drugs, all fibres, all woods, all resins; where the same product is used in more than one industry the exhibit may be duplicated, more or less modified, without disadvantage.

The investigation of economic plants and their products is accomplished through the Scientific Department, and few valuable results can be reached unless the scientific equipment is well developed. The two departments must work conjointly, both on account of the necessity of knowing just what species is under investigation, its structure, distribution and literature, and in order that the most approved and exact methods may be used in the research. Any idea that the scientific element can be dispensed with in connection with economic studies is palpably untenable.

Teaching and research in agriculture, pomology and plant pathology are so well organized in America, through our National Department of Agriculture and our numerous agricultural colleges and schools, that there is no great necessity for providing elaborate equipments for those branches in botanical gardens. But in case the endowment of a garden were sufficiently large to enable them to be successfully prosecuted, in addition to more necessary work, there can be no doubt that important additions to knowledge would be obtained. On the other hand, no such liberal allowances have been made with us for forestry or pharmacognosy, and research and instruction in these sciences must prove of the greatest benefit to the country.

The Aesthetic Element.—The buildings, roads, paths and planting of a botanical garden should be constructed and arranged with reference to tasteful and decorative landscape effect. The possibilities of treatment will depend largely upon the topographical character of the area selected and the natural vegetation of the tract. The buildings required are: A fire-proof structure or structures for museum, herbarium, libraries, laboratories and offices; a glass house with compartments kept at several different temperatures for exhibition, propagation and experimentation, or several separate glass houses; and to these will usually be added dwelling houses for some of the officers, a stable and other minor buildings.

The character, number and sizes of the buildings generally depend on financial considerations. In placing the structures intended for the visiting public, considerations of convenient access, satisfactory water supply and the distribution of crowds must be borne in mind, in connection with the landscape design. The planting should follow, as nearly as possible, a natural treatment, except immediately around the larger buildings and at the entrances, where considerable formality is desirable for architectural reasons. It is especially desirable that as much natural treatment as possible should be given to the areas devoted to systematic planting—herbaceous grounds, frutecetum, arboretum. The rectilinear arrangement of plant beds found in most of the older gardens has become abhorrent to landscape lovers, and the sequence of families desired can usually be quite as well obtained by means of curved-margined groups.

The cultivation of decorative plants, and especially the fostering of a taste for them, and the bringing of unusual or new species to attention and effecting their general introduction, are important functions of a botanical garden. For the accurate determination of these plants, information concerning their habits and structure, and suggestions regarding the conditions of their growth, the aesthetic side must rely on the scientific.

The Scientific or Biologic Element.—The important relations of the scientific department to the economic and aesthetic have already been alluded to. The library, herbarium, museums and laboratories are the sources whence exact information regarding the name, structure, habits, life-processes and products of plants are derived, and they are the more useful as they are the more complete and thoroughly equipped. It is practically impossible for any one library to have all the literature of botany and related sciences; any one herbarium to possess an authentic and complete representation of all species of plants, or any one museum to be thoroughly illustrative; absolute perfection along these lines cannot be obtained, but the more closely it is approximated the better the results. The research work of the scientific department should be organized along all lines of botanical inquiry, including taxonomy, morphology, anatomy, physiology and palaeontology, and the laboratories should afford ample opportunities and equipment for their successful prosecution.

The arrangement of the areas devoted to systematic planting, and the proper labeling of the species grown, are important duties of the scientific department. The sequence of classes, orders and families is usually made to follow some "botanical system." It is highly desirable that this should be a system which indicates the natural relations of the families, as understood at the time the garden is laid out, and be elastic enough to admit of subsequent modification, as more exact information relative to those relationships is obtained. The weight of present opinion is overwhelmingly in favor of an arrangement from the more simple to the more complex, and this will apply not only to the systematic plantations, but to the systematic museum and the herbarium.

The scientific possibilities of a botanical garden are the greater if an organic or cooperative relationship exists between it and a university, thus affording ready facilities for information on other sciences.

The Philanthropic Element.—A botanical garden operates as a valuable philanthropic agency, both directly and indirectly. Its direct influence lies through its affording an orderly arranged institution for the instruction, information and recreation of the people, and it is more efficient for these purposes than a park, as it is more completely developed and liberally maintained. Its indirect, but equally important, philanthropic operation is through the discovery and dissemination of facts concerning plants and their products, obtained through the studies of the scientific staff and by others using the scientific equipment.

Number and Distribution of Botanical Gardens.

There are somewhat over 200 institutions denominated botanical gardens, but only a few of them meet the requirements of the foregoing sketch. Some are essentially pleasure parks, with the plants more or less labeled; most of them pay some attention to taxonomy and morphology; many to economic botany; while a small number are admirably equipped in all branches of the science.

I have drawn freely on Prof. Penhallow's first annual report of the Montreal Botanical Garden, published in 1886, for the following approximate statement of the number in different countries:

Algeria, 1.
Australia, 5.
Austro-Hungary, 13.
Belgium, 5.
Brazil, 2.
Canada, 1.
Canary Islands, 1.
Cape of Good Hope, 3.
Ceylon, 1.
Chili, 1.
China, 1.
Cochin China, 1.
Denmark, 2.
Ecuador, 1.
Egypt, 1.
France, 22.
Germany, 36.
Great Britain and Ireland, 12.
Greece, 1.
Guatemala, 1.
Guiana, 1.
Holland, 4.
India, 7.
Italy, 23.
Japan, 1.
Java, 1.
Malta, 1.
Mauritius, 1.
Natal, 1.
New Zealand, 1.
Norway, 1.
Peru, 1.
Philippine Islands, 1.
Portugal, 3.
Reunion, 1.
Roumania, 2.
Russia, 16.
Servia, 1.
Siberia, 1.
Spain, 2.
Straits Settlements, 1.
Sweden, 6.
Switzerland, 4.
Tasmania, 1.
United States, 10.
West Indies, 6.

Notes on some Foreign Gardens.

1. Buitenzorg, Java. This is the largest botanical garden, occupying some 1,100 acres, at altitudes from sea level to about 6,000 feet. It was founded by the Dutch government in 1817, and has been well supported. Affording, as it does, highly favorable conditions for the growth of tropical and subtropical plants under natural conditions, it has yielded most important results, especially in taxonomy and plant physiology, many of which have been published in the ten large volumes of its "Annales."

2. The Royal Botanic Gardens at Kew are situated on the south bank of the Thames, about six miles west of Hyde Park Corner. They are reached by several railway routes, the time from Charing Cross being about 40 minutes, by steamer and by omnibus lines. The present area of the gardens is about 260 acres, an addition having been made during the past year. These world-famed gardens originated in the exotic garden of Lord Capel, in 1759. In 1840 they were adopted as a national establishment and opened as a public park. The botanic garden proper occu-

pies about 70 acres, and the remainder is given to arboretum and pleasure grounds. There are two main greenhouses: 1. The palm house, 362 feet long, the central dome rising 66 feet; 2. The temperate house, of which the central portion is 212 feet long, 137 feet broad and about 60 feet high, flanked by wings which give a total length of about 580 feet, the whole covering between one and one and one-half acres of ground. There are also fourteen other houses, grouped in two ranges and more or less connected, given to special collections. There are three botanical museums: 1. Devoted to economic products; 2. to miscellaneous products; 3. to timbers. There is also a large museum hall given to the exhibition of floral paintings by the late Marienne North. There is a small laboratory equipped for research in physiological botany. The herbarium and library occupy the old palace of the King of Hanover, near the main entrance to the garden, and they are the largest and most complete in the world. The herbaceous ground is planted in long parallel beds and contains several thousand species. The arboretum is thoroughly illustrative of all trees that will grow in the open at Kew, and the shrubs are, for the most part, cultivated in areas by themselves. There are numerous special features, such as the rock garden, the bamboo garden and the American garden.

The research work of Kew is principally economic and taxonomic. Around it centre the 24 botanical gardens and botanical stations of the British Colonies, which are manned chiefly by men who have studied or worked at Kew. The principal publications at present emanating from Kew are:

1. The Kew Bulletin of Miscellaneous Information.
2. Hooker's Icones Plantarum.
3. The Continuation of Hooker's Flora of India.
4. The Continuation of the Flora of Tropical Africa.
5. Annual Reports.
6. The Index Kewensis.

The monographs and separate writings of its staff of scientific men are too numerous to review at this point.

3. The Royal Botanical Garden of Berlin is situated in the southwestern part of the city, but a project for moving it out into the country is now being seriously considered. The palm house

reaches a height of about 90 feet, being the highest one yet constructed, and too high for satisfactory operation. The botanical museum is very extensive and has series of economic, systematic and archaeological collections. The herbarium is one of the largest in the world. The systematic beds are arranged on a strictly modern sequence, and portions of the garden are devoted to plant geography and plant biology. The arboretum is not extensive. Among special features may be mentioned the alpine garden and the collections of Cacti. The garden is an institute of the University, where the principal laboratories are situated. There is also an institute of plant physiology with a small separate garden. The official publications of the Berlin Garden are the "Notizblatt" and annual reports. A series of volumes of "Jahrbücher" was issued some years ago. The publications of the garden staff are voluminous and cover all lines of botanical inquiry.

4. The long-established "Jardin des Plantes," the gardens of the Museum of Natural History at Paris, are situated in the heart of the city, fronting on the Seine. The conservatories are grouped near the main museum building at one end of the grounds, are very large and contain a great variety of plants. The botanical library, laboratories, and the enormous herbarium are in a separate older building. The systematic beds are arranged in rows; owing to the limited size of the area devoted to them, they are much crowded, but contain a splendid assortment of species. But little space is given to trees; there are, however, some famous specimens. Many valuable contributions to the literature of botany along all its lines have emanated from this grand institution for over 100 years, published for the most part, in the "Annales" and "Archives" of the Museum of Natural History, and in the Bulletin of the Botanical Society of France.

5. The Botanical Garden of the University of Vienna was established about 1754, and is located in the heart of the city. There are here very important and extensive museums, herbaria and libraries, and one large fine greenhouse. The systematic plantations occupy the larger portion of the tract, and special areas are devoted to the cultivation of medicinal and other economic plants, to an arboretum of native trees, and to groups illustrating plant geography. The garden and associated laboratories

provide equipment for the prosecution of all lines of botanical research.

6. The Botanical Garden of Geneva was founded in 1817, and is situated in the heart of the city, near the University. There are two small greenhouses, a very large and important herbarium and library, and a small museum. The laboratories of the University are extensive and well equipped, affording capital facilities for work along all the lines of botanical investigation. The De Candolle herbarium and library, and the Boissier herbarium and library, which are near by, afford, in connection with the collections of the garden, unsurpassed facilities for taxonomic study.

7. The Royal Botanic Garden of Edinburgh covers about 60 acres, of which about one-half was added to the older portion some 12 years ago; there are possibilities of still further enlargement. The main greenhouses have a frontage of about 200 feet, the palm house rising 70 feet, and there are six small special houses. The botanical museum, lecture room and laboratories are in one building, the large herbarium and library in another. The systematic plantations of herbaceous species are extensive, the rock garden being an especially strong feature. The development of arboretum and frutecetum in the newer portion of the tract has made good progress. The institution is in intimate relationship with the University, nearly all the instruction in botany being given at the garden. The research work has been extensive, along taxonomic, morphologic and physiologic lines.

8. The Royal Botanic Garden of Dublin, situated at Glasnevin, just without the city, was founded through the influence of the Honorable and Honorable Dublin Society, in 1790, was for many years supported by this Society with the aid of government grants, and was transferred to the Science and Art Department in 1877. It includes about 40 acres of undulating land, bounded to the north by the small river Tolka. There are eight greenhouses, most or them rather old, but containing a valuable collection. There is a small botanical museum and herbarium. The systematic herbaceous plantations are irregularly shaped beds, arranged in a somewhat radial manner. The arboretum and frutecetum occupy about one-half of the area.

9. The Brussels Botanical Garden lies in the heart of the city

and embraces not more than ten acres of land, of which one-half is given to arboretum. The greenhouses are large but old. There is a very extensive herbarium and library. The systematic beds are arranged as quadrants of a circle, separated by concentric and radial paths. Special areas are devoted to ornamental and economic plants. Owing to the restricted size of the area available a very dense grouping of plants is necessitated. The research work accomplished here has been mainly taxonomic. The Botanical Society of Belgium has its headquarters at the garden.

10. The Imperial Botanical Garden at St. Petersburg is in close affiliation with the Academy of Sciences and the University. There is here a famous herbarium, a large botanical library and museum, and commodious and well-stocked greenhouses. The garden publishes "Acta," and many researches prosecuted there are printed in the Bulletin and Memoirs of the Imperial Academy.

11. The Royal Botanic Garden of Trinidad, situated at Port of Spain, was established in 1818, and now occupies about sixty-three acres, with some outlying plantations. There is a vast collection of tropical plants in cultivation, an extensive botanical library and herbarium and a small laboratory. The garden publishes "Annual Reports" and "Bulletin," dealing especially with topics of economic application.

12. The Botanical Department of Jamaica, West Indies, operates extensive gardens at Kingston, smaller ones at Castleton, and the several large Cinchona plantations. The scientific collections and library are valuable. The department publishes "Annual Reports" and "Bulletin," especially devoted to economic botany.

13. McGill University, at Montreal, Quebec, carries on a small botanical garden in connection with its laboratories. The Montreal Botanic Garden, begun in 1885, on about 75 acres of ground in Mount Royal Park, was soon abandoned, owing to political complications.

14. Among other foreign gardens of which mention must be made, and of which a description would be interesting if our time allowed, are those at Munich, Würzburg, Tübingen, Stockholm, Copenhagen, Upsala, Zurich, Ceylon, Calcutta and Oxford.

Botanical Gardens in the United States.

The first botanical garden established in America was begun by John Bartram in Philadelphia, in 1728. In it he placed a considerable number of plants obtained in the course of his extensive travels. The plot still remains, including the family homestead, somewhat modified, and it is a pleasure to know that it will be preserved as public ground.

André Michaux, in the latter part of the last century, planted gardens at Charleston, S. C., and New Durham, N. J., but they were essentially nurseries from which he sent seeds and plants to Europe.

In the year 1801 Dr. David Hosack, then professor of botany and materia medica in Columbia College, purchased twenty acres of ground in New York city, and called it the Elgin Botanic Garden; in this tract he accumulated, with great labor during the next ten years, a very large and valuable collection of plants. The institution was transferred to the State of New York, through an act of the Legislature, in 1810, and was then known as the Botanic Garden of the State of New York. It was subsequently granted to Columbia College. Funds for its maintenance were not provided, however, and it was ultimately abandoned. Two catalogues of its plants were issued by Dr. Hosack, one in 1806, and another in 1811. The condition of botanical gardens in America at that time is indicated by the following note in Dr. Hosack's catalogue of 1806:

"I learn, with pleasure, that a Botanic Garden is proposed to be established near Boston, and connected with the University of Cambridge. The Legislature of Massachusetts, with a munificence which does them honor, have granted, for this purpose, a tract of land, the value of which is estimated at thirty thousand dollars; and several individuals have evinced their liberality and love of science by voluntary subscriptions, to the amount of fifteen thousand dollars, towards the establishment and support of that institution. Another is also begun at Charleston, S. C., and a third is contemplated in New Jersey, in connection with the College of Princeton."

In the year 1824 there was published at Lexington, Ky., the "First Catalogues and Circulars of the Botanical Garden of Transylvania University at Lexington, Ky., for the year 1824," by W. H. Richardson, M. D., President of the Board of Managers, and C. S. Rafinesque, Ph.D., Secretary. This rare pamphlet, which is not recorded in Dr. Call's very complete life and writings of Rafinesque, is of 24 pages, and is printed alternately in English and French. It is essentially an appeal for plants and material for the garden, and a list of species that it could furnish to kindred institutions. This garden was evidently short-lived, inasmuch as in Rafinesque's "Neogenyton," of the following year, 1825, he remarks, "I mean, therefore, to indicate and propose in this small essay, many of the numerous new genera of plants detected or ascertained, some of which were indicated last year, 1824, in the Catalogue of the botanical garden which I have tried in vain to establish in Lexington."

The principal gardens at present operated and in course of development in the United States are as follows:

1. The Botanic Garden of Harvard University, at Cambridge, Mass., founded in 1805. There are about seven acres of land under cultivation, a small greenhouse and a famous herbarium and library from which have flowed during the past 40 years voluminous and invaluable contributions to taxonomy and morphology, especially of North American plants. There is also a small morphologic laboratory. The main laboratories and museums connected with the institution are situated in other of the Harvard buildings a short distance away. The system of garden, libraries, museum, laboratories and herbaria operated by Harvard College is one of the most complete in existence. It is hard to say, indeed, in what respect it is not ideal, except in the rather wide distance separating the several elements and the small amount of land available for planting.

2. The Arnold Arboretum of Harvard University, at Jamaica Plain, Mass., was founded through a bequest of $100,000, made about 1870, by Mr. James Arnold, of Providence, R. I., to three trustees, to be used for the improvement of agriculture or horticulture. The trustees wisely determined to devote it to forestry and dendrology, and effected cooperative agreements with Harvard College and the City of Boston, which have now given us the greatest tree museum in existence, freely open to the visiting pub-

lic. The planted area is about 160 acres, and will be materially increased in size. A small museum, library and herbarium building has been erected near the main entrance. The great *Silva of North America* and the journal *Garden and Forest* are noteworthy publications from this noble institution.

3. The Botanic Gardens of the United States Department of Agriculture, at Washington, have an extensive range of greenhouses and a large tract of land under cultivation. The herbarium of the department, now deposited with the United States National Museum, is very large and is at present increasing more rapidly than any other in America. There is a somewhat effective working library, which greatly needs material enlargement, and several poorly located and equipped laboratorias, in which a vast amount of important investigation is being accomplished, under very unfavorable conditions, which urgently demand improvement. Publications include: Bulletin of the Botanical Division, Bulletin of the Division of Forestry, Bulletin of the Division of Plant Pathology and Physiology, Contributions from the United States National Herbarium, Year-book of the United States Department of Agriculture, and circulars of the several divisions.

4. The Missouri Botanical Garden, at St. Louis, Mo., was established in 1889, through the provisions of the will of Mr. Henry Shaw, who for over thirty years previously had been bringing together material for it on the land about his residence, which was known as Shaw's Garden. There were in all some 670 acres devised to the institution under the will of the generous and philanthropic founder, and from the income yielded by much of this land, not nearly all the area being required for garden purposes, the institution derives its large maintenance fund, which will certainly be greatly increased as the land becomes more valuable, and will supply an income sufficient to operate the institution in the most effective manner. There are several greenhouses, a very large and valuable herbarium and library, while the laboratories of the Shaw School of Botany, at Washington University, are in close relationship to the garden. Much important research, principally taxonomic, has been prosecuted. Publications consist of seven volumes of Annual Reports and nine "Contributions from the Shaw School of Botany."

5. The Botanical Garden of the Michigan Agricultural College was begun in 1877. There are now about three acres under high cultivation, exclusive of the aboretum and decorative grounds, which together cover several acres. There are several small greenhouses, an herbarium of about 60,000 specimens, a good botanical library and extensive, well-equipped laboratories.

6. The University of California, at Berkeley, has a botanical garden of several acres, established some years ago, in which a large number of plants are grown. It furnishes a valuable adjunct to the work of the botanical department, which has well-appointed laboratories, a working library and a large herbarium.

7. The University of Pennsylvania has recently established a garden of about three acres in the immediate vicinity of its building, in Philadelphia, and has many species under cultivation. The extensive and well-appointed laboratories of its School of Biology, good library facilities and a small herbarium afford capital opportunity for research, especially in physiology and morphology.

8. Smith College, at Northampton, Mass., has also recently established a botanical garden, on the campus.

9. The Buffalo Botanical Garden, in South Park, Buffalo, N. Y., was commenced in 1893, and has since made rapid and encouraging progress. A small range of greenhouses has been built, and others are planned. A beginning has been made in accumulating a library and herbarium, and much permanent planting has been accomplished.

10. The New York Botanical Garden. The establishment of the New York Botanical Garden was authorized by the Legislature in 1891, and the enabling act was amended in 1894. The enterprise was inaugurated and the legislation procured by a committee of the Torrey Botanical Club, appointed in 1889. The Act of Incorporation provided that when the corporation created should have raised or secured by subscription a sum not less than $250,000 the Commissioners of Public Parks were authorized to set apart and appropriate a portion of one of the public parks, not exceeding 250 acres, and the Board of Estimate and Apportionment was authorized to issue bonds, aggregating the sum of $500,000, for the construction and equipment, within the grounds, of the necessary buildings. The subscription of $250,000 required

by the Act of Incorporation was completed in June, 1895, and the Commissioners of Public Parks, in the following month, formally appropriated 250 acres of the northern part of Bronx Park for the purposes of the Garden. Since that time the preparation of plans for the development of the tract has been steadily progressing, including designs for the museum building and a large horticultural house. This planning is still in progress, in charge of a commission of architects, engineers, gardeners and botanists, who will complete their work within a short time, and be ready to submit a complete scheme to the Board of Managers during the coming autumn. Meanwhile, much preliminary work has been accumplished in clearing the ground, in grading, in the planting of borders, in the establishment of an extensive nursery, and in the accumulation of herbarium, museum and lirbary material. Through a coöperative agreement entered into with Columbia University, the herbarium and botanical library of the University will be deposited with the Garden, and most of the research and graduate work of the University in botany will be carried on in the museum building.

The endowment fund has been materially increased, and about 430 persons have become annual members of the Garden, contributing ten dollars a year each to its support. The publication of a Bulletin has been commenced by the issue, in April, of the first number of Volume I.

N. L. Britton.

Proceedings of the second Annual Meeting of the Botanical Society of America.

Buffalo, N. Y., August 21st and 22d, 1896.

Subsequent to a meeting of the Council on the afternoon of Friday, August 21st, the Society met, with the retiring President, Dr. Wm. Trelease, in the chair, who introduced the President-elect, Prof. C. E. Bessey. Dr. Bessy addressed the Society in a brief and suggestive manner. The election of officers for the year 1897–'98 resulted as follows:

President, Prof. J. M. Coulter.

Vice-President, Prof. C. S. Sargent.

Treasurer, Mr. Arthur Hollick.

Secretary, Prof. C. R. Barnes.

Councillors, Dr. B. L. Robinson, Mr. F. V. Coville.

The Secretary reported the death of Mr. Michael Schuck Bebb, and a committee was appointed to prepare and report a suitable minute for record. The committee subsequently reported the following, which was unanimously adopted:

The Botanical Society of America desires to place on record an expression of esteem for its deceased member, Michael Schuck Bebb, who died on December 5, 1895, at San Bernardino, Cal. His published studies upon the difficult genus *Salix* have brought him to high rank as a professional botanist, and American botany owes to him a debt of gratitude, as one of its most distinguished representatives.

JOHN M. COULTER,
N. L. BRITTON,
CONWAY MACMILLAN,
Committee.

Mr. C. H. Peck, of Albany, N. Y., and Mr. B. T. Galloway, of Washington, D. C., were unanimously elected active members.

The question of the advisability of holding a midwinter meeting in addition to the regular annual meeting was discussed at length, and referred to the Council, with power. Professors Trelease, Atkinson and Britton were appointed a committee to nominate additional members.

The address of President Trelease, on "Botanical Opportunity," was delivered on the evening of August 21st, before a large and interested audience, and publication for it was requested from "Science" and the "Botanical Gazette."

The following papers were read on Saturday afternoon:

"Some Characteristics of a Fresh-water Insular Flora," by Prof. Conway MacMillan.

"A Species of *Eleocharis*, new to North America," by Prof. N. L. Britton.

The following were read by title:

"The Philosophy of Species-making," by Prof. L. H. Bailey.

"Some Problems in Sporophyll-transformation among dimorphic ferns," by Prof. Geo. F. Atkinson.

The Treasurer's report showed a balance on hand of $556.30.

The members present at the meetings were: G. F. Atkinson, L. H. Bailey, C. R. Barnes, C. E. Bessey, E. G. Britton, N. L. Britton, J. M. Coulter, A. Hollick, C. MacMillan, W. Trelease, L. M. Underwood.

Titles of Papers read before the Section of Botany, A. A. A. S., Buffalo Meeting, August 24–26, 1896.

Prof. N. L. Britton, Vice-President of the Association and Chairman of the Section, presided; Prof. Geo. F. Atkinson, Secretary.

Prof. Britton's Vice-Presidential address, on "Botanical Gardens," was delivered on the afternoon of Monday, August 24th. It is printed in full in this issue of the BULLETIN.

Papers were read as follows:

1. *The Relation of the Growth of Leaves to the CO_2 of the Air.* By D. T. MACDOUGAL.
2. *Directive Forces operative in Leaf-rosettes.* By R. N. DAY.
3. *On Crataegus coccinea and its Segregates.* By N. L. BRITTON.
4. *The Distribution of the Species of Gymnosporangium in the South.* By L. M. UNDERWOOD and F. S. EARLE.
5. *Morphology of the Canna flower.* By L. H. BAILEY.
6. *A Comparison of the Flora of Erie Co., Ohio, with that of Erie Co., New York.* By E. L. MOSELEY.
7. *The Significance of simple and compound Ovaries.* By C. E. BESSEY.
8. *On the bacterial Flora of Cheddar cheese.* By H. L. RUSSELL.
9. *The Terminology of Reproduction and reproductive Organs.* By C. R. BARNES.
10. *A comparative Study of the Development of some Anthracnoses in artificial Cultures.* By BERTHA STONEMAN.
11. *The Development of the vascular Elements in the primary Root of Indian Corn.* By W. W. ROWLEE.
12. *Some Remarks on Chalazogamy.* By J. M. COULTER.
13. *The Habitats of the rarer Ferns of Alabama.* By L. M. UNDERWOOD.

14. *On the Stem-anatomy of certain Onagraceae.* By FRANCIS RAMALEY.
15. *The Point of Divergence of Monocotyledons and Dicotyledons.* By C. E. BESSEY.
16. *Notes on the Pine-inhabiting Species of Peridermium.* By L. M. UNDERWOOD and F. S. EARLE.
17. *Reaction of Leaves to continual Rain-fall.* By D. T. MACDOUGAL.
18. *Studies in nuclear Phenomena, and the Development of the Ascospores in certain Pyrenomycetes.* By MARY A. NICHOLS.
19. *The Stigma and Pollen of Arisaema.* By W. W. ROWLEE.
20. *Notes on the Genus Amelanchier.* By N. L. BRITTON.
21. *Remarks on the northern Species of Vitis.* By L. H. BAILEY. (By title.)
22. *On the Formation and Distribution of abnormal Resin-ducts in Conifers.* By ALEX. P. ANDERSON.
23. *The Development of the Cystocarp of Griffithsia Bornetiana.* By ARMA A. SMITH.
24. *Notes on the Allies of the sessile Trillium.* By L. M. UNDERWOOD.
25. *On an apparently undescribed Cassia from Mississippi.* By C. L. POLLARD.
26. *A bacterial Disease of the Squash-bug, Anasa tristis.* By B. M. DUGGAR.
27. *What is the Bark?* By C. R. BARNES.
28. *Embryo-sac Structures.* By J. M. COULTER.
29. *Some Cyperaceae new to North America, with Remarks on other Species.* By N. L. BRITTON.
30. *Grasses of Iowa.* By L. H. PAMMEL.
31. *Ceres-Pulver: Jensen's new Fungicide for the Treatment of Smut.* By W. A. KELLERMAN.
32. *On the Cardamines of the C. hirsuta Group.* By N. L. BRITTON.
33. *The Relation between the Genera Polygonella and Thysanella, as shown by a hitherto unobserved Character.* By JOHN K. SMALL.
34. *An apparently undescribed Species of Prunus from Connecticut.* By JOHN K. SMALL.
35. *The Flora of the Summits of King's Mountain and Crowder's Mountain, North Carolina.* By JOHN K. SMALL.

36. *Parthenogenesis in Thalictrum Fendleri.* By DAVID F. DAY.
37. *A Discussion of the Order Pezizineae of Schröter.* By ELIAS J. DURAND.
38. *What should constitute a Type Specimen.* By S. M. TRACY.
39. *Rheotropism and the Relation of Response to Stimulus.* By F. C. NEWCOMBE.
40. *Some Adaptations of Shore-plants to Respiration.* By HERMANN VON SCHRENK.
41. *The Mechanism of Curvature in Tendrils.* By D. T. MACDOUGAL.
42. *Island Vegetation at the Lake of the Woods.* By CONWAY MACMILLAN.
43. *Sporophyll-transformation in dimorphic Ferns.* By GEO. F. ATKINSON.
44. *A Contribution to our Knowledge of the Relation between Growth and Turgor.* By E. B. COPELAND.

The meeting was pronounced the most successful hitherto held by the Section of Botany, and this was celebrated by an informal dinner held on Thursday evening, August 27th, which was enjoyed by forty members, Messrs. Hollick and MacDougal acting as toast masters in so felicitous a manner that they were unanimously requested to repeat the experiment at the next meeting.

On Friday, August 28th, the members of the Section were the guests of the Buffalo Naturalists' Field Club at Point Abino, Ontario, and enjoyed a beautiful day, and the study of a very interesting flora.

Officers for the next meeting, to be held at Detroit, Mich., beginning August 9th, 1896, are Prof. Geo. F. Atkinson, President, and Prof. F. C. Newcombe, Secretary.

Proceedings of the Botanical Club, A. A. A. S., Buffalo Meeting, August 25–29, 1896.

TUESDAY, AUGUST 25TH. MORNING.

In the absence of Mr. Coville, President, and Prof. MacMillan, Vice-President, Prof. Kellerman was elected President *pro tem.* Mr. Cowell, Secretary, submitted the registration book for signatures of members present and distributed badges.

Prof. Kellerman distributed copies of a map of Ohio, showing the distribution in the southern counties of that state of *Phoradendron flavescens*, *Bignonia crucigera*, which covers the fences in some places, and *Polypodium polypodioides*. Prof. Coulter remarked on the distribution of the *Phoradendron* in the lower Wabash region of Indiana and Illinois. Prof. Tracy stated that it is abundant in southern Illinois, and Prof. MacDougal recorded its occurrence at points in southern Indiana.

Prof. Kellerman remarked that the Canada Thistle, *Carduus arvensis* does not spread in southern Ohio. Prof. Lazenby stated that seeds of the plant are not formed in the region.

Prof. L. R. Jones described a method of distributing pure cultures of fungi. Owing to mixed growth of several species of fungi upon the same substratum, it is often difficult to obtain an uncontaminated growth for distribution in exsiccati. The growth and distribution of pure cultures easily obviates this difficulty. These pure cultures can readily be made in quantity and in convenient form for distribution by placing paraffined paper in the bottom of large culture dishes; the agar, or other nutrient medium, is then poured upon this, and seeded with spores from a pure culture. When colonies have reached sufficient development, the whole is dried down, the paper bearing the fungus is removed from the dish and cut up for distribution. Prof. Jones suggested that the method might be applied to the distribution of bacterial cultures. Concerning this, Prof. Russell stated that the method could not be used for the propagation of such cultures, as the bacteria, especially the non-sporogenous forms, die out so easily when subjected to desiccation. It might be of service, however, in preserving the appearance of colonies. Mr. Duggar inquired if

Prof. Jones had tried distributing cultures on mica. Prof. Jones replied that the paraffined paper was cheaper.

Mrs. Britton reported the occurrence of the moss *Tetraplodon bryoides* in large quantities on the timbers soaked with drainage from the stables on the summit of Mount Washington, N. H., and distributed specimens collected there in July, 1895, by Mr. Edwin Faxon, Dr. Geo. G. Kennedy and Mr. E. F. Williams; it had previously been found only in small patches on this mountain. She also remarked on the distribution of the species in North America.

Judge Day remarked as follows on *Iris:* It seems to be a character of the rhizomatous species of *Iris*, when forming flowers for the following season, to produce at the extremity of the rhizome three buds, side by side, of which the two lateral ones are merely vegetative and the central one, alone, productive of flowers. I have noticed this character in *Iris versicolor*, *Virginica*, *verna*, *cristata* and *cuprea*, of North America, and *Kaempferi*, *pumila*, *Siberica*, *Pseud-acorus*, *sambucina*, *Florentina* and *Germanica*, so-called, of the Old World. I have failed to find it in any of the bulbous *Irises*, or in any other genus of the Iridaceae, and think the observation has not been heretofore recorded.

Prof. Bessey remarked on the distribution of the bear-berry, *Arctostaphylos Uva-ursi*, in Nebraska, stating that it is known to occur with *Pinus pondorosa* in two widely separated stations near the 100th meridian, one of these being in a cañon in the central county (Custer) and the other a cañon on the south side of the Republican River, near the south border of the state. Judge Day said that in the Buffalo region it follows the Niagara River, but does not enter the gorge. Prof. Bessey remarked that ericaceous shrubs will not grow on the plains.

Tuesday, August 25th. Afternoon.

Prof. Newcombe described an improvement to the paraffine-bath, consisting of a device for adjusting the receptacles of the bath at various heights so as to secure different temperatures in the receptacles, while the temperature of the bath remains constant. This adjustment can only be made in baths in which there are closely fitting, removable receptacles, sitting into pockets. Such a bath can easily be made to order, and to the bottom of the receptacle brass strap-springs can be so riveted as to sustain the receptacle at any height by pressure against the side of the pocket.

Prof. Rowlee presented the following notes on the branching of oaks:

I. Our species of trees differ very widely in their method of branching. All, however, with the possible exception of the cottonwood, agree in that the branches are produced from the buds nearest the terminal bud of a season's growth. No group has this peculiarity in so marked a degree, however, as the oaks. In them the internodes near the terminal bud are shortened and the branches appear close together. The branches appear in periods upon a main branch, each branch-bearing region being in the immediate vicinity of a season's terminal bud. This peculiar method of branching contributes toward the rigid character of an oak tree. It is primarily due to the position of the branches and the short nodes in that region.

II. Normally oaks make a definite seasonal growth terminated by winter bud. A tree (*Quercus macrocarpa*) in the writer's yard has departed from this mode of growth during the present season in a very decided manner. Early in the season, in May and early June, the tree in question developed normal annual shoots, each terminated by a winter bud. In the early days of July these winter buds swelled and developed into leafy shoots duplicating the growth already made. There was more contrast between the first and last leaves of the last growth and the leaves were very light colored. The question naturally arose whether the double seasonal growth in length was accompanied by double cambial growth; sections show that up to the time of the investigation (August) but a single ring had been formed, that is, the cambial growth had been continuous.

[In the discussion which followed this paper it was stated that fruit trees frequently made a double seasonal growth in one year, and that autumnal flowering of fruit trees was accompanied by this phenomenon.]

III. Specimens of white oak branches were exhibited illustrating an unusual degree of variation in the branches of an individual tree. This tree is isolated from dwellings and from other trees and stands in a field east of Ithaca. The main part of the tree is normal, a single branch on the east side and low on the tree has much smaller leaves and acorns. The contrast between this branch and the rest of the tree is so marked as to be seen at considerable distance, and was well shown in the branches exhibited.

WEDNESDAY, AUGUST 26TH. MORNING.

Prof. L. R. Jones presented some notes on potato-leaf blights, stating that *Phytophthora infestans* D. By. is common only in northern New England, northern New York and Canada. The so-called "Early Blight," attributed to the parasitism of the fungus *Macrosporium Solani* E. & M., is generally due not to the attacks of any fungus, but to arsenical poisoning, or to drought or other unfavorable conditions surrounding the plant. On such dying potato leaves there occurs very generally a saprophytic fungus closely resembling *Macrosporium Solani*, but which in cultures develops quite differently. This fungus is distinctly an *Alternaria*, ten or fifteen spores often being produced in a single chain. *Macrosporium Tomato* Cooke, develops exactly similar chains of spores in culture, and it seems probable that the *Alternaria* from the potato leaf is the same as the tomato *Macrosporium*, but which should properly be called *Alternaria Tomato*. Under especially favorable conditions *Macrosporium Solani* has also developed spores in chains, and hence should be known as *Alternaria Solani*.

Dr. Russell described a method of hindering the condensation of water in Petri plates where agar is used as a medium. It was simply to enclose culture dish in an ordinary porcelain bowl and cover same with a smaller inverted one. This maintains an equal temperature, both inside and outside of culture, thereby preventing the accumulation of condensed water on under-surface of cover.

Dr. Bessey gave an outline of the flora of Colorado Springs, stating that there was here a sudden transition between the floras of the plains and the mountains. In the vicinity of the town, at an elevation above the sea of about 6,000 feet, the plants are nearly the same as those about Lincoln, Nebr., which is situated near the eastern side of the plains. He explained that radiating from Pike's Peak, down to the plains, there are numerous deep dark cañons, whose vegetation was very different from that of the plains or the mountains proper. The cañon flora, however, has been greatly modified by forest fires, causing the opening up and drying out of the gorges, as in the case of South Cheyenne Cañon, and by the vandalism of tourists who have ruthlessly destroyed ferns, columbines, *Calochortus*, and other showy plants. The flora of elevations from 10,000 to 13,000 feet is scant and low on the open dry ridges and summits; in the mountain meadows, grasses, sedges and clovers abound; the mountain swamps are overgrown with *Potentilla fruticosa*, but no sphagna were observed. Prof. L. R. Jones remarked that *Potentilla fruticosa* took possession of old fields and pastures in Vermont, becoming a weed.

Mr. E. J. Durand reported a new station for *Epipactis viridiflora;* this plant appeared with some ferns on a lawn in the village of Canandaigua, N. Y., which had been transplanted from some point in the vicinity. Judge Day remarked that attempts to cultivate it at Buffalo had not succeeded. Mrs. Britton said that a similar experience had been had with *Arisaema Dracontium* on Staten Island, which came up in a fern bed, while no other station for the species is known on the island.

Mr. Pollard, Assistant Curator of the U. S. National Museum, explained briefly the terms of transfer which has been effected of the National Herbarium from the control of the Department of Agriculture to that of the Smithsonian Institution. The work is now carried on by three assistant curators under the general supervision of Mr. Frederick V. Coville, Honorary Curator; and Congress has this year appropriated the sum of $10,000 for the care and maintenance of the herbarium.

Mrs. Britton made the following remarks on the rediscovery of *Schizaea pusilla* in Newfoundland: The Rev. A. C. Waghorne has recently sent me two small tufts of this little fern which he collected last year about 70 miles from Bay of Islands, Newfoundland; "in bogs, borders of ponds, the quarry N. W. of the railway." The specimens are small like those I collected in Nova Scotia, but they have an abundance of fertile fronds, which are quite mature. It will be remembered that this is the fern that was found in the herbarium of De La Pylaie, from Newfoundland, but that it was for a long time doubted whether it could possibly have been found there, Dr. Gray and others supposing that the locality must have been a mistake, and that the specimens must have come from New Jersey. This discovery completely settles that question, and makes it evident that it is only those who know what to look for will find this fern, and that it will be found in intermediate stations between Nova Scotia and New Jersey, along the coast of New England, possibly on Long Island.

Mr. Karl M. Weigand presented the following notes on the genus *Boschniakia*. Specimens of *Boschniakia* recently received from Tacoma were found not to agree at all well with the existing characterization of this genus as given in the Synoptical Flora. This led to an examination of all the herbarium material at hand, with the following results: It was found, in the first place, that instead of being " ebracteolate " all members of the *strobilacea* group have some or all of the flowers subtended by two subulate bractlets, and, instead of " calyx truncate behind and with three teeth in front," two teeth only were found in the above mentioned group and these were always lateral. The subdivisions found in the Synoptical Flora are also unjustifiable. In the *strobilacea* group the calyx-teeth are not longer than the tube, and not always subulate; the scales are not always obtuse, and the placentae in one case were found to be three instead of four. Specimens of *B. glabra*, the species on which the genus was founded, on the other hand, agree exactly both with the generic description and with the sections, and it seems, therefore, as if the characterization had not been properly changed in the addition of subsequent species. *B. Hookeri* is probably not distinct from *B. strobilacea*, as Dr. Gray suggested in Proc. Amer. Acad. in 1887. Although not a sufficiently large number of specimens have so far been examined to warrant definite conclusions, it seems certain that this genus is in need of a thorough revision, and it is thought desirable to call attention to the above noted discrepancies for the purpose of drawing criticism from others.

WEDNESDAY, AUGUST 26TH. AFTERNOON.

The committee on nomenclature submitted the following report:

To the Botanical Club, A. A. A. S.:

Your committee on nomenclature, which was requested at the Springfield meeting to prepare a report, would respectfully submit the following preamble and resolutions:

WHEREAS, A large number of requests for a list of all North American Pteridophyta and Spermatophyta has been received, and publication for such a list, when prepared, has been informally offered by the Assistant Secretary of the Smithsonian Institution;

Resolved, That the committee be and hereby is authorized to prepare for publication a list of Pteridophyta and Spermatophyta occurring in the United States and the British possessions of North America.

Resolved, That the committee be and hereby is authorized to prepare and publish a supplement to the "List of Pteridophyta and Spermatophyta of Northeastern North America," such supplement to contain additions and published corrections to the List. Such publication has been promised by the Editor of the Torrey Botanical Club.

Resolved, That the committee be and hereby is authorized to prepare a fuller statement of the rules adopted at the Rochester and Madison meetings, with examples illustrating their operation, and submit it to the Club at a subsequent meeting, for publication in the proposed List of North American Pteridophyta and Spermatophyta.

For the Committee,

N. L. BRITTON, *Chairman.*

The report was discussed by Prof. Coulter and Prof. Bessey, was approved and the resolutions unanimously adopted.

Mr. Pollard, on behalf of Dr. F. H. Knowlton and others, submitted a resolution calling for the appointment of a committee to consider and report on the desirability of the Club publishing a journal. After considerable discussion, it was laid on the table.

Prof. Barnes discussed the relative merits of the terms photosyntax and photosynthesis, maintaining that the first was the more desirable. Prof. MacDougal considered that both terms were temporary, but inclined to the use of the second.

Prof. Bessey remarked on the distribution of *Pinus ponderosa* in Nebraska, which to-day forms extensive forests on the summits of Pine Ridge (alt. 4,000 to 5,000 feet), in northwestern Nebraska, and extends eastward along the bluffs of the Niobrara River to within twenty-five or thirty miles of its mouth. It extends eastward along the North Platte River and Lodge Pole Creek, nearly or quite to Deuel County. It occurs, also, in isolated cañons in the central counties (in the Loup River Valley) and thence fifty or sixty miles eastward. Recently some remains of a considerable grove of pines was discovered along the bluffs of the Republican River, in Franklin County, about fifty miles east of the 100th meridian.

Mr. Cowell exhibited specimens of hybrid and double-flowered sunflowers, *Helianthus decapetalus* × *H. petiolaris* and *H. lenticularis*.

THURSDAY, AUGUST 26TH. MORNING.

Prof. Bessey remarked on the cañon flora of the plains. On the Great Plains there are two nearly distinct floras, viz: (*a*) that of the general surface, which, as we pass westward, is more and more like that of the arid regions, and (*b*) that of the river valleys and cañons, in which are found trees, shrubs and herbs which have invaded this dry region from the east and west. The line of demarkation between the cañon flora and that of the general surface is often very sharp, the one giving way to the other within the space of a yard or less.

Dr. E. B. Copeland discussed turgor-variations in the mosses. He stated that turgor is higher in the mosses than in most other plants, and exceedingly variable. Tests were made on various species, especially *Mnium cuspidatum* and *Funaria hygrometrica* at temperatures varying from 0°–34° Centigrade, the turgor being determined by plasmolysis in solutions of potassium nitrate. From near zero up to 20°C. there was a decided decrease of turgor with increase of heat. This variation is due to chemical changes in loco, but seems to be unaccompanied by any change in the starch or sugar present. In *Mnium*, however, it is dependent on the presence of not very remote products of assimilation. This adjustment of the concentration of the cell sap is of manifest advantage in resisting variations of temperature.

Dr. A. P. Anderson described a simple apparatus for spraying plants, consisting of two tubes at right angles to each other, similar to the one used by artists for spraying crayon drawings.

Mr. E. J. Durand described the structure of pseudo-parenchyma in the higher fungi. In most of the higher fungi there is a tissue which much resembles the parenchymatous or fundamental tissue of the higher plants. Owing, however, to its hyphal origin, it is usually termed pseudo-parenchyma. The transition from interwoven hyphae to this tissue may be well seen in the stromata of *Tubercularia*, especially if the perithecial forms be present. The hyphae become much septate and the cells swollen and coalesced, forming a tissue of rounded cells. In the *Pezizas* and *Discinas*, also, we find the transition nicely shown. In these plants the cells are often large and vesiculose, but are formed by the septation and coalescence of large hyphae.

Mr. H. von Schrenk discussed the host-plants of *Comandra umbellata*. He stated that though this species generally grows on various Ericaceae, notably *Vaccinium Pennsylvanicum* and *V. corymbosum*, he had found it on *Potentilla*, *Solidago* and *Phleum pratense*. He had found that there is no connection between the vascular systems of the parasite and the host-plant in *Phleum*, and had also cultivated the *Comandra* at St. Louis, independently of any host-plant, the plants growing to a height of several inches. He had collected *C. pallida* in Newfoundland, growing on *Vaccinium* and *Solidago*. Dr. Bessey stated that both *C. pallida* and *C. umbellata* occur in Nebraska at least 1,000 miles from any ericaceous plant. Prof. Coulter reported that he had satisfied himself that in the vicinity of Chicago *C. umbellata* grew unattached to any host.

Prof. MacMillan spoke on "The Function of the submerged Leaves of *Salvinia natans*." These hair-like leaves have been supposed to function as absorbing root-hairs, but he had observed that the rigid tips of these organs serve to prevent small aquatic animals from approaching the sporocarps, which they guard; he also stated that they project at right angles to the stem and thus serve as a counterpoise against the wind. Dr. B. B. Davis said that he had observed them entangled with humus and slime.

Prof. MacMillan remarked on "Nuclear Budding in *Cypripedium*." He stated that in *C. Reginae*, *C. acaule* and *C. hirsutum* the nuclei of the cells at the base of the hairs divided by an interesting and singular method, which differs from both methods known as phragmentation and karyokinesis, but was evidently referable to the former.

Prof. MacMillan also remarked on some unusual adaptations of conifers to wind-swept stations, stating that he had seen the white pine 40 feet high, with a small slender top and short branches, while at the base long branches had developed, lying prostrate on the rocks, having acquired a juniper-like habit; he had noticed that this habit was most frequently taken on when the main trunk was broken. Prof. Bessey recorded the same habit in Engelmann's Spruce, and Dr. Copeland recalled the well-known case of the Monterey Cypress.

Miss Florence Beckwith reported *Ononis repens* and *Plantago aristata* as additions to the flora of Monroe county, N. Y.

THURSDAY, AUGUST 26TH. AFTERNOON.

Officers for the next meeting were elected as follows:

President, Prof. S. M. Tracy.

Vice-President, Prof. L. R. Jones.

Secretary, Prof. E. S. Burgess.

Miss Edna Porter illustrated the pollination of *Epipactis viridiflora* by a model, stating that she had found the visiting insect to be a wasp, agreeing with Darwin's observations on the English species.

Dr. E. B. Copeland spoke on "The Lowest Limit of Turgor."

Nearly all of the material causing the turgor of normal stems, leaves and roots is unavailable as food, so that starvation can reduce the turgor but slightly. Thus it is seldom, if ever, possible to reduce this material by etiolation below the osmotic equivalent of 1.5% KNO_3. Where food is stored in solution it is of course represented in the turgor, but even in such organs there is usually a considerable unused, presumably non-nutrient, residue until death.

Dr. Emily L. Gregory presented the following "Notes on the Classification of Lichens:"

In many of the modern text-books of systematic botany the three groups, fungi, algae and lichens are reduced to two, the lichens being placed with the fungi. It is evident that this arrangement is based upon the notion that the lichen is composed of a fungus and alga living together in the characters of parasite and host. It is the fungus which determines the form and develops the spores; therefore those lichens whose fruiting is the same as the Ascomycetes are placed as a subdivision of this class, and the remaining forms, which follow the Basidiomycetes in their method of spore-formation, are classed with this group of fungi.

Within the past few years there has been a strong reaction against this method of classification on the ground that, by virtue of this long-continued parasitism, the lichens have attained fixed characters of their own, differing from those of both fungi and algae. Prof. Reinke, of Kiel, is one of the leading advocates of this old method of classification, namely, making the lichens an independent group coördinate with the fungi and algae. He has written an extensive paper on the subject, which is published in Pringsheim's Jahrbücher, volumes 26, 28 and 29. A careless or even hasty perusal of this article is apt to lead one to the conclusion that the author's views are radically opposed to those of Schwendener, who is generally known as the author of the theory of the dual nature of the lichens. It is probably owing to this fact that a rumor has obtained circulation among some of our botanists to the effect that the modern scientists are discarding the Schwendener theory of the nature of the lichens.

During the present summer I had an excellent opportunity to read and discuss this paper with Prof. Schwendener and in this way to obtain his present views on the subject. For these reasons I think a brief summary of his remarks may be of interest to the members of the Club and others who are not so familiar with the literature of this subject. It may be well to state at first that there is no difference of opinion between the two botanists concerning the real nature of the lichen. Reinke speaks in several places of his complete adherence to the principal theories set forth by Schwendener in his work published in 1869, "Die Algentypen der Flechten-gonidien," but he does not approve of the methods of classification which owe their origin to the acceptance of these theories. Reinke also strongly opposes the views held by Schwendener regarding the morphology of the podetium of the genus *Cladonia*. Schwendener claims that his experiments, together with those of Krabbe and others working in his laboratory furnish conclusive evidence that the podetium is a part of the fruit-body. Morphologically it is to be considered the stem of the organ containing the spores, and this reasoning is based principally upon the fact that the mycelium threads forming the so-called ascogon, and which terminate in the asci holding the spores, may be traced backward through the podetium or stem to the point of its insertion on the horizontal thallus below. Reinke claims with equal emphasis that the podetium is to be ranked as a thallus, that it forms no part of the fruit-body; he upholds his claim chiefly by the fact that it acts as an assimilating organ and therefore must be considered as a vegetative part of the plant and not a reproductive organ. The importance which Reinke attaches to his view of the morphology of the podetium explains perhaps the above-mentioned conclusion of some readers of the article that the two botanists are antagonistic in their views on the lichens. Their difference of opinion comes rather from a radical difference in their interpretation of morphological characteristics, and not from any real difference concerning the question at issue, viz: the place which the lichens ought to occupy in the natural system of classification.

Regarding this point, Schwendener expressly says that he has no objection to the plan proposed by Reinke of classing the lichens as a group by themselves, but also states that he does not think this plan would entirely do away with the difficulties in question. He gives as an example of these difficulties the fact that there are several species of fungi belonging to one genus, some of which live as parasites on algae, or as lichens, others are true fungi living entirely after the fashion of other plants of this group. If the lichens are to be classed as a separate group, there must be some provision made for such plants as these, for it surely would not be logical to separate such closely allied forms by putting them in different groups.

Reinke proposes not only a rearrangement by which the lichens would be restored to their original dignity of place, but also outlines a plan for classification within themselves based as nearly as possible upon what he considers phylogenetic principles. It may be noted in closing that it is a little curious and striking that this plan is founded upon the classification of Tuckerman, a botanist who attached little importance to the principles of phylogeny in his treatment of the lichens.

A paper by Prof. L. H. Pammel, "Notes on some Plants of Iowa," was read by title.

Prof. Coulter discussed the use of the terms close-fertilization and cross-fertilization.

A paper by Mr. R. S. Williams, "A List of the Mosses of northern Montana," was read by title. Mrs. Britton stated that sets of these mosses were in preparation.

Prof. Kellerman described a method of card-indexing a state flora, using for each species a card on which was printed a map of the state showing counties. He had used this in Kansas and in Ohio. Prof. Tracy said he had successfully applied it to Mississippi.

New and noteworthy Species of Saxifraga.

BY JOHN K. SMALL.

SAXIFRAGA OCCIDENTALIS S. Wats. Proc. Am. Acad. 23: 264. 1888.

This species was founded on plants collected on Vancouver Island, by Prof. Macoun. It is a beautiful and distinct species averaging one decimeter in height, with a purple hue which extends even to the petals and filaments; it also possesses an abundance of red or reddish tomentum on the lower surface of the finely crenate leaves. This form is not as widely distributed as indicated by Dr. Watson, when he states "the specific name is given to the species as the western correlative of the common eastern *S. Virginiensis*," nor is it the western correlative of the latter species, *Saxifraga Californica*, proposed in the following year holding that place. *Saxifraga occidentalis* is apparently confined to Vancouver Island and the mainland in the immediate vicinity.

SAXIFRAGA VIRGINIENSIS Michx. Fl. Bor. Am. 1: 269. 1803.

Represents one of the most variable and perplexing species of the genus *Saxifraga*, but notwithstanding its variability in habit, size and flowers, there are two characters which serve to separate it from its relatives in western North America, namely, the triangular triangular-ovate or rarely almost lanceolate acute or acutish calyx-segments, and the narrowly elliptic or elliptic-spatulate obtuse or acute (rarely if ever notched) petals.

While collecting in the cañon below the Falls of the Yadkin river in North Carolina last April, I found unusually well developed plants of *Saxifraga Virginiensis* ranging from four to five decimeters in height, but more remarkable was the great quantity of small bulblets produced by the subterranean portions of the plants, and also the numerous offsets. The same features were noticed in specimens gathered on Dunn's mountain in the same state.

SAXIFRAGA CALIFORNICA Greene, Pittonia, 1: 286. 1889.

In the light of recent discoveries, Prof. Greene has not pointed out any reliable distinguishing characters in discussing the relations between *Saxifraga Californica* and *S. Virginiensis.* The two species are closely related in habit, and the one is about as variable as the other. Prof. Greene lays much stress on the occurrence of small bulblets in *Saxifraga Californica*, but we now know that *S. Virginiensis* also possesses this character. After examining many specimens for the purpose of finding some diagnostic characters in the two closely related plants, I find that the flower furnishes the best. Besides the reflexed or erect calyx-segments, these organs in *Saxifraga Californica* are ovate or oblong-ovate and obtuse, while those of *S. Virginiensis* are triangular, triangular-ovate, or rarely nearly lanceolate, and acute or acutish. The petals furnish another character; those of the western plant are broadly oval or suborbicular, some or all notched at the apex, while their lateral nerves vanish in the blade; in the eastern plant they are narrowly elliptic or elliptic-spatulate, not notched at the apex, and the lateral nerves converge to the mid-nerve at the apex.

SAXIFRAGA FRAGOSA Suksdorf n. sp.

Perennial by an ascending or horizontal rootstock, scapose slender, pale-green, rough glandular-pilose with rigid hairs. Leaves basal, leathery, the blades ovate or oblong-ovate, 1.5–4 cm. long, usually exceeding the petioles, glabrate, obtuse, entire or undulately toothed, abruptly narrowed or truncate at the base, decurrent on the winged petiole, which is slightly dilated at the base; scapes erect or assurgent, 2–3 dm. tall, solitary, paniculately or somewhat corymbosely branched at the top, the branches ascending or nearly erect, subtended by lanceolate or spatulate bracts; flowers white, 5–6 mm. broad, in many-flowered cymules; calyx broadly campanulate, the tube 2.5 mm. broad, adnate to the ovary, the segments triangular or triangular-ovate, obtuse, 3-nerved, longer than the tube; petals obovate, obtuse or notched at the apex, 2.5 mm. long, strongly 3-nerved, the lateral nerves arising below the middle and converging toward the apex; filaments subulate, shorter than the petals; carpels of the ovary flat and surrounded by a disk; follicles globose-ovoid, 3.5 mm. long, distinct, tipped by short diverging styles; seeds obovoid, more or less pointed at both ends.

Wet rocks near the Columbia river, W. Klickitat County, Washington. Collected by W. N. Suksdorf. (no. 1727.)

The specimens on which this species is founded were collected in March and May, 1892, and distributed later with the manuscript name which I have taken up. It was collected also in Oregon, by Mr. Thomas Howell in May, 1895, "on wet slopes, Gladstone" (no. 192).

The species is related to *Saxifraga Californica*, but differs in its more rigid habit, rough and stiff pubescence, the narrow thyrsoid panicle or corymb and the triangular or triangular-ovate calyx-segments.

SAXIFRAGA TENNESSEENSIS n. sp.

Saxifraga Grayana Kearney, Bull. Torr. Club, **21**: 262. 1894. Not Britton, 1894.

Perennial by a short erect or ascending rootstock, scapose, glandular-pilose, bright green. Leaves basal, ovate or sometimes suborbicular, the blade 2–6 cm. long, obtuse or rounded at the apex, but usually terminated by a tooth, coarsely crenate-dentate, abruptly narrowed at the base, the petiole winged, longer or shorter than the blade; scapes erect or assurgent, 1–2.5 dm. tall; branches of the panicle subtended by linear or spatulate bracts; cymules open; flowers white, 8–9 mm. broad; calyx flattish, 5 mm. broad, its tube adherent to the ovary, its segments triangular-ovate, 1–1.5 mm. long, acute, spreading, longer than the tube; petals lanceolate, 3.5–4 mm. long, obtuse or slightly notched at the apex, sessile or nearly so, with two lateral nerves which arise below the middle and converge at the apex, the lateral nerves often giving off short secondary branches; filaments subulate, somewhat longer than the calyx-segments, mature fruit not seen.

Rocky bluffs of the Tennessee River about Knoxville. Altitude about 270 meters.

Saxifraga Tennesseensis was apparently first collected by Prof. A. Ruth, of Knoxville, Tennessee, but first brought to notice by

Mr. T. H. Kearney, who erroneously referred it to *Saxifraga Grayana*, a member of the subgenus *Hydactia*. The species really belongs to the subgenus *Micranthes* and is a close relative of the common *Saxifraga Virginiensis*. The primary character to debar it from relationship with *S. Grayana* is its subulate filaments; the calyx-segments, petals and follicles are also different from those of that species. The pubescence in *S. Tennesseensis* is inclined to be tomentose and tawny and is much more abundant than in *S. Virginiensis*. Besides its general habit, it can be readily distinguished by its lanceolate petals, which are notched at the apex and strongly marked with two yellow spots near the base.

SAXIFRAGA CLAYTONIAEFOLIA Canby n. sp.

Perennial by a short horizontal rootstock, slender, glandular-pilose above, glabrate below. Leaves fleshy, orbicular-elliptic, more or less oblique, 6-10 cm. long, glabrate, obtuse, entire, undulate, palmately six-eight-nerved, narrowed into a winged ribbed petiole which is as long as the blade or longer; scape erect or assurgent, 2-3 dm. tall, glabrate near the base, branched above; infloresence thyrsoid-corymbose, its branches subtended by small linear or linear-oblong bracts; flowers white, 4 mm. broad, each subtended by a small bractlet; calyx flattish, 2 mm. high, its segments spreading and recurved, thin, oblong, acute, 3-nerved, longer than the tube; petals spatulate or obovate-spatulate, 2 mm. long, slightly emarginate or minutely apiculate, gradually narrowed into a claw, marked with a stout midnerve which gives off two lateral nerves about the middle; filaments subulate, shorter than the petals, incurved at the summit; follicles (each) ovoid, 3 mm. long, the short stout styles spreading at an angle of 120° or more; seeds irregularly oblong, .7 mm. long, reddish, smooth, or very faintly striate.

Damp crevices of rocks, The Dalles, Oregon. Collected by Frank Tweedy, May, 1883.

I have taken up a specific name attached to a specimen, by Mr. Canby, preserved in the Canby Herbarium, now at the College of Pharmacy, New York. The form is without doubt an excellent species, differing from the related *Saxifraga integrifolia* by its leaves, which closely resemble those of a broad-leaved *Claytonia*, its flat calyx-tube, its oblong calyx-segments and its spatulate or obovate-spatulate petals, which are only 3-nerved and either notched or apiculate at the apex.

SAXIFRAGA NIDIFICA Greene, Erythea, 1: 222. 1893.

This rare *Saxifraga* has lately been sent me by Mr. E. P. Sheldon. The specimens are from Spokane, Washington, altitude 1,000–2,000 feet and were collected by J. H. Sandberg and J. B. Leiberg in May, 1893. *Saxifraga nivalis* (no. 1819) of Mr. Coville's Death Valley report, apparently belongs here, as does also Torrey's 155, collected in the Yosemite Valley and Mountains, California, in 1865.

SAXIFRAGA PLANTAGINEA n. sp.

Perennial by a thick rootstock, stout, scapose, glandular-pilose; leaves elliptic or elliptic-spatulate, 6–10 cm. long, obtuse, undulate or distantly and shallowly toothed, leathery, ciliate, 5-7-ribbed, narrowed into a winged petiole, which is usually much shorter than the blade; scape erect, 2–4 dm. tall, sparingly branched near the top, the branches subtended by elliptic bracts; flowers greenish, in dense cymules; calyx flat, its segments ovate, 3.5 mm. long, obtuse, 3-nerved, longer than the tube; petals suborbicular-oblong or some inclined to be broadly spatulate, 2–2.5 mm. long, greenish, shorter than the calyx-segments, obtuse, marked with a mid-nerve and several branches, narrowed into a broad claw; filaments converging, subulate, shorter than the petals; ovaries immersed in a lobed disk; fruit not seen.

Spokane, Washington, at 600–1,000 meters altitude; collected by J. B. Leiberg and J. H. Sandberg, in May, 1893. Communicated by Mr. E. P. Sheldon.

A fine species with leaves strongly resembling those of some of the broader-leaved *Plantagos*. The plant is very different from anything heretofore known in the genus *Saxifraga*. It is related to *S. integrifolia*. The broad greenish petals, which are exceeded by the calyx, serve to separate the species from all its relatives.

SAXIFRAGA SIERRAE (Coville).

Saxifraga integrifolia Sierrae Coville, Proc. Biol. Soc. Wash. 7: 78. 1892.

Saxifraga Oregana Howell, Erythea, 3: 34. 1895.

As Mr. Howell points out, *Saxifraga integrifolia* has been a composite species. Mr. Coville dwells on the differences in the leaves of *Saxifraga Sierrae* and *S. integrifolia*; these differences are much more marked in specimens collected later by Mr. Howell, in Oregon. But in addition to these leaf-characters, the flower furnishes good points of distinction.

The calyx-segments in *Saxifraga Sierrae* are suborbicular and broader than long (except in Mr. Howell's specimens, where the whole vegetative and floral systems are abnormally elongated), the calyx-segments in *S. integrifolia* are ovate and longer than broad; the petals are ovate or broadly oblong and retuse at the apex, as opposed to the obovate petals of *S. integrifolia* with their rounded apices.

SAXIFRAGA REFLEXA Hook. Fl. Bor. Am. 1: 249. pl. 85. 1833.

Several unsuccessful attempts to reëstablish this rare species have been made. Taking Hooker's excellent plate as a basis, and this is all we have to go on besides his description, I find that the following numbers from the collections of the Northern Transcontinental Survey, distributed as *Saxifraga nivalis*, are *S. reflexa:* 51a Scribner, 740 and 741 Tweedy, 757 Brandegee and 111 Canby. These are the only representatives of *S. reflexa* I have seen and are all in the Canby herbarium.

SAXIFRAGA MONTANENSIS n. sp.

Scapose, perennial by a stout horizontal or ascending rootstock, coarse, stout, glandular-pilose. Leaves basal, ovate or lanceolate, .5–1.5 cm. long, leathery, obtuse or acute, serrate-dentate, nearly sessile or apparently sessile on account of the broadly winged and dilated petiole; scapes solitary, erect, 3–6 dm. tall, stout (6–11 mm. in diameter), paniculately branched above, the branches usually shorter than the internodes; flowers greenish, almost 11 mm. broad, in dense glomerate cymules; calyx turbinate-campanulate, 5-parted to below the middle, its tube adnate to the ovary, its segments triangular-ovate, obtuse, at length deflexed; petals 5, greenish, lanceolate or linear, often slightly oblique, 3.5 mm. long, obtuse, 3-nerved, the lateral nerves arising below the middle, running close to the mid-nerve; filaments subulate, thrice shorter than the petals; fruit not seen.

Southwestern Montana, in bogs at 1,850 meters elevation. Collected by Mr. Frank Tweedy (No. 58), July, 1888. Also found by Prof. F. D. Kelsey at Millan, Montana. The proposed species stands between *Saxifraga Sierrae* and *S. Pennsylvanica.* It differs from the former in its harsh pubescence which gives it a dull green color and in its comparatively small greenish flowers. From the latter it may be distinguished by its habit, its more or less turbinate calyx-tube and the calyx-segments, which are triangular-ovate and about as long as the tube. In *Saxifraga Pennsylvanica* the calyx-tube is campanulate, the segments ovate-lanceolate or ovate and twice as long as the tube. The petals of the new species are oblanceolate or nearly linear, while those of its eastern relative are lanceolate or linear-lanceolate.

SAXIFRAGA NOOTKANA Moçin; Engler, Monog. Sax. 135. 1872.

Saxifraga Stellaris var. *Brunnoniana* Bong. Veg. Sitcha, 140. 1831. Not *S. Brunnoniana* Wall.

Saxifraga leucanthemifolia var. *Brunnoniana* Engler, Monog. Sax. 135. 1872.

Saxifraga Bongardi Presl; Engler, Monog. Sax. 135. 1872.

This is one of our northwestern forms that has usually been included under *Saxifraga leucanthemifolia* (*S. Michauxii*). It is more closely related however to the old world *S. stellaris*, but is nearer the Alleghenian *S. Michanxii* than any of the several west-American species of the subgenus *Arabidia* that have so persistently been referred to the Alleghanian form.

SAXIFRAGA FERRUGINEA Graham, Edinb. Philos. Journ. : 349. 1829.

This is another *Arabidia* of the Northwest. It is apparently very rare and has usually been referred to a variety of *S. Michauxii* (*S. leucanthemifolia* Michx.) or included in that species. Some of its distinguishing marks are the low stunted stature, the reddish-brown tomentum and the short few-flowered one-sided corymb. The only recent collection appears to be that of Dr. G. M. Dawson, made on the Queen Charlotte Islands in July, 1878.

SAXIFRAGA NUTTALLII.

Saxifraga elegans Nutt.; T. & G. Fl. N. A. 1: 573. 1840. Not Sternb. 1832.

Little was known of this beautiful and most delicate Saxifrage until it was rediscovered in Oregon in 1871 by E. Hall (156). There is a good and ample specimen of Nuttall's type in the Columbia University Herbarium. Mr. Howell has lately found it at three localities in Oregon.

The Stigmas and Pollen of Arisaema.*

BY W. W. ROWLEE.

(PLATES 272, 273.)

The native Araceae fall into two natural groups. One group, which Dr. Gray in his Manual calls "the genuine Araceae," consists of the genera *Arisaema*, *Peltandra* and *Calla*. The flowers in this group have no floral envelopes and are almost always monoecious or dioecious by the suppression of either the stamens or pistil.

The other group consists of *Spathyema*, *Orontium* and *Acorus*, genera composed of plants having complete and perfect flowers. This group is much more generalized in its characters than the other, and if either deserves to be called the "genuine Araceae," this, it seems to me, is the one.

So general is the belief now that the Araceae and the Lemnaceae present an illustration of specialization by reduction, it need hardly be mentioned that *Arisaema* and its congeners have departed farther from the ancestral forms than *Calla* and its congeners.

The stamens of *Arisaema* appear to stand singly upon the spadix, each stamen representing a single flower. In *A. triphyllum* this flower really consists of two stamens, the filaments of which are grown together so completely as to present the appearance of a single stamen.

The number of cells in the anther and the vascular strands in the filament reveal the fact that cohesion has taken place. The anthers are also simple in their structure. See 1, plate (I.).

While collecting material for class-work in the spring of 1895, I put a spadix of *Arisaema triphyllum* into alcohol for study. Later when sections were made it was found that although the anthers had dehisced, nevertheless the anther cavities had considerable pollen in them, and that many of these pollen grains, still remaining in the anther, had developed tubes. In some, the tubes were long, in others short, in some they had barely left the grain.

The longer ones instead of growing out in a straight path showed a great tendency to grow back upon themselves. The appearance at first led me to think that it grew in a close spiral-

* Read before Section G, A. A. A. S., Buffalo meeting, August, 1896.

like coil, but further examination showed that the tube folded back and forth upon itself in such a way as to form a double layer. This peculiar growth was due in all probability to the meager amount of moisture in the anther, the folding serving to conserve moisture most effectively. Some tubes made as many as five double folds. Apparently the folding occurred after the tube had attained considerable length.

Repeated examination of the pollen of both *Arisaema triphyllum* and *A. Dracontium* failed to afford another specimen in which germination had taken place, and it seemed scarcely probable that this precocious development would occur frequently. It may have been due to the season or the situation; so far as I can see, it in no way benefits the plant.

Warming, in his Systematic Botany, makes a group of monocotyledons which he calls the Enantioblastae, remarking that these plants ought perhaps to be amalgamated with the other orders. Although the Araceae are not included in this group, both species of *Arisaema* have truly enantioblastic ovules. The stigmas of *Arisaema* are remarkable in that the stigmatic surface not only covers the external surface of the capitate stigma, but extends down the short *open* style and forms a stigmatic surface at the summit of the cavity of the ovary, very much like the stigma on the outside of the ovary. The stigmatic hairs are club-shaped, quite long (short in the tube) and are not septate. They are closely packed together. The erect ovule reaches up to the hairs within the ovary. It remains to be seen just what the course of the pollen tube in these hairs is. It seems reasonable to suppose that the tube would enter the cavity of the ovary through the opening in the hollow style and that its entrance would be facilitated by the stigmatic hairs.

CORNELL UNIVERSITY.

Explanation of Plates.

PLATE 272.

Fig. 1. Vertical section of consolidated stamens of *Arisaema triphyllum*, showing anthers and anther-cavities, also structure of filament. ($\times$125.)

Fig. 2. Pollen grain. Fig. 3. Pollen grain germinated. Fig. 4. Pollen grain germinated, the tube closely folded upon itself. (Figs. 2, 3 and 4, $\times$1400.)

PLATE 273.

Fig. 5. Vertical section of pistil showing ovules and stigma. ($\times$350.)

Reviews.

An Illustrated Flora of the Northern United States, Canada and the British Possessions, from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean Westward to the 102d Meridian. By Nathaniel Lord Britton, Ph. D., Emeritus Professor of Botany in Columbia University, and Director-in-Chief of the New York Botanical Garden, and Hon. Addison Brown, President of the Torrey Botanical Club. In Three Volumes. Vol. I., Ophioglossaceae to Aizoaceae; Ferns to Carpet-weed. Royal 8vo, pp. 612, New York, Charles Scribner's Sons, 1896. Price per volume, $3.00.

An entirely distinct epoch in the study of the North American flora is marked and, as to its general influence, inaugurated by the publication of this great work. Popularization, but with a distinct gain to science; a more intelligent and natural arrangement of groups; the application of broader and more natural principles in the delimitation of species; a full and careful consideration of distribution; a rational and just system of nomenclature—these are some of the progressive steps which are forcibly and clearly brought to mind as we examine the pages of our new flora. In comparing new works with old, we are often led to disparage the former because of the poorer advantages which were possessed by the authors of the latter. It is, however, quite safe to say that in no preceding work of the kind have the materials at hand been more completely utilized, nor has there been a more careful consideration of principles, or a more exhaustive study of details. Those American botanists who have prayed for more botany and less nomenclature may now give thanks! The first portion of their prayer, at least, is answered. The scope and nature of the work cannot be better stated in brief than by quoting the opening paragraph of the authors' introduction:

"The present work is the first complete Illustrated Flora published in this country. Its aim is to illustrate and describe every species, from the Ferns upward, recognized as distinct by botanists and growing wild within the area adopted, and to complete the work within such moderate limits of size and cost as shall make it accessible to the public generally, so that it may serve as an independent handbook of our Northern Flora and as a work of general reference, or as an adjunct and supplement to the manuals of systematic botany in current use."

The introduction also informs us that about three-fourths of these species, some four thousand in number, are here figured for the first time. Vol. I contains 1425 figured species.

Not only is the conception of such a work as a practicable possibility to be credited to Judge Brown; the elaboration of the plan and the surmounting of the difficulties which have from time to time arisen have been his constant care. Above all, it is through his munificent provision of the substantial means that the accomplishment of the undertaking has been rendered possible. Much as we owe to the publishers, whose names appear upon the title-page, it must not be unknown to the public that the real publisher is the Hon. Addison Brown, nor that he undertook the publication as a labor of love, with little prospect at the time that it would ever prove other than an expensive contribution to the popularization of science. Nor is it out of place to hazard the opinion, after a study of the work, that the actual result will yet prove for the publisher a surprise upon the sunny side.

The value of illustrations thus presented need hardly be dwelt upon. Important as they are in introducing the general public to a knowledge of our plants, the value of reliable figures is appreciated by none more keenly than by the experienced botanist. Not because they are more important than some other features of the work, but because of their greater prominence, the illustrations are examined first.

The adoption of proper sizes for the cuts has required constant study and thought. To display undimmed the individuality of the plant was the first consideration, while upon the other hand, to destroy the popular character of the work by unduly enhancing the cost, was to sacrifice the principal object for which it was undertaken. Apparently the most successful result possible in this direction has been attained. When the entire plant could not be figured, it has been individually studied as to its most characteristic parts. Tall stems have frequently been included by representing them in a doubled or folded position. In all cases of reduction, life-size drawings have been employed. The magnification of such minute parts as sporanges, akenes, seed-coats and appendages is a feature of the very highest importance, and one the educational influence of which can hardly be over-estimated. Good instances are the fruits of the *Potamogetons* and dissections of the column in Orchidaceae. The reduction is conspicuously indicated beside the general illustrations; the degree of magnification of the minuter parts is not stated, being considered unnecessary; but we regret the omission, or, at least, that it was not made clear that the same degree was used in illustrating the same organ throughout a group.

The work upon the illustrations, both drawing and engraving, is of the very highest quality, and a remarkable degree of naturalness has in most cases been attained. In many cases, as, for instance, in that of *Xyris torta*, the figures are exceedingly beautiful. Drawn usually from herbarium specimens, the figures have afterward been compared as often as possible with the living plants. To have drawn all the figures from life, would, doubtless, have still further improved the appearances, but this was obviously impossible.

Natural considerations, which have been allowed to control the entire planning of the work, are manifest in the choice of the boundaries selected for the flora. Even the announced limits are over-stepped when necessary to complete a natural region, as in the inclusion of the extra-limital portions of Nebraska. That the relations between geography and botany have been attentively studied is evidenced in more than one way. Both local catalogues and local herbaria have been thoroughly searched to determine the precise range-limits, and great care has been exercised in indicating clearly the habitats of the species. In no preceding work has the subject of range been so well elaborated. We find in this work, moreover, about the first systematic attempt to give the altitudinal distribution. So little attention has been paid by collectors to this important subject that the information here accumulated by Dr. Britton can hardly be regarded as more than a working basis, but as such its value will prove very great. Not the least valuable of the geographical features is the statement, in a general way, of the extra-territorial ranges of the species. Having thus clearly established the ranges of the forms, they have been allowed to exercise a certain weight in deciding in difficult cases of species-limitation. So important has this subject of plant-geography come to be regarded in modern botany, that we may indulge a little natural pride in the appearance of so thorough a study of it by American authors.

It is scarcely necessary to review here the slow and laborious process by which systematic botanists since Linnaeus have worked toward the natural arrangement and sequences of plant-groups. It is sufficient to say that only by a masterly review of morphology, anatomy, physiology, distribution in time and place, and even of such subjects as chemistry and nutritive and physiological properties, have we been brought to an arrangement which commends itself to all who recognize and value a deciding influence higher than the dictum. Such inconvenience as results from working under the new arrangement may fairly be regarded as due to a failure to have taken natural relations into consideration. To those who have done so, the new arrangement will present no other unfamiliarity than that of a new thing which has been long and eagerly sought. As to beginning at the upper or lower end of the sequence, the reviewer confesses to but faint interest. It would appear to matter but little whether we turn to the right or to the left as we enter the herbarium. But it is of vital importance that those things should be brought together which show the closest relationship, and the acceptance or non-acceptance of any portion of the new arrangement may best be decided upon the basis of those principles upon which it has been founded. The following extract from the table of contents displays the arrangement of the families:*

* Underneath this table the authors print another, in which the common or English names of the families are substituted.

It is incidentally to be regarded as fortunate that this arrangement brings before our students in the first volume those families which are usually regarded as most difficult. By the aid of this volume, any field-student or collector can, during the coming months, and before the appearance of the remaining volumes, become fairly well acquainted with the representatives of these difficult groups which are afforded by his locality.

The work will doubtless be assailed by a certain class because of the narrowness with which the species-limits have been drawn. On this subject it may be well to quote the authors: "The present tendency of expert opinion is to separate more freely into convenient natural groups, as genera and families, according to similarity of structure, habit, form or appearance." (Introduction, p. v.) And it may be further remarked that the tendency to unite species is manifested rather by those who act as editors; to separate them, by those who pursue special studies. In the performance of this portion of the work, Dr. Britton has been exceptionally well situated. During the six years that this work has been under way, he has been surrounded by a large and energetic group of workers, trained and held together largely through the influence of the Torrey Botanical Club. These men and women have gladly undertaken from time to time the investigation of difficult or of poorly-known groups, and they have almost without exception brought to bear upon their work every modern method of research. This period has been noted farther for great activity in similar work throughout the country. An unusual amount of material in the way of field-notes has also been recently accumulated, a large part of it directly in the interest of this work. All this material has been assiduously studied. Although some of the cases of species-division appear surprising, yet in view of the minuteness with which the authors have conducted their studies, it may well be that such criticisms as shall be made will possess the demerit of being based upon a lower degree of scrutiny than the determinations themselves.

That the possibility of determining a plant by merely turning to a figure may induce habits of superficiality, is perhaps, true, though hardly so in case of such a work as this. Even in case of those fragmentary illustrated works which may be regarded solely or chiefly in the light of picture books, it is probable that the habits of observation and comparison they induce and develop more than counteract any such tendencies to superficiality; but in the present case every influence tends to lead the student on to deeper examination and more scientific methods. Reference has already been made to the illustration of the minuter structures beside the general illustrations. Even more important in this direction are the keys to the groups, so freely furnished as to form a complete system. No one, having learned to use botanical language, would of course think of consulting the cuts until the possibilities of the text—that of the keys, at least—had been exhausted. Those others, who may at first resort to the pictures, will, doubtless, quickly learn that time is usually saved by a different course, and a study of botanical terminology introductory to the use of the keys will almost surely follow. If there be some to whom this statement does not apply, the defect may be regarded as natural, and displayed in spite rather than because of the character of the book.

Keys, if not usually artificial, are pretty likely to accomplish their purpose the better in proportion as they are so. There is, however, in the keys of this flora an evident design of combining the advantages of a scientific relation and an artificial characterization, an attempt in which there is no end of room for the exercise of ingenuity. The result is that in most of them we note a combination of obvious "ear-marks" with more complex characters.

It is needless to say that the rules of nomenclature followed are those which have been officially adopted by American botanists and which are evidently in the near future to dominate botanical writings abroad as well as in America. The code is printed and briefly explained in the introduction. In a foot-note reference is made to the principal American contributions to the subject of nomenclature. The authors would here have done well to include one by the writer, who has labored diligently in the interest of this movement, especially in medical literature. It appeared in the *Bulletin of Pharmacy*, and set forth clearly and fully the history of the movement in this country. The importance of applying some system in the application of family names is urged, but its introduction, in advance of full discussion and official adoption, is wisely omitted.

The forms of type, use of capitals and symbols and rules of pronunciation are also here briefly explained.

Throughout the book the accent is indicated in botànical names, specific as well as others.

Much care has been devoted to the selection of the common names, which have also been printed in a separate index. It is hardly to be hoped that a high degree of satisfaction will be given in this direction. Those whose botanical work brings them into especial communication with those who speak of plants by their common names learn to be quite hopeless about satisfying local ideas (and this the authors have not attempted), except by devoting to synonyms an amount of space quite out of the question in such a work. The propriety of excluding a common name of general acceptance because it is misleading as to relationship, as, for example, "Dog's-tooth Violet," may well be questioned. Common names are common property, and where the advisability of having them disturbed on scientific grounds has been officially considered, as, for example, by the National Bureau on Geographical Names, it has been decided indefensible. Upon the other hand, when this is done by such a work as the Illustrated Flora, it serves the very useful purpose of reminding those who use such names that they are opposed to scientific authority, sufficient in many cases to lead to their disuse.

In the index to the botanical names the admirable system is followed of indexing the species as well as the genera and families.

The closing thought, that the two remaining volumes require only printing and binding, is by no means the least pleasing with which we regard the present occasion.

H. H. RUSBY.

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(*3*) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

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MEMBERS OF THE CLUB will please remit their annual dues for 1896, now payable, to Mr. Henry Ogden, Treasurer, 11 Pine St., New York City.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., October 25, 1896. No. 10.

The Genus Cephalozia in North America.

By Lucien M. Underwood.

The Trigonantheae as outlined by Richard Spruce form a somewhat natural group of the Jungermaniaceae. With us the species are all foliose, but in certain neo-tropical genera the gametophyte is reduced almost to the condition of protonema, producing leaves only on the branches bearing the sex apparatus. In the Australasian genus *Zoopsis*, the simple thalloid shoot in some species is provided with rudimentary leaves only, formed of one or two cells. The tribe, therefore, contains within itself, some of the connecting links which ally the more usual forms to the simple primitive hepatics.

The tribe is characterized by the archegonia being borne on a usually short ventral branch,* with a normally triangular perianth, so placed that the third or odd angle is ventral, the remaining two being lateral. The underleaves are usually wanting or small, only attaining the dignity of a third series of leaves in some of the species of *Lepidozia*, though in *Bazzania* and *Kantia* they are well marked structures. The tribe contains some species that form conspicuous mats like *Bazzania*, but others are small, minute or even microscopic in size. They inhabit old logs, or grow on the ground in swamps, on clay banks or occasionally even in sand and on the faces of moss-covered rocks, but with us are rarely, if ever, found on erect trees, where the species of *Frullania*, *Lejeunea*, *Radula*

* Exceptions to this occur in some rare species of *Cephalozia* where they are terminal.

and *Porella* are most abundant. One species is semi-aquatic in bogs.

Schiffner* recognizes twenty-six genera. Strongly in contrast with this arrangement is that of Spruce,† in which ten of the genera recognized by Schiffner appear as sub-genera of *Cephalozia.* Probably a more rational arrangement would be reached in a mean between these two somewhat extreme views.

The genera represented in temperate and boreal North America may be separated by the following artificial synopsis based on forms lacking the sporophyte or perianth as species are often met with in this condition:‡

Leaves succubous or rarely transverse; plants small or minute (except in some species of *Odontoschisma*).

eaves deeply bidentate or bifid.

Underleaves rarely present except on perianth-bearing branches. CEPHALOZIA.

Underleaves well developed.

Without root-hairs; underleaves like those of the stem. HYGROBIELLA.

With root-hairs; underleaves undivided. PLEUROCLADA.

Leaves rounded, entire or nearly so. ODONTOSCHISMA.

Leaves incubous; plants larger, often conspicuous (except in *Lepidozia*).

Leaves rounded, entire or minutely two-toothed; perianth wanting, the sporophyte rising from a buried pouch. KANTIA.

Leaves narrowed toward the end, usually 3-toothed. BAZZANIA.

Leaves palmately 3-4-cleft or divided. LEPIDOZIA.

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* Hepaticae, in Engler-Prantl: Die natürl. Pflanzenfam. 13: 94–103. 1893.

† On Cephalozia. 1882.

‡ The question so frequently asked by those who collect mosses is again answered here: "Why is it that we find hepatics so rarely in fruit?" In the first place the "fruit" (*sporophyte*) of the hepatic is less conspicuous than that of the true mosses and the seta is often short. The first answer then is: "Because you overlook it." In the second place there is a fundamental difference between the sporophyte of the hepatic and that of mosses. In the mosses the capsule develops after the seta; the seta is, therefore, a somewhat permanent structure and the moss remains "in fruit" for a considerable length of time. In the hepatic the capsule develops within the calyptra (which in turn is surrounded by the perianth) until fully mature when the seta develops, pushing through the calyptra; the seta is, therefore, a temporary and usually ephemeral structure, often withering away soon after the spores are scattered. The perianth is a more permanent structure, and specific and even generic characters are founded on it. Some stage of its development can usually be found in most hepatics. Except in a few cases the characters of the sporophyte are unimportant from a taxonomic standpoint when generic and specific limits are considered, a condition of things widely different from that which obtains among the mosses.

Of the above genera, *Hygrobiella* is represented by three north European species one of which *H. laxifolia* (Hook.) Spruce has recently been sent in from Idaho collected by Sandberg; it is also found in Greenland; *Pleuroclada*, a monotypic genus of boreal regions, has been found by Macoun in the Rocky Mts. of British America; *Odontoschisma* has three American species as known at present; *Kantia* is represented by four American species, one of them, *K. arguta* (N. & M.) Lindb., introduced in greenhouses;* *Bazannia*, so abundantly represented in tropical and south Temperate regions, has with us the two northern species that are likewise common in Europe; and *Lepidozia*, likewise a large genus of universal distribution, has with us only three species.†

The remaining genus, *Cephalozia*, is the largest and the most widely distributed genus of the tribe on our continent. The European species were somewhat increased in number by the researches of Lindberg in Scandanavia, and the greater part of the tangled synonomy, to which Lindberg also contributed, was worked out by Spruce in 1882, athough he added to the tangle by knowingly giving to one species the same name that Lindberg had already given (unwittingly) to another species! The latest curiosity in the nomenclature of the genus is that expressed by Schiffner,‡ who, after establishing all of Spruce's subgenera as genera, rejected the old generic name, *Cephalozia*, which has been in use for over a half century, and adopted the subgeneric name *Eucephalozia*, first used by Spruce in 1882 to designate the typical members of the genus, as a generic name!

Cephalozia was proposed as a section of *Jungermania* by Dumortier in 1831 and was erected into a distinct genus by the same

*_Kantia aquatica_ Underw. in Hep. Amer. (exsic.) no. 107, is a curious sub, merged form of *Lejeunea* (probably *L. serpyllifolia*) which has lost its basal lobes, apparently a case of reversion resulting from its abnormal habitat. Herr Stephani discovered rudiments of a perianth in one specimen which led to the determination of the true relations of this curious form.

†*L. chaetophylla tenuis* Pears. cited by Evans (Bull. Torr. Bot. Club, **20**: 308 1893), is a true *Blepharostoma* and must be known as *B. nematodes* (Aust.). It is *Cephalozia nematodes* Aust. Bull. Torr. Bot. Club, **6**: 302. 1879. *L. Californica* Aust. Bull Torr. Bot. Club, **6**: 19, 1875, is of course *Ptilidium Californicum*.

‡*Loc. cit.* 97. A few such anarchistic movements in nomenclature, exceeding anything produced in this country with all its objectionable "*Freiheit*," and entirely without reason or warrant, mar this otherwise excellent work.

author in 1835 with *Jungermania byssacea* Roth. as a type species. It was not accepted by the authors of the Synopsis Hepaticarum 1844–7, but the same is true of many other early genera not proposed by Nees, one of the authors of the work. It was afterwards accepted by Gottsche, and later hepaticologists have accepted it without question, Schiffner alone excepted, as above stated. Of its sub-genera, as noted below, *Nowellia* differs most widely in its general facies from the rest of the genus, but none of the groups seem sufficiently separate for generic distinction. The genus as here recognized can be characterized as follows:

CEPHALOZIA Dumort.

Gametophyte mostly small or minute, usually close-creeping; stems branching ventrally or rarely laterally, often flagelliferous; leaves obliquely placed, succubous, bifid from one-third to over one-half their length; leaf cells usually large, transparent, mostly hexagonal; under-leaves usually wanting on the stems, often present on perianth-bearing branches. Perianth long, triangular, with a narrowed, toothed or ciliate mouth.

Sporophyte an oval or oblong-cylindric capsule on an ephemeral seta, varying in different species from 2 mm. to 2 cm. long.

The genus includes some sixty species well distributed, but best known from the North Temperate zone. Fourteen species are found in America north of Mexico. These can be distinguished by the following table, which has been constructed with special reference to material in which the perianth characters can not be seen:

Leaves deeply concave or somewhat saccate with two long, curved, slender divisions; perianth on a short ventral branch. § NOWELLIA.
- Leaf cells 20–25 μ, isodiametric 1. *C. curvifolia.*

Leaves not deeply concave nor saccate.
- Branching ventral; leaves bifid, but the leaf margins otherwise entire.
  - Leaves wider than the stem; involucral leaves not united. § EUCEPHALOZIA.
    - Leaves small, 0.35 mm. or less long.
      - Leaves wide (0.35–0.4 mm.) decurrent at base; leaf-cells 35–40 μ; dioicous; perianth fleshy (3 cells thick at base.) 2. *C. media.*
      - Leaves narrow (0.2–0.25 mm.) not decurrent at base; leaf-cells 20–30 μ; perianth thin.
        - Leaves strongly narrowed above the base; perianth obovate-oblong. 3. *C. Sullivantiae.*

Leaves not specially narrowed above the base.

Perianth linear-fusiform, widest below the middle; dioicous. 4. *C. catenulata.*

Perianth linear-clavate, widest above the middle; dioicous or autoicous. 5. *C. Virginiana.*

Leaves medium size, 0.5–0.65 mm. long; leaf-cells 40–50 μ.

Leaves longer than broad, cleft half way to the base or more; perianth thin.

Smaller; leaves 0.5 mm. or less long; usually monoicous. 6. *C. bicuspidata.*

Larger; leaves 0.65 long with apiculate divisions; dioicous. 7. *C. extensa.*

Leaves as broad or broader than long; monoicous; perianth fleshy, usually narrowed at base. 8. *C. pleniceps.*

Leaves larger, 1–1.35 mm. long, usually narrowed at base; plant semi-aquatic. 9. *C. fluitans.*

Leaves only about the width of the stem or even narrower; innermost involucral leaves united into a cup. § CEPHALOZIELLA.

Plants small; stems 2–4 mm. long.

Perianth linear or narrowly fusiform, the mouth denticulate or nearly entire. 10. *C. divaricata.*

Perianth ovate-fusiform, the mouth ciliate. 11. *C. Macounii.*

Plants minute; stems less than 2 mm. long.

Underleaves lanceolate, entire, often present only near the end of the stem. 12. *C. Sullivantii.*

Underleaves everywhere present, the upper ones bifid. 13. *C. minima.*

Branching lateral; leaves bifid with dentate margins; perianth terminal; underleaves usually present. § PRIONOLOBUS.

Leaves complicate-bifid, equitant. 14. *C. Turneri.*

1. CEPHALOZIA CURVIFOLIA (Dicks.) Dumort. Recueil d' Obs. sur les Jung. 18. 1835.

Jungermannia curvifolia Dicks. Pl. Crypt. Brit. 2: 15. *pl. 5, f. 7.* 1790.

Nowellia curvifolia Mitt. in Godman, Nat. His. Açores, 321. 1870.

Gametophyte a green or reddish slender creeping leafy axis, sparingly branching; leaves somewhat orbicular, deeply concave, with two slender incurved teeth widely separated at base and soon becoming one cell wide; underleaves wanting; leaf cells isodiametric, 20–25 μ in diameter: monoicous or dioicous; perianth on a short branch, triangular-prismatic, about 1.3 mm. long, plicate, with the mouth constricted and short ciliate; involucral leaves in two or three rows, deeply bifid with broad serrulate divisions.

Sporophyte a dark brown oval capsule 0.7–0.8 mm. long, on a short seta 0.5–2 cm. high; spores 6–8 μ in diameter, nearly spherical, dark brown; elaters 250 long, wider than the spores, bispiral.

A very common species on rotten wood distributed from the mountain region of Georgia to Wisconsin and northeastward; also European.

It has been distributed by Sullivant: Musc. Alleg. 242 (as *Jungermannia curvifolia*); Austin: Hep. Bor.–Am. 60; and in Hep. Amer. 17. Several figures exist; of these, Hooker, Brit. Jung. *pl. 15*, and Suppl. *pl. 1*, and Ekart, Syn. Hep. Germ. *pl. 8. f. 59*, are among the best; that in Smith, Eng. Bot. *pl. 1304* poorly represents the plant.

2. CEPHALOZIA MEDIA Lindb. Medd. Soc. Faun. et Fl. Fenn. 6: 242. 1881.

Cephalozia multiflora Spruce, On Cephalozia, 37. 1882 (not of Lindb.).

Gametophyte a slender creeping, usually pale green leafy stem; leaves often wider than long, decurrent, slightly imbricate, bifid one third their length with an obtuse or rarely lunate sinus and acute connivent segments; leaf-cells mostly uniform, 36–40 μ in diameter: dioicous; perianth on a very short branch, linear-fusiform, fleshy, formed of three layers of cells at base and two above; antheridia usually near the apex of a branch. Sporophyte a short-stalked, oblong-cylindric capsule enclosed at first in a fleshy calyptra formed of three layers of cells; spores cinnamon-colored.

One of our most common species growing in large patches on decaying logs and rarely on the ground from Florida to Virginia, California and generally distributed over the northern portion of America; also European. The species was long confused with *C. connivens* (Dicks.) both in this country and in Europe. During this period it was distributed under the original name of *Jungermannia connivens* by Sullivant. Musc. Alleg. 246, and as *Cephalozia connivens* by Austin, Hep. Bor.–Am. 57. Lindberg, thinking that this species was the true *C. connivens*, gave to that species the name of *C. multiflora*. Later, Spruce, identifying the true *C. connivens*, unfortunately gave the same name (*C. multiflora*) to the present species. Under this name the species was distributed by us in Hep. Amer. 38 and by Macoun, Can. Hep. 19* Fortunately Lindberg, a year earlier than Spruce, had given the species a name that will effectually blot out the confusion arising from the use of the homonym, *C. multiflora.*

3. CEPHALOZIA SULLIVANTIAE (Aust.)

Jungermannia Sullivantiae Aust. Bull. Torr. Bot. Club, 3: 12. 1872. (Not *J. Sullivantii* Aust. Proc. Acad. Phila. for 1869: 221. 1869.)

Gametophyte a short, close-creeping, sparingly branched stem; leaves whitish, usually spaced, about 0.3–0.35 mm. long, two-thirds as wide, strongly narrowed just above the base, somewhat ovate, erect, spreading or nearly horizontal, bifid to one-half or two-thirds their length, with obtuse sinus and acute usually divaricate divisions; leaf cells 25–30 μ in diameter; dioicous; perianth at the end of a very short branch, obovate-oblong, 1.2–1.5 mm. long, the mouth deeply 10-cleft; involucral leaves mostly bifid with a large tooth on the outer margin near the middle or towards the base. Sporophyte a short-stalked mostly short oval capsule; mature spores not seen.

Apparently an uncommon species, seen only as yet from Ohio, whence it was distributed by Sullivant: Musc. Alleg. 241 (as *Jungermannia bicuspidata*, var. 2); Austin also reported it from Illinois, but I have seen no specimens. The name is unfortunately too near *C. Sullivantii* and may need change to prevent confusion.

4. CEPHALOZIA CATENULATA (Hüben.) Spruce, On Cephalozia, 33. 1882.

Jungermannia catenulata Hüben. Hepaticol. Germ. 169. 1834.

Jungermannia reclusa Tayl. Lond. Jour. Bot. 5: 278. 1846.

Cephalozia serriflora Lindb. Medd. Soc. Faun. et. Fl. Fenn. 1878.

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* In my set of Macoun's Canadian Hepaticae this species occurs under the following numbers:

No. 39 as *Cephalozia Lammersiana.*

No. 18 as *Cephalozia catenulata.*

No. 20 (mostly) as *Cephalozia pleniceps.*

The species thus appears in one set of exsiccatae under four distinct names! The smaller species of Hepaticae, like *Cephalozia* and *Marsupella*, are likely to grow intermixed, so that the greatest care is necessary in selecting them for issues of exsiccatae wh ch are to be used as works of reference. Spruce has called attention to the similar errors in European exsiccatae, particularly Gottsche and Rabenhorst's Hepaticae Europeae.

Gametophyte a slender creeping stem with pale leaves which are incurved in drying so as to cause the stems to resemble a chain; leaves subimbricate, slightly concave, oval-rotund, cleft one-half their length with a somewhat obtuse sinus and acute, more or less spreading divisions; leaf-cells 22–25 μ in diameter: dioicous; perianth on a short branch, 1.3 mm. long, linear-fusiform, widest below the middle, the mouth ciliolate; antheridia in he axils of the leaves of a short apical spike. Sporophyte a reddish oval-cylindric capsule borne on a short seta.

Somewhat common on the ground and on rotten wood from Newfoundland to British Columbia and probably southward, where it is often confused with the next species; also European. It was distributed by Austin in Hep. Bor. Am. 56.

5. CEPHALOZIA VIRGINIANA Spruce, On Cephalozia, 37. 1882.

Gametophyte a slender creeping whitish stem; leaves contiguous or slightly imbricate, obliquely ovate, cleft about to the middle, with acute or acuminate spreading divisions; leaf-cells isodiametric, about 22 μ in diameter: dioicous or sometimes autoicous; perianth large, linear-clavate, widest above the middle, the mouth constricted and unequally short-setulose; antheridia in the axils of the leaves of a short spike. Sporophyte an oval-cylindric reddish brown capsule on a rather long seta.

Through the kindness of Mr. Pearson I have a fragment of the type specimen described by Spruce from Portsmouth, Virginia. The species appears to be more or less widely distributed through the Southern States, but in the absence of mature perianths is distinguished with difficulty from the preceding species. It was distributed in Hep. Amer. 72.

6. CEPHALOZIA BISCUSPIDATA (L.) Dumort. Recueil d'Obs. sur les Jung. 18. 1835.

Jungermannia bicuspidata L. Sp. Pl. 1132. 1753.

Jungermannia Lammersiana Hüben. Hepaticol. Germ. 165. 1834.

Gametophyte a slender prostrate greenish leafy stem, 1–3 cm, long, flagelliferous branching; leaves distant in the basal portion. imbricate toward the apex, round-ovate, cleft to the middle or beyond, with spreading lanceolate, acute or acuminate lobes; leaf cells uniform, 30–40 μ in diameter: monoicous or in one form dioicous; perianth on a very short branch, about four times the length of the leaves, somewhat fusiform. Sporophyte cylindric-oblong on a short seta; calyptra thin; spores purple.

On rotten wood and on the ground; widely distributed from Newfoundland to British Columbia and southward along the Appalachian area; also reported from California (*Howe*); the species is also European. It was distributed by Sullivant: Musc. Alleg. 240 (as *Jungermannia bicuspidata*); by Austin: Hep. Bor. Am. 58, 59, the latter as var. *conferta*, a form with crowded leaves; and in Hep. Amer. 71. The form known as *C. Lammersiana* found in the British Possessions can hardly be maintained as distinct.

The species has been frequently figured, the best figures being Hooker, Brit. Jung. *pl. 11*, and Suppl. *pl. 4;* Ekart, Syn. Jung. Germ. *pl. 4, f. 23;* and Smith, Engl. Bot. *pl. 2239*.

7. Cephalozia extensa (Tayl.) Spruce, On Cephalozia, 44. 1882.

Jungermannia extensa Tayl. Lond. Jour. Bot. 5: 279. 1846.

Gametophyte a prostrate pale or rufous, sparingly branched leafy stem; leaves spreading, complicate-concave, those of the basal portion contiguous, those of the apical portion crowded, bifid more than one-half their length, with triangular-lanceolate acuminate and often apiculate divisions; leaf-cells about 35 μ in diameter: dioicous; perianth on a more or less elongated branch, linear-fusiform or sublanceolate, three times the length of the involucral leaves, which are in three or four ranks, deeply cleft and slightly longer than the ordinary stem-leaves. Sporophyte a long-stalked oval capsule, 0.7 mm. long; spores about 9 μ in diameter.

This plant was originally described from material collected by Dr. Scouler at Observatory Inlet, N. W. America and appears from present data to extend from Washington and British Columbia to northern California. It was distributed in Can. Hep. 22.

8. Cephalozia pleniceps (Aust.) Lindb. Medd. Soc. Faun. et Fl. Fenn. 9: 158. 1883.

Jungermannia pleniceps Aust. Proc. Phila. Acad. for 1869: 222. 1869.

Cephalozia crassiflora Spruce, On Cephalozia, 40. 1882.

Gametophyte a short slender prostrate leafy stem; leaves thick, obliquely orbicular, concave, not decurrent, cleft one-fourth to one-third their length, with acute or somewhat obtuse sinus and acute lobes; leaf-cells rather large, 36–40 μ in diameter: monoicous; perianth terminal on a short branch, 2.6 mm. high, obovate-cylindric, fleshy, three cells thick at base, reduced to two cells above the middle; involucral leaves in about three ranks, appressed, fleshy, composed of two strata of cells near the base; antheridia in the axils of smaller leaves crowded in spikes. Sporophyte a short-stalked oval capsule, 0.8 mm. long, enveloped until maturity in a thin calyptra; spores about 9 μ in diameter.

The type locality of Austin's plant was in the White Mountains of New Hampshire; that of Spruce's *C. crassiflora* in the Pyrenees. It occurs on the mountains of New England and in Canada, and according to Pearson extends westward to British Columbia; also reported from California (*Howe*). It is likely to be confused with *C. media* on account of its thick perianth, which in section is found to be made up of three strata of cells at base, and two strata if the section is made higher up; *C. media* is smaller and dioicous, with strongly decurrent leaves and probably has a much wider range in both latitude and altitude. *C. pleniceps* is also reported from various parts of Europe.

9. Cephalozia fluitans (Nees) Spruce. on Cephalozia, 50. 1882.

Jungermania fluitans Nees, in Syll. Ratisb. 129. 1823.

Cephalozia obtusilobata Lindb. Bot. Notiser, 1872: 164. 1872.

Gametophyte a slender elongate axis, growing over *Sphagna* or semi-aquatic; leaves distant, oval, ovate or oblong, somewhat cuneate at base, bilobed one-third to one-half to the base, with a narrow acute sinus and usually obtuse lobes; leaf-cells hexagonal, 40–50 μ in diameter: dioicous; perianth on a short branch, about 3 mm. long, oval, cylindric, trigonal only at the apex; involucral leaves rather smaller than the ordinary stem-leaves, bifid to the middle, with acute lobes. Sporophyte an oblong or oblong-cylindric capsule, on a short seta; spores minutely tuberculate.

Growing in wet places, in Sphagnum bogs or semi-aquatic in the margin of pools, New Jersey and New England to Labrador and northwestward. It has been distributed by Austin in Hep. Bor. Am. 35 (as *Jungermannia inflata* var. *fluitans*) and in Hep. Amer. 154, 173.

10. Cephalozia divaricata (Sm.) Dumort. Hep. Europ. 89. 1874.

Jungermannia divaricata Smith, Engl. Bot. *pl. 719.* 1800.

Jungermannia byssacea Roth, Fl. Germ. 3: 387. 1800.

Jungermannia confervoides Raddi, Mem. Soc. Mod. 18: 29. *pl. 4. f. 1.* 1820.

Jungermannia Starkii Funck; Nees, Europ. Leberm. 2: 215, 225. 1836.

Jungermannia Grimsulana Jack; Gott. et Rabenh. Hep. Europ. No. 56.

Gametophyte a slender green olivaceous or almost black, leafy stem with leaves scarcely wider than its diameter; leaves mostly spaced, especially on sterile stems, cleft about half-way to the base, the lobes complicate or divergent, acute; underleaves mostly wanting: dioicous; perianth linear or narrowly fusiform, sometimes purple toward the base, prismatic, 3–6-angled, the mouth somewhat constricted, denticulate or nearly entire; involucral leaves larger, more or less connate, bifid, the lobes denticulate. Sporophyte an oblong-globose capsule on a short seta.

On sand and rocks and occasionally on rotten wood, New Jersey to Labrador, and on the Pacific coast from California northward; also European. It was distributed by Austin in Hep. Bor. Am. 51, 52, 53, 54; and in Hep. Amer. 155.

The species has been well figured. Besides the figures of Smith and Raddi, noted above, the more important are Hooker. Brit. Jung. *pl. 12* and Ekart, Syn. Jung. Germ. *pl. 4. f. 34.*

11. Cephalozia Macounii (Aust.) Aust. Hep. Bor. Am. no. 55. 1873.

Jungermannia Macounii Aust. Proc. Phila. Acad. for 1869: 222. 1869.

Gametophyte a short creeping more or less branched leafy stem; leaves contiguous or somewhat imbricate, broadly spreading, bifid a little beyond the middle, the lobes spreading and broadly subulate, 2–4 cells wide at base, mostly acute; leaf-cells 15–18 μ in diameter; underleaves wanting: dioicous; perianth about 0.7 mm. long, whitish, ovate-fusiform, the mouth narrowed and ciliate; involucral leaves 2 or 3 pairs, appressed, 2–3-cleft nearly one-half their length, irregularly spinulose. Sporophyte not seen.

On rotten logs, mountains of New England (Austin), Ontario and British Columbia (Macoun). The plant was distributed by Austin: Hep. Bor. Am. 55. The species is rarely collected.

12. Cephalozia Sullivantii (Aust.) Aust. Hep. Bor. Am. No. 50, 1873.

Jungermannia Sullivantii Aust. Proc. Phila. Acad. for 1869: 221. 1869.

Gametophyte an exceedingly minute mostly simple, fleshy stem, often less than a millimeter long; leaves imbricate, ovate-orbicular, usually narrower than the stem, bifid with an acutish sinus; underleaves lanceolate-ovate, entire, often apparent only near the ends of the stems; perianth terminal on ascending stems, 0.5 mm. or less long, oval or somewhat obovate, plicate and truncate at the mouth. Sporophyte an oval capsule on a seta scarcely longer than the perianth.

Among mosses on rotten wood, New Jersey and Ohio (*fide* Austin); also Belleville, Ontario (Macoun). Not often collected but likely to be overlooked by collectors on account of its almost microscopic size. It was distributed by Sullivant: Musc. Alleg. 239 (as *Jungermannia divaricata*); this number forms the type; it was also distributed by Austin: Hep. Bor. Am. 50.

13. CEPHALOZIA MINIMA Aust.; Pearson, List Can. Hep. 11. *pl. 6.* 1890.

Gametophyte a minute dark green, usually simple leafy axis; leaves about the width of the stem, obovate or subquadrate, bifid one-third their length, with acute divisions, the margins entire; leaf cells 4–6-sided, about 16 μ in diameter; underleaves present, the lower entire and subulate, the upper larger and bifid: dioicous; perianth acrocarpus, oblong-oval, with rather wide sub-entire mouth; involucral leaves 3 pairs, larger than the ordinary stem-leaves, subquadrate, bifid one-third to one-half their length, spinulose-dentate; antheridia on short branches. Sporophyte not seen.

On rotten logs, Belleville, Ontario (Macoun); known only from the type specimen.

14. CEPHALOZIA TURNERI (Hook.) Lindb. Acta Soc. Sci. Fenn. 10: 502. 1875.

Jungermannia Turneri Hook. Brit. Jung. *pl. 29.* 1816.

Gametophyte a prostrate slightly branched leafy stem, 2–5 mm. long; leaves approximate, equitant, complicate-bifid half-way to the base, the margin everywhere sharply and unequally serrate-dentate; underleaves wanting: dioicous or monoicous; perianth whitish, 0.3–0.5 mm. long, pentagonal-prismatic, the mouth almost closed, obscurely ciliolate; involucral leaves larger than the ordinary stem-leaves, spinose-dentate, bifid with acute divisions. Sporophyte and oval capsule on a slender seta; spores dark brown, about 8 μ in diameter; elaters dark brown, about 200 μ long, with two close spirals.

This species was first announced by Mr. M. A. Howe from

Marin and San Mateo counties, California,* but a scrap of it had been previously collected (1888) with *Polytrichum* by Miss M. E. Parsons, of San Rafael, and overlooked in my collection. It is found mostly on the ground and is an interesting addition to our flora. It has long been known in Europe, but does not appear to be common. It was distributed in Hep. Am. 174, from fine material sent by Mr. Howe. The species has been illustrated in Smith, Engl. Bot. *pl. 2510* and in Ekart, Syn. Jung. Germ. *pl. 9, f. 69* in addition to the citation of Hooker above.

Species dubiae et inquirendae.

CEPHALOZIA DENTATA (Raddi) Spruce, On Cephalozia, 71. 1882.

Jungermannia dentata Raddi, Mem. Soc. Mod **18**: 22. *pl. 4. f. 4.* 1818.

(This species was reported by Mitten, Jour. Linn. Soc. **8**: 52, 1865, under the name *Trigonanthus dentatus*, from Galton Mountains, British Columbia, but as it is not otherwise known from North America the identification needs to be verified.)

CEPHALOZIA CONNIVENS (Dicks.) Dumort, Recueil d' Obs. sur les Jung. 18. 1835.

Jungermannia connivens Dicks. Pl. Crypt. Brit. fasc. 4: 19. *pl. 11. f. 15.* 1801.

Cephalozia multiflora Lindb. Acta Soc. Sci. Fenn. **10**: 501. 1875. (not Spruce *l. c.*)

(This species has been frequently reported from America but has been confused with *C. media*. It is likely to occur northward and can be distinguished from that species by its large leaf-cells (66 μ in diameter) and its perianth formed of a single layer of cells, with long ciliate mouth.)

* * *

The publication of a revision like the above is often accepted by botanical collectors as an indication that the information regarding the genus is closed. As a fact such a revision merely indicates the extent of our knowledge for the present and forms a datum line for further study. It also shows or ought to show the limitations of our knowledge. The remarks to follow apply not only to the genus *Cephalozia*, but to all genera and species of He-

* Erythea, **4**: 50. 1896.

paticae. Our knowledge of the distribution of species is very much limited. We know next to nothing of the Hepaticae of the entire range of the Rocky Mountains south of northern Idaho, and Mr. Leiberg and others who have sent in considerable quantities of interesting plants from farther north have only shown us the stores of information awaiting the collector in that region. Colorado, Utah, the Sierras from Oregon southward, and all the Southwest from Missouri to Texas, New Mexico and Arizona are a great unknown, no less among all of the lower cryptogams than in the Hepaticae. Much more needs to be done throughout all the States of the Mississippi valley, and especially the southern extension of the Appalachian area, which needs the careful attention of the resident observer, rather than the hasty notes of the transient collector. It is hoped that the above synopsis and descriptions will be sufficient to provide for any student of the group the ready means of identifying his material; we shall be pleased to receive doubtful material, or that illustrating additional facts of distribution.

NEW YORK, 24 September, 1896.

Notes on Potentilla.—IV.

BY P. A. RYDBERG.

(Plates 274 and 275.)

The *Aureae* resemble much the *Frigidae* except that the leaves have more than three leaflets. They are all low plants, generally less than 2 cm. high, except *P. dissecta*, which sometimes reaches a height of 3 cm. The pubescence is scant, silky, strigose or hirsute, only in a variety of *P. dissecta* a little tomentose on the lower surface of the leaves, and the plant often becomes glabrous and shining in age. The style in all is very slender and filiform, fastened near the apex of the achene and generally much longer than the achene. Most of the species belonging to this group have truly digitate leaves, but in the North American representatives the outer leaflets are often inserted lower down and the leaves become pinnate with approximate leaflets.

POTENTILLA RUBENS (Crantz) Vill. Prosp. Fl. Dauph. 46. 1779.

P. maculata Pourr. Act. Toloss. 3: 326. 1788.

This species comes very near the *Frigidae*, especially to *P. nana* and *P. Friesiana*. From the latter it differs little except in the number of leaflets. The leaves are much smaller than those of the other American *Aureae*, the leaflets being only 10–20 mm. long. The sepals are broadly ovate, while in the rest they are ovate-lanceolate or lanceolate. *P. rubens* grows in arctic and alpine regions of Europe, in Greenland, the Baffin Bay region and Labrador.

POTENTILLA DISSECTA Pursh, Fl. Am. Sept. 355. 1814.

P. diversifolia Lehm. Nov. Stirp. Pug. 2: 9. 1830.

It would be much better if Lehmann's name were used for this species, as this, without any doubt, belongs to it. As to *P. dissecta* Pursh, nobody seems to know absolutely what it is. Dr. Watson thought it to be the same as *P. diversifolia* Lehm. Lehmann had seen *P. dissecta* in Bank's herbarium, but thought that his *P. diversifolia* was different. Not being able to settle the matter satisfactorily, the author thinks it best for the present not to make a change in the "accepted" nomenclature, although *P. diversifolia* is a good name, and available, and besides has the advantage of belonging to this plant without any doubt.

To the author it seems as if *P. dissecta* rather belonged to *P. multisecta* (see below) or to *P. Ranunculus*. Lange's description and figure of the latter in Flora Danica, and the only specimen seen by me agrees much better with Pursh's description of *P. dissecta* than the present species does.

Dr. Watson included in his *P. dissecta*, with varieties, not less than five different plants, which I believe are all good species, viz.: *P. diversifolia* Lehm, *P. decurrens* (Wats.), *P. multisecta* (Wats.), *P. pinnatisecta* (Wats.) Aven Nelson, and *P. Drummondii* Lehm. These will be discussed further below. He also included *P. rubricaulis* Lehm.; I have not seen any authentic specimens of that. There are two forms that fairly agree with Lehmann's description and figure of *P. rubricaulis*. One differs from *P. diversifolia* Lehm. only in being smaller and with the leaves slightly whitened beneath. Following Gray and Watson, I have taken this to be *P.*

rubricaulis Lehm. and have made it a variety of the present species. I regard the other form as a new species and it will be discussed later.

P. dissecta varies much in the form of the leaves. In the type of *P. diversifolia* Lehm. the lower leaves were pinnate with approximate leaflets, but all the leaves are as often perfectly digitate. The leaflets are larger than in the other related species, oblanceolate, and generally seven in number. In the typical form they are generally appressed-hairy. All specimens seen are from the plain and mountain regions of the West, the range extending from Colorado to California, British Columbia and Saskatchewan.

POTENTILLA DISSECTA GLAUCOPHYLLA (Lehm.) Wats. Proc. Am. Acad. 7: 556. 1873.

P. diversifolia glaucophylla Lehm. Rev. Pot. 73. 1856.

Leaves nearly glabrous, glaucous-green and always digitate.

The range is the same as that of the species, but it is much more common within the United States.

POTENTILLA DISSECTA RUBRICAULIS (Lehm.).

P. rubricaulis Lehm. Nov. Stirp. Pug. 2: 11. 1830.

Leaves somewhat tomentose beneath when young. It may be a hybrid between *P. dissecta* and *P. nivea* or *P. concinna*, as it is rare and only found in the mountains, where these species also grow.

POTENTILLA DECURRENS (Wats.).

P. dissecta decurrens Wats. Proc. Am. Acad. 7: 557. 1873.

This species much resembles the preceding, especially the var. *glaucophylla*, but it is a more cespitose plant and has smaller and thicker leaves with prominent veins beneath. The leaflets are generally five and the lower often attached a little lower down and decurrent on the petioles, but this is not always the case by far. It is found in the higher moutains of Utah, Wyoming and Montana.

Potentilla Ranunculus Lange, Fl. Dan. *pl. 2964*, from Greenland, comes near to both the preceding, differing from both in the more deeply dissected leaves and scaly rootstock. The leaves resemble much those of *P. decurrens*, but are perfectly digitate and much thinner. It seems to be a very rare plant.

Potentilla ranunculoides Humb. & Bonp.; Nestl. Monog. Pot. 56, of Mexico, belongs also to this group, differing from the North American species by its large petals and very broad rounded leaflets.

POTENTILLA MULTISECTA (Wats.).

P. diversifolia multisecta Wats. King's Rep. 5: 86. 1871.

This was also included in *P. dissecta* by Watson. It is a probability that it is the original *P. dissecta* Pursh, the description of which fits this, as well as *P. Ranunculus* Lange, better than the plant for which the name is used, viz. *P. diversifolia* Lehm. From this, *P. multisecta* differs not only in the finely dissected leaves, but also in the smaller flowers. The leaves are not truly digitate, but the outer leaflets are attached a little lower, as in *P. decurrens*. All are divided into linear divisions. This species therefore connects the *Aureae* with the *Multijugae*, especially with *P. pinnatisecta* and *P. millefolia*. It ranges from Nevada to Montana and Wyoming.

A small group, nearly related to the *Aureae*, especially to *P. decurrens* and *P. multisecta*, but with the leaves more or less tomentulose beneath may be known as the *Subjugae*. The leaves are at the same time digitate and pinnate, *i. e.*, they are digitately 3–5-foliolate with a pair (in the last sometimes 2 pairs) of smaller leaflets further down on the petiole. In this respect they resemble *P. pulchella*, from which the *Subjugae* differ in the style, which is filiform. They are all low and tufted, or cespitose, delicate plants from Colorado, less than 2 dm. high, except the first, which sometimes reaches 3 dm. It approaches in size and habit the *Gracilis* group, *i. e.*, *P. gracilis* and its varieties as understood by Watson. Strangely, all four seem to be undescribed.

POTENTILLA SUBJUGA n. sp.

Tufted from a perennial root; stems many, 1–3 dm. high, silky-villous, few-leaved, rather divergently branched above, the lower portion covered with the brown scarious lower stipules; upper stipules green, ovate, entire. Basal leaves many, digitately 5-(seldom 3-) foliolate with an additional pair of smaller leaflets on the petiole, about 1 cm. below the others; leaflets 1–4 cm. long, oblong or obovate, deeply incised into oblong rather obtuse segments, silky and green above, silky and white-tomentose beneath; stem-leaves generally ternate, few and reduced in size; calyx silky-hirsute, in fruit 5–8 mm. in diameter; bractlets oblong, obtuse or acute, about ⅓ shorter than the ovate triangular acuminate sepals; petals broadly obcordate exceeding the sepals; stamens about 20; style filiform, nearly terminal; achenes smooth. (Plate 274.)

As before noted it resembles somewhat the species of the *Gracilis* group, especially *P. fastigiata* in size and *P. pulcherrima* in the form of the leaflets and the pubescence. The latter has digitate or more or less pinnate leaves with approximate leaflets, but they are never, as in *P. subjuga,* digitately 5-foliolate with a pair of smaller ones some distance below. In *P. subjuga,* the leaflets are more deeply incised and the stem and branches stricter and the latter rather divergent; they are few-flowered,* as in *P. nivea,* from which it differs in the number of the leaflets.

Colorado: N. H. Patterson, no. 192, 1892 (from near Empire, type); 1885 (from Gray's Peak); C. S. Crandall, no. 184, 1892 (from Graymont); T. C. Porter, no. 44; Hall and Harbour, no. 160, 1862, mainly.

POTENTILLA TENERRIMA n. sp.

Tufted from a perennial root; stems many, very slender, generally tinged with red, 1–1½ dm. high, sparingly strigose; stipules linear, lanceolate, acuminate, about 1 cm. long, the lower scarious and brown. Leaves digitately 3-foliolate, with a pair of smaller leaflets below, or, which is the same, pinnate of 2 pairs and terminal leaflet sessile, finely silky and a little grayish tomentulose beneath; leaflets obovate or oblanceolate in outline, divided to near the midrib into linear acute segments; flowers on slender pedicels, nearly 1 cm. in diameter; calyx silky-strigose, in fruit ½ cm. in diameter; bractlets linear, acute, very little shorter than the narrowly lanceolate sepals; petals obovate, slightly retuse, a little exceeding the sepals; stamens about 20; style filiform, nearly terminal; achenes smooth. (Plate 275, figs. 1–5).

It resembles a very slender form of the preceding, but the terminal leaflets, as in the two next, are always only three. The segments of the leaflets are also much narrower, as also the bracts and sepals, which are narrower than in any other North American species.

Colorado: Brandegee, no. 950, 1874 (from Bergen's Park, type); Hall and Harbour, no. 160 (in part, in the Harvard herbarium).

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* *P. rubricaulis* Lehm. may perhaps be a form of this with only 3 terminal leaflets and more erect branches.

POTENTILLA MINUTIFOLIA n. sp.

Cespitose, stems about 1 dm. long, slender, 1–2-leaved, sparingly silky or nearly glabrous, slightly striate; stipules ovate-lanceolate, the lower scarious and brown; basal leaves very small, on slender petioles 3–5 cm. long, silky-hirsute, slightly grayish beneath, pinnate, of two pairs of leaflets, the upper pair and the sessile odd leaflet about ½ cm. long; the lower pair only 2–3 mm.; leaflets obovate, incised, with oval rounded segments; flowers 1–2, about 15 mm. in diameter; calyx sparingly hirsute, in fruit 7–8 mm. in diameter; bractlets oblong, generally obtuse, about half as long as the oblong-lanceolate obtuse or acutish sepals; petals obcordate, about ½ longer than the sepals. (Plate 275, figs. 6–10.)

This somewhat resembles *P. subjuga*, but differs in the small size of the plant and of the leaves, the three terminal leaflets, and their short and rounded segments.

Colorado: Wm. M. Canby (Pikes Peak) 1895.

POTENTILLA SAXIMONTANA n. sp.

Densely cespitose; stems several, 1–3-flowered, less than 5 cm. long, silky pubescent. Basal leaves numerous, pinnate with 2–3 often approximate pairs of leaflets, silky pubescent and somewhat tomentose beneath, short-petioled; leaflets deeply dissected into oblong obtuse or acute segments; flowers about 1 cm. in diameter; calyx densely silky; bractlets oblong, obtuse, shorter than the broadly ovate-triangular sepals; petals broadly obcordate, much longer than the sepals; stamens about 20; style nearly terminal, about equalling the smooth achene.*

It somewhat resembles the preceding, but is still more cespitose, has much broader sepals and larger leaves, which have much shorter petioles. The leaves resemble somewhat those of *P. pinnatisecta* (Wats.) Aven Nelson (*P. ovina* Macoun), but are slightly tomentose. The flowers are much larger and the sepals much broader than in that species. It resembles also somewhat *P. Sommerfeltii*, but has much more dissected leaves, and the style is different. The following specimens have been examined:

Colorado: John Wolf, no. 366, 1873 (Wheeler's expedition, type); Hooker & Gray, 177 (Torrey's Peak); Knowlton, no. 19, 1896 (Pike's Peak).

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* The plate of this will appear in a subsequent number.

Notes on the Pine-inhabiting Species of Peridermium.*

BY LUCIEN M. UNDERWOOD AND F. S. EARLE.

There seems to have been much confusion regarding the pine-inhabiting species of *Peridermium* not only in this country but also in Europe, and the difficulties in the way of a clear understanding of the species have not been entirely removed. So far as we have been able to discover we have only three species of this group in the eastern United States besides three nominal species from western North America which we have not been able to examine.† It is possible that the examination of the type of another Eastern species (now inaccessible for the time) may reveal some features that its description does not show and require further modification of the synonymy.

Two of our species are foliicolous and produce only a minimum of disturbance in the tissues of their host, while the third is found only on stems producing extensive gall-like swellings often of enormous size. These may appear on the smaller limbs, or on branches of various sizes, or on the main trunk of trees of considerable diameter. So far as the economic relations are concerned, the foliicolous species rarely produce any considerable damage, but the stem-inhabiting species causes extensive damage in some portions of the South in the deterioration or death of chiefly young pines. The Eastern species are as follows:

1. PERIDERMIUM ACICOLUM (Wallr.).

P. pini var. *acicolum* Wallr. Fl. Crypt. 262. 1833.

P. oblongisporium Fuck. Symb. Mycol. 42. 1869.

This species, which is very distinct from the stem-inhabiting *Peridermium pini* of Europe, appears to be confined to the North-eastern states and is not separable from the forms occurring in Europe on various hosts. With us it has been found only on *Pinus rigida*. We have seen specimens from Massachusetts (Underwood, Seymour) and New Jersey (Pennypacker) only. The spores are

* Read before Section G, A. A. A. S., Buffalo meeting, August, 1896.

† *P. Englemanni* Thuem., from Colorado; *P. filamentosum* Peck, from Arizona and *P. Harknessii* Moore, from California.

large, usually oval, often reaching 40 μ; the peridial cells form a thin tenacious membrane and do not readily separate from one another when placed in dilute potash; their ends are usually rounded, but are sometimes obliquely truncate, imbricate or occasionally in rows placed end to end; they are somewhat intermediate in this respect between our other two species.

EXSICC. Ellis & Everhart. N. A. Fungi, 2222; Seymour & Earle, Economic Fungi, 223.

The above species has been confused with *P. pini.* Wallroth was the first to distinguish it as a foliicolous variety, while Fuckel made it a distinct species. Unless we are to recognize only one pine-inhabiting *Peridermium* which is clearly illogical, we must maintain this as a distinct species. If we are to follow in the lead of some of the highly imaginative fungiculturists, some of whom maintain that this form is the aecidial stage of a *Cronartium*, while *P. pini* is similarly regarded as the corresponding stage of a *Coleosporium*, the two must be at least specifically distinct, since in their mature stage they would belong to two totally different genera! Winter singularly unites them in one species without even maintaining a varietal distinction.

2. PERIDERMIUM ORIENTALE Cooke, Indian Forester, 3: 91.

With some hesitation we refer the large leaf-inhabiting species of the Southern States to this name, originally described from northern India. In this we are supported by three somewhat questionable principles: (1) A writer is supposed to know his own species (a principle, however, which does not always follow) and the specimens issued in Ravenel's Fungi Amer., cited below, were doubtless examined by Cooke, who was the author of the species in question; (2) There is little in the description of the species as quoted in Saccardo that would stand in the way of such a reference; and (3) The species has commonly been referred to this name by American authors. While, therefore, it seems hardly probable that there should be a species of *Peridermium* common to two such remote localities as India and the southern United States, and while the original specimen may, in the light of characters now recognized that are not touched upon in the original description, prove totally distinct, it seems hardly wise to us to establish a new species without first seeing the type of the one to which it has been referred. On this principle of *laissez faire* we retain with some mental reservations the above name.

This species seems to have a wider range of host plants as well as a greater geographic distribution than the preceding. We have examined specimens as follows:

On *Pinus taeda*. Georgia (Ravenel, Underwood); Alabama (Underwood & Earle).

On *Pinus palustris*. South Carolina (Ravenel); Florida (Martin, Underwood); Alabama (Earle & Underwood); Mississippi (Earle & Tracy).

On *Pinus* sp. Missouri (J. G. Barlow).

This handsome species is quite abundant in the Southern States, and while found more commonly on comparatively young trees it frequently appears on trees of considerable size. It was first distributed by Ravenel as *Aecidium pini* of which he curiously gives *Peridermium pineum* Schw. as a synonym, notwithstanding Schweinitz alludes distinctly to the peculiar gall-like growths that are discussed under the following species. Later Ravenel distributed the same thing under the name of *P. orientalis* [*sic*] Cooke.

The spores are small, rotund or broadly oval, and like the peridial cells, thickly beset with long weak obtuse spines; in size they are variable, averaging 20 μ. The peridial cells approach rectangular, are truncate and placed end to end, are variable in size, averaging about 40 by 25 μ, and readily separate from one another; they are thickly beset with long, obtuse echinulations, which, when seen from above, give the appearance on a casual examination of being radiate-striate on the margin.*

EXSICC. Ravenel. Fungi Carol. fasc. 1, no. 93 (as *Aecidium pini*).
Ravenel. Fungi Amer. 270.
Ellis. N. A. Fungi, 1026.
Seymour & Earle. Economic Fungi, 224 (as *Peridermium pini* var. *acicolum*).

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* This character is common to all the species of *Peridermium* we have examined, though it seems to have been overlooked, since the peridial cells are usually described as wrinkled or striate margined. The echinulations are unusually long and conspicuous in this species.

3. Peridermium cerebrum Peck, Reg. Rep. 25: 91. 1873.

Peridermium pineum Schw. Trans. Amer. Phil. Soc. 4: 294. 1835. Not Lk.

? *Peridermium pyriforme* Peck, Bull. Torr. Bot. Club, 6: 13. 1875.

This stem-inhabiting species was first mentioned by Schweinitz in Syn. Fung. Carol. *No. 456* and afterward in Syn. Fung. Bor. Am., where he describes it as follows: "In Pennsylvania prope Philadelphia et alibi non rarum. Specimina ampla, pedalia in ipso trunco Pini inopis mihi obvia, analogon praebuerunt Gymnosporangis juniperini." Later the species was collected by Lintner at Center, New York, on *Pinus rigida* and described by Peck as *Peridermium cerebrum*. Professor Peck informs us that the species is not common in eastern New York. We have seen the type specimen, which is not different from the forms common about Washington on *Pinus Virginiana* and farther south on *P. echinata*, except that the gall is larger in proportion to the size of the stem.

Peck described later a second species sent him by Ellis either from New Jersey or Georgia. Of this we have not been able to see the type, but its striking characteristic of pyriform spores mentioned in the description we have found in both forms of *P. cerebrum* as they occur in the South. A form distributed by Ellis, N. A. Fungi, 1021, "On seedlings of *Pinus inops* Ait," shows microscopic characters similar to this species, but in the set examined the fungus appears to make only a slight swelling and that totally unlike the normal one produced on *P. Virginiana*. There may have been some error in the determination of the host. This matter has been left for later consideration.

Specimens have been examined as follows:

On *Pinus rigida*, New York (Peck); New Jersey (Ellis); Massachusetts. (Underwood); the last named specimen was in the form of a convex swelling at the base of a large tree; the others are of the typical globose form.

On *Pinus Virginiana*. Virginia (Galloway); Alabama (Underwood); to these should be added the Schweinitzian reference to Pennsylvania above cited; all these forms are of the globose type.

On *Pinus echinata.* Alabama (Earle & Underwood). These are also of the globose type.

On *Pinus taeda.* Alabama (Underwood & Earle); Mississippi (Tracy). These are of the fusiform type described below.

On *Pinus sp.* Webster County, Mississippi (W. B. Stark). Also of the fusiform type, though represented only by fragments.

In microscopic characters this species is related to the European *Peridermium pini* (P.) Wallr., but sufficiently distinct. The spores are of medium size, 20–30 μ long, irregularly oval, ovate or pyriform; the peridial cells are long and narrow, with pointed ends, arranged imbricately and never end to end; they are about 40–60 μ by 15–20 μ and do not readily separate from one another in dilute potash.

Exsicc. Ellis, N. A. Fungi. 1022.

We have observed the development of the globose type on *Pinus echinata* in central Alabama, where it is very common and causes considerable damage among the pines. It frequently appears as globose swellings less than two centimeters in diameter, on small twigs, and often during its early stages of growth no spores are developed. The mycelium is perennial and later produces conspicuous yellow peridia, which are often arranged so as to form convolutions giving a resemblance to the surface of the brain. Within these, spores are produced in prodigious quantities. Unless the branch is killed, the parasite continues to grow for a succession of seasons, producing more spores each season. Usually the gall entirely surrounds the branch, but in some cases the branch escapes with only one side affected. Occasionally the main trunk will be first affected and, continuing to grow with its gall, will form a large ball a foot or more in diameter. Since the plant is perennial the necessity of an alternate host is not immediate, and it will be a matter of future investigation as to what becomes of the spores. Some source of infection must be at hand, since the parasite is very abundant in the South, some considerable areas in eastern Alabama showing nearly every tree of the species more or less affected.

On *Pinus taeda* the form of the gall is entirely different. Instead of a globose type, which occurs on the other hosts, we have an elongate fusiform enlargement of the branch almost uniform in every direction, so as to produce an almost perfect spindle. So far as we can discover, there are no microscopic differences between this form and the globose type, either in the spores or peridial cells, both showing the same characters and the same variations. The difference in the gall, however, is so marked and so constant, and the parasite on both pines is so common, that the shape of the gall often serves as a ready means of identifying the trees at a glance. Occasionally larger trunks will be affected, and then the gall retains its typical elongate character instead of the rounded convex forms that appear on *Pinus echinata* in the South, and that we have seen on *Pinus rigida* as far north as Massachsetts. The occurrence of such marked macroscopic characters opens up an interesting question as to how much weight should attach to what may be called "habit characters." Shall they be disregarded, shall they be recognized as varietal differences, or shall they serve as specific characters of equal weight with those which require a microscope to detect? We have provisionally adopted the first course in the present case.

AUBURN, ALABAMA, July, 1896.

Studies in the Botany of the southeastern United States—VII.

BY JOHN K. SMALL.

RUMEX LANGLOISII n. sp.

Perennial, glabrous, somewhat scurfy, dark green (when dry). Stem erect or ascending, 5–7 dm. tall, simple or with a few nearly erect branches, more or less flexuous, at length strongly furrowed; leaves oblong or linear-oblong, 3–12 cm. long, acuminate or acutish, erose crenulate, slightly crisped, somewhat prominently nerved especially beneath, narrowed into a petiole which is usually 1 or 2 cm. long; ocreae very thin, early falling away; panicle rather open, not leafy, 1–2 dm. long; racemes strongly ascending, 5–10 cm. long, usually interrupted; flowers about 2 mm. long, in dense whorls (in fruit); pedicels about 5 mm. long, articulated near the base, enlarged towards the end; wings rather coriaceous, deltoid, 4 mm. long, the sides rounded, the apex blunt, the surface prominently nerved, each bearing a papillose calosity 1 mm. broad and 3 mm. long; achene ovoid, nearly 3 mm. long, abruptly contracted into a very short base, slightly acuminate at the apex, the faces dark red, the angles slightly paler and margined.

Southern Louisiana, New Orleans (Joor, according to Trelease) and Pointe a la Hache (Langlois).

This is *Rumex Floridanus* Trelease, but not *R. Floridanus* Meisner. With the original specimens of *R. Floridanus* Meisner at hand I cannot separate them from *R. verticillatus*, to which Meisner says the species is closely related. Prof. Trelease has given the plant its correct position, but referred it to the wrong species. *R. Langloisii* is intermediate between *R. verticillatus* and *R. altissimus* in these respects: its inflorescence suggests the latter, while its foliage suggests that of the former.

POLYGONELLA Michx. Fl. Bor. Am. 2: 240. 1803.

[LYONIA Raf. Med. Repos. N. Y. 5: 352. 1808.]
[STOPINACA Raf. Fl. Tellur. 3: 11. 1836.]
[GONOPYRUM F. & M.; C. A. Meyer, Mem. Acad. St. Petersb. (VI.) 4: 144. 1840.]

Key to the Species.

Flowers polygamo-dioecious; filaments subulate or filiform, nearly alike or some slightly dilated at base; embryo axial
- Ocreae fringed with a few bristle-like cilia. 1. *P. ciliata.*
- Ocreae naked.
  - Leaves 1–5 mm. broad.
    - Achenes rhomboidal; leaves filiform-subulate. 2. *P. brachystachya.*
    - Achenes ovoid or oblong-ovoid; leaves wedge-shaped or spatulate.
      - Stems branched above; outer calyx-segments not reflexed. 3. *P. gracilis.*
      - Stems diffusely branched at the base; outer calyx-segments reflexed. 4. *P. polygama.*
  - Leaves 5–25 mm. broad. 5. *P. macrophylla.*

Flowers perfect; filaments dissimilar, the inner conspicuously dilated; embryo near one of the faces of the endosperm.
- Annual; outer calyx-segments not reflexed, the inner not becoming conspicuously larger than the outer. 6. *P. articulata.*
- Perrennial; outer calyx segments reflexed; the inner developing large wings. 7. *P. Americana.*

1. POLYGONELLA CILIATA Meisn. in DC. Prodr. 14: 81. 1856.

Vicinity of the Manatee river, Florida.

As late as the year 1894 there seems to have been only one collection of the above species; this was Rugel's 429, on which

Meisner based the species. In August, 1895, Mr. Nash collected specimens at Palmetto, Manatee county, Florida (no. 2429). This second station is in the vicinity of the original station. The geographic range of *Polygonella ciliata* seems to be very restricted.

2. Polygonella brachystachya Meisn. in DC. Prodr. **14**: 80. 1856.

Polygonella Croomii Chapm. Fl. S. States, 387. 1860.

As far as I can see, these two species must be united. Having the types of both at hand I cannot find any distinctive characters and in addition the labels show that *Polygonella Croomii* is from "South Florida," and not from "Carolina or Georgia," as Dr. Chapman records in the Flora of the Southern United States.

3. Polygonella gracilis (Nutt.) Meisn. in DC. Prodr. **14**: 80. 1856.

Polygonum gracile Nutt. Gen. **1**: 256. 1818.

Polygonum setaceum Nutt.; Meisn. in DC. Prodr. **14**: 80. 1856.

Sand hills, South Carolina to Florida and Louisiana.

4. Polygonella polygama (Vent.) A. Gray, Bost. Journ. Nat. Hist. **5**: 231. 1847.

Polygonum polygamum Vent. Hort. Cels, *pl. 65*. 1800.

Polygonella parviflora Michx. Fl. Bor. Am. **2**: 241. 1803.

Atraphaxis dioica Bosc; Meisn. in DC. Prodr. **14**: 80. 1856.

Polygonella parvifolia var. *subenervis* Meisn. in DC. Prodr. **14**: 80. 1856.

Dry, sandy soil near the coast, from North Carolina to Florida.

5. Polygonella macrophylla n. sp.

Perennial (?), stoutish, glaucous, glabrous. Stem solitary, erect, 8 dm. tall, simple below, branched above; leaves obovate or oblanceolate, 2–6 cm. long (sometimes shorter on the branchlets), obtuse, 3–5-nerved, leathery, exceeding the internodes except on the upper part of the stem; ocreae cylindric, slightly oblique, not pointed, increasing in length toward the upper part of the stem; racemes very dense, 2–3 cm. long, disposed in ovoid panicles; ocreolae funnelform, densely imbricated, slightly pointed; pedicels jointed at the middle; calyx (flowering stage not seen), the outer segments slightly accrescent, the inner developing wings; filaments subulate, somewhat dilated at the base; style 3-parted to the base; wings oblong, 4 mm. long; achene 3-angled, narrowly oblong, acuminate at both ends, 4 mm. long, brown.

"Sandhills near the coast, Florida, A. W. Chapman."

Strikingly different from anything heretofore described in the genus but related to *Polygonella polygama.* It differs from all its relatives in its stout build, wand-like stem and remarkably large leaves for the genus.

6. POLYGONELLA ARTICULATA (L.) Meisn. Gen. 2: 228. 1836-43.

Polygonum articulatum L. Sp. Pl. 363. 1753.

Sandy beaches along the Atlantic coast from Maine to Florida and along the Great Lakes.

7. POLYGONELLA AMERICANA (F. & M.) Small, Mem. Torr. Club, 5: 141. 1894.

Gonopyrum Americanum F. & M. Mem. Acad. St. Petersb. (VI.) 4: 144. 1840.

Polygonella ericoides Engelm. & Gray, Bost. Journ. Nat. Hist. 5: 230. 1847.

Polygonella Meisneriana Shuttlw.; Meisn. in DC. Prodr. 14: 81. 1856.

Sandy soil, Missouri to Georgia, south to Alabama and Texas.

With the two excellent specimens from which Meisner drew his original description, to compare with a generous supply of *Polygonella Americana* and observations in the field, I cannot separate *Polygonella Meisneriana* from *P. Americana.* There may be two species in what is now included in the latter species, but the separation must be on different lines.

THE GENUS WAREA.

I have always been impressed with the remarkably inconsistent descriptions that have been applied to the plant we have known as *Warea amplexifoliia.* The discovery, by Mr. Nash, of a third species of *Warea* in western Florida renewed my interest in the group and led me to investigate it. The facts seem to be as follows: In 1822 Nuttall described *Stanleya? amplexifolia,** founding the species on a specimen from eastern Florida. This plant had amplexicaul leaves. In 1834 Nuttall founded the genus

* Am. Journ. Sci. 5: 297.

Warea,* making the type a *Warea amplexifolia* founded on a plant from western Florida. This plant had sessile leaves, according to the author and his plate. Nuttall was not as shrewd as usual, and failing to see that his *Warea amplexifolia* was different from *Stanleya amplexifolia*, combined the original description of *Stanleya amplexifolia* with that of *Warea amplexifolia*; this blunder has been followed to the present day and consequently the ambiguous descriptions.

The plant from eastern Florida has been represented in our herbaria by good and ample specimens while only a few fragments of the west Florida plant seem to be extant, but now that we are furnished with excellent material the specific lines appear very distinct. I append a synopsis of the genus.

WAREA Nutt. Journ. Acad. Phila. 7: 83. *pl. 10.* 1834.

Key to the Species.

Leaves narrowly cuneate at the base; claws of the petals pectinate-fimbriate. 1. *W. cuneifolia.*

Leaves rounded or auricled at the base.

Leaves sessile, not auricled at the base; claws of the petals granular-toothed. 2. *W. sessilifolia.*

Leaves clasping, auricled at the base; claws of the petals serrulate. 3. *W. amplexifolia.*

1. WAREA CUNEIFOLIA (Muhl.) Nutt. Journ. Acad. Phila. 7: 84. 1824.

Cleome cuneifolia Muhl. Cat. 61. 1813.

Stanleya gracilis DC. Syst. 2: 512. 1821.

Cleome laevigata Soland.; DC. Syst. 2: 512. As synonym. 1821.

Sand hills, Georgia to Florida, near the coast.

2. WAREA SESSILIFOLIA Nash, Bull. Torr. Club. 23: 101. 1896.

Warea amplexifolia Nutt. Journ. Acad. Phila. 7: 83. *pl. 10.* 1834. Not *Stanleya amplexifolia* Nutt.

Sandhills, West Florida at about 100 feet above sea-level.

3. WAREA AMPLEXIFOLIA (Nutt.)

Stanleya amplexifolia Nutt. Am. Journ. Sci. 5: 297. 1822.

Sand hills, East Florida, near sea-level.

CARDAMINE ARENICOLA Britton, Bull. Torr. Club, 19: 220. 1892.

This has been found by Prof. Scribner growing in sand and

* Journ. Acad. Phila., 7: 83. *pl. 10.*

shaly soil about Knoxville, Tennessee. It is also plentiful in the sandy summit of Little Stone Mountain, Georgia.

EUPHORBIA HUMISTRATA Engelm.; A. Gray, Man. Ed. 2. 386. 1856.

The known geographic ranges of the above species has lately been greatly extended southward by collections from Mississippi Professors. Tracy and Earle found it on Horn Island (2886) and at Biloxi (2913).

The name *Gatesia* cannot be applied to the Acanthaceous genus of the southern United States, with which it has lately been associated, having previously been used for an entirely different plant. I take pleasure in using in this connection the name of Prof. W. S. Yeates, State Geologist of Georgia, for while on his survey I first met this rare and peculiar species along the Flint river, in southwestern Georgia. Previously it had not been known to occur east of Alabama.

YEATESIA.

[GATESIA A. Gray. Proc. Am. Acad. 13: 365. 1878. Not Bertol. 1848.]

YEATESIA LAETE-VIRENS (Buckl.).

Justicia laete-virens Buckl. Am. Journ. Sci. 45: 176. 1843.

Rhytiglossa viridiflora Nees, in DC. Prodr. 11: 346. 1847.

Dicliptera Halei Ridd. New Orleans Med. Journ. 1852.

Gatesia laete-virens A. Gray, Proc. Am. Acad. 13: 365. 1878.

Justicia viridifolia Buckl.; Nees in DC. Prodr. 11: 346. As synonym. 1847.

Tennessee to Georgia, Florida and eastern Texas.

VIBURNUM RUFOTOMENTOSUM.

Viburnum prunifolium var. *ferrugineum* T. & G. Fl. N. A. 2: 15. 1841.

Viburnum ferrugineum Small, Mem. Torr. Club, 4: 123. *pl.* 78. 1894. Not Raf. 1838.

Viburnum prunifolium is said to grow as far south as Mississippi and Florida, but during all my travels in the Southeast I have not met with the species. *Viburnum rufotomentosum* seems to replace our common plum-leaved *Viburnum* in the Southern States. The most southern station at which I have collected *V. prunifolium* is Salisbury, North Carolina.

New Species of Fungi.

By Chas. H. Peck.

Lepiota mutata.

Pileus thin, convex, subumbonate, slightly scabrous on the disk, white, changing to brown on the disk in drying; lamellae close, thin, subventricose, free, white; stems slender, equal, hollow, white; the annulus slight, sometimes evanescent; spores elliptical, .0003 to .0004 in. long, .0002 to .00024 broad; pileus 1 to 1.5 in. broad; stem about 1 in. long 1 to 2 lines thick.

Ground in woods. Kansas. July. E. Bartholomew.

In the fresh condition this plant is entirely white, but in the dried specimens the umbo or disk has become brown. This change in color suggests the specific name. In the other white species, *L. erminea* and *L. alba*, the spores are longer, and in *L. Miamensis* and *L. subremota* the pileus is scaly.

Clitocybe subsocialis.

Pileus fleshy, convex, becoming somewhat depressed centrally, minutely squamulose, pale tawny or subrufescent, flesh white, taste and odor nauseous; lamellae subdistant, decurrent, white, the interspaces venose; stem equal, solid, colored like the pileus, having a white mycelioid tomentum at the base; spores subelliptical, .00024 to .0003 in. long, .00016 to .0002 broad, slightly apiculate at one end and usually containing a shining nucleus; pileus 6 to 18 lines broad; stem 1 to 2 in. long, 1 to 2 lines thick.

Grassy ground. Camas, Washington. December. F. C. Yeomans.

The species is apparently closely allied to *Clitocybe socialis*, from which it differs in its strong odor, squamulose pileus and white lamellae. It also approaches *C. sinopica* and *C. infundibliformis* in color, but in both these the pileus is also glabrous. The squamules are somewhat granular in appearance.

Omphalia luteola.

Pileus thin, convex or sub-hemispherical, glabrous, centrally depressed or broadly umbilicate, buff-yellow; lamellae few, 10–15, distant, decurrent, pallid; stem slender, glabrous, solid, brown, with white mycelium at the base; spores subelliptical, .00024–.00028 in long, about .00016 broad, commonly uninucleate; pileus 2–4 lines broad; stem about 6 lines long, .5 thick.

Decaying wood of fir trees. Camas, Wash. February. Yeomans.

The small size, buff pileus solid stem and pallid lamellae are the distinguishing features of this species. It is closely related to *O. Campanella*, but the paler colors of the pileus and lamellae and the white mycelium will separate it. The stem appears to be solid, but it is possible that in fully mature specimens there may be a small cavity.

LACTARIUS LUTEOLUS.

Pileus fleshy, rather thin, convex or nearly plane, commonly umbilicately depressed in the center and somewhat rugulose, pruinose or subglabrous, buff color, flesh white, taste mild, milk copious, flowing easily, white or whitish; lamellae close, nearly plane, adnate or slightly rounded behind, whitish, becoming brownish where wounded; stem short, equal or tapering downward, solid, but somewhat spongy within, colored like the pileus; spores globose, .0003 in. broad; pileus 2–3 in. broad; stem 1–1.5 in. long, 3–5 lines thick.

Dry woods. East Milton, Massachusetts. August. H. Webster.

This species is related to *Lactarius volemus* and *L. hygrophoroides*, but its smaller size and short stem will distinguish it from the former and its close lamellae from the latter. Its paler buff color will separate it from both. Some specimens have a narrow encircling furrow or depressed zone near the margin and a slightly darker shade of color on the margin. The milk constitutes a remarkable feature of the species. According to the notes of the collector it is exceedingly copious, rather sticky, serous in character with white particles in suspension. It flows from many points as soon as the plant is disturbed and it stains the gills. It is impossible to collect an unstained specimen, so free is the flow of the milk. He says, "I have never succeeded in picking a specimen so quietly as to prevent an instant and copious flow of its milk."

RUSSULA SUBDEPALLENS.

Pileus fleshy, at first convex and striate on the margin, then expanded or centrally depressed and tuberculate-striate on the margin, viscid, blood-red or purplish red, mottled with yellowish spots, becoming paler or almost white with age, often irregular, flesh fragile, white, becoming cinereous with age, reddish under the cuticle, taste mild; lamellae broad, subdistant, adnate, white or whitish, the interspaces venose; stem stout, solid but spongy within, persistently white; spores white, globose, rough, .0003 in. broad; pileus 3–6 in. broad; stem 1.5–3 in. long, 6–12 lines thick.

Under a hickory tree. Trexlertown, Pennsylvania. June. W. Herbst.

Closely related to *Russula depallens*, from which it differs in having the margin of the pileus striate at first and more strongly so when mature, also in the pileus being spotted at first, the lamellae more distant, the stem persistently white and the spores white.

Marasmius gregarius.

Pileus submembranous, glabrous, centrally depressed or broadly umbilicate, striatulate when moist, bay-brown or pale alutaceous, a little darker in the center; lamellae narrow, subdistant, adnate, some of them branched, whitish; stem short, slender, inserted, hollow, flocculose or almost pubescent, pale bay-brown, a little darker toward the base; spores subglobose, about .00016 in. broad; plant gregarious; pileus 4 to 6 lines broad; stem 4 to 6 lines long, about .5 line thick.

Decorticated wood. Mammoth Cave, Kentucky. June. C. G. Lloyd.

Panus betulinus.

Pileus thin, suborbicular or dimidiate, nearly plane, glabrous, prolonged behind into a short stem, grayish-brown, darker or blackish toward the stem; lamellae narrow, close, decurrent, whitish; stem adorned with a slight tawny hairiness which is more fully developed toward the base; spores minute, .00016 to .0002 in. long, .00006 to .00008 broad.

Decaying wood of birch. Newfoundland. October. Rev. A. C. Waghorne.

Lentinus magnus.

Pileus thick, hard, convex, slightly depressed in the center, glabrous, dingy-white, the surface cracking into broad areolae or scales, margin involute, flesh whitish; lamellae broad, close, thick, slightly decurrent, coarsely dentate or lacerate on the edge, pallid; stem stout, hard, solid, squamose, slightly thickened at the base, colored like the pileus; spores oblong-elliptical, .0003 in. long, .00015 broad; pileus 6 in. or more broad, stem about 4 in. long, 1 in. or more thick.

Gregarious on ground abounding in humus. Mount San Antonio, California. August. Prof. A. J. McClatchie.

This large species was found at an elevation of 10,000 feet. It is well marked by the peculiar areolate and scaly cracking of the surface of the pileus. The scales of the stem are similar to those of the pileus. The lamellae are thicker than those of *Lentinus lepideus* and the spores are smaller. The scales are concolorous, not spot-like, as in that species.

Lentinus Underwoodii.

Pileus fleshy, tough, convex or nearly plane, the glabrous surface cracking into areola-like scales which are indistinct or wanting toward the margin, whitish or slightly tinged with buff or pale ochraceous, flesh white; lamellae moderately close, decurrent, slightly connected or anastomosing at the base, somewhat notched on the edge, whitish, becoming discolored in drying; stem stout, hard, solid, eccentric, squamose, colored like the pileus; spores oblong, .0005–.0006 in. long, .0002–.00025 broad; plant caespitose; pileus 3–6 in. broad; stem 1.5–3 in. long, about 1 in. thick.

Wood of oak. Tuskegee, Alabama. July. Prof. L. M. Underwood.

This differs from *L. magnus* in its caespitose habit, eccentric stem, longer spores, less distinctly areolate-squamose pileus and in its habitat. The lamellae are connected at the base very much like those of *Pleurotus ostreatus*.

Lentinus ventricosus.

Pileus fleshy, nearly plane above, glabrous, shining, white, the thin margin involute, flesh whitish; lamellae narrow, close, decurrent, serrate on the edge, whitish; stem short, thick, ventricose, smooth, solid, abruptly narrowed or pointed at the base, annulate, white, tinged within with isabelline; spores .0004 to .0005 in. long, .0002 to .00024 broad; pileus 4 to 6 in. broad; stem 1.5 to 2 in. long, nearly as broad in the thickest part.

Auburn, Alabama. December. Underwood.

A species well marked by its white glabrous pileus and its short ventricose annulate stem.

Pholiota sabulosa.

Pileus convex or nearly plane, glabrous, pale yellowish-brown; lamellae adnate, subdistant, yellowish-brown; stem short, equal or slightly tapering downwards, hollow, colored like or a little paler than the pileus, paler above the slight subevanescent annulus; spores subelliptical, brownish-ferruginous, .0003 to .0004 in. long,

.0002 to .00024 broad; pileus 9 to 12 lines broad; stem about 1 in. long, 1 to 2 lines thick.

Sandy soil. Alabama, December. Underwood.

In the dried specimens the pileus is pale-tawny and the lamellae are brownish ferruginous.

Flammula Underwoodii.

Pileus convex or nearly plane, often irregular from its crowded mode of growth, squamulose or furfuraceous, yellowish-brown; lamellae rather broad, close, adnate or slightly decurrent, yellow; stem tapering downward, radicating, longitudinally streaked with brownish hues, yellow at the top; spores elliptical, ochraceous, .00024 to .0003 in. long, .00016 to .0002 broad; plant caespitose; pileus 1 to 4 in. broad; stem 2 to 4 in. long, 3 to 6 lines thick.

Pine trunks. Alabama, November. Underwood.

The species is apparently related to *Flammula sapineus*, from which its densely caespitose habit and brownish streaked stem will easily separate it.

Galera semilanceata.

Pileus membranous, acutely conical or campanulate, often sharply umbonate, glabrous, sulcate-striate, pale-yellow or buff; lamellae rather broad, ascending, distant, adnate, tawny-ferruginous when mature; stem slender, glabrous, hollow, pallid; spores elliptical, ferruginous, .0004 to .0005 in. long, .0002 to .00024 broad; pileus 4 to 6 lines broad; stem 1.5 to 2 in. long, .5 to 1 line thick.

Among fallen leaves, sticks, mosses, etc. Washington. December. Yeomans.

Mr. Yeomans remarks that this plant in size, shape and color corresponds very closely to Cooke's figure of *Psilocybe semilanceata*, but that the spores have a dark yellow-ochre color. The umbo when present is small and almost papilla-like.

Tubaria tenuis.

Pileus membranous, hemispherical or convex, obtuse or sub-umblicate, glabrous, hygrophanous, reddish-cinnamon when moist, cream color or pale-ochraceous when dry, either faintly striate or sulcate-striate on the margin; lamellae 1–2 lines wide, distant, ventricose, adnate or slightly decurrent, tawny-ochraceous; stem slender, flexuous, often uneven, hollow, pruinose at the top, downy at the base, pale-yellow or cream color; spores elliptical,

.0003 in. long, .0002 broad; pileus 4–8 lines broad; stem 1–2 in. long, about 1 line thick.

Among mosses on gravelly hillsides. Pasadena, California. January. McClatchie.

This species is variable and somewhat ambiguous between *Naucoria*, *Galera* and *Tubaria*, but the attachment of the lamellae indicates a close relationship to the genus *Tubaria*. From *Naucoria melinoides*, which it much resembles, it may be separated by its paler stem and smaller spores and by the tendency of the pileus to become centrally depressed or umbilicate. From *Naucoria pygmaea* and *Galera pygmaeo-affinis* it may be distinguished by its yellowish stem and adnate or decurrent lamellae.

Cortinarius intrusus.

Pileus fleshy, rather thin, convex, then expanded, glabrous, somewhat viscid when moist, even or radiately wrinkled on the margin, yellowish or buff, sometimes with a reddish tint, flesh white; lamellae thin, close, rounded behind, at first whitish or creamy white, then cinnamon, often uneven on the edge; stem equal or slightly tapering either upward or downward, stuffed or hollow, sometimes beautifully striate at the top only or nearly to the base, minutely floccose when young, soon glabrous, white; spores broadly elliptical, brownish cinnamon, .00024 to .0003 in. long, .00016 to .0002 broad; pileus 1–2.5 in. broad; stem 1–3 in. long, 3–6 lines thick.

Mushroom beds, manured soil in conservatories or in plant pots. Boston, Massachusetts. R. Macadam. Haddonfield, New Jersey. C. McIlvaine.

This interesting species is closely allied to *Cortinarius multiformis* and belongs to the Section Phlegmacium. It has a slight odor of radishes and is pronounced edible by Mr. McIlvaine. Its habitat is peculiar, but it possibly finds its way into conservatories and mushroom beds through the introduction of manure or soil, or leaf mold from the woods. It seems strange, however, that it has not yet been detected growing in the woods or fields. *Hebeloma fastibile* is said sometimes to invade mushroom beds, and our plant resembles it in so many particulars that it is with some hesitation that I separate it. The chief differences are in the stem and spores. The former, in *Hebeloma fastibile*, is described as solid and fibrous-squamose and the latter as 10x6 micromillimeters in size. The brighter color of the smaller spores and the stuffed or hollow smooth stem of our plant will separate it from this species.

Hypholoma atrofolium.

Pileus submembranous, at first convex or hemispherical, then broadly convex, commonly umbonate, minutely and irregularly furrowed, striate to the apex when mature, hygrophanous, burnt-umber or wood-brown when moist, fading to pale-tawny or cream color in drying, veil fugacious; lamellae subdistant, adnate, at first pale-brown or drab, then dark seal-brown, almost black; stem slender, fibrillose, hollow, pallid or cream color; spores very dark-brown, elliptical, .0004 in. long, .0002 broad; pileus 9–24 lines broad; stem 1–2.5 in. long, 1–1.5 lines thick.

Among bushes. Pasadena. January. McClatchie.

The plants are gregarious or loosely caespitose. The lamellae, when mature, are almost black, and on this account the species might be sought in the genus *Psathyrella*, but the form of the pileus indicates a closer relationship to the genus *Hypholoma*. Its hygrophanous character places the species in the section Appendiculata. In some respects it approaches *H. hymenocephalum*, from which its convex pileus, less close and darker colored lamellae and longer spores will separate it.

Psathyrella gracillima.

Pileus membranous, convex or nearly plane, finely striate nearly to the disk, subhyaline, bluish-white with a pinkish tint, the disk yellow and commonly depressed; lamellae thin, close, rounded behind and adnexed or nearly free, light slate color when young, becoming black or variegated with black; stem slender, elongated, erect, hollow, whitish or cream colored; spores oblong-elliptical, pointed at one end, .00055 to .0006 in long, .00024–.0003 broad; pileus 6 to 18 lines broad; stem 3–5 in. long, about 1 line thick.

Damp ground among weeds. Kansas. July. Bartholomew.

The notes of the collector describe the spores as dark brown, but they appear to me when viewed by reflected light to be black. The plant is very graceful and fragile. Its relationship seems to be with such species as *Psathyrella hiascens*, *P. trepida* and *P. hydrophora*, from all of which it may be separated by the attachment of the lamellae. The depressed disk suggests *Coprinus plicatilis*, but the specimens give no evidence of the deliquescence of the lamellae.

Psathyrella debilis.

Pileus membranous, campanulate, umbonate, finely striate nearly to the umbo, subhyaline, whitish, becoming grayish; lamellae thin, narrow, close, adnate, whitish when young, becoming black; stem slender, weak, flexuose, never erect, hollow, white; spores broadly elliptical, .0005 in. long, .0003 broad; pileus 6–15 lines broad; stem 2–3 in. long, 1–1.5 line thick.

Damp ground attached to decaying stems. Kansas. July. Bartholomew.

The plants are suggestive of *Psathyra gyroflexa*, but they differ in the umbonate pileus, the larger spores and in having no purplish tint to the lamellae.

Boletinus appendiculatus.

Pileus fleshy, convex, glabrous, ochraceous-yellow, the margin appendiculate with an incurved membranous veil, flesh pale-yellow, unchangeable; tubes rather small, yellow, their mouths angular, unequal, becoming darker or brownish where wounded; stem solid, slightly thickened at the base, yellow; spores pale-yellow, oblong, .0004 to .0005 in. long, about .00016 broad; pileus 4 to 8 in. broad; stem 2 to 3 in long, 4 to 6 lines thick.

Under or near fir trees. Washington. September to December. Yeomans.

Boletus tabacinus.

Pileus fleshy, convex or nearly plane, subglabrous, often rimose-areolate, tawny-brown, flesh at maturity soft and similarly colored; tubes concave or nearly plane, depressed around the stem, their mouths small, angular, colored like the pileus; stem subequal, solid, reticulated, concolorous; spores oblong or subfusiform, .0005 to .00055 in. long, about .0002 broad; pileus 2.5 to 5 in. broad; stem 1.5 to 3 in. long, 6 to 10 lines thick.

Along roadsides. Alabama. May. Underwood.

The species is referable to the section Calopodes, but the tubes are more or less depressed about the stem. It is well marked by its color which is some shade of brown or tawny-brown throughout, inclining at one time toward wood-brown, isabelline-brown or broccoli-brown, at another toward sepia-brown. The flesh in the dried specimens appears a little darker than the surface of the pileus. It is almost tomentose in texture.

Polyporus Bartholomaei.

Pileus thin, rather soft but tough, obovate or subspathulate, azonate, unpolished, thin on the margin, narrowed behind into a flattened stem-like base, whitish; pores small, short, subrotund, decurrent, whitish; pileus 6–10 lines broad, about 1 line thick.

Decaying sticks and chips on damp ground. Kansas. July. Bartholomew.

This plant resembles *Polyporus humilis* in size, color and general appearance, but it differs from it in texture. The notes of the collector say that the pileus is hygrophanous. In the dried specimens its upper surface appears almost as if minutely tomentose or velvety pubescent. The margin beneath is sterile.

Tylostoma punctatum.

Peridium subglobose, flattened and umbilicate at the base, the external peridium falling away above, persistent at the base, the internal peridium papery but rather firm and tough, minutely and irregularly punctate-pitted, whitish, the mouth slightly prominent, small, lacerated; stem cylindrical, obscurely squamose or rimose-squamose, sulcate-striate above, hollow, subferruginous, white within; spores pale-ferruginous, globose, minutely warted or roughened, .00016 to .0002 in. broad, the threads of the capillitium hyaline, sparsely branched, .0003 to .0004 in. broad, broader than the spores, the ends obtuse or subtruncate, occasionally thickened; spores globose, .00016 to .0002 in. broad; plant 1 to 1.5 in. high, peridium 5 to 6 lines in diameter; stem about 2 lines thick.

Sandy ground in pastures. Kansas. July. Bartholomew.

The peculiar character of the species is in the minute punctate pits or impressions in the inner peridium. These are somewhat scattered and unequal and are similar to those seen in the seed coat of some species of *Lithospermum*. I find no mention of such a character in any of the published species.

Clavaria platyclada.

Clubs caestipose, more or less connate at the base, simple or forked, rarely with one or two irregular branches, solid, compressed, tapering below into a whitish base, canary yellow, white within, the tips flattened, obtuse, becoming brownish with age; spores globose, .0002 to .00024 in. broad. Tufts 3 to 4 in. high; clubs 2 to 4 lines wide, scarcely more than 1 line thick.

Woods. Maine. September. Harriet C. Davis.

The species is closely allied to *Clavaria fusiformis*, from which it is separated by its solid, obtuse, compressed and often forked or branched clubs tapering below into a whitish base.

Peziza odorata.

Cups .5 to 3 in. broad, gregarious or scattered, thin, sessile, rather brittle when fresh, shallow expanded or even convex from the decurving of the margin, at first brownish, then white or whitish, the hymenium ochraceous-brown; asci cylindrical, opening by a lid, .01 to .012 in. long, .0006 to .0008 broad, paraphyses filiform, obscurely septate, slightly thickened at the tips; spores elliptical, even, .0008 to .0009 in. long, .0004 to .0005 broad.

Ground in a cellar. Maine. June. F. L. Harvey.

The plant when fresh has a peculiar fungoid odor suggestive of that of chestnut blossoms. The species is apparently allied to *P. Petersii*, from which it may be distinguished by its larger spores and distinct but peculiar odor. The spores also are not binucleate, as in that species. In drying, the hymenium is apt to become blackish.

Slerotinia infundibuliformis.

Cups thin, regularly infundibuliform, glabrous, stipitate, rugose, bay-brown; hymenium even, bay-brown; stem long, slender, flexuous, attenuated downwards, colored like the cup, sometimes a little darker toward the base, growing from a small wrinkled black sclerotium; asci cylindrical, 8-spored, .005–.006 in. long, .0004–.0005 broad; spores elliptical, .0005 in. long, .00025 broad; paraphyses filiform, slightly thickened at the apex; cups 3–4 lines broad and high; stem about 6 lines long.

Wet woods. Newfoundland. August. Waghorne.

Further Observations on Antidromy.

By George Macloskie.

It was shown in the Bulletin of last year (p. 389, 466), by examples drawn from a large number of orders of Phaenogams, that there are probably two castes, a dextrorse and a sinistrorse, of every species. This "antidromy" was also traced generally to a diversity of the embryo in the seed, depending on whether it grows on one or other margin of a carpellary leaf. A further explanation, then only suggested, proves to hold in many cases: namely, that a forking rootstock produces antidromic plants on the two branches of the fork. This last explanation applies to such cases as *Richardia*, *Podophyllum*, *Nuphar*, *Helonias*, *Chaemae-*

lirium and many other Liliaceae, and *Carex* (whose tussocks, arising from a common stock, consist of relatively antidromic plants). This fact may have a bearing on the problem of homology of seeds and root-buds, and may suggest a diversity between subterranean and ordinary cauline buds.

During the past summer I have enlarged my range of observations on this subject by help of the great botanical gardens and museums of Europe, and have found light on some difficult points.* Among the numerous additional evidences of antidromy I may cite many Cactaceae (as *Mammillaria*), *Tamarix Gallica*, Screw Pines (*Pandanus utilis*, etc.). and generally the palms. Dr. Urban, of the Berlin Botanische Museum, has published papers on the spirally twisted fruits of species of *Medicago*, and of certain genera of Loasaceae. His monograph of the genus *Medicago* shows that most of the species have a sinistrorse twist, a few (as *M. tuberculata*) mostly dextrorse; and he knows of no clear case of one individual plant having two kinds of twists among its fruits. These results on the whole harmonize with the general rule of antidromy; and they seem to be well established by his large collection of specimens which he kindly showed me. I also examined living specimens of this genus in the Botanische Garten, but failed to correlate the spirality of the fruits with the phyllotaxy of the plant which bare them: this failure was due to the difficulty of deciding the order of phyllotaxy of such straggling plants. His paper on *Loasaceae* brings out the interesting facts that in some of the species the fruits are spirally twisted, the direction of the twisting being either one for a species (several species of *Cajophora*), or constant in a genus (*Blumenbachia*) and dextrorse or locally specialized, all the plants from one locality being alike, but different for the same species between different localities (*Sclerothrix*); or the fruits following one another in one specimen may be antidromic (species of *Cajophora*).

* I beg to express my thanks for courtesies extended by the officers of Kew Gardens, England; of the Jardin des Plantes, Paris; by Mr. F. A. Bather, of the Natural History Museum, London; Herr Otto Müller, of the Botanische Garten of the University of Strassburg; and Dr. Ign. Urban, of the Museum der Koenigl. Botan. Garten of Berlin. I may explain that in quoting Dr. Urban I render his word "dextrorse" by "sinistrorse" and conversely, so as to turn his terminology into conformity with our method of designating the spiral thread of a common screw as "dextrorse."

Of these plants I examined the living *Blumenbachia hieronyma* Urb., and found that whilst all its fruits were dextrorsely twisted, as he had stated, its foliage shows true antidromy. Though the leaves are opposite, only one of a pair bears an axillary pedicel, and in some plants the leaves having a pedicel form a dextrorse, in others a sinistrorse spiral. Thus the plant is found to have antidromy in its foliage, and monodromy of its carpels. (In other cases, *e. g.*, *Impatiens*, and *Prosopis* carpels as well as foliage are antidromic and very frequently the anthotaxy, or order of growth of the components of an inflorescence, is antidromic.)

There are very many torsions in plants which have no relation to antidromy, and which are usually constant in all individuals of a species; as is Convolvulus, Hop, etc. *Canna* proves to be of this kind; its numerous species and many thousands of specimens growing in the Jardin des Plantes, all have the young leaves *directly* enfolded (that is clock-wise); *Musa* is similar, but the case is different with *Aloe*, as all its young leaves are folded in the same direction in one plant, but antidromically as between different plants.

The trunks of the Horse Chestnut, and of Catalpa, are always twisted dextrorsely; this is best seen in old trees, and is very obvious in the miles of old trees of Horse Chestnut, which extend from St. Cloud towards Versailles. Each trunk is fluted and strengthened by rounded pilasters representing the continuation downwards of the large branches, and always dextrorsely twisting. As the leaves are opposite, we cannot readily determine the order of phyllotaxy. But the seeds even when viewed from the outside are easily seen to be of two kinds, the radical of one turning towards your right, of the other towards your left. Even the small winged seeds of *Catalpa* have a mark which betrays the diversity; and also the opposite leaves of *Jacaranda obtusifolia* H. B.K., of the same Bignoniaceous order with *Catalpa*, has its opposite leaves arranged in spiral orthostiches, which leave no doubt as to the antidromy.

The leaf-scars and cone-spirals of Gymnosperms conclusively prove their title to a place in the realm of antidromy, not only the pines and araucarias, but the various genera of Cycads, as *Cycas*, *Zamia*, *Ceratozamia*, *Encephalartos*, are uniformly antidromic (the peculiar habit of Gnetaceae obscures the evidence with them). Of still greater interest were the coal-plants and the modern tree-ferns. In the South Kensington Museum of Natural History I found *Lepidodendron Sternbergii* and *Sigillaria tesselata* clearly antidromic, the leaf scars forming different spirals, and sinistrorse and dextrorse specimens of each being seen. Of the fruits of *Palaeoxyris carbonaria* some were twisted in one way, some in the other way. The fact that some of the fossils have regularly bilateral markings received a curious illustration from the tree-ferns. We have in Princeton a piece of fern-stem (an *Alsophila*) with its scars absolutely symmetrical. But in Kew Gardens Museum and in one of the greenhouses in Paris I saw tree ferns (*Cyathea Schauschii* Mart. and *Alsophila Brunoniana* Wall.) having about 10 feet of the lower part antidromic, that is dextrorse and sinistrorse in different plants, and the upper part of the same stems closely beset with symmetrically placed scars. This shows how the primitive antidromy may become exhausted, and may disappear, or even as in *AEsculus*, may be overlaid by a different kind of spirality subsequently acquired.

I should add that Herr Otto Mueller of the University Gardens of Strassburg informed me that he has often observed the duplex order of phyllotaxy, though he had never seen any reference to this in print.

PRINCETON, September 29, 1896.

Botanical Notes.

Coleosporium Campanulae (Pers.) Winter. While visiting at Earlville, Madison county, N. Y., the present summer, I found the common *Campanula rapunculoides* everywhere covered with this fungus, which does not seem to have been reported from this country, although it is common in Europe on this and other members of the *Campanulaceae*. Subsequently Mr. F. L. Stevens has sent me some of the same fungus collected at Jamesville, Onondaga county, N. Y. It is likely to be found elsewhere as soon as attention is called to it. L. M. UNDERWOOD.

Notes from Binghampton, N. Y. During the present year the botany of this section has been enriched by the discovery of several plants new to the region, and by the addition of several interesting facts regarding more common ones.

On May 31, 1896, I found a considerable amount of the mouse-ear hawkweed (*H. Pilosella* L.) growing on a dry bank near New Milford, Susquehanna county, Pa. The plant is reported to be not uncommon in that locality.

A dry wooded hill within the city limits of Binghampton, yielded an abundance of *Silene antirrhina divaricata* Robinson, in July.

Linnaea borealis was found on July 4, 1896, at Killawog, Broome county, N. Y., altitude, 1050 feet. The plant is reported from several points in this latitude, but so far as I am aware, always from higher elevations.

On the 12th of July 1896, a large swamp filled with *Woodwardia Virginica* was noted ten miles north of Binghamton. This fern is very rare in this part of the Susquehanna Valley. The only other station known to me was found by Mr. James A. Graves at Susquehanna, Pa.

Orontium aquaticum, previously known to grow here, has been found in much larger quantities in a swamp. On the borders of certain small lakes in the territory south of us, this plant is very abundant, but in all situations where it grows the fact that it is an introduced species seems apparent.

The corn-speedwell (*Veronica arvensis*) has become quite a weed in cultivated grounds. It differs from the usual *V. arvensis* in producing deep blue blossoms.

The stipules of *Porteranthus trifoliatus* are supposed to be small and awl-shaped, but in this locality specimens are common with ovate-lanceolate incised stipules three-quarters of an inch in length.

Ranunculus repens, which occurs occasionally in wet places, has taken up its abode in several lawns about the city. In such situations the leaves are white-spotted and close to the earth and the stems are flat on the ground and root at every joint. The whole plant is so low that the lawn mower will not touch it, and in consequence is hard to eradicate. WILLARD N. CLUTE.

Cleome serrulata spreading eastward.—This western species has now obtained a foothold east of the Mississippi River. I have noticed scattering plants for several years past, growing on the sandy banks of the above river at Rock Island, Ill., and apparently perfectly at home. A botanical friend informs me that it has crossed the river and become well established at East St. Louis, Ill. This showy plant will make a charming addition to our way-side denizens.
FRANK E. McDONALD.

Asplenium ebenoides, the rarest of our ferns, has recently been collected by me at Blacksburg, Va. My field notes are published in the October number of the "Linnaean Fern Bulletin."
W. ALPHONSO MURRILL.

Proceedings of the Club.

TUESDAY EVENING, OCTOBER 13th, 1896.

Vice-President Lighthipe occupied the chair and there were 33 persons present.

The following were elected active members:

Mrs. George Such, South Amboy, N. J.

Mrs. Edward C. Bodman, 835 Madison Ave., N. Y. City.

Miss Olive M. Ewing, Long Branch City, N. J.

Prof. L. M. Underwood, Columbia University.

Dr. A. Emil Schmidt, 448 East 59th St.

Prof. Francis E. Lloyd, Forest Grove, Oregon.

Mr. J. A. Lindbo, Stanton, Nebraska.

Mr. Martin Bimbaum, 939 2d Ave., N. Y. City.

Dr. Britton reported for the Field Committee that the field meetings during July and August, which during previous years had been unsuccessful as regards attendance, have this year been entirely successful.

Miss Ingersoll reported for the Herbarium Committee that a number of specimens had long needed mounting and placing in the herbarium. After discussion, it was unanimously resolved that the sum of ten dollars should be appropriated to pay for this work.

Dr. Britton spoke of the numbers of the BULLETIN which were out of print and stated that this want interfered with filling orders for sets of that journal. He had thought of offering the early volumes of the MEMOIRS to the more recently elected members, to complete their files, at a reduced rate, the proceeds to go toward the reprinting of missing BULLETIN numbers. The proposition was discussed by Judge Brown. It appeared that about $200 would be required for this purpose. It was unanimously resolved that the editor be authorized to exercise his judgment about carrying out the proposed plan.

The regular program of the evening was then taken up.

Judge Addison Brown, "Notes from Connecticut;" Miss Helen M. Ingersoll, "Notes from the Palisades;" Dr. J. K. Small, "Notes from the Southern Alleghenies;" Rev. L. H. Lighthipe, "Notes from Florida;" Dr. H. H. Rusby, "Notes from Venezuela." Dr. Rusby also exhibited specimens of fruits preserved fresh and unaltered by the use of formalin. Prof. Lucien M. Underwood remarked upon fern collecting in Florida and Alabama. Dr. Britton spoke of his summer's work, which had included but a small amount of field observation, but had consisted chiefly in the proof-reading of the *Illustrated Flora* and in perfecting the plans for the Botanical Garden. He exhibited some diagrams showing tentative plans for the large greenhouse. Mrs. Britton spoke of her observations and collections in Pennsylvania and in the Adirondacks.

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POTENTILLA SUBJUGA RYDB.

1–5 POTENTILLA TENERRIMA RYDB. 6–10 P. MINUTIFOLIA RYDB.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

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BULLETIN

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Vol. 23. Lancaster, Pa., November 25, 1896. No. 11.

Notes on Potentilla.—V.

BY P. A. RYDBERG.

(PLATES 276, 277.)

The *Subviscosae* is a small group of low plants with many more or less spreading branches from the caudex, with a silky or hirsute pubescence, often intermixed with almost sessile glands, but not at all tomentose; with digitate leaves of 5–7 leaflets, and in fruit, with incurved sepals which enclose the large, but comparatively few achenes. The petals are more or less contracted at the base, *i. e.*, semi-unguiculate, although indistinctly so in *P. Wheeleri*.

POTENTILLA WHEELERI Wats. Proc. Am. Acad. 11: 148. 1876.

The pubescence is quite densely silky, and the typical form is apparently without glands. The leaflets are obovate and crenate at the rounded summit, 1–1.5 cm. long. The petals are obcordate, slightly contracted at the base, and a little exceed the calyx. It has been collected in southern California, Arizona and northern Mexico. A form connecting it with the next may be regarded as a variety or perhaps as a distinct species. It may be known for the present as

POTENTILLA WHEELERI VISCIDULA n. v.

Subcaespitose, rather hirsute with spreading hairs, somewhat glandular-granuliferous on the calyx, pedicel, etc.; leaflets shorter and broader, generally less than 1 cm. long.

The following specimens have been seen:

Arizona: C. G. Pringle, 1881; J. G. Lemmon, no. 158. 1881.

California: W. G. Wright, 1879; Coville & Funston, no. 1672. 1891.

Pringle labelled his specimens *Potentilla subviscosa* Greene (near *P. Wheeleri* Wats.). I think, however, that it should be referred to *P. Wheeleri* rather than to *P. subviscosa*, as it does not have the dissected leaves and the subunguiculate petals of *P. subviscosa.*

POTENTILLA SUBVISCOSA Greene, Bull. Torr. Bot. Club, **8**: 97. 1881.

Differs from *P. Wheeleri* in the leaflets, which are deeply cleft into oblong divisions, and the middle one often 3-divided to near the midrib, in the petals which are more or less plainly unguiculate and about one-half longer than the sepals, in the more hirsute pubescence which is intermixed with numerous glands. It resembles closely the figure of *P. Dombeyi* in Nestler's Monograph, but neither Nestler nor Lehmann mention anything concerning the glands or the unguiculate petals. *P. Dombeyi* was described from specimens from Chili, but has been reported from Mexico. I have not seen any specimens and doubt its existence there. *P. subviscosa* grows in Arizona and New Mexico.

POTENTILLA RAMULOSA n. sp.

Stems several from the thick perennial root, about 1 dm. high, scarcely exceeding the basal leaves, more or less hirsute, and branched. Stipules lanceolate, the lower scarious and brown, the upper herbaceous; basal leaves on hirsute petioles 5–8 cm. long, finely pubescent, in age shining; leaflets 5–7, obovate, coarsely and generally doubly toothed with somewhat divergent teeth, prominently veined beneath, the larger 5–7 cm. long. Flowers slender-pediceled in an open cyme; calyx and pedicels hirsute and with numerous sessile glands; bracts oblong, a little shorter than the oblong-ovate sepals; both distinctly veined, in fruit incurved and inclosing the rather few large achenes; petals obcordate, deeply emarginate and evidently contracted in a short claw; stamens 15–20; pistils rather few; achenes striate. (Plate 276.)

P. ramulosa resembles *P. subviscosa*, but is a much larger plant. The leaves, by their size, pubescence and form, remind one somewhat of *P. Nuttallii* and *P. Blaskeana.* The leaflets reach a length of even 7 cm. The general habit, form of calyx and corolla, etc., are those of *P. subviscosa*, but the achenes are striate. The following specimens have been examined:

Arizona: J. G. Lemmon, no. 399, 1881; H. H. Rusby, 1883.

The *Concinnae* have the same relationship to the *Niveae* as the *Aureae* have to the *Frigidae, i. e.*, they are *Niveae* with more than three leaflets. From the *Subviscosae* they differ by the tomentum on at least the lower surface of the leaves, and by their petals, which are not at all unguiculate.

POTENTILLA CONCINNA Richardson, Frank. Journ. 736. 1823.

P. concinna resembles *P. nivea* in many respects, especially the variety *quinquefolia*, but is always more or less prostrate, and has broader petals and sepals. It is very variable as to the shape of the leaves. In the typical form the leaflets are obovate or cuneate and crenate, and slightly tomentose also on the upper surface. It ranges from Colorado to Utah and Saskatchewan.

Potentilla concinna humistrata Rydberg, Cont. U. S. Nat. Herb. 3: 497 (*P. concinna humifusa* Lehm. Rev. Pot. 112. *P. humifusa* Nutt. Gen. 1: 310.) is a less spreading form with leaves that are green on the upper surface, but the two forms grade into each other in so many ways that it is useless to try to draw a line between them.

P. CONCINNA DIVISA n. v.

P. nivea dissecta S. Wats. Proc. Am. Acad. 7: 556, at least in part. 1873. Not *P. dissecta* Pursh, 1814.

Leaflets pinnately divided. In a few cases the leaves are also pinnate rather than palmate.

Dr. Watson included the three first specimens cited below in his *P. nivea dissecta*, but in every respect they are much nearer *P. concinna* than *P. nivea*, the sepals, petals and general habit being exactly that of the former.

Rocky Mountains: Douglas.

Montana: Howard.

South Dakota: Jenney. 1875; W. H. Forwood, 1887; P. A. Rydberg, nos. 672 and 673. 1892.

Assiniboia: John Macoun, no. 10,468, 1895.

POTENTILLA BICRENATA n. sp.

Low and simple from an erect scaly rootstock; stem erect, 5–7 cm. high, about equalling the leaves, 1–3-flowered, nearly leafless; basal leaves on petioles 3–6 cm. long, digitately 5-foliolate, silky and greenish above, white-tomentose beneath; leaflets ½–2 cm. long, oblong-cuneate, margins entire, except at the very apex, where there are 2 (seldom 4) notches making the leaflet 3- (seldom 5-) toothed at the apex, the middle tooth generally the smallest; flowers about 1 cm. in diameter; calyx silky; bractlets and sepals ovate or lance-ovate, the former smaller; petals obovate, merely truncate.

It much resembles the preceding, but is more delicate, not at all spreading, has a subscapiform stem and smaller flowers, but the most striking difference is the form of the leaflets.

New Mexico: C. D. Walcott, no. 66, 1883 (Type).

Colorado: E. L. Greene, 1875.

The *Multijugae* is a group of Potentillas in many respects reminding us of the *Multifidae*. The leaves in both are pinnate with several leaflets, but the pinnae in the present group are generally much more numerous; the pubescence is hirsute, strigose or silky, always without any indication of tomentum, and the style is always long and filiform. To this group belong *P. Richardii* Lehm., from Mexico, differing from *P. Plattensis* mainly in the spreading pubescence, and the following North American species:

POTENTILLA PLATTENSIS Nutt.; Torr. & Gray, Fl. N. Am. 1: 439. 1840.

The type specimens of Nuttall have light green leaves with 4–8 pairs of oblong-cuneate leaflets, dissected into broadly oblong obtuse segments ½ cm. long, and a stem that is more or less ascending. In the more common form, however, the segments are often ¾ cm. long, nearly linear and often acute, the stem more or less spreading and the flower-clusters very irregular. It may be a good variety.

All forms of *P. Plattensis* are characterized by the stipules, which are unusually large for the size of the plant. Its range is from Colorado and Utah to the Saskatchewan, but it belongs to the valleys of the high plains rather than to the alpine regions.

POTENTILLA PINNATISECTA (Wats.) Aven Nelson, Bull. Wy. Exp. St. 28: 104. 1896.

P. diversifolia pinnatisecta Wats. King's Rep. 5: 87 (in part), 1871.

P. ovina James Macoun, Can. Rec. Sci.

The specimens from which *P. diversifolia pinnatisecta* were described, viz: Watson's nos. 331 and 332 of the King Expedition illustrate, I think, not less than three different species. In the Gray Herbarium, no. 331 is represented as it seems by a typical *P. Plattensis*. This is doubtless the reason why Watson afterwards transferred the var. *pinnatisecta* to that species. No. 332, which Watson, in King's Report, characterizes as an alpine more hairy form, is there represented by a specimen of what James Macoun describes as *P. ovina*. This may be regarded as the typical *P pinnatisecta*, as the other forms of the collection are already named In the Columbia Herbarium, no. 331 is represented by an unusually large form of *P. pinnatisecta* (*P. ovina* Macoun) and no. 332 by a depauperate specimen of *P. Breweri expansa* Wats.

The main differences between *P. Plattensis* and *P. pinnatisecta* are well pointed out by Prof. Nelson, *l. c.*, only that his characterizing of *P. Plattensis* refers rather to the most common, more prostrate form with narrow segments, mentioned above, and that his specimens representing *P. pinnatisecta* are unusually large, less hairy and with longer segments than usual. The typical form is subcaespitose, seldom over 1 dm. high, with nearly leafless flowering stems, smaller stipules than in *P. Plattensis*, and a densely hoary pubescence, especially when young. It ranges from Colorado and Utah to British America, and is a strictly alpine plant.

POTENTILLA MILLEFOLIA n. sp.

Low, prostrate or spreading; stems numerous from the caudex, about 1 dm. long, few-leaved, only a little exceeding the basal leaves, appressed-strigose, often sparingly so. Lower stipules lanceolate and scarious and brown, the upper ovate-lanceolate, acute or acuminate, green, often 2–3 cleft. Basal leaves pinnate, of many pairs, sparingly strigose-ciliate, nearly as long as the stems; stem-leaves much reduced. Leaflets divided nearly to the base into linear subulate divisions, which therefore look as if verticillate. Pedicels slender, 1–2 cm. long, in fruit abruptly reflexed below the strigose-hirsute calyx. Bractlets and sepals lanceolate, acute, the former slightly smaller. Corolla 12–18 mm. in diameter. Petals obcordate, deeply notched, longer than the sepals. Stamens about 20. Achene smooth, with a slender filiform nearly terminal style. (Plate 277, figs. 1–5.)

P. millefolia most resembles *P. Plattensis*, but differs in the long and very narrow segments of the leaves, the reflexed fruiting calyx and the longer sepals. The following specimens have been examined:

California: J. G. Lemmon, 1873, 1874, and no. 86, 1875 (Type); E. L. Greene, no. 750, 1876; J. W. Congdon, no. 277, 1880.

POTENTILLA MULTIJUGA Lehm. Rev. Pot. 29, 1856.

This species has been lost for about 40 years. As in the collections of this country there were no specimens of a *Potentilla* whose leaves resembled those of Lehmann's plate, and as those of the latter resembled the leaves of *Horkelia cuneata*, most botanists have cited *P. multijuga* as a synonym of that species, and even Professor Greene, in Flora Fransiscana, has adopted the name. It is not very likely that such an acute observer and eminent botanist as Dr. Lehmann would have figured a *Horkelia* with true *Potentilla* flowers. In two collections, viz., those of the National Herbarium and the herbarium of Harvard University, I have found a *Potentilla* that answers Lehmann's description and plate, except that the plant is more rank and the leaflets are larger, more irregular in form and position.

P. multijuga resembles much *P. Plattensis*, but the leaflets are more numerous, 8–13 pairs, obovate-cuneate and toothed only toward the apex, and the sepals broader ovate and abruptly contracted at the apex. The leaflets in Lehmann's figure are about 2 cm. long; some in the latter specimens are nearly ½ decimeter. Lehmann's figure illustrates an undeveloped specimen about 2½ dm. high. Some of the better developed specimens are ¾ m. high, with leaves 3 dm. long.

POTENTILLA DRUMMONDII Lehm. Nov. Stirp. Pug. 2 : 9. 1830.

Watson included this in *P. dissecta*. As he had only comparatively poor specimens, with few, more approximate leaflets, it was not strange that he did so, especially with his tendency of uniting forms somewhat related. Had he had such specimens as those collected by Suksdorf, or the one from which Lehmann's figure was drawn, I doubt if he had done it. Such well-developed specimens have pinnate leaves of 3–5 rather distant pairs of leaflets, very large stipules resembling those of *P. Plattensis* and a large calyx which is strongly hirsute. From *P. Plattensis* and the other species of the group it differs in the stoutness of the plant, which is 3–6 dm. high and by the fewer (2–5 pairs) and larger leaflets, which are from 3–6 cm. long, and the acute teeth. It is a rare species. The only specimens seen are the following:

Washington: W. N. Suksdorf, no. 539. 1875.
Oregon: Elihu Hall, no. 135. 1871.
California: J. G. Lemmon, no. 1200. 1875.
British Columbia: John Macoun, no. 32. 1890.
Rocky Mountains of British America: E. Bourgeau, 1858.

Phyllotaxy as a Guide to Plant Analysis.

By A. L. Benedict.

There are few discrepancies in teaching more striking than the contrast between the elaborate discussion of leaf-arrangement in nearly all text-books and courses on Organography and the neglect of the subject in practical analysis.

Omitting the leaves of cryptogams and the coniferae, two methods of arrangement are found, the verticillate or whorled and the spiral, alternate or scattered. The words verticillate and whorled are really the same, if we seek their root. The term *scattered* is highly objectionable, since it suggests that the leaves occur haphazard, but nowhere in botany is a more exact mathematical system followed than in the putting forth of leaves. The term *alternate* should, from its meaning, be limited to the simplest variety of spiral phillotaxy, in which the leaves occur, first on one side and then on the other, of the stem.

If we conceive the outer layer of the stem to be made up of a number of columns of cells, we have a simple and lucid explanation of the decussation of adjacent whorls and of the spiral line in which leaves are otherwise thrown out. The development of a leaf involves a tremendous expenditure of vitality and it is easy to understand why one whorl of leaves should issue from the columns which have rested during the formation of the preceding whorl, and why, in the other form of phyllotaxy, the effort should take place in relays till the first column is again reached.

Considering the number of primitive leaves in the seed, it is obvious that we must regard the normal phyllotaxy of exogens as originally whorled and with two leaves in a whorl, while the leaves of endogens have, at first, a spiral arrangement. This conception, however, must not be taken as a practical guide for the study of mature plants, as it would prove misleading in a large proportion of cases. It is also obvious that the flower is, in nearly every instance, a compact series of whorls, whatever the arrangement of the foliage leaves.

The whorled phyllotaxy is very simply subdivided, according to the number of leaves in a circle. This number, omitting the primitive leaves and the flowers, is the same for every whorl of any individual, although it may differ in individuals of the same species. For example, I have found growing within a few feet of one another, *Eupatoria* with five, six and seven leaves, respectively, in a whorl; yet all were of the same species (*E. purpureum*, I believe) and, from their proximity, may very probably have grown from seeds of the same plant. Like almost every botanical feature not connected with the flower, phyllotaxy is a very unreliable guide to generic and family grouping. Thus, all the mints have opposite leaves, but the closely-allied family of figworts includes examples of both general kinds of phyllotaxy; none of the genera of the composite family embrace species illustrating both kinds, but the genus *Cornus* includes both alternate-leaved and opposite-leaved dog-woods.

My notes on phyllotaxy as a guide to analysis, relate almost without exception to the trees of North-eastern America, and are supplementary to the excellent table of Charles S. Newhall. All subsequent statements, must, therefore, be understood with this qualification.

First of all, is to be noted a great preponderance of the spiral phyllotaxy, there being only seven genera represented, with opposite leaves—*Acer*, *Negundo*, *Fraxinus*, *AEsculus*, *Viburnum*, *Chionanthus*, and the single species, *florida*, of *Cornus*. *Catalpa* is the only instance of a tree with more than two leaves in a whorl, having usually three (but sometimes only two.—Wood).

Although not strictly belonging in a discussion of phyllotaxy, the arrangement of leaflets is an interesting and valuable guide to the study of our native trees. The palmately compound leaf is represented only by the genus *AEsculus*, whose leaves are also opposite. Of the trees with pinnately compound leaves, only two genera, *Fraxinus* and *Negundo*, belong to the opposite-leaved group, and of all the trees with compound leaves there are but two with abruptly pinnate leaves, namely, *Gleditschia* and *Gymnocladus*, in which the compounding is also carried to the second or third degree.

The spiral phyllotaxy is subdivided according to the number of leaves in a series, which may be considered as a whorl lengthened out by the growth of the stem between the times at which leaves were put forth. The beginnings of the several series—or, of course, any corresponding leaves of different series—are in the same perpendicular column. A series of any particular number of leaves is also included in a certain number of spiral turns about the stem. Thus, the simplest series has its leaves arranged 1–2, 1–2, each leaf being half a circumference from the next and the series of two leaves being completed in one turn. The next series runs 1–2–3, 1–2–3, each leaf being a third of a circumference from its neighbor, so that this series is also completed in one spiral turn. The next series contains five leaves, but each is $\frac{2}{5}$ instead of $\frac{1}{5}$ of a circumference from the next leaf above or below, so that the series requires two turns about the stem before we reach a leaf directly above no. 1. It will be noticed that nature has apparently formed this third series by adding together the number of turns and the number of leaves of the two preceding series, just as little children would add the fractions $\frac{1}{2}$ and $\frac{1}{3}$, numerator to numerator and denominator to denominator, and get the result $\frac{2}{5}$. The next series, characterized by eight leaves and three spiral turns, seems, likewise, to have been formed by adding the one-turn and three-leaf series to the two-turn and five-leaf series. A series higher still has $2 + 3$ turns and $5 + 8$ leaves. Beyond this, we may still imagine nature continuing to add numerator to numerator and denominator to denominator, but the leaves become so densely crowded, that we cannot bring them into order and, hence, we term the arrangement a fascicle, or *bunch* to translate literally. It should be remembered that Nature never adds any but consecutive series together, and this is the best possible support of our theory, that one series really is joined with the next one, the distance between the adjacent leaves being averaged so that each successive fraction represents the numerator to numerator and denominator to denominator addition of the two next simpler series.

The elms, hornbeam, hop-hornbeam and beeches form a group by themselves. All have simple leaves, of about the same general outline, ovate or quite broadly elliptical, with acuminate apices, rounded bases and serrated margins, those of the elms and the hornbeam being bi-serrate, and, most remarkable of all, every one of this group has its leaves arranged on the ½-spiral plan, with the additional peculiarity that the leaves of a branch lie in the same plane with the stem, as if already pressed. The basswood, buttonwood and mulberries have the same flattened spray, but the similarity of the individual leaves is not marked. The mulberries are like the sassafras in having leaves of different shapes, some being broadly ovate, others resembling mittens, others being best described as "double-thumbed" mittens. In following out a young branch—this phenomenon is not so distinct on older trees—the first leaves are of simple outline, then the thumb is formed on the side of the leaf away from the branch, then follows a similar mitten, but the two are right and left-handed, then a pair of leaves with "thumbs" on both sides of the leaf, then a pair again right and left, with two fingers on the outer side and one on the inner side. Almost exactly the same arrangement may be seen on the sassafras. It seems that nature, setting out with a very simple plan, keeps improving upon it, always adding the variations on the side away from the branch, so that there results a succession of pairs of leaves, identical except for being right and left-handed. So far as I know, no other native tree has leaves of different pattern, save for the slight variations always seen in natural objects of any kind.

The study of the higher spirals is attended with considerable difficulty, the branches from which no leaves are missing being quite short, so that the leaves are apparently crowded into a fascicle, while older branches are apt to be deformed by accidents. It is to be noted, also, that Nature seems to have followed in practice the theory by which we have explained her curious development of series. For example, a short willow branch seems to exemplify the $1/3$ phyllotaxy, but a longer stem plainly shows a $\frac{2}{5}$ arrangement. The plum and apple, similarly, are promoted by the careful student from the $\frac{}{5}$ class to the $3/8$ class; and the walnut and butternut, which we are at first tempted to consider examples of the $3/8$ spiral, belong at least to the $\frac{5}{13}$ series, and the suspicion grows on us that, if we could find a perfect branch with a large number of leaves on it, we might ascend still higher in the range of spiral series. But it is of analytical value to be able to assign a plant to a place in one of two series, just as it is helpful to be able to say, "such a leaf has from five to seven pairs of leaflets."

The tulip tree, oaks, hickories, staghorn sumach and alternate leaved dogwood (the last two being arborescent) have the $\frac{2}{5}$ arrangement quite distinctly. In other instances the results were so conflicting, or the practical difficulties of obtaining good specimens were so great, that the summer closed before I could reach definite conclusions, if, indeed, it is possible to ascribe plants to certain series in all instances.

With the exception of the dogwoods, variations in phyllotaxy never cross generic lines and seldom if ever infringe upon the limits of families.

Reinke's Discussions of Lichenology.

By Albert Schneider.

It is thought advisable to give a review of Reinke's paper on lichenology, because this author is doubtless the most competent advocate of modern scientific lichenology. Although much of the author's discussion is based upon theory and the observations of others, yet the papers are of inestimable value to the special student, and we hope that they will be collected and issued in book form. Meanwhile it is hoped that this review may be found useful by those English-speaking students who can not readily avail themselves of the original communications.

I.

The Podetium of Cladonia.*

This paper is in reality a criticism of Krabbe's† monograph of the genus *Cladonia.* Krabbe maintains that the podetia belong to and are a part of the spore-bearing organs (apothecia). His conclusions are based upon the observation of the morphological characters and the mode of development which, according to Reinke and other modern biologists, are not sufficient. Nor can the morphological characters or structure be deduced from its development. Krabbe assumes that since the podetia of *Cladonia* originate in a manner similar to the apothecia of *Ramalina*, *Parmelia*, *Lecanora*, etc., they must be apothecial structures. The entire discussion depends upon the points of view. Krabbe, having considered the podetia from the morphological and developmental point of view, naturally comes to different conclusions from Reinke, who views the same structures from the physiological standpoint. It is an excellent example illustrating the necessity of combining morphology and physiology. Reinke very aptly states that if we allow morphology and development to dominate our investigations we may come to the absurd conclusion that the floral leaves are foliage-leaves and, *vice versa*, that the foliage-leaves are floral leaves. Extending the illustration we might conclude that mosses are liverworts, and that fungi are algae, etc. Reinke believes that the development of an organ should be represented as describing a curve which extends from the beginning to the point of maximum development of that organ. All intermediary stages of development are to be considered, but the special importance is to be attached to the fully developed structure. According to this view thallus, foliage-leaf, thorn, tendril, sepal, petal, stamen, pistil, should be represented as terminating at different points of the curve. With these and similar introductory considerations, the author finally enters upon the discussion of the podetia of *Cladonia*.

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* Reinke, J. Abhandlungen über Flechten. I. Das Podetium von *Cladonia*. Pringsheim's Jahrbücher, **26**: 495-523. 1894.

† Krabbe, G. Entwickelungsgeschichte und Morphologie der polymorphen Flechtengattung *Cladonia*. Ein Beitrag zur Kenntniss der Ascomyceten. Leipzig (A. Felix). 1891.

Reinke contents himself with de Bary's definition of the lichen-thallus; de Bary designates it as the vegetative organ bearing the apothecia, spermagonia, and in certain instances also pycnidia. This rather negative definition is accepted by most modern lichenologists who define the vegetative organ as the structure whose prime function is to take up and assimilate food-substances. Reinke also accepts, or at least expresses his disinclination to change, de Bary's definition of the reproductive organs; that is, the reproductive organs are the apothecia and spermagonia. If the experiments and observations of Stahl* and Sturgis† prove correct it would be more correct to speak of the *carpogone* and *spermagone* as the reproductive organs; but since it is highly probable that the spermagonia are merely parasitic fungi, or since their true nature is as yet problematical, we have no scientific authority to designate them as reproductive organs. This difference of opinion does not have any important bearing upon the question under consideration. It is, however, evident that Reinke considers the spermagonia as reproductive organs.

Reinke recognizes two portions of the *Cladonia*-thallus: the horizontal portion which is also called primary thallus or protothallus, and the vertical portion, or the podetium of lichenologists. The term thallus is quite generally applied to the horizontal or primary thallus, while the term podetium is retained to designate the vertical thallus. In all instances the podetium takes its origin from the gonidial (algal) zone of the horizontal thallus. Whether the beginnings of the podetium are due to a sexual act or not, is not definitely known. Krabbe and Reinke are inclined to believe that it is nonsexual. Reinke, however, hints at a *possible* sexual act represented by a fusion of the nuclei of two neighboring hyphal cells.

The primary axis of the podetium is negatively geotropic, thus differing essentially from the transversely geotropic dorsiventral horizontal structure of the primary thallus. If the podetia branch, it is found that the negative geotropism decreases with

* Stahl, E. Beiträge zur Entwickelungsgeschichte der Flechten, I. and II., Leipzig. 1877.

† Sturgis, W. C. On the Carpologic Structure and Development of the Collemaceae and Allied Groups. Proceedings of the American Acad. 25: 1890.

the number of branchings. In cross section the podetium is seen to have a radial structure, hollow, bearing a gonidial zone just within the outermost protective (cortical) covering. The assimilative surface of the podetium is usually much greater than that of the thallus-lobe, from which it took its origin. Both Krabbe and Schwendener * look upon the two distinctive forms of thallus as a species of alternation of generation. Wainio † believes that the apothecial stalk is converted into a vertical thallus by a form of metamorphosis. A similar view is held by Reinke; that is, the podetium was originally an apothecial stalk (perhaps comparable to that of the Caliciaceae and of *Baeomyces*) which finally became metamorphosed into a true thallus. This metamorphosis was of such a nature that the increase in size and assimilative function of the podetium corresponded to a decrease in size and function of the primary thallus.

The author enters into a more detailed discussion of the morphological characteristics of the leading types of *Cladonia* for the purpose of illustrating the structural modifications of the podetium and its relation to the primary thallus and apothecia. Life-size figures of the types accompany this discussion. Reïnke quite frequently speaks of "fertile forms" when only "pycnidia" are present, which shows conclusively that he considers these structures as reproductive organs coequal in importance to the apothecia. The fact that the pycnidia (and spermagonia) may occur on either the primary thallus or the podetium, while the apothecia occur on the podetia (excepting a few *Cladonias* which are said to have no podetia or only pseudo-podetia) does not seem to raise any question in the author's mind as to the feasibility of considering the former as true sexual organs. This is only in passing, but it is well to remember that sexual organs are generally not so variable in their occurrence and position on the vegetative portion as the pycnidia and spermagonia evidently are.

Without going into further details the following summary may be given of Reinke's reasons for assuming that the podetium is a thallus rather than a reproductive organ.

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* Schwendener, S. Untersuchungen über den Flechtenthallus. Nägeli's Beiträge zur Wissenschaftlichen Botanik, 2: 169. 1860.

† Wainio, Monographia Cladoniarum Universalis. Helsingfors, 1867.

1. A gonidial layer is present whose special function is that of assimilation. This is, however, not conclusive, since all apothecia with a thalloid exciple contain gonidia (algae), and therefore aid in the process of assimilation.

2. The extreme variability in the size and form of the podetium indicates that it belongs to the vegetative portion of the plant rather than the reproductive portion. Constancy in size and form is peculiar to the organs of reproduction.

3. The association of a large primary thallus with a small podetium and, *vice versa*, a small primary thallus (or none at all) with well developed, much-branched podetia seems to indicate that the podetium is specially adapted to supplant the function of the primary thallus.

4. Cladonias with highly developed podetia (*C. furcata*, *C. rangiferina*, etc.) are quite generally sterile (devoid of apothecia) and with primary thallus rudimentary or wanting. It would be absurd to consider such plants as reproductive organs since their prime function is vegetative.

Reinke admits that the podetia are phylogenetically derived from apothecia and thus in part agrees with Krabbe. The following are the main reasons for assuming that this is the case:

1. Podetia are developed endogenously from the gonidial zone of the primary thallus, similar to the apothecia.

2. Podetia have a radial structure similar to apothecia and apothecial stalks. This is in sharp contrast to the dorsiventral structure of the primary thallus.

3. The apothecia occur upon the podetia. An apparent exception is met with in *C. miniata* in which the apothecia seem to be sessile upon the upper surface or margin of the primary thallus. In this case the podetium has become much reduced, while the primary thallus has become much enlarged.

The general conclusion at which Reinke arrives is that *the podetium is a true lichen-thallus phylogenetically derived from the apothecium.*

II.

The Systematic Position of Lichens.*

This paper is a critical review of lichenology since the time of Schwendener's epoch-making investigations.† The author credits De Bary with first having indicated the dual nature of lichens by demonstrating that species of *Nostoc* and *Chroococcus* may be converted into gelatinous lichens upon becoming penetrated with the hyphae of certain parasitic Ascomycetes. It must be remembered that as late as 1863 Schwendener still believed that the gonidia (algae) were developed upon lateral and terminal branches of the hyphae.‡ De Bary made his discovery in 1865. In 1868§ Schwendener accepted this view and added that all lichens were the result of the union of an alga with some fungus. As the result of his investigations Schwendener concludes that lichens should no longer be considered as a distinct class, but as fungi parasitic upon algae (gonidia). He states: "In development the vegetative organs and the organs of reproduction of lichens are in all respects similar to those of *Ascomycetes*." Reinke has always agreed with Schwendener in the belief that the gonidia of lichens were true algae and the hyphae true fungi. Their opinions differed, however, as to the relationship of the two organisms. Reinke was not at all willing to look upon it as a form of ordinary parasitism. During the summer of 1872, in verbal communication with Griesebach, Reinke pointed out that the relationship indicated a mutual benefit. While the alga supplied the fungus with assimilated food-substances, the latter supplied the alga with water, nitrogen, phosphorus, sulphur and mineral salts. The relation of the fungus and alga in the lichen was comparable to the relation of the root and the leaves of a tree. In order to distinguish this form of relationship (symbiosis) from parasitism (antagonistic symbiosis) it was necessary to introduce a new term. Reinke and Grisebach

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* Reinke, J. Die Stellung der Flechten im Pflanzensystem. Pringsheim's Jahrbücher, 26: 524–542. 1894.

† Schwendener, S. Die Algentypen der Flechten-gonidien. Basel, 1869.

‡ Schwendener, S. Nägeli's Beiträge zur Wissenschaftlichen Botanik, 3: 133–136. 1863.

§ Schwendener, S. Nägeli's Beiträge zur Wissenschaftlichen Botanik, 4: 195–202. 1868.

finally hit upon the word "consortism" as being especially appropriate. Reinke gives conclusive evidence that he has not been duly credited with first having pointed out the true conditions met with in the lichen thallus. This credit is given to de Bary, who is generally supposed to have been the first to point out and explain the phenomenon of "symbiosis" * as it occurs in lichens. The author had, however, previously explained this condition in three different publications.† From these it is evident that De Bary was not the discoverer of the phenomenon now known as mutualistic symbiosis, and that the term consortism antedates that of symbiosis. Reinke explains his views with regard to the lichen-thallus more fully as follows: "We have, therefore, in the thallus of lichens, a consortism, the components of which form a unit, a morphological individual, somewhat as the different tissues in a higher plant unite to form the individual. The fact that the alga can exist independently is dependent upon its ability to assimulate carbon. In the state of consortism, at least in the heteromerous thallus, the alga is nourished by the enclosing fungus; that is it receives from the hyphae the necessary minerals, nitrogen, oxygen, hydrogen and water. The alga in return supplies the fungus with the essential carbon compounds. From this it is evident that the components (alga and fungus) are biologically associated, mutually dependent upon each other, for the formation of the organic substances required for the upbuilding of the common body." The above is certainly conclusive evidence that Reinke had a correct view of the mutualistic relationship of alga and fungus in the lichen-thallus and furthermore that he was convinced that the lichen formed an autonomous structure.

The author expresses it as his opinion that the fungi of the higher Ascolichenes no longer exist independently, perhaps never so existed. The alga is, however, still able to lead an independent existence. It is also evident that there are free algae closely related, if not identical with the gonidia of lichens. This fact is of great importance in the consideration of the phylogenetic devel-

* De Bary, Die Erscheinung der Symbiose. Strassburg, 1879.

† Reinke, J. Göttinger Nachrichten. p. 100. 1872.

Reinke, J. Morphologische Abhandlungen. Leipzig, 1873.

Reinke and Grisebach, A. S. Oersted's System der Pilze, Lichenen und Algen. 1873.

opment of lichens. It is practically impossible to determine what free fungi are identical with the fungi of lichens. All investigators in this line have met with very unsatisfactory results, a thing naturally to be expected. According to Tavel* the fungi of the Collemaceae, Arthoniae and Lecideaceae are more or less closely related to the Patellariaceae. The relationship of the fungi of the Pertusariae, Lecanareae, Pannarieae, Umbilicarieae, Peltidiaceae, Parmeliaceae, Usneaceae, Cladoniaceae, Sphaerophoreae, Ephebeae and Lichineae is practically unknown. The Verrucarieae, Decampieae and Endocarpieae are related to the Amphisphaeriae, Sphaerelloideae. Such uncertainty is certainly very unsatisfactory

Although there may be algae, such as *Cystococcus humicola, Pleurococcus vulgaris, Nostoc lichenoides*, etc., which only await the opportunity to unite with some fungus to form a lichen, yet it is evident that no true Ascomycete has the power to enter into such a union. There is great uncertainty as to the exact method by which the first lichen or lichens were formed. The author makes the following hypothetical assumption: "In the beginning several lichens were formed by the union of true fungi with algae. According to Möller† such a process is now going on in the case of *Cora pavonia* and the related forms of *Dictyonema* and *Laudatea* The gelatinous lichens are very likely the oldest forms of the Ascolichenes. Such a gelatinous lichen took its origin as the result of the parasitic union of a fungus and a spherical colony of *Nostoc lichenoides.* The question of the origin of the fungus coincides with the question of the phylogenetic origin of parasitic fungi in general and need not be further discussed. The fungus which at first behaved like a true parasite (antagonistic symbiosis) took its entire food-supply from the nostoc. The condition of mutualism (consartism) was a phylogenetic product; perhaps due to natural selection or other formative causes resulting from the union of alga and fungus. From this proto-*Collema* other gelatinous lichens were evolved; finally also such with heteromerous thallus. It is probable that in the course of phylogenetic

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* Tavel, F. Vergleichende Morphologie der Pilze, pp. 94 and 108. Jena, 1892.

† Möller, A. Ueber die eine Thelephoree, welche die Hymenolichenen: *Cora Dictyonema* und *Laudatea* bildet. Flora 77: 254–278. 1893.

processes the developing spores of gelatinous lichens acquired the ability to enter into a mutually symbiotic union with other algae. A series phylogenetically derived from *Collema* may have taken an upward course, that is, proceeded from the lower to the higher, from the simpler to the more complex. As an example we may cite the natural series *Collema*, *Leptogium*, *Hydrothyria*, *Peltigera*. If *Stictina* is derived from *Peltigera*, *Sticta*, which is evidently *Stictina* with bright green algae, would also be included in the series. Every phylogenetically derived lichen-type constituted the beginning of a new series which may have proceeded upward or downward; that is in the direction of either higher or lower forms. In certain cases it is difficult to decide whether given lichens form the beginnings of a series or whether they are degenerate forms. Among such doubtful forms are included *Biatora uliginosa*, *Thelidium minutulum*, and species of *Buellia* and *Arthonia*. Many of these plants live parasitically upon other lichens, and no doubt bear a relation to these similar to the relation of *Cuscuta* and *Monotropa* to the chlorophyll-bearing genera of the same family. The above summary leads to the conclusion that there is a natural system of lichens distinct from that of fungi.

The author deplores the pernicious effect of Schwendener's plan of the arrangement of lichens. As a result lichens received only casual mention in an appendix to the different groups of lichens. Lichenologists (systematic) in general have strongly opposed Schwendener's plan of classification. Although Reinke has always sympathized with these lichenologists, yet he regrets very much that they should have made their special attack upon Schwendener's theory of the dual nature of lichens.

The following is a brief summary of the leading items discussed in this paper:

1. The true relation of fungus and alga in the lichen-thallus was first pointed out by Reinke.

2. The term *Consortism* antedates the term *Symbiosis*.

3. Schwendener's (De Bary's) theory of the dual nature of lichens is fully accepted.

4. Most of the algal types occurring in lichens have been specifically determined. The fungal types no longer exist (at least in most cases) and can therefore not be determined.

5. A lichen is a phylogenetically derived morphological unit.

6. Lichens form groups of natural series phylogenetically derived from distinct prototypes. Lichens have, therefore a polyphyletic origin.

7. Lichens differ from the fungi morphologically as well as physiologically.

The following are the general conclusions at which Reinke arrives:

1. Although fully accepting Schwendener's theory, lichens are phylogenetically, morphologically and physiologically wholly distinct from fungi, and it is therefore inconsistent to arrange them under fungi.

2. Lichens form a natural group coequal in systematic importance with fungi and algae.

Since Reinke has written this paper Schwendener in a personal interview with E. L. Gregory * stated that he had no objection to the proposed plan of classification. Tubeuf, † as well as other recent authors, expresses the opinion that the lichen is an autonomous structure, a morphological unit. There are also strong objections, such as those cited by Lindau. ‡

A new Gymnogramme from Venezuela, with Remarks on some other Venezuelan Ferns.

BY B. D. GILBERT.

Last spring Dr. H. H. Rusby, Secretary of this club, and Mr. R. W. Squires, of Minneapolis, made a botanical trip to Venezuela together and brought back with them a large collection of pressed plants, among which were about two dozen species of ferns. This fall Dr. Rusby placed the ferns in my hands for identification and it is found that although the collection is small it con-

* Gregory, E. L. Notes on the Classification of Lichens. Bull. Tor. Bot. Club. 23: 361. 1896.

† Tubeuf, K. F. Pflanzenkrankheiten. p. 102. Berlin. 1895.

‡ Lindau, G. Die Beziehung der Flechten zu den Pilzen. Hedwigia, 34: 195–204. 1895.

tains a number of choice things. Of course there are several common species which grow throughout the Antillean and South American tropics, such as *Polypodium Phyllitidis* and *P. Plumula*, *Dryopteris trifoliatum* and *D. macrophyllum*, *Nephrolepis acuta* and *N. exaltata*, *Asplenium serratum* and *A. cicutarium*. But along with these are others by no means so common, some of which are deserving of special mention.

The first of these in importance as well as interest is a new *Gymnogramme* belonging to the sub-genus *Selliguea*. Mr. Squires was particularly interested in collecting ferns and other cryptogams, and this species was gathered by him on the last day of the expedition, after all their other specimens were packed up. As Dr. Rusby says: "It was fired into a bale of paper on the fly, and dried itself. Two or three times afterward it was dropped aside and all but lost; and it seems quite remarkable that it should have survived for a description." Fortunately the specimens were finely fruited and complete in every respect; and they enable me to present herewith a full description of the plant.

GYMNOGRAMME (SELLIGUEA) HETEROPHLEBIA n. sp.

Rhizome wide-scandent, the younger part thickly clothed with long (¼ in.) lanceolate acuminate bright brown scales, the stipes springing directly from the rhizome, the older portion of rhizome bearing short branches on which the stipes are tufted.

Stipes single or two to three in a cluster from the same short branch of rhizome, when single ¾ to 1½ in. apart, ¼ to 1 in. long, clothed at base with same scales as rhizome.

Rachis distinct from base to tip stramineous naked. *Frond* 5–8 in. long, ⅞–1½ in. broad, lanceolate-ovate point generally acuminate, but sometimes round and blunt, surfaces naked, edge entire or slightly wavy, lower part of frond shortly narrowed into stipe; color light brown, texture membranaceous.

Veins of two kinds, primary ones raised, very distinct, running in wavy line from rachis two-thirds of way to edge. Also a finer series forming irregular areoles between the main veins with occasional free veinlets included, exterior veinlets free and clavate just within the edge.

Sori extending in two series from base to tip, one sorus in each space between the primary veins situated half way between the rachis and edge oblique, one to three lines long, one line wide.

The affinity of this species is with *G. membranacea* HK., a native of the Malay and Philippine Islands. It differs from that species in having a short and stramineous stipe instead of one that is black and 2–6 in. long; also in the character of the veins, the primary veins not reaching the edge and the intermediate ones being much less distinct. Such a wide geographical separation as lies between the Philippines and South America need not of necessity be a bar to identity of species, since we have such examples as *Asplenium filix-foemina* and *Dryopteris mollis* that extend almost the world around. But these instances are quite rare; and in the genus *Gymnogramme* I am not aware of a single species that is common to both the eastern and western hemispheres.

This fern enjoys the distinction of being the only species, in the section of *Selliguea* to which it belongs, that is found in the western hemisphere. Out of 21 known species of *Selliguea*, including this, only 4 are natives of the new world, and of these only one occurs in any abundance. The fact that *Gymnogramme heterophlebia* has never been detected before is good evidence that it is a rare plant; for although new species of ferns are still discovered occasionally, South America has been pretty thoroughly ransacked and any fern that has hitherto escaped observation may be safely ranked among the rarities of that family.

This species happily illustrates the duplication of venation in different genera. If the sori were round instead of long the species would be a good example of the sub-genus *Phymatodes* in *Polypodium*, and would stand not far from *Phymatodes persicariaefolium* Schrad.

Another exceedingly interesting species in this collection is *Adiantum olivaceum* Baker. This belongs to the sub-genus *Hewardia*. In 1840 John Smith, of the Royal Botanical Gardens at Kew, then acknowledged to be one of the ablest pteridologists of his day, read a paper before the Linnaean Society and published a description in Hooker's Journal of Botany, in which he represented *Hewardia* as an entirely new genus from Guiana, which he dedicated to his friend Robert Heward, a Jamaica botanist of that period. The pinnules of the original *Hewardia* are from 4 to 8 in. long, and are characterized by having a continuous involucre all around the edge. The involucre, however, is that of *Adiantum*, and when Sir Wm. Hooker came to publish his Species Filicum in 1858 he stated that he could "not see that it is agreeable to nature to separate a genus of ferns on account of the mere anastomosing of the veins of the pinnae." By that time another species of *Adiantum* with reticulated veins had been discovered on the Pacific side of tropical America, and Hooker only noted the two by putting them in a section by themselves. But ten years later, when the Synopsis Filicum was issued, he made a sub-genus of *Hewardia*, founded on the venation, and included two other species having long but interrupted sori. One of these was the fern now collected by Rusby and Squires, which was originally named by Mr. Baker. All of these four species belong to Guiana, although *A. olivaceum* has now been found in Venezuela, and *A. dolosum* occurs in Jumaica and on the continent from Guatemala to Brazil. The last named is the only one of the *Hewardiae* that can be regarded as at all common, while *A. olivaceum* is a rare and very desirable species.

There are specimens of three arborescent ferns in this collection, viz.: *Alsophila blechnoides* Hooker; *Hemitelia grandifolia* Spreng.; and *Hemitelia Guianensis* var. *Parkeri* Hook. In Hooker's Species Filicum he was inclined to regard *H. Parkeri* as distinct from *H. Guianensis;* but before publishing the Synopsis Filicum he had received a large suite of specimens from South America and became satisfied that the two supposed species were only slight varieties of one and the same thing. *H. Parkeri* is distinguished by its more abundant hairs and by a larger number of sori which extend farther up the segments. *Hemitelia grandifolia* is found in the West India islands as well as on the continent. The caudex of these species is so low that they can be called "arborescent" only by courtesy and because they belong to a genus the majority of whose species are truly arborescent.

Another curious fern in the collection is *Dryopteris meniscioides* (Willd.) Unlike any other species of the *Aspidium* section, its barren and fertile fronds differ in form, the fertile being contracted and made narrower by the excessive production of fruit. The entire under side of the pinnae is filled with the sori in regular lines, and as the indusia are persistent after the sporangia have burst out all around the edges of them, it forms a very pretty and unusual sight. On the upper side of the pinnae the moon-shaped veins are quite plainly to be seen similar to the veins of the genus *Meniscium* and these give the fern its specific name. Neither Hooker's Species Filicum nor the Synopsis Filicum mentions the crowded state of the mature sori which gives this fern such a remarkable appearance; but Grisebach, in his Flora of the British West Indies, notes it as one of the characteristic features.

The genus *Antrophyum* contains 18 acknowledged species, of which only six, or just one-third, are inhabitants of the western hemisphere. The species of this genus present quite as good an example as those of *Acrostichum* of the changes that may be rung on a simple fronded fern without cutting of any kind to break it up into separate sections. The forms are created by differences in breadth and width, by long or short stipes, by blunt or acute apices, and by possessing or not a distinct midrib. Two species are distinctly characterized by the last-named feature. The commoner one is *Antrophyum Cayennense* Kaulf., which grows in Cuba as well as on the continent. The other *A. subsessile* Kze., is much less abundant, and this is the one which Dr. Rusby's collection contains. As its name implies, its fronds are almost, and sometimes quite sessile, whereas *A. Cayennense* has a stipe from 1 to 3 in. long. Another feature is that while the *veins* are reticulated as in all the species of this genus, the *sori* follow the oblique forkings of the veins, but seldom the reticulations. It is an interesting species for study. I might go on and speak of other attractive ferns in this collection, but the ones already mentioned are the most important and infrequent, while the others are liable to be found in almost any series coming from the American tropics. Enough has been said, however, to show that this collection contains more good things than would ordinarily be found in such a limited number of species.

The following is a complete list of the ferns of this collection:

Hemitelia grandifolia Spr. Rocky banks in deep forest along Eleanor Creek (110).

Hemitelia Guianensis Parkeri Hook. Rocky soil along creek, Manoa (384).

Alsophila blechnoides HK. Rocky banks in deep forest along Eleanor Creek (123).

Trichomanes pinnatum Swz., with unusually large pinnae (385).

Trichomanes membranaceum L. Completely covering the vertical faces, on the down-stream side, of large rocks among the cascades on Eleanor Creek and in deep shade (365).

Adiantum Kaulfussii Kze. Steep hillsides in heavy forests along Eleanor Creek (375).

Adiantum tetraphyllum Willd. With the last (374).

Adiantum (*Hewardia*) *olivaceum* Baker. With the last (376).

Pteris Kunzeana Agardh. With the last, but in dryer soil (373).

Asplenium serratum L. In rich mould about high ledges, in partially sunny places, along Eleanor Creek (372).

Asplenium cicutarium Swz. In rather dry locations on steep hillsides, in deep forest along Eleanor Creek (118).

Asplenium cuneatum Lam. On rocks in bed of stream in deep forest, Eleanor Creek (363).

Dryopteris meniscioides (Willd.) Kuntze. With the last (379).

Dryopteris trifoliata (L.) Kuntze With phenomenally small sori. Steep hillsides in deep forest, Eleanor Creek (383).

Nephrolepis exaltata Schott. Pendant from the axils of palm leaves, Sacupana (368).

Nephrolepis acuta Presl. On decaying logs in deep forest, Santa Catalina (386).

Polypodium piloselloides moniliforme Hook. Climbing shrubbery in partly cleared land, Santa Catalina (369).

Phegopteris tetragona megaloda (Schk). Forests about Santa Catalina (388).

Polypodium Phyllitidis L. Rich mould about high ledges, in sunny positions, Eleanor Creek (370).

Polypodium Plumula HBK. Pendant from axils of palm leaves, Santa Catalina (366). With unusually long fronds, more than 4 feet in length (367).

GYMMOGRAMME (SELLIGUEA) HETEROPHLEBIA n. sp. Climbing on tree-trunks, in deep forests about Santa Catalina (382).

Meniscium serratum Cav. On rocks in bed of stream, in deep shade, Eleanor Creek (378).

Acrostichum (*Gymnopteris*) *alienum* Swz. With the last (380).

Dryopteris propinqua (Br.). In the Synopsis Filicum this is made a variety of *N. unitum*, but it agrees with no *N. unitum* that I ever saw. Rocky banks of Eleanor Creek, in deep forest (128).

Dryopteris (*Sagenia*) *Martinicensis* (Spreng.) Kuntze. (*Aspidium macrophyllum* Baker.) Steep hillsides in deep forest, Eleanor Creek (381).

Antrophyum subsessile Kze. Dry hillsides about Menoa (371).

Nos. 364, 377, 380 and 401 are without fruit and not in a fit condition for determination.

Resemblance of an Insect Larva to a Lichen Fruit.

By G. E. Stone.

During the past summer while examining the bark of some sickly Camperdown Elms I observed a number of bodies about ⅛ inch in diameter, with a dark center and a drab lacerated foliaceous margin.

These bodies were considerably scattered over the trunk of the tree, they being confined largely, however, to the crevices caused by the irregularities of the bark. In taking a hasty glance at these bodies my first impression was that they were the apothecia of some lichen with which I was not familiar, although they had a marked resemblance in color, size and form to the apothecia of *Physcia hypoleuca*. In fact some of these bodies were attached to the thallus of species of *Physcia*, while others were simply attached to the bark, thus giving the appearance of a lichen fruit without a thallus. This feature impressed me as rather singular, as I had no previous recollection of seeing apothecia of this nature without a thallus. On closer examination, however, it could be seen that these bodies were not vegetable organisms, as piercing them with a sharp pointed stick soon revealed their animal characteristics. Indeed, so marked was the resemblance of these bodies to certain lichen fruit that it required some little observation before they could be discriminated.

On taking them to the College Insectary I soon learned that they were the larvae of an insect known to entomologists as the Imported Elm-leaf Beetle—*Gossyparia ulmi* Geoff—which has not been in Massachusetts but a few years.

The insect is common in Europe and attacks the European elms, but much less seldom our native *Ulmus Americana.* Whether there is any remarkable significance in the close resemblance of the insect larvae to the fruit of certain lichens common to the elm I am not able to say. The close resemblance nevertheless suggests mimicry.

MASSACHUSETTS AGRICULTURAL COLLEGE.

Two Nuttallian Species of Oxalis.

By JOHN K. SMALL.

In the earlier part of this century Mr. Nuttall collected two species of *Oxalis* on the Pacific slope; the one he secured in Oregon, the other in California. The collector sent descriptions of his two new species to Torrey and Gray while they were publishing their Flora of North America. The descriptions were accompanied by specimens which are now preserved in the Herbarium of Columbia University.

Torrey and Gray reduced both the species to *Oxalis corniculata** and printed Mr. Nuttall's descriptions in a foot-note and thus the two plants for many years, and one to the present time, remained without further recognition.

The first of the two species described was *Oxalis pumila.*† It was said to occur in "Forests of the Rocky Mountains and Oregon." The original specimen I have to refer to is from Oregon, and consists of two plants, the one in flower the other in fruit. This form was later described by Professor Trelease as *Oxalis Suksdorfii*,‡ which name may stand on account of the earlier described *Oxalis pumila*,§ of D'Urville. The ample supply of *Oxalis Suksdorfii* which we now have from Oregon, agrees in all details with Mr. Nuttall's original specimens of *Oxalis pumila.* In addition to our material from Oregon, I find two specimens from California; they were collected many years ago and sent to Dr. Torrey. The

* Fl. N. A. 1: 212.

† T. and G. Fl. N. A. 1: 212.

‡ Mem. Bost. Soc. Nat. Hist. 4: 89.

§ Mem. Soc. Linn. Par. 4: 616. 1826.

record accompanying one is simply "California, Rev. A. Fitch," while the other was collected by Dr. Parry when on the Mexican Boundary Survey, "between 32° and 36° N. Lat., and 114°–121° W. Long."

Professor Trelease referred with some doubt, both the original specimens of Mr. Nuttall and the later ones from California to his *Oxalis corniculata* var. (?) *macrantha*,* which position, in the light of recent material and our present knowledge of geographic distribution, cannot be maintained. The species is beautifully distinct, and in addition to other characters, the pod is diagnostic, as Mr. Nuttall intimates,† differing from that of all other relatives in its short conic form. As descriptions of the plant are not easy of access I append the following:

OXALIS SUKSDORFII Trelease, Mem. Bost. Soc. Nat. Hist. 4: 89. 1888.

Oxalis pumila Nutt.; T. & G. Fl. N. A. 1: 212, 183. Not D'Urv. 1826.

Perennial by a slender horizontal or creeping woody rootstock, caulescent, low and bushy or much elongated, somewhat pilose or sparingly villous. Stems ascending or decumbent, .5–4 dm. long, simple or nearly so; leaves palmately 3-foliolate, 2–3 cm. broad, usually glabrate except the ciliate edge; petioles slender, 3–8 cm. long; stipules obsolete, or a narrow dilation; leaflets broader than long, sharply notched, the lobes usually unequal, ciliate; peduncles usually surpassing the leaves; pedicels forming umbellate cymes, commonly 2, subtended by linear-subulate bracts; flowers usually bright yellow, about 2 cm. broad; sepals oblong or oblong-lanceolate, 4–5 mm. long, obtuse, villous, erect or ascending; petals obovate, 12–15 mm. long, undulate; filaments pilose; capsule conic, 8–11 mm. long, about twice as long as the sepals, usually pubescent; seed oval in outline, nearly 2.5 mm. long, its tubercles almost united into continuous transverse ridges.

Oregon and California.

The second species described by Mr. Nuttall in this connection, under the name *Oxalis pilosa* is just as worthy of specific rank as *Oxalis Suksdorfii*. It is apparently rarer; however the scarcity of it in our herbaria may be due to the fact that some collectors are inclined to pass by apparently well-known species in the field. The history of this species is shorter than that of *Oxalis*

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* Mem. Bost. Soc. Nat. Hist. 4: 88. (See supra, p. 268).

† T. & G. Fl. N. A. 1: 212.

Suksdorfii; it begins with the original description* and ends with its union to *Oxalis corniculata* var. (?) *macrantha*,† as in the case of its sister species.

Mr. Nuttall collected his type in "Woods around St. Barbara, California," as is shown by his description and the label accompanying the type. The original specimen is sufficient to mark it as a very distinct species, and to support this I found an ample specimen preserved in the Torrey herbarium, which agrees with Nuttall's type in every particular. This second specimen consists of two plants which were collected in the "Valley of the Sacramento, California," by Dr. Stillman.

The gross characters which separate *Oxalis pilosa* from *Oxalis Suksdorfii* are habit, the densely pale pilose pubescence found on the stems, petioles, peduncles and pedicels, and the longer columnar pods. The species doubtlesss occurs in many herbaria. I give the following description:

OXALIS PILOSA Nutt.; T. & G. Fl. N. A. 1: 212. 1838.

Perennial by a woody base, caulescent, stoutish, densely pilose throughout, pale green. Stem erect, ascending, or decumbent, 1–3 dm. long, usually simple, woody below; leaves peltately 3-foliolate, 1–2 cm. broad, pilose on both sides; petioles slender, 2–6 cm. long, with narrow dilated stipules; leaflets mostly broader than long, sharply notched at the apex, ciliate, the lobes equal or nearly so; peduncles stoutish, surpassing the subtending leaves, topped by 1–3 umbellate-cymose pedicels which are subtended by linear-subulate bracts; flowers yellow, nearly 2 cm. broad, rarely solitary; sepals ovate-lanceolate or oblong-lanceolate, 4–5 mm. long, obtuse, pilose; petals obovate, notched, 12–15 mm. long; filaments pilose; capsule columnar, 1.4–1.7 cm. long, abruptly pointed, tipped by the spreading style-tips, clothed by a minute gray pubescence, commonly longer than the reflexed pedicels; seed obovoid, 1.5 mm. long, marked with slightly interrupted transverse ridges.

California, from the Valley of the Sacramento to Santa Barbara.

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* T. & G. Fl. N. A. 1: 212.

† Mem. Bot. Soc. Nat. Hist. 4: 88.

Notes on New England Marine Algae—VII.

By Frank S. Collins.

(Plate ——.)

Lyngbya gracilis (Meneg.) Rab.; Gomont, Monographie des Oscillarieés, 144. *pl. 2, fig. 20.*

A small species, 5–8 μ in diameter, with slender sheath and cells usually shorter than broad; remarkable for the color, which is a purplish red, the living plant under the microscope reminding one of a very minute *Bangia.* I found it in July, 1896, at Cape Rosier, Maine, among other algæ on a mooring buoy that had been hauled up on the beach.

Spirulina versicolor Cohn; Gomont, Monographie des Oscillarieés, 273.

The trichomes are much like the common *S. subsalsa* Oersted, but the spiral is denser and more regular. The color is very distinct, a dark purple in the stratum, and a rosy purple in the trichome. In the dried specimen this color disappears almost entirely, giving place to the usual light green of the genus. Found at Cape Rosier, on the mooring buoy, with the *Lyngbya* mentioned above.

These two species just mentioned are, as far as I know, the only marine Nostochineae of a red color found in America; and it is somewhat interesting that both should have been found at the same time and place. The object on which they grew gives somewhat unusual conditions for the growth of algae; practically uniform depth combined with considerable movement of the water. It would hardly be safe to draw the conclusion that these conditions tended to produce the exceptional color, but it is of interest to note that the localities given by Gomont for both species are in the Mediterranean, Adriatic and Baltic, in all of which the tidal movement is quite small.

Enteromorpha minima Naeg. in Kuetz. Sp. Alg. 482.

A small species, somewhat resembling *E. micrococca* Kuetz., but with larger cells, 5–7 μ diam. In *E. micrococca* the cell-wall is much thickened, especially on the inside, while in the present species there is no perceptible thickening, and the frond is only about 8–9 μ thick, as against 18 μ in *E. micrococca*. In consequence of this *E. minima* is softer and more flaccid than the other species. Found at half-tide mark, on the shore of Spectacle Island, Penobscot Bay, Maine, July, 1896.

ECTOCARPUS OVATUS Kjellman, Om Spetsbergens Thallophyter, Part 2, 35. *E. polycarpus* Kjellm. Skandinaviens Ectocarpeer och Tilopterideer, 93. *pl. 1. f. 5.*

A delicate species, characterized by the ovate plurilocular sporangia 28–52 μ long, 18–28 μ broad, sessile on the branches and opposite to each other or to a branch. Found at Edgartown, Mass., by Miss Colt, Feb., 1892.

SOROCARPUS UVAEFORMIS Pringsheim, Beiträge zur Morphologie der Meeresalgen, 12. *pl. 3. f. 1–8.*

Habit of *Ectocarpus*, differing in having the plurilocular sporangia in dense masses, usually at the bases of the branches. Found at Martha's Vineyard, Mass., by Miss Colt, in 1892.

PHYCOCELIS MACULANS n. sp.

Basal layer of radiating densely packed dichotomous somewhat irregular filaments, cells 12–14 μ diam.; vertical filaments simple, 14–16 μ diam., terminating in a colorless hair; plurilocular sporangia ovate-lanceolate, 50–60 x 18–25 μ, either terminal on few-celled filaments rising from the basal layer, or more commonly lateral on the longer erect filaments, and either sessile or on a one–several-celled pedicel.

In early stages the basal filaments are quite irregular in shape and branching, but when fully developed, form a regular circular disk, which, however, separates easily into fan-shaped segments. The erect filaments are long, straight, not tapering, with cells in the lower part one or two diameters in length; at the place of growth, in the upper part of the filament, the cells are quite short, and above this point they are much longer, and nearly or quite colorless. Short filaments bearing plurilocular sporangia may arise from any part of the basal layer; but more commonly sporangia are borne on the long erect filaments, and are either sessile or shortly pedicelled. One or several may be borne on a filament; in the latter case they are usually secund, but sometimes alternate; they issue about at right angles to the filament, and are usually produced a short distance below the point of growth.

Found growing on *Rhodymenia palmata* Grev., in company with other epiphytic algae, in a warm shallow tidepool on Spectacle Island, Penobscot Bay, Maine, from July to September, 1894 to 1896. Distributed in Collins, Holden and Setchell, Phycotheca Boreali-Americana, No. 274.

PHYLLITIS ZOSTERIFOLIA Reinke, Algenflora der Westlichen Ostsee, 62.

Distinguished from the common *P. fascia* Kuetz. by the very narrow, strictly linear frond. *P. fascia* varies much in width, but even the narrowest forms broaden upward, and are proportionally much wider than those of this species, which may attain a length of 3 dm, with a width of hardly 5 mm. After one has recognized the plant there is no danger of mistaking for it any of the numerous forms of *P. fascia*; which moreover is essentially a winter and spring plant, while *P. zosterifolia* is a plant of the summer months. Collected at Magnolia, Mass., at extreme low-water mark, by Miss Cora H. Clarke, August, 1896. Distributed in Collins, Holden & Setchell, Phycotheca Boreali-Americana, no. 277.

LEPTONEMA FASCICULATUM Reinke, Atlas Deutscher Meeresalgen, 13, *pl. 31.*

The filaments resemble those of a small *Elachista*, and grow in similar tufts, branching only at the base, where are situated the ovate unilocular sporangia. The plurilocular sporangia, which form the principal characteristic of the genus, may be formed from any of the intercalary cells, but occur mostly in the upper part of the filament; the cell grows in a direction at right angles with the length of the filament, forming rather few-celled, usually pointed sporangia. Found at Spectacle Island, Penobscot Bay, Maine, September 2, 1894, growing on *Rhodymenia palmata* Grev., in a tide pool; a form corresponding to var. *majus* Reinke, l. c., the abundant sporangia occurring through the whole length of the nearly straight filament, and pointing in all directions.

DICTYOSIPHON HISPIDUS Kjellman, Algae of the Arctic Sea, 270.

Resembles a slender, much branched *D. foeniculaceus* Grev., and grows in similar places. Beside the ordinary branches of indefinite growth, the frond is beset with tapering branchlets, 2–4 mm. long; these cover the whole plant, except the base of the main stem and of the larger branches in old plants, from which they have apparently fallen off. The main stem is hollow, and the branches become hollow at an earlier stage of growth than in *D. foeniculaceus*: the sporangia are smaller than in the latter. Originally described as a form of *D. foeniculaceus*, it is now generally recognized as a good species. My specimens, collected at Nahant, Mass., in June, are of a darker brown in the dried state than European specimens, which are more of an olive color; otherwise they agree well.

ANTITHAMNION BOREALE (Gobi) Kjellman, Algae of the Arctic Sea, 180.

A few small plants growing on *Ptilota pectinata* Kjellm. were thrown upon the shore of Eagle Island, Penobscot Bay, Maine, after a storm in July, 1896. They seem to belong to forma *typica* of Kjellman, and agree quite well with a specimen from northern Norway, received from Foslie. This species might be mistaken for a small form of *A. Americanum* (Harv.) Farl., but the latter is proportionally more slender and has longer cells. *A. boreale* seldom exceeds 3 cm. in length; the ultimate branches are secund oftener than opposite. *A. Americanum* is a plant of early spring; *A. boreale* of late summer and autumn.

RHODOMELA VIRGATA Kjellman, Algae of the Arctic Sea, 110. *pl.* 7.

This species in its sterile state is hardly to be distinguished from *R. subfusca* Ag., the latter being, however, somewhat more densely and decompoundly branched. The distinction in fruit is strongly marked; in *R. subfusca* the tetraspores are formed in spring, in the slender terminal branches, which often become somewhat moniliform. In *R. virgata* they are found in winter, in short, densely branching ramuli, which issue without much order from the main stem and branches; cystocarps and antheridia occur in similar situations. Both these forms of fruit have long been known, but both have been supposed to belong to *R. subfusca;* see Harvey, Nereis Boreali-Americana, Part 2, 26. The distinctions of the two species are shown in detail by Kjellman, l. c. Probably common, but to be distinguished with certainty only when fruiting, which occurs chiefly in December and January. Found at Revere Beach, Mass., by the writer; at Martha's Vineyard by Miss L. E. Jernegan.

POLYSIPHONIA VESTITA J. Ag. Algae Mediterraneae, 133; Species Algarum, 2: 987.

To this species I refer a plant from Martha's Vineyard, collected by Miss L. E. Jernegan. It is four-tubed, somewhat corticated below, with long patent branches, which are repeatedly branched and have a somewhat pyramidal outline. The whole plant is beset with short tufts of very fine and soft branching ramuli; in the older parts distant, in the younger closely set; color reddish purple. The specimen does not agree with any of the species credited to this coast, but is quite like the *P. vestita* of J. G. Agardh, as represented by a specimen from Hauck's herbarium; the *P. vestita* of Kuetzing is a different species.

Unless otherwise noted, all the species mentioned above were collected by the writer.

Explanation of Plate 278.

Phycocelis maculans Collins.

Fig. 1. Basal filaments at an early stage of growth. Fig. 2. Portion of fully developed basal disk. Fig. 3. Short, erect filament with terminal sporangium, and lower part of long erect filament, both arising from basal layer. Fig. 4. Upper portion of erect filament. Fig. 5. Portion of erect filament with two lateral sporangia, one of them emptied.

Reviews.

The Nursery Book. By Prof. L. H. Bailey. pp. 365. *figs. 152.* The Macmillan Company, New York. Price $1.00.

This is a very comprehensive, compact and lucid description of all the various modes of propagation of plants, not only belonging to the nursery proper, but takes in the denizens of the herbaceous garden, greenhouse, and all plants usually found on either commercial or private grounds; it is profusely illustrated, showing very minutely the best methods of seed testing, the sowing of seeds, propagating by layering, budding, grafting and by cuttings. It gives very minute directions as to the treatment of all plants during their embryo state, in fact, all that can be learned about it except the actual practice. Some idea may be formed of the minute details gone into in this work when it is found that 180 pages are devoted to propagating alone. Altogether it is a very useful book to have handy either for the professional or amateur.

SAMUEL HENSHAW.

Proceedings of the Club.

WEDNESDAY EVENING, OCTOBER 28th, 1896.

Vice-President Allen occupied the chair and there were 29 persons present.

Mr. T. M. Fry, of 154 W. 98th street, and Mr. Laurence G. Goodhart, of 1148 Park avenue, were elected active members.

A paper by Mr. B. D. Gilbert, entitled "A New *Gymnogramme* from Venezuela, with Remarks on other Venezuelan Ferns," was presented by Prof. L. M. Underwood, the author not being present. The paper is published in this issue of the BULLETIN.

In discussing it, Prof. Underwood mentioned several ferns of the collection which grow also in Florida. Dr. Britton remarked on the heterogeneous elements which seem to be included in the genus *Gymnogramme*. In reply Prof. Underwood assented, and expressed the opinion that the new fern was really a *Polypodium*, although present artificial generic limitations required that it be assigned to *Gymnogramme*. Mrs. Britton remarked upon its resemblance to a Bolivian *Polypodium*. Dr. Rusby spoke of the great beauty of another fern of the collection, *Trichomanes membranaceum* L., as it covered the rocks in Eleanor Creek, where the specimens were collected.

For the author, Mr. J. H. Lovell, who was not present, Dr. Britton presented a communication on "Cleistogamy in *Dalibarda repens*." Discussing the paper, Dr. Britton referred to previous references in the BULLETIN on the same subject. Mr. Lovell also sent specimens illustrating polyphylly in the strawberry.

Dr. H. H. Rusby described a new genus from Bolivia, in the family *Icacinaceae*, illustrating it by specimens and black-board drawings. Its structural relations to the other groups of the family and to the associated genera were discussed. The communication was discussed by Dr. Britton. It will be published in the BULLETIN.

A communication from Miss S. B. D. Lewis on the species of *Nymphaea* found in Raquette Lake was presented by Dr. Allen. It was illustrated by colored drawings. The form of *Pontederia cordata* with cream-colored flowers was also reported by Miss Lewis. An animated discussion of the communication was participated in by Dr. Britton, Prof. Lloyd, Mr. Rydberg, Mrs. Britton and the Secretary.

Dr. Allen remarked on his collections and observations in the Far North, and exhibited a number of interesting specimens.

TUESDAY EVENING, NOVEMBER 10th, 1796.

The President in the chair and 27 persons present.

Miss S. B. D. Lewis was elected a corresponding member.

Miss Catharine Burnett read her announced paper entitled "The Influence of Light on the Morphology and Anatomy of Dorsiventral Organs," which will be published in a subsequent issue of the BULLETIN.

Dr. Emily L. Gregory remarked on her observation of numerous adventitious buds on the roots of the Horsechestnut tree (*AEsculus Hippocastanum*), when exposed to light by excavations for a street. An extended discussion of the occurrence of adventitious buds normally produced on the roots of other trees followed.

Prof. Francis E. Lloyd read a paper on "Some Interesting Forest Trees of Oregon," of which the following is an abstract:

The physical and climatic conditions of Oregon and Washington are such as to result in a large annual rainfall in the region west of the Cascade Mountains. This rainfall, while not excessive, is plentiful and nearly continuous for the greater part of the year. Further, a large body of snow is collected upon the Cascade Mountains; through the melting of this snow is furnished an abundant supply of water. The combined effect of a rich water supply and mild temperature is seen in the abundant vegetable growth, and most strikingly in the forests. These are made up largely of conifers, a fair proportion of hardwoods being found in the valleys.

Among the trees described the most important are: *Pseudotsuga taxifolia*, *Thuya gigantea*, *Pinus Lambertiana*, *Pinus ponderosa*, *Picea Sitchensis*, and *Chamaecyparis Lawsoniana*, and of the hardwoods, *Quercus Garryana*, *Q. Californica* and *Acer macrophyllum*.

Their form and characters were briefly described and their economic value discussed.

Of more botanical than immediate economical interest are the alpine trees, of which there were described: *Pinus albicaulis*, *Tsuga Pattoniana* and *Abies lasiocarpa*. The influence of the winds at high elevations produces compact growth and spreading base in the latter two, while in the former extreme distortion obtains, together with low stature. These may be regarded as the forerunners of the future forests; it is their duty to subdue the rough mountain peaks.

The conditions for reforestation are of the best, and tree growth is rapid. The present methods of lumbering in the Pacific Northwest is extremely prodigal, and forestry methods should soon be insisted upon.

A number of photographs of trees were shown illustrating the discussion.

Index to recent Literature relating to American Botany.

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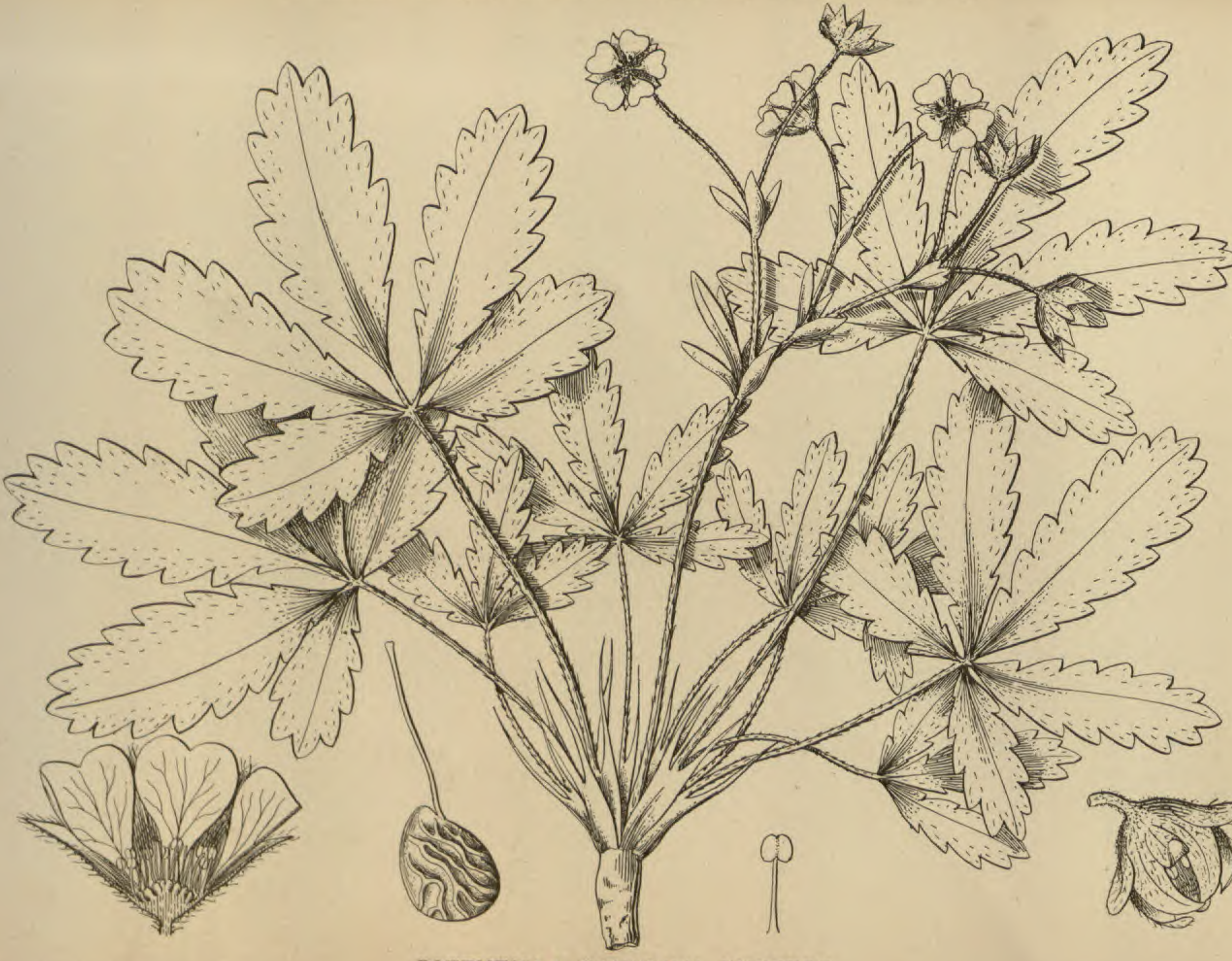

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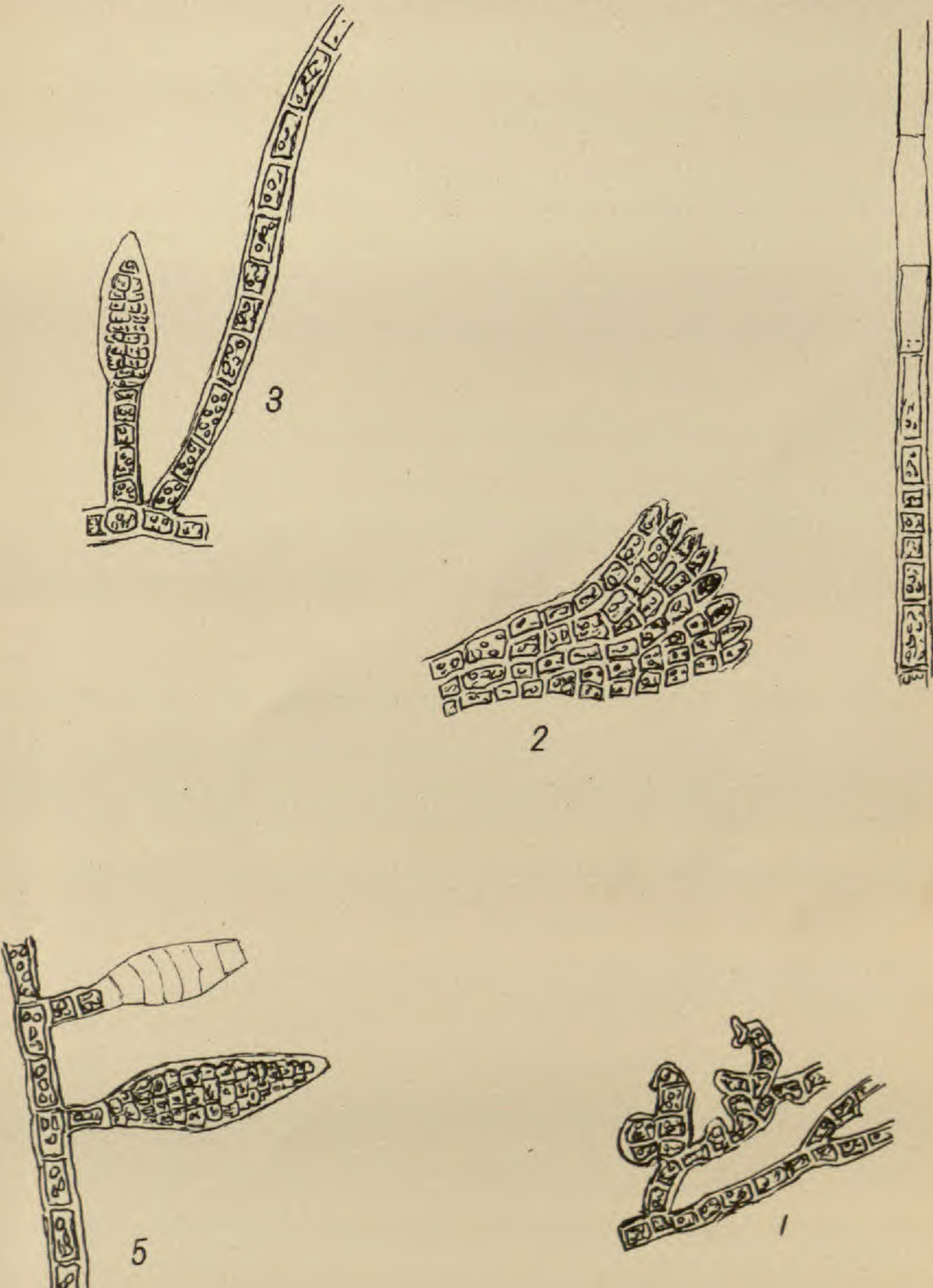

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(*3*) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

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The Club meets regularly at Columbia University, 49th Street and Madison Avenue, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1897, now payable, to Mr. Henry Ogden, Treasurer, 11 Pine St., New York City.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. 23. Lancaster, Pa., December 28, 1896. No. 12.

An Enumeration of the Plants Collected by H. H. Rusby, in Bolivia, 1885–1886.—II.

By Elizabeth G. Britton.

MUSCI.

There has been a long delay in publishing this portion of the enumeration of Dr. Rusby's collection, because at the time that the first comparisons were made at Kew in the summer of 1888, I felt that further study, and, in many cases, better material would be necessary in order to accurately determine many of the species. Furthermore, all of Mandon's specimens, which were collected in the same localities which Dr. Rusby visited, such as La Paz and Sorata, were still lying in Schimper's herbarium undescribed and bearing only manuscript names.

In all instances when Dr. Rusby's specimens agreed with Mandon's the latter have been cited by number and locality, but as we did not possess at that time a set of Mandon's mosses, and my time at Kew was limited, it was impossible for me to write descriptions of all of the new species preserved in Schimper's herbarium collected by him. Hoping, however, that some one better fitted to do this than myself would have the opportunity of studying these Bolivian mosses, and also in recognition of the special privileges accorded to me at Kew while studying there, the first and most complete set of Dr. Rusby's duplicates was deposited there. The second set was sent, after having been carefully studied and named as far as possible by one unacquainted with

Tropical American genera, to Dr. Carl Müller, at Halle. He treated them in the same way that Schimper did Mandon's, giving most of them manuscript names, making few or no critical comparisons, and furnishing no descriptions. As far as we know, they are still lying in his herbarium unpublished.*

When we went to Europe, in 1891, I again took with me all the doubtful species and those supposed to be new, for the sake of making further comparisons at Kew with Schimper's specimens. In several cases, as shown in the text, I found that Dr. Müller was mistaken, and that my original determinations were correct; in several others I found manuscript names of Schimper's given to Mandon's specimens which had priority over those of Müller's given to Dr. Rusby's specimens. In several other cases the types were not at Kew, and the specimens had to be referred to William Mitten and Emile Bescherelle for further study. We visited Mr. Mitten and I showed him and gave him several species, the types of which were in his herbarium. He very kindly made the comparisons for me, and in several cases shared his specimens with me.

We also took a set of the duplicates for M. Bescherelle, and I spent a day with him at the Jardin des Plantes in Paris looking up some of Montagne's types. In a letter received from him at Kew he says:

"As for the mosses collected in Bolivia by Mandon, I think I remember that they were distributed by me in 1869, after the death of Mandon, which occurred on the 30th of December, 1866. Schimper named them, but did not describe or diagnose them. All of Mandon's mosses, Bolivian and Madeira, were sent to me by M. Cosson to be made up into sets, which were sold for the benefit of the widow. I kept one set and the residue, and proposed publishing at least the list of new species with the numbers and localities, in order to save Schimper's priority in the new discoveries. Unfortunately, other occupations have prevented my accomplishing this project. It will give me pleasure to share with you my duplicates."

We have to thank M. Bescherelle for a very good set of Mandon's mosses and we were also fortunate enough to secure Dr. Spruce's own private set of his Musci Amazonici et Andini, so

* Since this manuscript was sent to the printer we have learned that Dr. Müller is proposing to publish a Brylogia Boliviana in the Nuovo Giornale Botanico Italiano.

that we are now better able to study and compare Dr. Rusby's specimens.

In 1893 we received a much larger collection of mosses than Dr. Rusby's, made by Mr. Pierre Jay in northern Bolivia, also from the vicinity of La Paz and Sorata. I again wrote to M. Bescherelle, offering to send him a complete set if he would name them. He replied that he was so occupied with his studies of the mosses of Japan that he found it impossible to undertake it and that it was a thankless task acting as secretary for some one else. I might, perhaps, have been strongly tempted to take the same stand had there not been twelve pages skipped in the reprints of Dr. Rusby's enumeration and held in reserve for this list of mosses. Just as we are going to press I have received a postal card from M. Emile Levier, inquiring for the Bang collection of Bolivian mosses and telling me that Dr. Carl Müller is printing in Florence a *Bryologia Boliviana.* As my manuscript is completed and the priority of Schimper's names from Mandon's collections is maintained throughout, we think it best to publish our enumeration independently.

This summer I have also commenced wrapping and sorting Mr. Jay's collections and have found several of Dr. Rusby's new species in fruit, which had previously only been collected sterile, so that the work promises to be of great interest, but will take a good deal of time to accomplish with the limited collection at my disposal and the pressure of other duties. However, it seems best to publish the list of Dr. Rusby's collection as it stands, first with such determinations and descriptions as I now know to be correct, and to modify and amend this list subsequently as I find time to study and compare the fine collections made by Mr. Jay.

The sequence of genera followed is nearly that given by Mitten in his Musci Austro-Americani (Journn. Linn. Soc. **12**: 12–25. 1869). Thirty-nine genera and ninety-six species are enumerated in this collection of which forty-two are new or previously undescribed. Six mosses, as many hepatics, four lichens and a few algae and fungi were also collected in Bolivia by A. M. Bang and enumerated by Dr. Rusby (Mem. Torr. Bot. Club, 4: 273). These were named by Mr. Wright at Kew, but the *Sphagnums* have since been examined and corrected by Dr. Warnstorf from specimens preserved in the Boissier Herbarium at Geneva.

ACROCARPI.

Ceratodon Nova-Granatensis Hpe. Mapiri, 5000 ft. (3107)= Lindig, Nova Granada, Boq. Tequedamas, 1863.

Leptodontium gracilescens C. Müller. Yungas, 6000 ft. (3108); Sorata, 8000 ft. (3108a) *fide* C. Müller. E. Bescherelle says: "Affine *L. luteo* foliis tamen patulis haud appressis or minus longe cuspidatis differt."

At Kew in Herb. Hooker there are four specimens of Jameson's from the Andes of Quito, labelled *Didymodon luteum*, evidently the types of Hook. Lond. Journ. 5: 48. No. 174 is annotated by Wilson: "var. foliis magis recurvis patenti-recurvo serrulato." A part of 143 has the leaves much recurved as in 193b, both of which are sterile. On the same sheet is a specimen of G. Mandon's Plantae Andium Boliviensium Exsicc., no 1616, from vicinius Sorata labelled *Didymodon luteus* Taylor, which quite agrees with Rusby's specimens in its bright yellow recurved leaves, longer pedicels two or three in the same perichetium, and capsules twice longer than Jameson's specimen's.

LEPTODONTIUM GRACILE C. Müller, n. sp. Mapiri, 5000 ft (3111); Unduavi, 8000 ft. (3109).

Plants bright yellowish green, stems slender, leaves squarrose and curled when dry; cells densely papillose and obscure above, clearer and oblong below, margins entire and recurved to above the middle, sharply and doubly serrate above. Plants all sterile.

Allied to *Didymodon cirrifolius* Hpe. by its papillose leaves but with the aspect of *L. gracilescens* Müll. "Affine *L. luteo* foliis longioribus quam *L. gracilescenta* acutioribus margine non repetito denticulatis." E. Bescherelle, teste.

LEPTODONTIUM GRIMMIOIDES C. Müller, n. sp. Sorata, 13000 ft. (3192).

Plants dark and discolored below, tips of the branches bright yellowish green, stems 3–4 cm. long, leaves squarrose, spreading and curled when dry, remaining undulate when moist, margins entire and recurved below with a few protruding teeth above, vein generally excurrent into a cuspidate apex, cells clear but papillose at base, densely and finely papillose above. Plants sterile.

Leptodontium Mandoni Sch., *fide* C. Müller. Unduavi, 10000 ft. (3110). (Sterile.)

There is no specimen in Schimper's Herbarium at Kew bearing this name, so no comparison was possible. These specimens of Dr. Rusby's have the leaves strongly costate to the apex, the costa is papillose on the back, the margins are entire below, serrate and recurved above, papillose and undulate, the upper cells are small and round, but not opaque, the basal cells longer and brown.

HOLOMITRIUM BOLIVIANUM C. Müller, n. sp. Near Yungas, 4000 ft. (3190).

Plants in light yellowish tangled mats, mixed with hepatics; stems 3–4 cm. long, flexuous and matted, with light-colored tomentum; leaves 3–5 mm. long, linear lanceolate, twisted and curled when dry, costate to apex, serrate and papillose above as well as undulate, entire with revolute margins below; cells round and small, lower ones hyaline. Plants sterile.

This species was compared with *H. flexuosum* Mitt. at Kew, but it differs from No. 21 Spruce from Andes Quitenses in the leaves, nor does it agree with any other species from this region at Kew. It should be compared with *H. longifolium* Hpe.

Dicranella angustifolia Mitt. Near Yungas, 4000 ft. (3112).

DICRANELLA NANOCARPA C. Müller, n. sp. Near Yungas, 4000 ft. (3139 pp).

Stems 3–5 mm. high, simple or branching, leaves erect or slightly secund when dry, uppermost often 2 mm. long, linear-subulate, margin entire, vein excurrent with a few indistinct teeth at apex; perichetial leaves broader and clasping at base. Dioecious. Pedicels 5–8 mm. long, twisted above, bright orange; capsule erect, ovoid, less than .5 mm. long, with a longer straight beak on the lid than the theca, which becomes broad and hemispherical when empty; mouth with a dark border, peristome red, teeth fugacious; cells of the walls oblong or hexagonal in regular rows.

Only six plants found mixed with a specimen of *Philonotis*, No. 3139; the alliance was not determined.

DICRANUM SPECTABILE Sch. mss. Unduavi, 12000 ft. (3113.)

Plants stout and large, much discolored at base, glossy and yellow at the tips of the branches; stems 10–15 cm. long, decumbent, branching by short innovations, tomentose in the axils of the leaves, often slender and interruptedly foliate; leaves longest at the tips of the branches, often 15 mm. in length and 1 mm. broad at base, to a concave apex with involute margins, entire below, serrate, becoming spinose along the excurrent vein; basal cells larger and brown, a few hyaline ones near the vein, others conspicuously porose, becoming long, spindle-shaped above and oblique along the margin. Monoecious antheridia in small buds on the tomentum in the axils of the leaves. Pedicels 15–20 mm. long, much twisted to the left; capsule 3–4 mm. long, erect, smooth, ovoid, largest at base, abruptly contracted or with a short neck; lid with a slender oblique beak 2 mm. long; mouth small, teeth short, slender and bifid.

Compared with and equal to Mandon Plantae Andium Boliviensium, No. 1609. Hab. vicinius Sorata, also Songo, 1857.

Nearest to *D. speciosum* Hk. & Wilson. Compared with No. 325 of W. Jameson's Pl. Aequatoriales from which it differs in its more slender habit, shorter leaves and pedicels half as long. Dr. C. Müller, also recognized this as a new species.

Dicranum species? Yungas, 6000 ft. (3115).

These specimens are sterile, and have baffled Dr. Müller, and Mr. Mitten as well. They have been compared with all the specimens at Kew likely to be the same. Mr. Mitten sent me a portion of his specimen of *Dicranum Mittenii* CM., but they do not agree. Dr. Müller named them *Campylopus concolor* Hook., but they were compared at Kew with specimens in Hooker's herbarium collected by Lindig in Bogota, and they differ in being much stouter plants of a glossy yellow color, with longer and broader leaves, which are serrate *only* at the apex and have a much broader blade.

Pilopogon gracilis Hook. Near Yungas, 6000 ft. (3159 in part).

Compared with Hooker's specimens at Kew collected by Weddell in the Province of Yungas, Bolivia, May, 1847, with which they agree in every way. The leaves are hyaline at the basal angles and these cells extend up along the margins; the short transverse walls of the cells are thickened; the vein is broad, the margins incurved, and there are a few teeth at the apex. The perichetial leaves end in a very long tip, often extending half the length of the pedicel.

Dr. Müller gave this a manuscript name under *Catagonio.*

CAMPYLOPUS TRIVIALIS C. M. n. sp. Mapiri, 2500 ft. (3196).

Plants loosely matted, dirty green; stems flexuous, not rigid, 3–5 cm. long, usually simple, occasionally with crowded branches at the apex of the stems; stem leaves short, 3–5 mm. long, slightly falcate at the tips of the branches, tubular with incurved, entire margins; vein more than one-third of the width of the base of leaf excurrent with a few teeth at apex; basal cells thin, hyaline to the vein, not colored.

Plants sterile and much less rigid than is usual in this genus; their alliance was not indicated nor determined.

Campylopus sp. undetermined. Yungas, 6000 ft. (3116).

Plants fragmentary and broken. Stems 2–3 cm. high, proliferous with fasciculate branches at apex, branches often 15 mm. long with the leaves crowded at the summit; leaves curled and twisted when dry, 3–5 mm. long, blade narrow, forming a serrate border of one row of cells almost to the apex; vein papillose on the back; cells enlarged at base, brown at angles; leaves of the branches shorter, often entire, and radiculose at base, perichetial leaves very long pointed, costate, entire, or scarcely serrulate; cells much enlarged at base, brown, upper oblong; antheridia in heads matted with brown radicles; pedicels several in the same head, 8–10 mm. long, curved, becoming erect where dry; capsules 1.5 mm. long, ovoid, not ribbed when dry; peristome red, lid not seen.

These specimens are closely allied to *C. annotinus* Mitt., and *C. brachyphyllus* Mitt., and *C. multicapsularis* Sch., from all of which they differ in the leaves and the smooth walls of the capsules when dry.

GRIMMIA NANO-GLOBOSA C. M. n. sp. Mapiri, 5000 ft. (3195).

Plants pulvinate in gray cushions, stems 5–8 mm. high; leaves crowded with a long, rough, white hair-point, blade carinate, cells small, almost quadrate, sinuous, basal ones elongated. Dioecious(?). Perichetial leaves with a long sheathing base, the white tip reaching the lid of the capsule. Pedicel erect, straight, 3–4 mm. long; calyptra lobate-mitrate, capsules 1–1.5 mm. long, lid with a straight beak, .5 mm. long; annulus narrow, of several single rows of cells falling in fragments with the lid; peristome red; teeth short, papillose; spores smooth, .008–.010 mm.

A smaller species than either *G. ovata* Web. & M., or *G. longirostris* Hook.

Compared at Kew with Matthews' Peruvian specimens labelled *G. ovata* and illustrated by W. Wilson. The Bolivian specimens are smaller.

Grimmia (*Racomitrium*) *crispipila* (Taylor) Mitt. Sorata, 10000 ft. (3117).

Agrees with specimens at Kew collected by Pearce at Unduavi and Yungas, duplicates of which are in our collection, sent by Mr. C. H. Wright with the permission of the Director.

GRIMMIA (RACOMITRUM) DIMORPHUM C. Müller, n. sp. Unduavi, 10000 ft., Oct., 1885 (3118).

Plants in dark dirty mats, stems blackened beneath, decumbent, giving off lower branches 3–4 cm. long, branchlets short, fasciculate; leaves subsecund, incurved and twisted when dry, spreading when moist, carinate, plicate with one strongly involute margin, generally blunt apex, but occasionally with a white mucronate tip or the apical ones with white crisped tips, vein prominently keeled, ending below the blunt apex or continuous into the white prolongation; cells all uniformly sinuous, elongated with faint transverse walls; perichetium short, 3 mm. long, broadly convolute, sheathing; bracts broad, apex acute, cells scarcely sinuous. Pedicels short, less than 1 cm., long, arcuate, twisted; capsule erect, or bent, 3 mm. long, smooth except just below the small dark bordered mouth; lid 1 mm. long, conic beaked, teeth long, slender, papillose, yellow.

Compared with *R. crispipilum* Taylor in Herb. Hooker, nos. 135, *a, b;* Spruce Musci Am. et And.

Leaves less cirrous pointed than 135 *b;* stems shorter than 135; leaves exactly alike; capsules on shorter pedicels, less cylindric, shorter and broader, with a broader mouth. General aspect quite different.

Leucobryum longifolium Hpe. Mapiri, 2500 ft. May, 1886 (3119).

Sporophyte immature. Agrees with no. 71 c. of Spruce's Musci Amazon. et. And. and with no. 7169 of A. Glaziou from Rio Janeiro, both at Kew.

LEUCOBRYUM STRICTUM C. Müller, n. sp. Unduavi, 10000 ft., Oct., 1885 (3119a).

Plants short, loosely tufted, mats dull gray when dry, stems short, decumbent at base, less than 2 cm. high, brown when moist, with light tips; leaves erect and slightly spreading, iridescent when dry, about 1 cm. long by 2 mm. broad, concave from a broad white base, tubular and dark above the middle, margin narrowly hyaline, apex with a few brown cuspidate teeth.

Plants sterile, smaller and darker than *L. iridans* (Brid.). "Ab *L. longifolium* Hpe., cellulis chlorophyllis tantum latioribus differt." E. Bescherelle.

Tortulaceae.

The treatment of this group by Mitten in his "Musci Austro-Americani" is far from satisfactory. It has seemed best, however, to follow him in this as in the other families. Duplicates of these were not sent to Dr. C. Müller, as they had not been carefully studied nor compared at that time. Later M. Bescherelle had a set of them, and made one or two comparisons for me with Montagne's types at the Jardin des Plantes. It will require more study and comparison with a more modern treatment of the family, before the specimens listed can be thoroughly understood.

Tortula (*Trichostomum*) *contortifolium* Mitt.? Unduavi, 8,000 ft. October, 1885 (3126).

There were no specimens of this species at Kew; hence these specimens were named only from the description on page 147 of Mitten's Musci Austro-Americani. They were shown to Mitten and sent to M. Bescherelle, but should be compared with Spruce, "No. 213, Andes Quitenses, Chimborazo (10000 ped.)"

Tortula (*Trichostomum*) semivaginatum Sch. mss. in Herb., no. 1618. Mandon, Plantae Andium Boliviensium. De Capanuta a Songo, 18 Obr., 1857, in Herb. Schimper. Vicinius Sorata, April, 1858, in Herb. Hooker. Near Yungas, 4000 ft., 1885, in Herb. Rusby, no. 3128.

Plants 2–3 cm. high, dark below, red-brown above; stems simple or branching by subapical innovations 1–2 cm. high; leaves curled and twisted when dry, spreading when moist from an erect, glossy clasping base, the lanceolate blade 2 mm. long, suddenly bent and contracted from the hyaline base, 1 mm. long, upper cells small, dense and with thickened irregular walls and small, blunt papillae, decurrent at the margins a short distance on each side of the clasping base, vein large, yellow, ending in the acute apex. Dioecious? Perichetial leaves smaller, with a longer, more sheathing base. Pedicels 5–15 mm. long, twisted in two directions; capsules 2–3 mm. long, straight, cylindric, smaller at the mouth; lid with a long curved beak, annulus large, falling with the lid; peristome fragile, pale, papillose, teeth long and slender, thickened and united at the basal joints, not twisted.

Closely related to *T. decolorans* Hpe., from which it differs in its larger size, longer, more spreading and clasping leaves and paler not twisted peristome.

Tortula (*Barbula*) *campylocarpa* Taylor. Unduavi, 8000 ft. October, 1885 (3127).

Compared with Spruce Musci Am. et And. nos. 185 and 201, agrees with specimens at Kew and has been verified by Bescherelle. Also compared with *T. rectifolia* Taylor, nos. 193–196, Spruce, from which it differs in its larger size and longer, more acuminate leaves.

BARBULA AUSTRO-REVOLUTA Besch. mss. Near La Paz, 10000 ft. April, 1885 (3129).

Plants in dense light yellowish-green or slightly glaucous, and dirty tufts; stems 1–2 cm. high with numerous, slender, subapical branches; leaves erect-spreading when moist, spirally twisted around the stem when dry, small, 1 mm. or less long, with strongly revolute margins and a broad, thick, yellow vein, ending in and forming the blunt apex; lower cells oblong, clear; upper smaller, denser and papillose; dioecious (?), perichetial leaves with a longer, more hyaline, clasping base. Pedicels light yellow, 5–7 mm. long; capsule 2 mm.; lid conic-beaked,cells spirally formed; peristome immature.

Closely related to no. 1622 of Mandon's Bolivian Mosses, collected in April, 1856, near Sorata, and labelled *B. glaucescens* in Herb. Schimper, but differing in the shorter, more blunt leaves, the more revolute margins, and in the yellow pedicel. Bescherelle says of it, "*B. revoluta* affinis sed foliis magis obtusa acuminatis glaucescentibus cucullatis; pedicello flavo, peristomio longe distat."

TORTULA (*Syntrichia*) sp.? Near Yungas, 4000 ft., 1885 (3124). Unduavi, 8000 feet. October, 1885 (3125 and 3127 pp).

Plants in dirty, yellowish-brown tuffs; stems 1–1.5 cm. high, branching; much abraded and discolored below; leaves erect-appressed when dry, tufted on the stems, upper, green with white hair-points, the vein papillose on back, and excurrent into a rough awn, apex rounded, margins involute; upper cells densely papillose, lower, clear and hyaline. Dioecious? Seta 10–12 mm. long, red below, twisted; capsule narrowly cylindric, 1 mm. long, straight or slightly arcuate when old, with a long-exserted columella; mouth small, annulus narrow, falling in fragments when old; peristome short or broken, twisted from a short basal membrane; teeth pale, papillose.

These plants were compared with several of Mandon's Plantae Andes Boliviensium, but their alliance was not determined by me while at Kew, nor by M. Bescherelle, to whom they were subsequently submitted.

Tortula (*Syntrichia*) *Andicola* Mont. Unduavi, 8000 ft. October, 1885 (3120). Sterile plants only collected.

Large sterile specimens answering the description given in the Ann. Sci. Nat. (Series 2, 953) and compared at the Jardin des Plantes with the type collected by D'Orbigny near La Paz, in the Bolivian Andes.

Tortula (*Syntrichia*) *aculeata* Wils.? Mapiri, 5000 ft. April, 1886 (3123); Sorata, 10000 ft.

Compared at Kew with Spruce, no. 144 and Jameson's specimens from Pichincha, both cited by Mitten under the description of this species. Ours agree with Jameson's better than Spruce's no. 144, and it would seem as if the two were distinct or the species very variable. Bescherelle also seems to think there is room for separation here, as he says: "*T. aculeata* Wils. affinior sed primo viso differt. Foliis integerrimis, magis papillosis, duplo longioribus, pilo valde longiore diversa, ut videtur—forsan species nova?

TORTULA (SYNTRICHIA) BIPEDICELLATA n. sp. Bescherelle, M. S. Mapiri, 5000 ft. May, 1886 (3123a).

Plants in small yellowish-brown tufts; stems 1–2 cm. high; leaves not crowded, curled and twisted when dry, 3–4 mm. long, without a hyaline point, the vein stout and brown, but ending in a short mucronate point at the apex of the leaves; margins plane or rarely slightly revolute below; upper cells densely papillose, lower large, clear and oblong. Dioecious perichetial leaves not differentiated. Pedicels mostly two together, about 1 cm. long, straw-colored; capsules 3–5 mm. with a long beaked lid, straight or slightly curved; mouth small, red; peristome not developed.

Closely related to *T. glacialis* Kze. Compared at Kew with Weddell's no. 20, collected in Bolivia, province of Larecaja, June, 1847, with which it agrees in the leaf characters but differs in having the pedicels more uniformly in pairs. There is a mixture also in this species at Kew, for the specimens collected by Liebmann on Mt. Orizaba and Poeppig in Chili are very different in aspect. Brescherelle says of them: "Affinis *T. glacialis* Kze., foliis tamen duplo-longioribus, ad summum planis haud undulatis; capsula geminore, peristomio non afformato."

Tortula fragilis Taylor? Sorata, 10000 ft. (3121).

Compared with specimens at Kew collected by Lindig, New

Granada, 2075, and Jameson's, from the Andes of Quito, 1847. Our plants are larger than Lindig's, the capsules longer and the pedicels single. The leaf is broadly undulate, ending in a short cusp, the marginal cells short, quadrate and papillose, the basal cells oblong and hyaline. The basal membrane of the peristome is very short, the teeth twisted once, white and granulose. Bescherelle says of this: "Folia ad basin margine recurvis, cellulis inferioribus similibus differe mihi videtur. *T. fragilis* (N. Grenada, Lindig, 2075) folia basi plana, ab cellulis marginales inferiore minores ut marginata habet: an *T. fragilis* forma peculiaris?"

Tortula Pichinchensis Taylor (*Barbula affinis* Hpe.). Ingenio del Oro, 10000 ft. (3122).

Compared at Kew with Spruce's nos. 185, 194, 197, 200–202 Andium Quitensium. Also verified by M. Bescherelle.

Orthotrichum pariatum Mitt. Sorata, 10000 ft., Feb., 1886 (3130).

Compared with no. 130 Spruce, And. Quit., with which it agrees.

MACROMITRIUM RUSBYANUM E. G. Britton, n. sp. Unduavi 12000 ft. October, 1885 (3188).

Plants large and showy in yellowish-brown tufts; stems 9–10 cm. long, repeatedly branching; leaves brown, broken and abraded on the lower parts of the stems, light yellow, longer and spirally twisted at the tips of the branches, 5–9 mm. long, lanceolate-linear, from a broader yellow or brown base, margins finely serrate above, vein ending in the channelled apex; lower cells elongated, porose; upper, shorter with thick protruding walls. Dioecious? Seta twisted or arcuate, 5 mm. long, stout; capsule almost globose, 2 mm. long, walls smooth and thick, brown and shining; lid conic-beaked; peristome double, outer, a thick fleshy membrane; inner, short, fragile, with bright yellow smooth teeth; calyptra, not seen; spores large, .0810–.0864 mm.

This is one of the handsomest species collected by Dr. Rusby and was dedicated to him by Dr. Müller, but referred to a new genus allied to *Leptodontium;* but after careful comparison at Kew with specimens of *Macromitrium trichophyllum* Mitt., and *M. scoparium* Mitt., I have concluded that its alliance is with these species. The absence of the calyptra is unfortunate, but in all other respects the likeness is very close, and the alliance is concurred in by William Mitten, to whom specimens were sent.

SCHLOTTHEIMIA RUSBYANA C. Müller, n. sp. Near Yungas, 4600 ft. 1883 (3191).

Plants densely matted together in dark red-brown cushions among the roots of orchids. Stems trailing, branches erect, about 1 cm. long; leaves densely crowded at the apex of the branches, erect-appressed and plicate when dry, 1–1.5 mm. long, oblong, obtuse, the vein ending in a short cuspidate apex; upper cells in regular transverse rows, the blade slightly undulate; lower elongated with thickened papillose ends. Plants sterile; alliance not determined.

Zygodon recurvifolius Sch. Sorata, Bolivia, 8000 ft. Feb., 1886 (3194.)

Compared with type in Herb. Schimper at Kew, no. 1629, G. Mandon Plantae Andium Boliviensium Exsicc. from Vicinius Sorata; also compared with no. 1627 *Z. ferrugineus* Sch., of the same Exsiccatae, Dr. Müller having determined Dr. Rusby's specimen as the last named species. It is unmistakably the former having much larger leaves which quickly become recurved when moistened. The plants also are not at all rusty. M. Bescherelle has subsequently supplied me with duplicates of Mandon's nos. 1629 and 2627 and I have recently been able to verify my previous determination.

ENTOSTHODON PAPILLOSUM E. G. Britton, n. sp. Sorata 10000 ft. Feb. 1886 (3131).

Plants scattered on hard, bare patches of earth; plants including the sporophyte 5–8 mm. high; leaves few, rosulate, long subulate, acuminate, the vein excurrent into or ending below the long slender tip, margins entire; cells very lax. Dioecious. Seta 5–8 mm. long, stout, densely papillose, erect or slightly arcuate when dry, sinuous when moist; capsule globose-pyriform, about 2 mm. long, including the stomatose neck; lid flat; peristome none; calyptra not lobed at base.

Allied to *E. Lindigii* Hpe. according to the description and key given by Mitten (Musci, Austro-Americani, p. 243), but differing in the densely papillose pedicel. This and the following species were found growing together in the same patches.

Entosthodon Lindigii Hpe.? (ex. descriptio.) Sorata 10000 ft. Feb. 1886 (3131).

Compared with specimens of *E. Mandoni* Sch. mss., no. 1645, Mandon, Bolivia, the leaves of which are less acuminate and have not a subulate tip; in both, the leaves are not bordered and the mouth is small and surrounded by 3–4 rows of darker, denser cells. In *E. apiculatus* Sch., no. 1646 of Mandon, the lid of the capsule is beaked, not flattened as in our specimens, and the leaves are not subulate pointed.

Funaria hygrometrica (L.) Sibth. Near Yungas, 4000 ft., 1885 (3132a).

Growing mixed with *Bryum argenteum* var. *lanatum*.

Funaria calvescens Schwaegr. Near Yungas, 4000–6000 ft., 1885 (3133a); Unduavi, 8000 ft., Oct., 1885 (3133b).

FUNARIA INCURVIFOLIA C. Müller, n. sp. Near La Paz, 10000 ft., Oct., 1885 (3132).

Plants 1–2 cm., pale straw-yellow; stems often several together, 2–5 mm. high; leaves rosulate, 2–2.5 mm. long, incurved, carinate-cucullate; vein yellow, ending in the acuminate, incurved apex; margins with a narrow border of 1 row of elongated cells, entire or faintly subserrulate; cells of the basal angles large, swollen. Dioecious; seta 5–10 mm. long, pale yellow and twisted; capsule small, 1.5–2 mm., oblique-pyriform; annulus large, compound, falling with the blunt lid; teeth with projecting cross-bars; inner peristome present, of short slender segments.

Belonging to the section of *F. hygrometrica* with which it was compared; differs in being smaller with incurved, more hyaline leaves, the cells with thinner walls.

Both *F. hygrometricoides* Sch. (Mandon, no. 1648) and *F. Mandoni* Sch. (Mandon, no. 1647) have shorter, blunt leaves, with cells more lax and thicker walled, and the vein ending below the apex with the marginal cells more swollen.

PHILONOTIS ASPERRIMA C.M., n. sp. Sorata, 10000 ft. (3140).

Plants small; stems matted with brown tomentum, branches short, less than 5 mm. long, numerous; leaves of two kinds, those of the main stems with a long subulate tip, a dark excurrent vein and serrate, revolute margins, with clear, rectangular cells; branch leaves smaller, the upper part of the leaf very spinose, the vein ending in the shorter, acuminate apex, margins plane or slightly recurved, sharply serrate; lower cells quadrate, smoother and clearer than in the upper ones. Dioecious. Perichetical leaves, broad, hyaline, and clasping at base, with a long subulate apex. Pedicels short, 1 cm.; capsules globose, 1.5–2 mm., oblique, strongly ribbed; lid mamillate, appressed; peristome double, endostome shorter than the teeth, mouth bordered by 4–6 rows of darker denser cells.

Growing mixed with *Bryum argenteum* var. *lanatum* and a sterile species of *Dicranum* in dense tufts, copiously fruiting. Compared with nos. 11, 13, 14, 17, 18, 20 and 21 of the species listed by Mitten in his Musci Austro-Americani. Most closely related to *P. gracilenta* Hpe., but differing in its smaller size and shorter pedicel.

PHILONOTIS PAGIONIFOLIA C. M., n. sp. Yungas, 4000–6000 ft. 1885 (3139).

Plants forming dense, matted tufts, with little fruit; stems short, branches fasciculate, about 5 mm. long, slender and curved at apex; leaves erect-spreading or secund, narrowly lanceolate, acuminate from a clasping, slightly decurrent base; margins thickened or revolute with several rows of teeth from base to apex; vein thick, excurrent into a toothed subulate apex; cells clear and square at base, all papillose on the upper surface. Dioecious; perigonium broad and clear at base, long-cuspidate at apex; perichetium concave, hyaline at base, ecostate, also with a long serrate tip; both sets of bracts much longer than the stem leaves. Pedicels 20–25 mm. long, bright glossy, orange-colored; capsule 3 mm. long, oblique, strongly ribbed when dry; lid mamillate; peristome double.

Resembling *P. gracilenta* Hpe. (Lindig, New Granada) but the leaves are more blunt. Compared with Mandon's no. 1676 from Sorata, Bolivia, named by Schimper *Philonotis Boliviana*, it differs in its slender and delicate branches, which are less fasciculate. Specimens at Kew are much confused in this troublesome group of species, but ours do not seem to agree with any of theirs. The nearest are those collected by Matthews at Casapi, Peru, in Herb. Hooker, named by Wilson and labelled "No. 2313, *Bartramia uncinata*" (*B. scabrida* Schwaegr. Supp. *pl. 57*), but they differ in the leaves being non-cuspidate and in the large ecostate perichetium.

BARTRAMIA (PLICATELLA) SCORPIOIDES C. Müller. n. sp. Near Yungas, 4000 ft., 1885 (3138).

Plants large, 5–6 cm. high, decumbent and matted with brown tomentum at base, yellowish-green, glossy; stems arcuate, branching by innovations 1–2 cm. long, or fasciculate; leaves secund, uncinate, acuminate, plicate; vein narrow, ending in the carinate serrulate apex, forming a sharp point; cells all papillose, the end walls thickened; dioecious; the antheridia surrounded by broad orange-colored bracts, with serrate papillose tips; perichetial leaves broad, clasping and hyaline, smooth and entire, vein narrow, excurrent into a slender point; pedicels 10–15 mm. long, red, curved at tip; capsules all eaten off or decayed.

Resembling *B. andina* Mitt. in its secund leaves, but when compared with Spruce no. 429 from Pichincha they are quite distinct, our species belonging to the section with *B. arcuata* and *B. scoparia*, but agreeing with neither. The absence of fruit prevents the determination of its closest alliance.

Bartramia tomentosa (Sw.) Mitt. Near Yungas, 4000 ft., 1885 (3136b.) Unduavi, 10000 ft. Oct. 1885 (3136a). Sorata 13000 ft. February, 1886 (3136).

Bartramia (*Breutelia*) *Brittoniae* R. & C. Bull. Soc. Bot. Belg. 31: 161. 1892. Sorata 13000 ft. February, 1886 (3137).

Large plants of a glossy golden green color; stems 6–7 cm. high densely matted with brown tomentum below; capsules few and immature.

Mixed with and resembling *B. tomentosa*, but differing in its squarrose, not secund leaves, which are longer and more sharply acuminate, and serrate.

Bartramia (*Cryptopodium*) *Jamesoni* Tayl. Near Yungas, 4000 ft. 1885 (3134).

BARTRAMIA THRAUSTA Schpr. mss. in Mandon's Plantae And. Boliv., no. 1673. Vicinius Sorata, 3200–4000 m. Mapiri, 5000 ft. May, 1886 (3135) H. H. R.

Plants decumbent and matted together with brown tomentum at base; stems 3–4 cm. high; leaves very brittle, with a conspicuous, white, clasping imbricate base, those of the young branches with a slender twisted apex 3–5 mm. long; older ones all broken off, the white base smooth, the upper part opaque and papillose on the short walls of the cells; margins bordered by 1 row of long yellow cells with small appressed teeth; vein narrow, toothed on back. Dioecious. Perichetial leaves with a short base and long serrate awn. Pedicel curved, 5 mm. long, red; capsule curved, 2 mm. long, with a small orange-colored lid; mouth small; walls ribbed; peristome short, double.

Allied to *B. potosica* Mont., but differing in the longer, less crowded, more spreading leaves with a more conspicuous white clasping base. Named by Dr. Müller for Dr. Rusby but Schimper's name has priority.

BARTRAMIA (VAGINELLA) AURICOLA C. M. n. sp. Ingenio del Oro, 10000 ft., February, 1886 (3135b). Sorata, 10000 ft., February, 1886 (3135a).

Plants light green or brown when old, with numerous, erect, simple stems, 1–2 cm. long, matted together with brown tomentum at base; leaves 2–6 mm. long, crowded, their white bases imbricated, the green upper part of the blade spreading, much broken, except on the youngest branches; margins finely and sharply serrate, bordered by one or two rows of smooth, elongated, clear cells, those of the blade densely papillose and opaque, vein narrow, keeled and spinose on back. Dioecious, perichetial leaf with a short basal blade only covering the foot and a long rough awn; pedicels short, 3–5 mm. long, pseudo-lateral, straight or curved; capsules large, 3 mm., erect or oblique, strongly ribbed when dry and brown; lid mamillate, appressed; peristome double, teeth, orange-red, trabeculate on the inner face; spores large, .027–.032 mm., rough, brown.

Differing from *B. thrausta* in its smaller size, more strict, erect habit, stouter more rigid leaves. Agrees with Lechler's no. 2680, from Chili, labelled *B. potosica* at Kew, but differs from the type of that species at Paris in the much more conspicuous white base of the leaves.

BRYUM RUSBYANUM C. Müller. n. sp. Yungas. 6000 ft. 1885 (3148a).

Plants slender, stems erect with short, strict branches, bearing small, erect, lanceolate, serrate leaves, vein disappearing below the apex; stem leaves larger, acuminate with a prominent red vein, also disappearing below the apex. Dioecious; pedicel, 3 cm. long, tawny, capsule pendent, 3–4 mm. long, with a neck half its length; lid mamillate; annulus double, inflated, dehiscent in fragments; mouth with an orange-colored border; cell-walls of exothecium much thickened, peristome double, teeth white, granulose, erose and irregular, endostome also granular with a basal membrane, segments hardly distinguishable from the teeth, neither carinate nor parted, basal rudiments of cilia two; spores large, yellow.

Seemingly a *Dicranobryum* most nearly allied to *D. fusiferum*, Mitt. with the type of which it was compared at South Kensington. Nat. Hist. Museum.

Bryum (*Webera*) *albicans* (Wahlb). Near Valparaiso, Chili, June, 1885 (3145). Antheridial plants only. Sorata, Bolivia, 10000 ft. February, 1896 (3193). Sterile.

Compared with Austin's, No. 189, Musci Appalachiani, these specimens agree perfectly in all the leaf characters, but are a little taller, 3–4 cm. in height.

Bryum candicans Taylor. Sorata, 13000 ft. February, 1886, (3144).

Bryum argenteum L. Near Yungas, 4000 ft. 1885 (3142). Mapiri, 5000 ft. May, 1886 (3142a).

B. argenteum var. *lanatum* Br. & Sch. Mapiri, 5000 ft. May, 1886 (3143).

BRYUM HUMILLIMUM C.M., n. sp. Ingenio del Oro, 10000 ft. March, 1886 (3147).

Plants small, bright glossy, yellowish-green; with julaceous branches less than 1 cm. high; stems red; leaves small, 1 mm. or less, imbricate, concave, those of the young branches obtuse and closely imbricated, the vein dividing and ending below the apex; lower cells lax and enlarged, upper rhomboidal spindle-shaped, forming small inconspicuous teeth. Dioecious. Pedicels short, 5–7 mm. long, darker below; capsules 2 mm. long, pendant; neck nearly half the length, contracted below the spore-sac; lid mamillate, orange-colored, rim red; annulus large, falling with the lid; peristome double, outer of light yellow teeht, papillose outside, trabeculate inside; endostome a shorter membrane with carinate segments, open along the keel, with rudiments of two cilia between.

Closely allied to *Bryum julaceum* Sm., but differing from European specimens at Kew in the shorter more rigid branches, with more closely imbricated leaves and shorter pedicels. Specimens collected by Mandon near Guyaboya, 28th May, 1866, named *B. julaceum*, at Kew, differ in much longer, more slender branches and pedicels 10–12 mm. long.

Bryum soboliferum Taylor. Sorata, 10000 ft. February, 1886. Ingenio del Oro, 10000 ft. (3148).

Compared at Kew with specimens collected by Jameson from Quito, nos. 151–200, and Pichincha, no. 328. Sent to Dr. Müller and with this name, and he replied "forsan species nova."

BRYUM COLORATUM, C. Müller, n. sp. Near La Paz. October, 1885 (3141).

Plants cespitose, in loose light-green cushions; stems with several 4–5 short fasciculate innovations about 1 cm. high; leaves in rosettes at the ends of the branches, 2–6 mm. long, oblong-lanceolate carinate, serrate above the middle, margins bordered by 2–3 rows of elongated cells; vein round, ending in a short mucronate apex; cells all regularly rhomboidal. Dioecious. Perichetial shorter with a longer mucronate tip. Pedicels straight or bent, about 2 cm. high, glossy yellow; capsules nodding, 4–5 mm. long, bright yellowish-brown; neck short, plicate; lid conic-apiculate; annulus compound, falling with the lid; peristome double perfect, teeth brown, inner membrane deep, carinate segments open along the keel with 3–4 slender, papillose, appendiculate cilia; spores brown .013–.016 mm.

Resembling *B. cernuum* Hedw. in the bright yellow color of its capsules, but a larger and coarser plant, seemingly one of the smaller *Rhodobryums*, with the leaves twisted when dry, allied to *B. andicola*.

Mielichhoferia campylocarpa H. & T. Near Yungas, 4000 ft. 1885 (3150).

Compared with no. 1694 of Mandon's Bolivian mosses, with which it agrees.

Mielichhoferia brevicaulis Hornsch. Near Yungas, 4000 ft. 1885 (3149).

Mielichhoferia n. sp.? Ingenio del Oro, 10000 ft. March, 1886 (3146).

These specimens were compared at Kew with all the species described by Mitten (Jour. Linn. Soc. 12, 320) having leaves at all similar and found to be most nearly related to *M. diplodonta*, but as the fruit is too immature to determine any peristome characters, it cannot be safely referred to any of them. A portion sent to C. Müller was named by him *Mielichhoferia modesta* n. sp.

Rhizogonium spiniforme (L.) Bruch. Yungas, 6000 ft.; Mapiri, 5000 ft. (3151).

POLYTRICHADELPHUS GROSSIDENS C. Müller, n. sp. Yungas 4000–6000 ft. 1885 (3159).

Plants dark red, glossy; stems erect, unbranched 5–6 cm. high, leaves erect, 5 mm. long, closely imbricate with a brown clasping base; margin coarsely serrate; vein pellucid, excurrent into a smooth blunt cusp; perichaetium longer tipped, enclosing long dark protruding paraphyses; Dioecious, the male plants proliferous at apex. Pedicels stout, erect, 2–3 cm. long, bright fulvous, capsules horizontal 4–5 mm. long; lid conic, beak hooked, 2 mm. long.

Compared with *P. rubiginosus* Mitt. no. 211, J. Weir, Andes Bogotenses, pedicels shorter, leaves more sharply dentate; with *P. aristatus* Hpe., no. 2002, Lindig, New Granada, Bogota (1859), and another not numbered, collected in 1863, in the fewer but larger multicellular teeth and short cuspidate apex as well as in the longer pedicels and larger capsules of Dr. Rusby's plants.

Polytrichadelphus umbrosus Mitt. Unduavi, 10000 ft. October, 1885 (3160).

POLYTRICHADELPHUS INTEGRIFOLIUS C.M., n. sp. Unduavi, 10000 ft. October, 1885 (3159a).

Stems 5–8 cm. high, leafless below and tomentose, proliferous at apex; leaves erect, slightly spreading, vein broad, excurrent into a smooth, dark awn; margins entire, incurved; lamellae seven, rows of cells high, uppermost cells rounded in section. Dioecious. Perigonial bracts scarious, with short triangular points.

Male plants only collected, and from the robust stems and broad, scarious, perigonial bracts it strongly resembles *Polytrichum*. Compared with various species of *Polytrichadelphus* at Kew, none of which it resembles.

Pogonatum oligodus Kze. Near Yungas, 4000 ft. 1883 (3157).

Pogonatum tortile Sw. Near Yungas, 4000 ft. 1885 (3158).

Agrees with specimens so named collected by Matthews in Peru.

Polytrichium juniperinum Hedw. Sorata, 13000 ft. February, 1886 (3156).

Polytrichum cuspidigerum Sch. Teste C. Müller. Unduavi, 18000 ft. October, 1885 (3156c).

Plants 5–8 cm. high; stems naked below, densely leafy above; leaves erect-appressed, almost imbricate when dry, 5 mm. long, margins serrate with a few large, coarse, teeth; lamellae filling almost all of the blade, margins only slightly incurved. Perichetial leaves longer, erect, innermost with a scarious base and long, slender tips; pedicel 15–25 mm. long; capsules 3 mm. long with a small hypophysis; teeth lax, short, pale and regular.

No specimens bearing this name can be found in Schimper's Herbarium at Kew.

Polytrichum aristiflorum Mitt. Unduavi, 8000 ft. October 1885 (3155a).

This species has also been collected at Yungas by Pearce There are a great many diverse localities cited for this species by Mitten, and there is as much diversity in the specimens at Kew. We referred all of Dr. Rusby's specimens from Yungas, nos. 3155b and c and no. 3155a from Sorata and 3155c from Mapiri to this species, but Dr. Müller gave it a manuscript name, which is antedated by *P. patulum* Harvey (Müll. Syn. Musc. 1: 210) from Nepaul. It seems probable that there is room for the separation of several species, but as ours agree with Jameson's from the Andes of Quito and Weddell's from Peru, we have thought it best to enumerate them under this species.

POLYTRICHUM ANGUSTICAULE C.M., n. sp. Near Yungas, 4000 ft., 1885 (3155).

Plants large, 8–10 cm. high; stems simple, 2–4 cm. high; leaves 6–8 mm. long, the clasping base oblong, brown or slightly scarious on the margins, tapering into a slightly longer apex, with incurved entire margins; vein rough on back, with two or three rows of sharp teeth, excurrent into a smooth or only slightly roughened awn; lamellae covering almost all of the blade, of 6–7 rows of cells, the last row elongated, conical and smooth. Dioecious; male plants proliferous; perichetial leaves with a long smooth point; seta 6–8 cm. long, stout, glossy, curved at apex; capsules large, 5 mm. long, cubic, with a short wrinkled apophysis; lid dark red, beak long; teeth white, 64.

Closely allied to *P. aristiflorum* Mitt., and compared with specimens sent us by Wm. Mitten, collected in Venezuela by Funk and Schlim, no. 472. Differs in the longer, scarcely roughened awn of the leaves, which are more closely appressed when dry, and in the larger capsules.

PLEUROCARPI.

All the specimens of the pleurocarpous mosses as well as the acrocarpous ones were carefully studied and separated before duplicates were sent to Dr. Müller, yet in two cases in the genus *Hookeria*, there was evidently a mixture of species growing together, which in one instance seems to have misled Dr. Müller.

HOOKERIA BAKERI E. G. Britton, n. sp. Near Yungas, 4000 ft. 1885 (3163).

Plants yellowish-green, large and coarse; stems 2–3 cm. long; branches 1 cm., leaves curled and crisped when dry, more or less undulate with long subulate tips 2 mm. long, veins prominent when dry, ending just inside the margin, which is entire below, serrulate along the tapering apex and bordered by 3 rows of narrow, elongated cells; those of the blade very large and clear, not papillose. Pedicel 20–25 mm. long, bright, glossy brown; capsules ovoid, 2 mm., brown, walls thick; lid conic-rostrate; teeth long, slender, brown and incurved in pairs, and papillose; endostome yellow, erect, carinate segments closed.

Compared with *H. marginata* to which it is related, but differs in the lighter green leaves, broader and less acuminate, the cells more lax and hyaline.

Dedicated to Mr. J. G. Baker, of the Royal Herbarium at Kew, in grateful acknowledgement of the many kind favors received from him while at work, under his charge, on Dr. Rusby's Ferns and Mosses, and also as a small recognition of the task he accomplished in mounting and putting in order the Herbarium of W. P. Schimper, presented to Kew by the Baroness Burdett-Coutts.

This species was first named *H. castanea*, from the description only, and when submitted to Dr. Müller he discovered three new species in it; but as we can find but one specimen in our packet, and have no means of determining which of his names apply to our species, we have discarded all his manuscript names.

HOOKERIA PURPUREOPHYLLA C.M., n. sp. Near Yungas, 6000 ft. 1885 (3164).

Plants small, light reddish brown, .7–1.5 cm. high; stems branched, distichous, or flattened; leaves small, 1 mm. long, closely imbricate, appressed with flexuous, filiform spreading points; veins ending below the rounded part of apex, toothed at the back of the leaf above; margins serrate to below the middle, more coarsely so above; cells papillose, upper wine-color, lower colorless and longer; pedicel purple, 15 mm. long, arched at apex; capsule 2 mm. long; neck tapering; lid conic-rostrate. Peristome not yet matured, torn off with lid.

Compared with *H.* (*Callicostella*) *rufescens* Mitt. (Spruce, no. 629) from which it differs in the longer acuminate leaves; they also are more slender and not so crisped as those of *H. purpurea* and are too acute for *H. incurva.* Our plants are mixed with a small, golden yellow *Hypnum* in fruit, and a brown Hepatic, but we cannot find the two species of *Hookeria*, indicated by Dr. Müller in his letter by two other manuscript names.

Hookeria crispa C.M. Near Yungas, 4000–6000 ft. 1885 (nos. 3161 and 3161a).

Hookeria falcata Hook. Near Yungas, 4000–6000 ft. 1885 (3162).

BRAUNIA CANESCENS Sch. in G. Mandon, Plantae Andium Boliviensium, Exsicc., no. 1641. Vicinius Sorata, 1858, Mandon. Sorata, 10000 ft., February, 1886, H. H. R. (no. 3153).

Plants crowded in brown masses, stems copiously branching, less than 2 cm. high, discolored beneath, green at tips of branches; leaves closely imbricated, lower ones with short white tips, those at the ends of the branches frequently prolonged into flexuous white hairs, ovate and quite concave in the middle with a plane border of small square cells in straight rows, and the margins double or recurved, bluntly papillose, frequently brown in the upper half with elongated cells in the centre of the base, and others sinuous; apex serrulate or erose when long and hyaline; perichetium short, 3 mm., enclosing very long paraphyses, bracts strongly plicate, cells long and clear, apex not hyaline; pedicels 1 cm. long, capsules about 3 mm. with small orange-colored mouth and apiculate lid.

Mandon's specimens at Kew in Herb. Schimper are somewhat larger and lighter colored than Dr. Rusby's, but agree in all essential characters, especially no. 1641 of the Exsiccatae in Herb. Hooker. Sent to Dr. Müller as *H. cirrhifolia* (Wils.) Mitt. (J. L. Soc. xii., 406, ex descriptio) and named by him *Braunia argyrocarpa* n. sp., also to Bescherelle, who says, "ut videtur foliis tamen apice diaphanis quod nos indicat Mitten."

BRAUNIA SUBPLICATA E. G. Britton, n. sp. Ingenio del Oro, 10000 ft., May, 1886 (3154); Mapiri, 5000 ft. (3154a).

Plants dark brownish green, in large dense mats, stems decumbent, pinnately branched, often giving off radiculose stolons, branches erect, 4–5 cm. long; leaves subsecund when moist, imbricate and erect when dry, with three blunt ridges, not hyaline pointed, ovate-concave, over 1 mm. long, less than 1 mm. broad, with entire revolute margins and a conspicuously rolled border to the concave center, apex acute and concave, erose dentate, but not hyaline, conspicuously papillose at the tips of the branches, basal cells elongated brown, others regular and sinuous; perichetium narrowly lanceolate, erect, sulcate, 3 mm. long, with oblong yellow cells at base and middle and blunt erose tips; pedicels 1 cm. long, erect or cernuous twisted, fulvous as well as the base of the capsule, which is 2 mm. long with a straight beak over 1 mm. long, mouth with a thick red rim, calyptra brown, 3 mm. long, tufted and ragged at base with a straight beak 1 mm. long.

Differs from *H. plicata* Mitt. (Bridges, Bolivia in Herb. Hooker) in the dull brown color of the plants and in the leaves not being hyaline tipped; from *H. secunda* (Hook. Musci Exot. t. 46, Humboldt's type in Herb. Hooker) in the larger, less secund leaves with more strongly revolute margins; resembling only an unnamed scrap in Herb. Hooker, collected by Mathews in Peru at Casapi, and a part of *Braunia subsecunda* Sch. M. S., no. 5, in Herb. Schimper without locality or name of collecter. (See Jaeger, p. 86) pencilled Mexico? by J. G. Baker. Sent to E. Bescherelle as *B. plicata* Mitt. he says = "? var. *foliis majoribus!*"

Hedwigidium imberbe Sm. Unduavi, 1000 ft. (3152) Sterile. Mapiri, 5000 ft. with 3154a fertile.

Compared with G. Mandon Plantae Andeum Boliviensium Exsicc., no., 1638 vicinius Sorata, labelled *Harrisonia rhabdocarpa* Hpe. with which it agrees. As also with Lindig's New Granada, no. 2000. Both of these are considered to be *H. imberbe* Sm. (Mitt. J. L. Soc. **12**: 405). The plants mixed with 3154a are coarser and brighter green, agreeing better with Spruce Musci Am. et. And., nos. 1293–1295, of *H. imberbe.* There is considerable variation in the size and color of this species, also in the degree of ramification of the stems and the appression of the leaves, but otherwise the leaves are indistinguishable when placed side by side under the same cover-glass under the microscope. Weddell's no. 9 Peru, are small, little over 1 cm. high and almost simple like 3152 H. H. R., while Spruce no. 1295 and Rusby's 3154a are nearly 6 cm. high and quite pinnately branched.

CRYPHAEA (EUCRYPHAEA) BOLIVIANA Sch. mss. Mandon (no, 1688), vicinius Sorata, 3200 metr., 1857. H. H. Rusby. Sorata, 10000 ft. 1886 (3165).

Plants large, slender; stems bipinnate, 10–15 cm. long, branches pendant, 5–6 cm. long, branchlets few and distant, 1–1.5 cm. long; leaves spreading when dry, those of the branches 2 mm. long, those of the branchlets only about 1 mm. long, both lanceolate-acuminate, vein ending below the long subulate, serrate apex, margins entire below, slightly recurved in the middle; basal angles auricled, decurrent. Capsules two or three together at intervals along the branches, perichetial leaves with a broad, clasping base covering the capsule, vein scarcely extending below the long nearly smooth awn, exceeding the base in length. Capsules 2 mm. long; peristome double, the outer of long, spreading, broad teeth, the inner of shorter, narrower segments, composed of a double row of papillose cells, attached to a basal membrane.

Allied to *C. pilifera* Mitt., and possibly referable to that species, but recognized also by Müller as a new species, Schimper's name having priority.

Cryphaea ramosa Wilson. Unduavi, 12000 ft., October, 1885 (3166).

Prionodon luteo-virens (Taylor) Mitt. Unduavi, 10000 ft., October, 1885 (3167). Also collected at Yungas and Unduavi by Pearce.

Phyllogonium viscosum Beauv. Near Yungas, 6000 ft., 1885 (3168). Also collected by M. Bang near Yungas, 1890 (565).

METEORIUM (PAPILLARIA) CLADONIELLA C. M. n. sp. Near Yungas, 4000 ft., 1885 (3189).

Plants light yellowish-green, glossy; stems creeping horizontally, 10–12 cm. long; branches simple, 1–3 cm. long; leaves crowded, concave, plicate, appressed, with short spreading points; vein broad at base, or rarely lacking; apex suddenly subulate; margins minutely serrate; cells all papillose.

Plants sterile. Alliance not determined.

METEORIUM LONCHOTRICHUM C. M. n. sp. Near Yungas, 4000 ft. 1885 (3172).

Plants bright yellowish-green, glossy; stems long, creeping; branches irregularly pinnate, 2–3 cm. long; leaves 1–1.5 mm. long, undulate, crisped when dry, lanceolate-acuminate, serrate, vein ending below the apex, cells of the basal angles enlarged.

Plants sterile. Allied to *M. patulum* Sw.

Meteorium filiferum (C.M.) Mitt. Near Yungas, 4000 ft. 1885. (3173).

Plants dark green or black with lighter yellowish branches. Youngest shoots very slender, filform, and totally different in aspect from the older stems; stem leaves, entire, concave, the vein ending below the short recurved cuspidate point; basal angles conspicuously inflated at the inner angle, with a small round group of yellow cells; leaves of the young branchlets much smaller, distant, narrowly lanceolate-acuminate, vein ending below the long filiform point; basal angles decurrent with the same conspicuous round auricle, at the inner point of insertion.

Named from description, and compared with No. 131 collected by Weir, Andes Bogotensis from which it differs in aspect, and the presence of the long filiform branches described in the original.

METEORIUM (PILOTRICHELLA) PERINFLATA C.M. n. sp. Near Yungas, 6000 ft. 1885 (3171).

Plants light yellowish-green, glossy; primary stems 10–15 cm. long, creeping; branches simple, 1–2 cm. long, or with a few short branchlets; leaves concave, the margins so completely incurved as to almost meet, quite entire; vein narrow, ending below the short, sharp-pointed apex; cells of the outer basal angles square, enlarged, slightly auricled and decurrent. Fruiting branches 5 mm. long, perichetial leaves far exceeding the capsules, imbricate, each with a long, squarrose, acuminate apex, with a short vein or veinless. Capsule brown, thick-walled, ovoid, about 2 mm. long, on a short seta; peristome double, teeth long, slender, yellow, endostome as long, carinate segments rarely open along the keel; spores green, .021–.024 mm.

Allied to *M. crinitum* Sull., but differing in the entire leaves and the long peristome, the inner not adhering to the outer Specimens not compared.

METEORIUM (PILOTRICHELLA) REFLECTO-MUCRONATA C. M. n. sp Sorata, 10000 ft., February, 1886 (3170).

Plants light green, glossy; stems creeping and rooting; branches about 1 cm.; leaves imbricate, concave, with reflexed points; vein very short and indistinct; margins incurved, entire, forming a cucullate cuspidate apex; cells of basal angles enlarged, but indistinct, slightly decumbent.

Plants sterile. Alliance not determined.

Neckera Jamesoni Taylor. Sorata, 8000 ft., February, 1886 (3169); Unduavi, 8000 ft., October, 1885 (3169a).

Beautiful plants with pendant branches, often 18–20 cm. long.

Thamnium longirostre (Hook)? Near Yungas, 4000 ft., 1885 (3174a); Sorata, 10000 ft., February, 1886.

POROTRICHUM (THAMNIUM) BOLIVIANUM C. M. n. sp. Near Yungas, 4000 ft., 1885 (3174).

Plants light yellowish-green, with a creeping rhizome; stems 4–5 cm. long, naked below, about 2 cm., bipinnate; branches flattened, frond-like, red; leaves compressed, elliptical-oblong, unequal at base, about 1 mm. long; vein dividing and disappearing below the broad sharply serrate apex; margins entire below; cells of the basal angles only slightly differentiated; monoecious; antheridial buds on different branches from the archegonia; perichetial leaves longer, outer squarrose, subulate, often veinless, inner erect-clasping, with a narrow vein; seta red, flexuous, 10–15 mm. long; capsule 2 mm., ovoid-cylindric, neck short; lid 2 mm. long, with a long beak; annulus large, simple; peristome double, teeth long, slender, endostome of slender papillose carinate segments, open along the keel; cilia none.

Allied to *Porotrichum longirostrum* (Hook.) Mitt. and possibly referable to this variable species, according to Mitten. Compared at Kew with specimens collected by Spruce (And. Quit. nos. 1361–1363) from which ours differ in being much coarser, with less slender, not flagellate branches and shorter stouter pedicels, agreeing better with Weddell's no. 53 from the Andes of Peru, but our plants are smaller with shorter leaves, turning yellower with age, and more coarsely and doubly serrate at the apex.

Entodon Jamesoni (Tayl.) Mitt. Unduavi, 8000 ft. October, 1885 (3175).

FABRONIA SINGULIDENS C.M., n. sp. Ingenio del Oro., 10000 ft. March, 1886 (3176); Mapiri, 10000 ft. (3182 pp).

Plants in dense pale, yellowish-green mats; stems with numerous short branches 3–5 mm. long; leaves crowded, spreading minute, ovate-acuminate with a long subulate point, margins spinose-dentate or rarely entire at the apex of the branches, vein ending above the middle; basal cells square at the angles. Perichetial leaves broad and serrate at apex, with a suddenly subulate point; vein short. Pedicel erect, 5 mm. long; capsule small, little over 1 mm. long, ovoid; neck distinct, tapering into the pedicel; lid conic-rostrate, small, yellow; mouth small, bordered by 4–5 rows of transversely elongated, darker, denser cells; peristome short, teeth brown when old, pale when young, united in fours or divided when old, smooth, slender at apex.

Closely related to *F. polycarpa* Hook. from which it differs in its abruptly subulate perichetial leaves and its ovate capsule.

HYPNUM (CUPRESSINA) ENTODONTICARPUM C.M., n. sp. Unduavi, 12000 ft. October, 1885 (3186).

Plants in dense, yellowish-green, glossy cushions; stems pinnately branched, arcuate, 1–2 cm. long, branches 5–8 mm. long; leaves crowded, uncinate hooked, entire, veinless; cells of basal angles inflated, yellow. Monoecious. Perichetial leaves longer, outer uncinate, inner erect, subulate, all veinless. Pedicels red below, twisted above, 15–20 mm. long; capsules erect, cylindric or arched; neck tapering; walls thin; mouth bordered by denser, brown cells; peristome double; teeth brown, short and thick, bordered by the adherent segments of the inner peristome.

Compared with *Drepanium hamatum* Mitt., no. 1046, Spruce Musci Am. et And.), specimens of which are preserved at Kew but are not listed by Mitten. Closely related to this species, but differs in its more clearly veined leaves and longer pedicels.

Leskea aciculata Taylor. Near Yungas, 6000 ft. 1885 (3177).

Compared with Jameson's specimens from Quito with which it agrees.

LESKEA (SCHWETSCHKEA) BOLIVIANA C.M., n. sp. Mapiri, 10000 ft., 1886 (3102). Sorata, 10000 ft., February, 1886 (3185).

Plants in dense yellowish-green mats; stems 1–3 cm. long, creeping, with short, irregular branches 5–8 mm. long; leaves imbricate with spreading points, ovate-acuminate, less than 1 mm. long; margins entire; vein ending below the apex; cells rhomboidal above, transversely elongated below, not papillose; monoecious; perichetial leaves longer, erect, base long, clasping, vein ending below the acuminate apex; cells elongated; pedicels red, 10–15 mm. long; capsule cylindric, 2 mm.; lid conic; annulus falling in fragments, narrow, single; mouth bordered by darker, denser cells, walls thin; peristome double, teeth long, slender, papillose at apex; endostome with a short basal membrane and slender, carinate, papillose segments, thickened at the joints, or appendiculate; cilia none.

Allied to *L. gracillima* Tayl., which has also been collected in Bolivia by Bridges, but differs in the vein ending below the apex and the leaves being quite smooth. Identical with no. 3185 cited above, which was also sent to Dr. Müller and named by him *Pseudoleskea amblystegiella* n. sp., but this name is too near *P amblystegioides* C.M. from Costa Rica, Polanowsky.

PSEUDOLESKEA ANDINA Sch., mss. Prov. Larecaja, vicinius Sorata, 3200 metr. November, 1857 (1694), legit, G. Mandon "super arbores." Sorata, 13000 ft. February, 1886 (3181). H.H.R. and Unduavi, 12000 ft. October, 1885 (3180)

Plants in dense brown cushions; stems 7–9 cm. long, irregularly pinnate; branches .5–1.5 mm. long, slender; paraphyllia small, clustered, branching; leaves small, less than 1 mm., crowded, minute; base concave appressed, apex subulate, serrulate; vein thick, channelled, excurrent; cells rhomboidal, papillose, those of the basal angles erect, rectangular and denser on each side of the basal folds. Perichetial leaves longer and more acuminate, and not papillose, outer recurved, inner sheathing, all pale and plicate with the vein ending below the apex. Pedicels straw-colored, 2 cm. long; capsules arched, 3 mm. long, slightly contracted below the mouth when dry; lid mammillate; mouth bordered by a deep flaring rim; peristome inserted below the rim, double; teeth yellow, trabeculate; endostome yellow, segments as long as the teeth, carinate, rarely divided or open along the keel, attached to a short, basal membrane, appendaged at the joints; cilia none; spores rough, .016–.021 mm. green.

No. 3181 was named for Dr. Rusby, by C. Müller, but Schimper's name has priority.

Thuidium Peruvianum Mitt. Near Yungas, 6000 ft. (3178), Unduavi, 8000–10,000 ft. October, 1885 (3179).

Compared with Jameson's specimens from Pichincha and Pearce's from the Andes, duplicates of which have been sent to us from Kew. The specimens collected by Miguel Bang (No. 482) at Yungas, and listed by Dr. Rusby (Mem. Torr. Club, **2**: No. 3, p. 274) as *Thuxidium delicatulum*, were so named by Mr. C. H. Wright at Kew. Duplicates of all our specimens, including these, were submitted to Dr. George N. Best for critical comparison. He says: "They apparently belong to one and the same species. The stem leaves differ from those of *T. delicatulum* in not being closely appressed when dry; they are more concave, broader at base and more abruptly acuminate, somewhat undulate and rugose above, and the leaf-cells are more rectangular and less rhomboidal. Notwithstanding these differences, which indicate a variety rather than a distinct species, the general type remains well marked. I should refer your specimens to *T. delicatulum*." But as these specimens are much larger and coarser than any of *T. delicatulum* which we have ever seen, and they seem worthy of a distinctive name, we have maintained them as above listed.

SPHAGNACEAE.

Sphagnum Peruvianum Mitt. Near Yungas, 6000 ft., 1885 (3100).

Sphagnum acutifolium Ehrh. Near Yungas, 6000 ft., 1885 (3102), near La Paz, 10,000 ft. October, 1885 (3103).

Sphagnum Meridense C.M. Unduavi, 10,000 ft. October, 1885 (3104).

Sphagnum recurvum Hoffm. Unduavi, 8000 ft. October, 1885 (3106).

Sphagnum recurvum var. *mucronatum* Russ. Near La Paz, 12,000 ft. (3105).

HEPATICAE.

The Hepaticae of the collection were enumerated by Dr. Richard Spruce in Memoirs of the Torrey Botanical Club, **1**: 113–140. 1890.

On the Formation of Circular Muskeag in Tamarack Swamps.

CONWAY MACMILLAN.

(PLATES 279–281.)

In 1892 observations made by the writer upon plant-distribution in the valley of the Minnesota led him to recognize and describe what were termed *tension-lines* between groups of plants established in their habitats. In addition to that principal tension between centrally and distally distributed floras arising from what was denoted as *equatorial pressure*, other tensions due to topographic conditions were defined as secondary and as minor tensions. "By the latter term there is not meant the forest and prairie delimitation, for that is to be referred in large part to the principal lateral tension, developed by equatorial pressure. The various topographical features of the Minnesota valley with its gorges, glens, vales, meadows, hills and headlands bring about slight but distinguishable segregations of floral elements. Between meadow and bluff there exists a minor tension-line; between swale and knoll on the prairie, between hill and ravine in the forest, there are to be discovered such minor tensions."* In this paragraph was laid the foundation for a series of studies in the zonal distribution of plants, and much interesting material has since been reviewed. In an extended paper not yet published, but read before the Botanical Society of America at the Buffalo meeting in 1896, and given in abstract in an American journal,† the zonal distribution of plants upon the *roches moutoneés* of a fresh-water archipelago and upon lake strand and sand-dune islands was discussed and certain intimate and remarkable connections between physiographic and plant-distributional conditions were indicated.

Zonal distribution was studied in 1893 by Ant. Magnin,‡ who described the *Carex*, *Phragmites*, *Scirpus*, water-lily, pond-weed and *Chara* formations which, by their sequence, mark the increasing depth of the water off shore in the lakes of the Jura. A month or two later *Equisetum* zonal distribution was noted in the

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* MacMillan, Metaspermae of the Minnesota Valley, 596, 1892.

† The Botanical Gazette, 22: 218. 1896.

‡ Magnin, A. Recherch. Veg. Lac. du Jura. Rev. Gen. Bot. 5: 241. 1893.

lakes of northern Minnesota* and in the following year numerous papers along this general line were published both in America and abroad. Pieters† adapted the formation classification of Magnin to an American lake and the writer published a short account of two singular floating or anchored atolls of sphagnum which he had observed in central Minnesota.‡ The general facts are well brought together by Warming§ in his recent text-book, although with that too frequent disregard of American investigation which is a blemish to so much European compilation.

Such zonal limnetic formations occur in all parts of the world and afford fine examples of this type of distribution.

At present it is desired to call attention to the tension-line between sphagnum moor and the higher forest-clad ridges surrounding such moors as they exist in Minnesota. Sphagnum formations with the various attendant plants are commonly designated as *Muskeag* by the woodsmen of Minnesota, and the northern half of the State, in particular, furnishes many splendid examples of this type of plant association. The smaller muskeags are quite generally round or approximately elliptical in outline, while the larger ones, although preserving for the most part rounded outlines, are more irregular in shape. They occur abundantly in the neighborhood of the glacial lakes so characteristically disposed throughout the morainic region of Minnesota and are by no means confined to the belt of pines, for they may be observed about Minneapolis, in Chisago county and in the middle western counties of the State. Unlike the more ancient lakes of western Ontario and the international boundary region between Minnesota and Canada, these lakes have the typically rounded form of a glacial basin and rarely imitate in outline the long, rock-bound and irregular bodies of water so omnipresent in northern Canada.

The sphagnum moors or muskeags may be regarded as such glacial ponds or lakes in process of conversion to forest, and almost every imaginable transition may be found, from open lakes with

* MacMillan, C. Shore formation of *Equisetum limosum*. Bot. Gaz. 18: 316 1893.

†Pieters, A. J. The Plants of Lake St. Clair. Pamph. 1894.

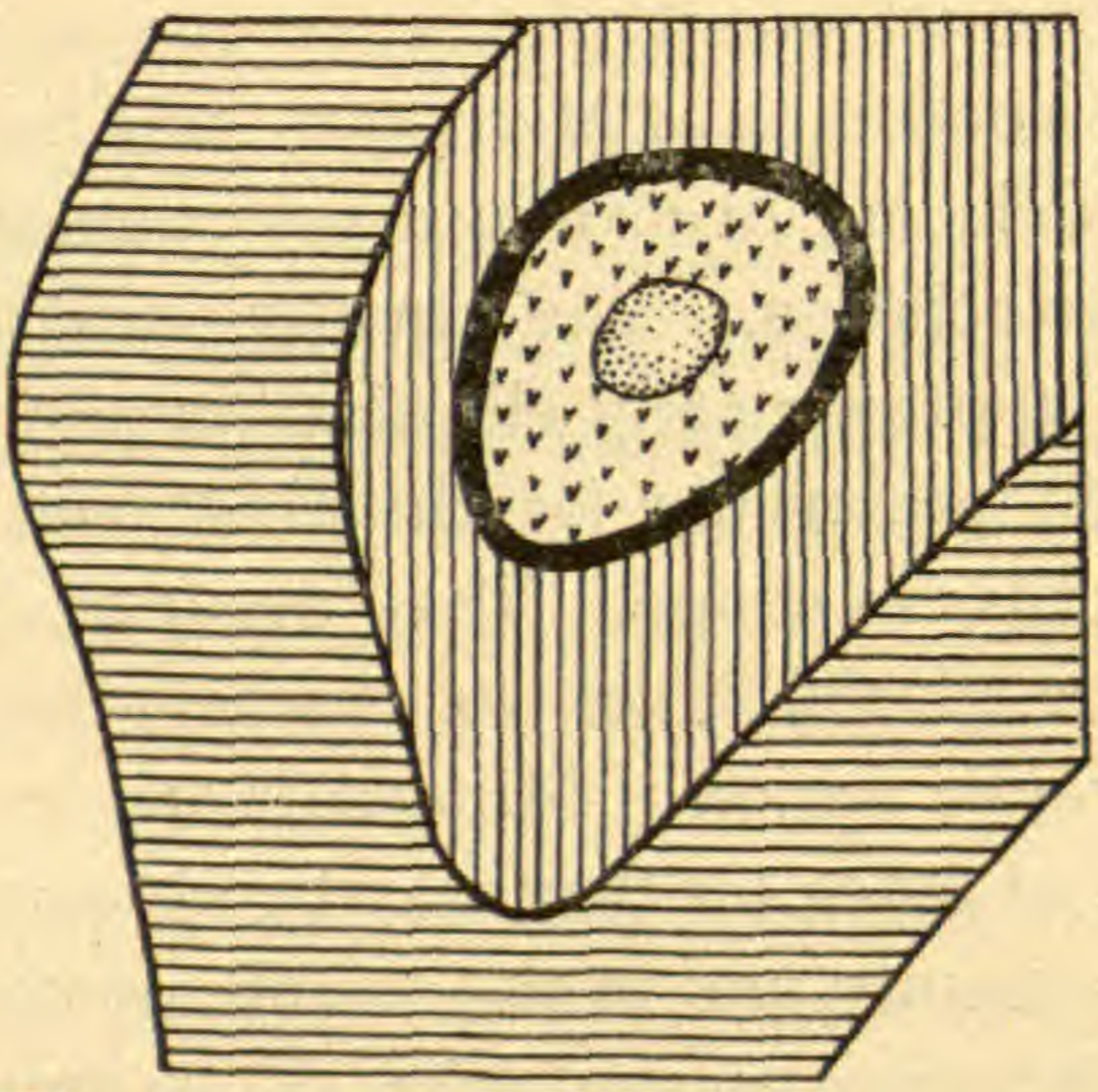
‡ MacMillan, C. On the Occurrence of Sphagnum Atolls in Central Minnesota. Minn. Botan. Studies, 1: 1. 1894.

§ Warming, E. Lehrbuch der Oekologishen Pflanzengeographie, 162. 1896.

sandy beach-lines continuous on all sides—a testimony to the untrammelled action of the waves—to solid masses of spruce and tamarack timber. The latter is displaced again by pines or hardwood and is converted eventually into mixed wood or perhaps even into meadow.

Typical muskeag with spruce and tamarack may clearly be taken as an intermediate physiognomic distribution of vegetation, linking the original open lake with the later glade or forest. A description of such an area may be given briefly and reference to the plates accompanying this paper will indicate clearly enough what relation the different plants bear to each other.

The center of the muskeag is ordinarily softer and more yielding than the edges, although this is not true of older specimens of



Ridges with *Pinus divaricata*.

Zone of *Larix laricina*.

Zone of *Picea Mariana*.

Zone of *Ledum* and *Eriophorum*.

Central *Sphagnum* and *Utricularia*.

the formation. In them, and in many of the small muskeags, the center is quite as firmly filled with soil as the circumference. Towards the center of those younger muskeags, which will be considered as typical, there is a preponderance of the sphagnum. If the very center is occupied by an open pool, this is usually covered with *Utricularia*, *Lemna trisulca*, or even pond-weeds and water-lilies. Farther from the center *Kalmia* and *Andromeda*, with such orchids as *Pogonia* and *Limodorum*, various species of *Carex* and *Eriophorum*, *Sarracenia*, *Salix*, *Vaccinium*, *Schollera* and kindred plants establish themselves. *Ledum* commonly affects drier and more peripheral positions, and is often the most abundant heath when the sphagnum has disappeared, except from isolated patches among the tamaracks. Surrounding this group of plants, herbaceous and shrubby, many of them with the pronounced xerophytic characters of sphagnum-moor inhabitants, are frequently spruces—either *Picea Canadensis* or *Picea Mariana*, but ordinarily the latter—tamaracks (*Larix laricina*) and sundry species of *Salix*, with *Alnus incana* and dwarf *Betulas*.

A very perfect series of muskeags, uninjured by fire or lumbering operations, occurs in the vicinity of Grand Rapids, Minn. I have been able through tne kindness of Mr. W. W. Pendergast, Director of the State Experimental Sub-Station at that point, to secure photographs of two of these moors, taken in such a way as to bring out the zonal distribution of the tamaracks and spruces. The general ridge group of plants in this region may be described briefly as forests of *Pinus divaricata*—the "Jack Pine" of the loggers. It is this tree which occupies the ridge in the background of Plate 279, to the left. Here and there in the valleys the muskeags are situated, each surrounded and, as it were, marked off from the pines by a circle of tamaracks. In the particular muskeag from which Plate 279 was taken the open area is almost elliptical in shape and contains about 1250 square rods. The ring of tamarack varies in width, but is estimated as about 75 yards across at the point shown. Where it faces the moor it is lined with black spruce. Small spruce trees are scattered out into the moor and a *Salix* shrub is seen in the foreground. The spruces nearest the open part of the moor are both smaller and younger than those farther back, although it must be observed that the difference in age is somewhat less than is indicated by the difference in size. Those growing out in the colder water and lighter peat soil are dwarfed in consequence. In this muskeag the principal accessory plants are *Andromeda*, *Chamaedaphne*, *Kalmia* and *Ledum*.

The following measurements and determinations of the age of trees in the muskeag and in its border-line were secured for me by Director Pendergast.

Tree.	Distance in rods in from border-line.	Diameter, inches.	Height, feet.	Age, years.
Spruce	0	5.5	28	49
Spruce	3	1.25	5	15
Spruce	6	4	17	38
Spruce	6	2	8	21
Spruce	6	2	8	21
Tamarack	0	7	30	55
Tamarack	2	2.5	12	45
Tamarack	10	1.25	6	18

Mr. H. B. Ayres, who has studied the habit of spruces growing in muskeag,* but publishes no comparative measurements, assures Director Pendergast that in cold bogs he has found black spruce little more than an inch in diameter and seventy-five years of age. A consideration of the table above will indicate, however, that the older trees are in general banked near the edge of the moor, while the trees that have pushed out into the moor, though much older than they appear, are actually younger than the individuals of the border-line.

The muskeag shown in Plates 280 and 281 is upon the Experiment Station grounds at Grand Rapids. The view shown in Plate 280 was obtained with the camera placed nearly under the trees of the opposite side and looking towards the northwest. Plate 281, taken from the same position, looks slightly southwest, and the two together give a very intelligent idea of the actual size and shape of the moor. In Plate 280, especially, the sharp demarcation between the zone of spruces facing the moor, and the zone of tamarack just behind is well brought out. *Eriophorum*, which did not appear in Plate 279 (the white flowers here being probably *Limodorum*), is abundant in the other two views and with *Carex*, *Ledum* and *Vaccinium* forms the principal secondary vegetation, the sphagnum being regarded as the primary group. Plate 281 shows tamarack facing the moor to the left, and spruces, with tamarack behind, to the right.

* Ayres, H. B. The Muskeag Spruce. Gard. and For. 7 : 504. 1894.

An examination of the three views of the moors suffices to convince anyone that in the same sense that zones of *Carex*, *Phragmites*, *Scirpus*, *Nymphaea*, *Potamogeton* and *Chara* are described as characteristic of the limnetic distribution in the lakes of the Jura or elsewhere, so also are zones of *Larix*, *Picea*, *Ledum*, *Andromeda* and *Utricularia*, characteristic of the filled lakes or moors of Minnesota. It is scarcely worth while to designate the zones as *Laricetum*, *Picetum*, etc., for an indefinite number of such names might be found necessary in different parts of the world.

Certain points that have been touched upon might rightfully claim a more extended discussion. The presence of the spruce between the tamarack and the moor is peculiarly interesting. Large numbers of these muskeags form no spruce ring at all. This is especially true of those towards the southern limits of the formation, as for example near Minneapolis, which is south of the black spruce belt in Minnesota. In such cases the tamarack trees themselves stand facing the moor, and the transition is through *Salix*, *Cornus*, *Ilex* and kindred shrubby plants. A number of views illustrating this type of tension-line between moor or meadow and tamarack swamp have been obtained and may be published later. Apparently the exact habitat offered outside the sphagnum and inside the larch zone is seized upon by spruces, and they establish themselves where the water is too cold or the soil too thin for the tamaracks to flourish.

Cedar swamps offer a number of ecologic conditions that can not be entered upon here. Combinations of cedar and spruce in the tension line surrounding muskeag are met with. Their study is deferred until later.

In the case of the spruce trees established in their zone peripheral to the *Ledum* formation, the gradations in size connected as they are, under the reservations made above, with gradations in age, indicate that the tamarack and spruce rings are slowly closing in upon the central formations and should eventually occupy the whole area of the moor to the exclusion of those plants which flourish in the open. As a matter of fact, such circular or elliptical tamarack formations, solid clear to the core, are frequent in southern Minnesota, while in northern Minnesota a slight variation arises from the ordinary presence of a small central group of spruces in such formations. Such tamarack swamps with central spruces are well developed in Cass county, Minnesota, especially in the vicinity of Gull lake, where I have studied them.

In any given instance it is apparent that several considerations should enter into a judgment concerning the probable origin of a solid or spruce-centered formation of tamarack. If the formation be a small one it may properly be questioned whether a stage with central moor had ever intervened. Furthermore, the contour of the bottom and depths of water in the original pond or lake would always have to be regarded in any generalization. For example, I have convinced myself that in some cases successions of muskeag openings with intervening tamarack arise from the filling of a lake with bars or reefs upon the bottom, the original positions of which is perpetuated by the lines of larches. Had the slant in the lake been strongly off-shore and the pond been deep in the middle a moor might then have been established at first with open water in the center, and only after a long lapse of years could the trees have crept out upon the peat. Had, on the other hand, the slant been slight and the pool sufficiently shallow at the center it might probably have filled without passing through any moor stage. Therefore some, at least, of the circular tamarack swamps with or without spruce cores could scarcely be regarded as necessarily derived from moors with tamarack or tamarack and spruce border-rings. This would, on the other hand, not hold true of all, and a consideration of the size and age of the trees from circumference to center will indicate that many of the solid tamarack swamps must have developed by this process of closing in a ring of timber upon a constantly diminishing moor.

Exceedingly pretty examples of the dispersion and obliteration of plants by such movements of tension-lines as here described may be observed. After the tamarack formation has become solid the sphagnum often manages to persist in little clumps and mats at the bases of trees where considerable rain water is drained into a small area by the tree trunk with its radiating branch system above. *Sarracenias*, *Vaccinums*, *Empeliums*, the dwarf cornel and other moor plants continue thus among the trees. The *Eriophorums*, *Salices* and many others do not seem to find the shade so grateful and commonly disappear altogether from the formation.

It will be noted that various generalizations upon the zonal distribution of plants might be based upon such facts as have been given above. Indeed it would seem that there are two principal types of plant arrangement in their habitats. These are: (1) Zonal and (2) Azonal. The first is connected either with environmental conditions as a principal factor, as in the case of the zonal distribution upon dome-shaped islands, upon *roches moutonées*, and on a larger scale upon mountain peaks and isolated ranges, along lake or ocean strand, and surrounding moors, or it may depend more particularly upon the character and habits of life of the plants themselves, as, for instance, in the care of the "fairy-ring" fungus. The matter may be summed up in a sentence. *Generally when there is well-marked radial symmetry in the topographic feature upon which a group of plants is distributed zonal arrangement is the response of the plant population to these symmetrical physiognomic conditions; but when the topographic feature is devoid of such well-marked radial symmetry the plants dispose themselves according to the azonal type.* Talus-heaps, flat extended meadows, highly irregular hills, shallow marshy ponds and other such localities may serve as illustrations of asymmetrical habitats. A variety of conditions determine whether the distribution upon a given area be zonal or azonal. And it is worthy of note that the same formation may in one case arise by zonal, in another by azonal distribution. This was brought out in the discussion of circular solid tamarack formations upon a previous page.

The contemplation of vegetation in any region with these principles in view is certainly illuminating. Practically it connects at once ecologic distribution with physiography, and enlarges the content both of topography and of botany.

Description of Plates.

Plate 279. Muskeag near Grand Rapids, Minn., showing the pine-covered ridge in background, and zones of tamarack, black spruce and *Ledum* in the foreground.

Plate 280. Muskeag near Grand Rapids, Minn., showing spruce zone against the tamarack, and a central moor with *Eriophorum*. Looking northwest.

Plate 281. Same muskeag as in Plate 280. On the left tamarack faces the moor; on the left the black spruce formation intervenes. The vegetation in the foreground is *Andromeda*, *Eriophorum*, *Carex* and sphagnum.

Plates all from photographs obtained for the author by Director W. W. Pendergast, of the Grand Rapids Experimental Sub-station, 1896.

The North American Species of Agrimonia.

By Eugene P. Bicknell.

(Plates 282, 283.)

Perhaps no one of our long-known plants has more effectually escaped a right understanding by botanists than the familiar Agrimony of the Eastern States, long current in local floras and text-books as *Agrimonia Eupatoria* L. This name, it seems, has been doing duty since the beginning of American botany for a considerable *group* of related species, of which at least five may now be clearly recognized. Nor is this all; for, as first shown by Dr. Britton (Bull. Torr. Club, **18**: 366, 1891), the true *Agrimonia Eupatoria* is not known at all as an American plant and is very distinct from that particular one of our native species which has been more especially referred to it.

For the initial fault in this misunderstanding we must go back to "Species Plantarum," wherein, under *A. Eupatoria*, we find the citation "Gron. Virg.," although the inconsistency follows that the species is attributed to Europe only. Walter seems to have been the first of our writers to adopt the name definitively into the American flora (Fl. Car. 1788), though it is not now possible to determine the exact sense in which he used it. And so with most subsequent authors the name as used has doubtless a composite significance, though mainly intended to designate our most common and generally distributed species.

Muhlenberg appears to have been the first to perceive that this plant was not identical with the European and he gave it its first distinctive appellation—*hirsuta* (Cat. 47, 1813). Muhlenberg, indeed, seems to have better understood our group of species than any subsequent writer except Wallroth, although he has been quite overlooked, and his name *hirsuta*, for our representative species, which it now becomes necessary to adopt, was afterwards independently used by Torrey for a more hairy form of the same plant.

The genus *Agrimonia*, with especial reference to the North American species, may be characterized as follows:

AGRIMONIA L. Sp. Pl. 448. 1753.

Perennial, erect or assurgent, mostly glandulose herbs, simple or branched above, with alternate, conspicuously stipulate, odd-pinnate leaves bearing interposed subleaflets, and small regular perfect yellow flowers in spicate racemes. Flowers short-pedicelled or subsessile, axillary from small 3-cleft bracts and with a pair of trifid or entire bracteoles at the base of the calyx. Calyx-tube in fruit obconic, turbinate or hemispheric, short-stipitate, sulcate, uncinate-spinose or bristly above, contracted at the throat to form a flattened or convex disk which supports a central process formed by the five connivent calyx-lobes. Petals 5, inserted with the 3–15 stamens in the margin of a waxy disk which surrounds the terminal styles in the throat of the calyx; anther-cells mostly separated by a broad connective. Carpels 2, included, developing into one or sometimes two one-seeded achenes with membranous testae contained in the indurated calyx tube, seeds suspended.

Leaflets crenate, dentate, serrate or incised, the teeth mucronulete or having a minute callosity in the tip. Lower stipules smaller and simpler than those above. Stamens variable in number in the some species, often fewer than normally in the terminal or later flowers. Roots either fibrous or tuberous-thickened.

The North American species, as far as known, are as follows. The ranges given are based alone on specimens actually examined, and are doubtless subject to considerable extension in some cases.

1. AGRIMONIA HIRSUTA (Muhl.).

A. Eupatoria of most American authors, not L.

A. eupatoria hirsuta Muhl. Cat. ed 1, 47. 1813.

A. Eupatoria β hirsuta Torr. Fl. 473. 1824.

A. gryposepala Wallr. Beitr. 1: 49. 1842.

New Brunswick to Minnesota and Nebraska, south to North Carolina; California.

2. AGRIMONIA STRIATA Michx.

A. striata Michx. Fl. Bor. Am. 1: 287. 1803 (*fide* T. & G.).

A. eupatoria β glabra Muhl. Cat. ed. 1, 47. 1813.

A. parviflora DC. Prodr. 2: 587, excl. Aiton. Not Soland. 1821.

A. Eupatoria δ parviflora Hook. Fl. Bor. Am. 1: 197. 1830.

A. microcarpa Wallr. Beitr. 1: 39. 1842.

A. rostellata Wallr. Beitr. 1: 42. 1842. ="*A. americana* Luca in herb." Wallr. loc. cit. as syn.

Southeastern New York, and doubtless Connecticut, to Virginia, west to Missouri.

3. AGRIMONIA PUMILA Muhl.

A. pumila Muhl. Cat. ed. 1, 47. 1813.

Pennsylvania and Maryland to Florida, west to Kentucky and Louisiana.

4. AGRIMONIA MOLLIS (T. & G.) Britton.

A. Eupatoria γ mollis T. & G. Fl. **1**: 431. 1840.

A. platycarpa Wallr. Beitr. **1**: 38. 1842. ="*A. Eupatoria americana* Beyrich in Herb." *fide* Wallr. loc. cit.

A. pubescens Wallr. Beitr. **1**: 45. 1842. =" *A. parviflora* Kinn in Herb." *fide* Wallr. loc. cit.

A. mollis Britton, Bull. Torr. Club, **19**: 221. 1892.

Southeastern New York, and doubtless Connecticut, to Michigan, south to Georgia, Tennessee and Kansas.

5. AGRIMONIA BRITTONIANA n. sp.

New Brunswick and Quebec to western New York and doubtless further north and west, south to Ulster and Westchester counties, N. Y., and along the Alleghenies to West Virginia; Montana; Laramie Peak, Wyoming and, either this or an allied form, in Arizona and New Mexico.

6. AGRIMONIA PARVIFLORA Soland.

A. parviflora Soland. in Ait. Hort. Kew. **2**: 130. 1789.

A. Eupatoria Michx. Fl. Bor. Am. **1**: 287. 1803, chiefly, *fide* T. & G. Not L.

A. suaveolens Pursh, Fl. **1**: 335. 1814.

A. serrifolia Wallr. Beitr. **1**: 40. 1842. = " *A. Eupatoria americana* Kinn in herb." *fide* Wallr. loc. cit.

Southeastern New York, and doubtless Connecticut, to Illinois and Missouri, south to Georgia and Mississippi.

7. AGRIMONIA INCISA T. & G.

A. incisa T. & G., Fl. **1**: 431. 1840.

Florida, Alabama, Georgia, South and North Carolina.

Key to the North American Species of Agrimonia.

Leaflets serrate, dentate or crenate with numerous teeth.

Racemes and leaves beneath glabrous or with loose spreading hairs.

Roots not tuberous; fruit large, turbinate, with numerous radiating bristles. 1. *A. hirsuta.*

Roots tuberous-thickened; fruit very small, hemispheric, with few ascending or erect bristles. 2. *A. striata.*

Racemes and lower surface of the leaves closely or softly pubescent.
  Roots tuberous; stems pubescent; leaflets not glandular-dotted beneath.
    Small or simple, with elongated terminal raceme, leaflets 3–5. 3. *A. pumila.*
    Larger, branched, leaflets 5–11. 4. *A. mollis.*
  Roots not tuberous; stems hirsute; leaflets glandular-dotted beneath.
    Leaflets 5–9, oblong or rhomboid; fruit large, the bristles connivent, 5. *A. Brittoniana.*
    Leaflets 9–23, lanceolate; fruit small, the bristles radiate. 6. *A. parviflora.*
Leaflets incised with few salient teeth. 7. *A. incisa.*

1. AGRIMONIA HIRSUTA (Muhl.).

Commonly 3°–4° tall (2°–6°), simple, to loosely wide branched above, minutely glandulose and somewhat viscid on the branches, aromatic. Stem usually zig-zag from leaf to leaf, villous-hirsute with slender spreading hairs. Leaves bright green, large, 4′–12′ long, 3′–8′ wide, the villous leaf-stalks usually with short petiolar portion. Leaflets large, rather thin, commonly three pairs (2–4 pairs), elliptic, broadly oblong or obovate-oblong, acute, sessile or subsessile, often with rounded or subcordate base, the odd leaflet short-stalked or subsessile with narrowed base, coarsely serrate with acute or somewhat rounded mucronulate teeth, the margins ciliate-fringed, upper surface glabrous or with short, scattered, appressed hairs, lower surface minutely, often sparsely, pulverulent-glandulose and with scattered hairs on the larger nerves, rarely subpubescent. A frequent size of the leaflets is about 2½′ × 1¼′, an extremesize 5′ × 3′. Interposed leaflets normally three pairs in the distal interspace, fewer or smaller in the lower interspaces, the middle pair much the largest, ovate or obovate from a broad base, acutely lobed, often subopposite, in weak plants sometimes much reduced, rarely to a small entire pair. Stipules normally very large, sometimes over an inch broad, the pairs cordate-amplexicaule, often overlapping around the stem, openly cut-serrate or dentate-lobed in the rounded outer margin which is abruptly contracted into the ovate-acuminate incurved terminal lobe. In reduced plants the stipules are smaller and narrower, the lowermost sometimes entire. Branches openly compound, widely spreading or loosely ascending, bearing spreading racemes. Racemes commonly under a foot in length (4′–16′), often inclined in fruit, minutely pulverulent-glandular and thinly spreading-villose, somewhat closely many-flowered or the lower flowers distant on slender ascending pedicels 2″–5″ long, the uppermost sometimes subverticillate clustered. Bracts relatively large, the narrow lobes ciliate-fringed, often exceeding the flowers at anthesis; bracteoles lanceolate-attenuate, narrowly 3-cleft or entire. Flowers 4″–6″ broad, bright yellow; anther-cells separated by a distinct connective; flower buds ovoid, narrowed to a prominent point, minutely glandulose. Mature fruit reflexed, large, 3″–6″ long over all and as wide across the bristles, short-turbinate, mostly contracted abruptly to the stipitate base, strongly fluted, pulverulent-glandulose, often slightly strigose at the extreme base; bristles numerous, spinose, loosely covering the convex disk, the lowermost reflexed from the prominently expanded margin of the disk, those above spreading and erect, the innermost slightly exceeding the acute beak-like calycular process and at least half the length of the fruit. The mature calyx-lobes taper into rigid, minutely hooked points which are finally incurved together, a feature which Walroth recognized by his name *gryposepala.* The roots are fibrous, often slightly thickened throughout their length, but never tuberous. They are not fragrant as those of the European *A. Eupatoria* are said to be. (Plate 282, fig. 1.)

Borders of woods and thickets in sun or half shade, growing in vigorous groups or sometimes scattered.

Begins to flower at New York in the first week of July, two or three weeks in advance of any other species, and ceases to flower in August, also earlier than any of its congeners. The date of first flowering has ranged in nine years from June 29 to July 10.

The young herbage, when crushed, exhales an agreeable fragrance which somtimes even suggests that of the Japanese Honeysuckle.

It may be noted that the name *hirsuta* of Muhlenberg now adopted for this plant displaces *hirsuta* of Bongard for a Brazilian species.

2. Agrimonia striata Michx.

Slender, commonly 1½°–2½° high (8′–5°, simple to delicately paniculate-branched, minutely glandulose nearly throughout, viscid above and in the racemes, agreeably aromatic. Stem glabrous or with scattered spreading hairs (sometimes thinly hirsute at the base, and rarely finely subpubescent above), the slender leafstalks thinly hairy-pubescent to glabrate, scabrous on the lower side. Leaves rarely reaching nearly the extreme size of those of *A. hirsuta*, but usually much smaller. Leaflets sessile or subpetiolulate or the odd leaflet on a slender, sometimes foliolate stalk, commonly two pairs (1–4 pairs, the larger number occurring only rarely and on the lowest leaves), thin, glabrous or nearly so above, below sprinkled with pellucid glandules and sparingly hispidulous on the larger nerves, the margins subciliate. The leaflets are somewhat variable in form, but are commonly blunter and more obovate-cuneate than those of *hirsuta*, with broader, less acute teeth, the marginal pattern mostly coarsely crenate-dentate to boldly crenate; sometimes they are throughout narrowly obovate-oblong with broad, shallow, semicrenate teeth; on the reduced often trifoliate upper leaves they may be very narrow and sharply dentate-serrate. Interposed leaflets elliptic to obovate, acute, often confined to the distal interspace, usually a small or minute entire pair, occasionally larger and dentate-lobed, rarely with a minute pair on either side. Stipules smaller and narrower than in *hirsuta*, rarely becoming ½′ wide, often very small, lanceolate to semi-cordate, cut-serrate to deeply incised, the lowest often entire. Inflorescence varying from a short terminal raceme to a delicately branched nearly naked loose panicle, the glandulose racemes only 3′–6′ long and rather loosely flowered. Flowers very small, 2″–3″ wide, pale yellow, on slightly spreading pedicels 1″ or less long; anther-cells contiguous. Bracts minute, ciliolate; bracteoles ovate, 3-lobed or entire. Flower-buds subglobose, almost truncate, the sepals ovate-oblong, obtuse, downy-canescent within the apical margins. Mature fruit subspreading or nodding, very small, 1″–1½″ wide, the body subhemispheric, 1″ long below the marginless rim, pellucid-glandulose, bristles few and weak, short, erect and slightly spreading, equalled or exceeded by the truncate calycular process which caps the very tumid disk; sulcae rather broad and shallow, converging into the narrow and curved stipe-like base. Roots developing tuberous thickenings which reach a size of 3′ × 2″; elongated roots sometimes show two or three successive swellings. (Plate 283, fig. 6.)

Hilly woodland, mostly in light rich soil; of scattered growth, or forming loose colonies, but never massed in close groups.

Begins to flower at New York from about the middle to the end of July and continues to bloom into early September.

This species need be compared only with *A. hirsuta* which, in its stouter forms, it sometimes closely resembles. It differs most obviously in its tuberous roots, lesser size and more slender habit, nearly glabrous stem and branches, delicate short racemes, smaller flowers with obtuse sepals, much smaller hemispheric fruit with unmargined disk and few mostly erect bristles, smaller narrower stipules and more crenate leaves. The leaves, generally fewer than in *A. hirsuta*, are more obovate in general outline, the more slender leafstalk rougher below and more narrowly and deeply grooved along the upper side, the leaflets mostly more obversely broadened and rounded at the apex, the pairs separated by wider intervals, the lowest pair relatively much smaller, the interposed leaflets much less developed, the petiolar portion of the leafstalk longer. In its earlier stages the inflorescence is strikingly different from that of *hirsuta*. In the latter the longer and stouter villous racemes are closely flowered and conspicuously bracteose; in *striata* the delicately slender rearly glabrous racemes are more viscid-glandular and much less closely flowered, with minute inconspicuous bracts and rounded-truncate instead of pointed flower buds.

In adopting the name *striata* for this species I have simply followed Dr. Gray who, having seen Michaux's material, cites the name as a synonym, not of *A. Eupatoria*, but of *A. Eupatoria* var. *parviflora* of Hooker, the plant here taken up, giving to the reference his mark of authentication. (T. & G. Fl. loc. cit.).

3. Agrimonia pumila Muhl.

The smallest of our species, 1°–2° high, erect or more slender and assurgent, simple or with a few ascending branches from the lower part of the elongated terminal raceme. Stem clothed with loose often coarse pubescence and hirsute with spreading hairs which become subappressed above and obsolete in the pubescent racemes. Leaves often crowded low on the stem, often trifoliate, small, 1½′–3½′ long, 1½′–2½′ wide, the upper ones much reduced. Leaflets firm, 1–2 pairs, the lower pair always small, oval to obovate or the odd leaflet cuneate, sessile or subpetiolulate, obtuse or rounded at the apex or sometimes acute, crenate or dentate or sometimes boldly crenate-dentate, commonly 1′–1½′ long, dark-green above and loosely appressed-hairy to nearly smooth, the margins loosely appressed-ciliate, paler and softly pubescent below, pilose-pubescent or hairy along the veins, obscurely, if at all glandulose; leafstalk villous; subleaflets wanting or a minute pair, entire or few-dentate. Stipules small, the main pairs rounded and cordate-clasping, acutely dentate-lobed or incised, sometimes dentate on the inner margin. Racemes loosely-flowered, often remotely-flowered below. Flowers small, the buds subglobose. Fruit small, 2″ long, 1″–1½″ wide, turbinate or subhemispheric, minutely glandulose, often canescent in the sinuses when young, the disk mostly obscurely margined and rising to the short and broad calycular process, the bristles loosely ascending and erect. Roots developing short tuberous thickenings. (Plate 283, fig. 5.)

This species is nearly related to *A. mollis* and occasional depauperate plants of the latter are with difficulty distinguishable from it. I think there can be no doubt, however, that the two species are distinct and that a comparative study of growing plants would disclose more pronounced differences than dried specimens have revealed. The uniformly small size and simple or nearly simple habit of *pumila* and its slender and elongated loosely-flowered raceme are usually sufficient to distinguish it. The pubescence seems to be generally coarser and more hirsute than in *mollis*, and the much smaller, mostly trifoliate leaves more crowded on the lower part of the stem and apparently of thicker texture. I have not seen satisfactory material in mature fruit. The range of the plant is clearly more restricted northward than that of *mollis*, and more extended southward as far as at present known.

I adopt Muhlenberg's name *pumila* for this species with some hesitation and only to avoid the alternative of conferring a new name. Muhlenberg characterized his plant by the one word "little" and gave its habitat as Mississippi. Applying the rule of exclusion it would appear that only this species could have been intended. If it should be found that *A. mollis* extends into Mississippi the name would have only a dubious claim to availability.

4. Agrimonia mollis (T. & G.) Britton.

Not aromatic and obscurely if at all glandulose, mostly slender and 2°–3° high (1° to over 6°), the branches ascending or sometimes spreading, either few and simple or forming a loose panicle which exceptionally attains a spread of as much as 2°–3°. Stem below loosely tomentose-pubescent and weakly villose with spreading or subspreading hairs, becoming finely hoary-tomentose or subappressed pubescent above and in the racemes. Leaves rather dark green, 3′–12′ long, 2′–7′ wide, a common size being 5′ or 6′ by 3′ or 4′. Leaflets commonly 2 or 3 loosely separated pairs (1–4 pairs), mostly obovate-oblong, varying from obovate to elliptic, subsessile, rounded or somewhat acute at apex, dentate-serrate to crenate, the odd leaflet mostly obovate, often on a foliolate stalk, reaching an extreme size of 4½′ × 2′, the largest lateral leaflets becoming 3′ × 1½′; upper surface sparsely hirtellous-pubescent and roughish to glabrate, the margins finely subappressed-ciliate, lower surface paler and minutely downy to velvety-pubescent; leafstalk finely pubescent and somewhat tomentose-villose. Stipules varying from small, lanceolate and entire on the lower leaves and in dwarf plants to cordate-clasping with cut-serrate or incised outer margin, on stout plants sometimes 2′ long by 1′ wide. Interposed leaflets often only a small entire pair in the distal interspace, sometimes larger, obovate-oblong and dentate above with a single minute one or a pair on either side. Racemes slender, mostly 5′–10′ long, rarely 16′, rather loosely flowered. Flower-buds rounded, scarcely or not at all glandulose. Flowers 3″–5″ broad, rather deep yellow; anthers with broad connective. Bracts and bracteoles pilose-ciliate, very small, at least the bracts narrowly 3-cleft. Fruit before maturity oblong and ascending, later reflexed or subspreading on short appressed pedicels, minutely subglandulose and slightly strigose, small, 2″–2½″ long, 1½″–2″ wide, narrowly turbinate to subhemispheric, often with a somewhat narrowed nonsulcate basal portion, or the lowest fruit of the racemes sometimes depressed-turbinate, marginless or obscurely margined, the disk flat or slightly convex with obtuse sepaline process, bristles loosely ascending or closer and nearly erect, equalling the body of the fruit or only half its length. Roots tuberous-thickened as in *A. striata*, but the swellings often thicker and less tapering at either end, often club-shaped. (Plate 282, fig. 3.)

Dry open woods and copses and weedy banks and hillsides. Of scattered or solitary habit of growth.

Begins to flower at New York from the middle to the end of July and blooms later than any other species; belated flowers are sometimes to be found at the middle of October.

Reduced plants are sometimes trifoliate nearly throughout and simulate *A. pumila*. It will be usually evident to the collector of such forms, however, that they represent a state of imperfect development under unfavorable conditions of growth.

This is the most variable of our species and runs into several unstable forms. It should not be overlooked, however, that it shows a well-defined tendency to separate into two particular forms or varieties. Extreme examples of both are common and exhibit so considerable a degree of divergence that the eye always gives them instant recognition. Although both varieties are to be found holding their characters perfectly under identical conditions of soil and situation, intermediate forms, or what appear so to be, are of such frequent occurrence that I have not been able to satisfy myself of the expediency of giving a distinctive varietal name. For the sake of definiteness, however, the foregoing description of *A. mollis* has been made to cover only the form represented by the type, a specimen of which is preserved in the Herbarium of

Columbia University (" Red River, Dr. Pitcher"), excluding its variety, which may be separately characterized as follows:

Pubescence throughout denser and more pilose than in the type, the smaller and narrower leaves dull grayish green, the leaflets much narrower and dentate rather than crenate, the pairs closer and often more numerous. The hairs of the stem are longer and weaker than in the type and often loosely appressed, the pubescence above tending to become dense and pilose-canescent. The leaflets are mostly 4 pairs, though often 5–6 pairs on the narrowed lower leaves, narrowly-oblong (linear- or lanceolate-oblong) to elliptic, often inequilateral and backwardly subfalcate, blunt or subacute, abruptly narrowed or rounded at the sessile base, mostly dentate or dentate-serrate, often with broad, shallow, uneven teeth, the odd one mostly sessile, or when petiolulate frequently cleft basally into a pair of narrow decurrent lobes, above finely pubescent to softly appressed pilose, whitened below and softly appressed pubescent, the veins pilose, subleaflets narrower than in the type, often borne well forward in the interspace. Stipules irregularly cut-serrate or dentate-lobed, usually less incised than in the type with shorter termination, the upper ones often dentate-serrate on the inner margin and more spreading. Fruit often with more convex disk and longer more spreading bristles, usually also with a perceptible rim. Apparently the tuberous thickenings of the roots tend to become stouter than in type and to develop on shorter roots; the largest found were 3½′ long by 3½″ thick. (Plate 282, fig. 4.)

The specimens that have come under my observation would appear to indicate that this form was of more coastwise range than the type extending from southern New York to Virginia Beach and to middle North Carolina and East Tennessee.

5. Agrimonia Brittoniana n. sp.

Becoming stout and tall and strongly virgate-branched, 2°–7° high (6° 9′ at York Harbor, Maine), the stems sometimes 4″–5″ thick at the base, erect, but often leaning under the weight of the heavy fruiting racemes, somewhat aromatic. Stem roughened with glandular papillae and hirsute with short spreading brownish hair which passes into a downy or pilose-hairy pubescence in the racemes. Leaves numerous, often ascending or subappressed, 4′–8′ long, 2′–4′ wide, the villous pubescent leafstalks downy-tomentose on the upper side. Leaflets 3–4 pairs or 5–6 pairs on the narrower and longer-petioled lower leaves, often directed sharply forward, strongly veined, becoming thickish and rugose, dark green above and more or less hispidulous or scabrous, at least near the edges, the margins finely ciliolate, below paler and pubescent (soft-pubescent to nearly glabrous) with longer usually subappressed brownish hairs on the nerves and freely sprinkled with minute glistening glandules, in shape lanceolate to elliptic or ovate-elliptic, tapering from near the middle to either end, often decidedly tetragonal or rhomboid, acuminate or very acute, sharply serrate with mucronulate often deeply cut teeth (rarely with broader even subcrenate teeth), the narrowed base and acuminate apex often entire, usually petiolulate or the distal pair sessile and decurrent, the odd leaflet sessile or on a foliolate stalk and frequently pinnatifid at the base, the lateral leaflets more rarely basally pinnatifid, but never on the lower side in the distal pair. A common size of the leaflets is $2' \times \frac{3}{4}'$, and extreme size $3\frac{1}{2}' \times 1\frac{1}{2}'$ (on the lower leaves the leaflets are often shorter and less pointed with more deeply cut narrower teeth). Interposed leaflets 2–7 pairs, frequently subopposite, narrow, often linear-oblong, the main pair dentate-serrate above the middle, the others much smaller or minute, entire; not seldom a minute pair subtends a pair of leaflets like a set of stipels. Stipules lanceolate to half ovate, laciniate or cut-lobed, the terminal lobe broader and acuminate sometimes with one or two teeth on the inner margin. Main racemes $12'$–$18'$ long, obscurely pulverulent beneath the pubescence, densely flowered except near the base, some of the flowers often subverticillate-clustered, rarely loosely flowered, erect or ascending, at maturity often declined from the weight of the abundant fruit. Flower-buds mammillate; flowers $3''$–$5''$ wide, shorter-pedicelled than in *hirsuta*, the petals more rounded, mostly thicker and deeper yellow; anthers smaller with narrower connective; bracts smaller and less ciliate; bracteoles ovate, short-acuminate, entire or slightly lobed. Mature fruit closely reflexed against the pedicel and stem, large, $2''$–$3''$ broad, $3''$–$4''$ long, rather long-turbinate, the walls thickened and much indurated, strongly fluted between the deep furrows, minutely puberulent-granular and with traces of appressed hairs, the furrows strigose-canescent; disk becoming flat or concave, marginless; bristles numerous, short, one-quarter to one-third the length of the fruit, at first ascending and erect, finally connivent in a conical mass over the concealed calycular process. Sepals less acuminate than in *hirsuta* and more canescent within the tip, the apex at maturity scarcely hooked. The tips of the bracts, sepals and bristles with the callosities tipping the teeth of the leaves early become tinged with reddish-purple. Rootstock much as in *hirsuta*, but even stouter, the long roots as in that species slightly thickened throughout and not tubiferous. (Plate 282, fig. 2.)

Roadsides and borders of woods, flowering from the end of June to late in August. Usually forming close colonies or compact groups.

SPECIMENS EXAMINED:

Maine, St. Francis, St. John's River, Aug. 10, 1893. M. L. Fernald.

Canada, Notre Dame du Lac, Temiscouata Co. Aug. 6, 1887. John L. Northrop.

New York, near Elizabethtown, Essex Co. Sept. 5, 1892. N. L. Britton

" Tannersville, Green Co. Aug. 7, 1891. Miss Anna Murray Vail.

" White Plains, Westchester Co. Miss Phoebe McCabe.

Massachusetts, Lenox. July 11, 1889. W. M. Whitfield.

Pennsylvania, Lycoming Co. September 18, 1890. John K. Small and A. A. Heller.

West Virginia, Lone Tree Knob, Summit. C. F. Millspaugh, M. D. Flora of West Virginia, No. 450.

Montana, Belt Mountains, near Hound Creek. Aug. 2, 1883. F. Lamson Scribner.

Wyoming, Laramie Peak. Aug. 8, 1895. Aven Nelson. Flora of Wyoming, No. 1653.

I have also received the plant from Lewis and Ulster Counties, N. Y., and have collected it at York Harbor, Maine, the type locality, and in the Pocono region of Pennsylvana.

Type specimens from York Harbor are deposited in the Herbaria of Columbia University, and the New York Botanical Garden.

I take pleasure in naming this species in honor of Dr. N. L. Britton.

To anyone not having given particular attention to our species of *Agrimonia* it is altogether likely that this plant would pass unquestioned for *A. hirsuta.* It has more the general aspect of that species than of any other, the large fruit distinguishing it at once from *A. mollis*, with which in some respects it appears to have closer affinity. From *hirsuta* it may be readily distinguished by reference alone to its hoary pubescent racemes and darker green acuminate leaflets pubescent on the lower surface. It is less glandulose and aromatic than *hirsuta* and grows to be stouter and taller with straighter stem, stouter more ascending branches and longer more virgate racemes. The hairiness of the stem is also of a different character, being coarser and denser, with shorter, stiffer hair. The leaves are commonly narrower and less spreading, the thicker rugose-veiny leaflets more sharply serrate and acuminate with pubescent lower surface bearing brighter glandules and having the margins ciliolate instead of ciliate-fringed. Numerous specimens of *hirsuta* have failed to show any indications of incised bases of the lateral leaflets or a decurrent distal pair, or subleaflets in the position of stipels. The stipules of *A. Brittoniana* are narrower and more incised than those of *hirsuta*, and the bracteoles are notably unlike. The fruit, which is more crowded and closely reflexed, is of a different form, wanting the expanded marginal rim, tumid disk and contracted base characteristic of the fruit of *hirsuta* and, at maturity, presenting a signally diverse appearance from all our species by reason of the conical mass of connivent bristles.

From *A. mollis* the species differs in greater size, the stouter stem harshly hirsute instead of loosely villose or tomentose-pubescent, larger and thicker acuminate leaves provided with shining glandules on the lower surface and quite wanting the obovate or oblong figure and crenate or dentate margins of those of *mollis*, larger, more crowded flowers, much larger, more turbinate and deeply sulcate fruit having the bristles crowded and connivent instead of loosely ascending or erect.

The general character of the pubescence and branching of *A. Brittoniana* is much like that of *A. parviflora*, and the glandules beneath the leaflets present nearly the same appearance in both species. Other, if slighter, evidences of relationship between the two plants may also be noted, such as the sharply serrate often narrow leaflets of *Brittoniana*, the occasionally decurrent distal pair, the narrow and numerous subleaflets, the elongated racemes. These characteristics are more or less destinctive of *Brittoniana* among our species other than *parviflora*, in which they all find a more pronounced expression. The fruit of the two species is, however, remarkably different.

A. Brittoniana is in fact very distinct from any American species while nearly related to certain Asiatic forms—*A. viscidula* Bge., *A. pilosa* Ledeb. and *A. Dahurica* Willd., plants which have been variously confused together by authors, and all of which have finally been referred to *A. Eupatoria* L.

6. Agrimonia parviflora Soland.

Aromatic and glandulose, commonly 3½°–4½° tall (1½° to over 6°) virgate-branched above, the ascending branches simple or loosely few-branched and forming elongated strict racemes. Stem stout, becoming 4″–6″ thick below, papillose-roughened and densely hirsute with spreading brownish hair which conceals a fine surface pubescence and passes into a close hoary pubescence in the racemes; in immature plants the hairiness is very dense and subappressed, the young branches and racemes densely canescent-pilose. Leaves bright green, numerous, mostly spreading, but often the lower leaves are deflexed, those above spreading, the upper ones rapidly diminished in size and ascending or erect, mostly oblong to narrowly-oblong in general outline, 4′–12′ long, 2′–7½′ wide; leaflets commonly 11–17, or sometimes as many as twenty-three on the narrowed lowermost leaves, strongly-nerved and rugose, minutely petiolulate or sessile, spreading, the distal pair obliquely contiguous to the odd one and often decurrent on the leafstalk, the lower pairs frequently somewhat alternate, lanceolate, sometimes narrowly lanceolate, tapering to either end, acutely serrate, 1′–4¼′ long, 4″–14″ wide, a common size being 2½′ × 8″–9″, above obscurely hispidulous to glabrous, usually finely scabrous near the edges, the margins minutely ciliolate, paler below and thinly to softly pubescent, with longer appressed or spreading often brownish hairs on the nerves and sprinkled with minute shining glandules. Leafstalk villous, tomentose-pubescent on the upper side. Interposed leaflets crowded, mostly 4–5 pairs except in the lowest interspaces, often subopposite, mostly narrowly oblong and sessile by a broad base, the main pair sharply serrate to below the middle, separated by only a minute pair from the succeeding pair of leaflets, the others gradually smaller, all but the most minute sharply-toothed. Stipules, except the reduced lower ones, broadly cordate-amplexicaule, sometimes 1′ broad, the outer margin serrate or cut-serrate, deeply cleft at the tip into a narrow attenuate lobe sometimes 1′ long, which stands either abruptly erect against the stem or is bent sharply backward. Racemes glandulose beneath the pubescence, mostly erect or sharply ascending, 10′–21′ long, many-flowered. Flowers 3″–5″ broad, rather pale yellow with thin narrow petals; anthers small with broad connective. Bracts very small, pilose-pubescent, the lobes filiform; bracteoles very small, trifid. Flower-buds very small, somewhat obovoid and subtruncate, slightly mamillate, somewhat glandulose, sepals ovate-oblong, acute. Fruit small, nodding on slightly spreading pedicels, 1″–2″ wide and long, minutely glandulose; the slender stipe-like base slightly strigose, the body subglobose, short-turbinate or hemispheric below the bristles, the disk much elevated; bristles medial on the fruit, the outer short and reflexed, the innermost erect, equalling or exceeding the broad subtruncate calycular process. Base of the stem bulbous-thickened in the form of an oblong tuber sometimes nearly 1′ in diameter. Roots not tuberous-thickened.

Comes into flower from the middle to the end of July, continuing to bloom till about the middle of September.

This species is naturally a plant of low damp grounds and in such situations reaches its fullest development, commonly growing in scattered communities about the borders of weedy thickets. Occasionally it establishes itself in dry soil and becomes much reduced and quite distinct in appearance from the normal plant, though clearly nothing more than a dry ground state of the species. Extreme examples of this form are only 1½° tall and simple, terminating in a raceme 6′–8′ long; the leaves are much crowded, often reflexed and not larger than 3′–5′ long by 2′–2½′ wide; the small leaflets number only 3–5 pairs and are mostly elliptic and finely and sharply serrate, the subleaflets reduced in size and number and obovate, the stipules very small; on small sterile plants, the small leaflets may be oval and rather bluntly serrate and sometimes number only 2–3 pairs. (Plate 283, fig. 7.)

7. Agrimonia incisa T. & G.

From 1°–3½° tall, either simple, terminating in an elongated strict raceme, or bearing also ascending racemes from bracts or reduced leaves on the upper part of the stem. Stem clothed with a close soft-pubescence and villous with loosely spreading hairs which become subappressed and more pilose above and disappear in the pubescent and glandulose racemes. Leaves numerous, rather close and ascending, becoming gradually smaller and appressed above, narrowly-oblong or oblanceolate in general outline, 3′–6′ long, 1½′–2′ wide, the leafstalks tomentose-pubescent and villose. Leaflets thickish, prominently veiny, commonly 4–5 pairs, short, mostly oblong and ¾′ in length, 4″–7″ wide, sessile, or subpetiolulate, abruptly acute at base, rounded or acute at apex the odd one rather longer and with more narrowed base, acutely incised-serrate with few (3–6 on each side) salient, often slightly recurved teeth penicillate-haired from the apex, upper surface velvety, lower surface soft-pubescent and pilose-hairy, thickly covered with minute shining glands. Subleaflets a small 3-cleft pair in each interspace, with or without a minute entire pair on either side. Stipules narrowly laciniate-lobed, the terminal lobe longer, often cut on the inner side. Flowers rather large, rather loosely disposed on short subappressed pedicels; sepals elliptic; bracts and bracteoles very small. Fruit about 2″ long, 1″–1½″ wide, short-obovate or obconic with rather broad furrows, the numerous crowded bristles mostly marginal, ascending and erect, exceeding the broad obtuse calycular process. Roots not seen. (Plate 283, fig. 8.)

Dry pine woods, according to the label on one specimen.

Explanation of Plates 282 and 283.

Fig. 1. *Agrimonia hirsuta* (Muhl.).
" 2. " *Brittoniana* n. sp.
" 3. " *mollis* (T. & G.) Britton.
" 4. " *mollis* var.
" 5. " *pumila* Muhl.
" 6. " *striata* Michx.
" 7. " *parviflora* Soland.
" 8. " *incisa* T. & G.

Geum Canadense flavum (Porter) Britton, a valid species.

BY EUGENE P. BICKNELL.

This plant is clearly an excellent species and should stand as *Geum flavum* (Porter). It is common in the vicinity of New York and shows itself to be perfectly distinct from its near relative, *Geum Canadense* Jacq., with which it is often found associated. Its points of difference from the latter are by no means confined to the size and color of the petals, but involve the pubescence, the form and texture of the leaves the branching of the inflorescence and other less obvious features. As these characters have never been pointed out, it may be useful to draw attention to them.

Geum flavum is much more coarsely pubescent below than *Canadense*, in which the basal petioles and lower part of the stem are often glabrate or only sparsely pubescent; in *flavum* the lower stem is hirsute-pubescent, often equally so with *Geum Virginianum* L., the leafstalks spreading-villose.

The leaves of *flavum* are mostly larger, thinner and duller green than in *Canadense*, often becoming very large and lax. The largest in specimens before me are 8′ long by 7′ wide on petioles 3′ in length, dimensions which greatly exceed anything seen in *Canadense*. The long-petioled basal leaves at flowering time are exceedingly multiform, varying from cordate-orbicular through trifoliate to pinnate with two or three pairs of leaflets, showing a much readier tendency to a pinnate form than those of *Canadense* and to the development of small subleaflets on the petiole. The lower cauline leaves reveal the same tendency to greater subdivision than those of *Canadense*, which are rarely other than trifoliolate or subpinnate. In *flavum* they are usually distinctly pinnate with 3–7 leaflets, the odd leaflet elongated and obliquely pinnatifid or pinnately-parted into oblong decurrent lobes; the lowest pair of leaflets are frequently also pinnatifid. In the trifoliolate stem-leaves of *flavum* the end leaflet is much longer relatively to the lateral ones than is the case in *Canadense*, and the simple upper leaves are mostly oblong or narrower with often obtuse basal lobes, usually in marked contrast with those of *Canadense*, which are rhombic-ovate or obovate and cuneate with acuminate or very acute lobes or angles mostly at or above the middle.

The dentition of the leaves in *flavum* is coarser than in *Canadense*, especially in the upper leaves, which are very coarsely dentate with irregular shallow teeth, in striking contrast with the much more finely and acutely dentate-serrate leaves of the latter.

The stipules of *flavum* are conspicuously larger than those of *Canadense* and variously incised and lobed; an extreme size is 1¾′ long by 1¼′ broad; the largest on specimens of *Canadense* now before me are 8″ x 4″. The pubescence of the leaves is in *flavum* coarser and looser than in *Canadense*, especially along the veins on the lower side of the basal leaves; it is much sparser on the upper leaves which are sometimes glabrate; in *Canadense* the leaves beneath are finely soft pubescent and velvety to the touch.

While *flavum* is generally more slender and weaker than *Canadense* this is not always true, except perhaps of the inflorescence, which is simpler and fewer-flowered with longer, more ascending branches and peduncles, the bracts often more foliaceous and sometimes entire.

The flowers of the two plants are always conspicuously different and constitute their most obvious distinctive character. In *flavum* the very small petals are cream-color or palest yellow and much shorter than the lobes of the calyx, 1″–1½″ long, ½″–1″ wide, linear-oblong or often broadened to the abrupt or truncate often retuse tip; in *Canadense* they are pure white, oblong or obovate, and two to four times as large (2″–4″ long, 1½″–3″ wide) equalling or exceeding the calyx-lobes. In both species the anthers show a shade more color than the petals. The flowers differ further in the sepals, which in *Canadense* are more accuminate, and in the bractlets of the calyx, which are rather larger in *flavum*. In the latter the flowers are at first nodding; in *Canadense* they are erect or sometimes a little declined.

The fruit-heads of *flavum* are rather larger and more densely-fruited than in *Canadense* and usually paler green, and the mature achenes are slightly larger with longer slenderer beak. The receptacle is also longer and more cylindric, with coarser and stiffer tawny hair; in *Canadense* it is ovoid and clothed with longer and weaker white hair.

Geum flavum needs no close comparison with the very distinct *G. Virginianum*, although according to our text-books its flowers would refer it to the latter rather than to *Canadense*, and this very mistake appears to have been made in some of our local lists. It may be noted, therefore, that the flowers of *Virginianum* are considerably larger, especially the central carpellary portion; the creamy-white petals are larger, 2″–3″ long, 1½″–2″ wide and obovate-oblong, with revolute margins, thus often appearing linear. The pubescence of the stem in *Virginianum* is bristly-hairy throughout. In both *flavum* and *Canadense* the pubescence above is very fine and close, in the former often with longer scattered hairs.

Geum flavum comes into flower at New York from the end of June to the middle of July, one to three weeks later than *G. Canadense*, which begins to bloom, according to the season, from the second to the fourth week of June. *G. Virginianum* flowers still earlier, usually in the first week of June.

The latter is distinctively a plant of boggy ground. *G. Canadense* is the most generally scattered of the three species, occurring in damp or dry soil in woods and thickets and along roadsides. *G. flavum* is more solitary in its habits, and grows chiefly in rich, loose soil, in copses or upland woods, often among rocks.

The range of *G. flavum* appears to be much more restricted than that of *Canadense*. Prof. Porter has found it common at Easton, Pa., the type locality, and it is also common at New York. Elsewhere it seems to have been detected only in Lancaster county, Pa., and at Marion, Va., at an altitude of 2100 feet, by Dr. Small.

It is interesting to note that this species was known to Muhlenberg, who took it up in his 'Catalogue' as *G. Virginianum* L., naming the latter plant *G. hirsutum*, and distinguishing the two species by their different times of flowering.

Terminology among the Orders of Thallophytes.

By Lucien Marcus Underwood.

"To understand things in their proper relations is an important part of a student's education." In Botany, as in other subjects of extensive specialization, the student often fails to get the bearings of his subject, and in his presentation shows an utter lack of what may be called botanical perspective. One cause of this failure is the disposition, now happily growing less, to become botanists without knowing plants; without knowing them in their gross characters as well as their microscopic, in the field in their native haunts, as well as in the paraffin bath; in their natural environment as factors in a life-struggle for existence, as well as with only an environment of celloidin. We have had instances galore of young men without this perspective who have been skilled manipulators of microscopic machinery and little more, whose productions were studies without relations, complete and excellent in themselves, but without any recognized or recognizable bearings on botanical science. May we be protected from a prospective crop of graduates under the inflowing tide of physiological botany, which promises to be the next wave of the subject that sweeps the country, for of all men who do not know plants as a part of their preparation it seems as though the physiological botanist could be capable of the most harm of any.

A second reason why this lack of perspective is sometimes so apparent is the failure to grasp clearly the system of relations existing among the various groups of plants. This is partly the fault of those who present the subject, some of whom are the products of the extreme reaction against the old and meaningless method of study of botany; partly the fault of the makers of the systems themselves. It is of this last feature that I would speak at some length.

The average student, or even the brightest one, looking through a series of modern text-books, especially those treating of the lower plants, would probably be lost in a maze at the diverse systems of terminology and subdivision that are there presented, and if he saw signs of a real system among the various combinations proposed he would get at best an indistinct notion of relationships and coördinations. While nature does not draw many hard and fast lines, it is still possible to present in a somewhat simple manner a conspectus of the groups of living things she does develop. It is the purpose of this paper to suggest some methods in which these relations can be more satisfactorily presented to our students, with less possibility of giving them a confused conglomeration of unrelated categories.

In order to show more clearly the extent of this confusion I have selected for an illustration the group of the Ascomycetes, with particular notice of the allies of *Peziza*, and will show in parallel columns their arrangement in groups by some of the modern authors. I select this group for several reasons, among others the fact that it has been recently treated by several specialists in fungi, although most or all of them are naturally more or less influenced by the extensive researches of Brefeld. It is also a group that contains very diverse elements and permits of numberless combinations based on real or supposed relationships. (See table next page.)

Of the above statements of a system, that of Von Tafel, conservatively cautious and indefinite, is entirely silent on the group names; coördinate groups only are recognized and these may probably be taken as the conception of these relations held by Brefeld himself.

Rehm consistently uses the term " Familie " as subordinate to " Ordnung," but complicates his system by the introduction of two additional groups between order and family, " Hauptordnung " and " Unterordnung." His family names lack uniformity as seen in the examples *Exoasci*, *Dothidiaceae*, *Ascoboleae*. In fact the termination *-aceae* is used by him for groups of at least four different ranks, as: *Hysteriaceae* (Ordnung) *Pezizaceae* (Hauptordnung), *Sphaeriaceae* (Unterordnung), and *Hypocreaceae* (Familie).

Although Schroeter does not so characterize each group distinctively as "order" or " family ;" their rank is clearly implied in the context and the termination *-aceae* is consistently used for the family. His ordinal groups, though mostly natural ones, lack uniformity and are often complicated in pronunciation, *e. g.*, Phacidiineae, Pyrenomycetineae, Hysteriineae.

*F. Von Tafel.**	*H. Rehm.†*	*J. Schroeter.‡*	*W. Zopf.§*	*S. H. Vines.‖*	*E. Warming.¶*
ASCOMYCETEN	3. Classe. ASCOMYCETES	II. ASCOMYCETES	Gruppe IV. ASCOMYCETEN	Sub-class 4. ASCOMYCETES	Sub-class ASCOMYCETES
Exoasci	1. Ord. Gymnoasceae	Hemiasceae	Ord. 1. Gymnoasceen	Ord. 1. Gymnoasceae	Series 1. Exoasci
Endomyceten	*Fam. Exoasci*	1. Hemiascineae	*Fam. 1. Saccharomyces*	Ord. 2. Pyrenomycetes	Series 2. Carpoasci
Taphrineen	*Fam. Gymnoasci*	Euasceae	*Fam. 2. Exoasci*	Sub-ord. Perisporiaceae	Fam. Gymnoascales
Carpoasci	2. Ord. Pyrenomycetes	2. Protoascineae	*Fam. 3. Gymnoasci*	Sub-ord. Tuberaceae	Fam. Perisporiales
Gymnoasceen	Unterord. Perisporiaceae	3. Protodiscineae	Ord. 2. Perisporiaceen	Sub-ord. Hypocreaceae	*Ord. Erysiphaceae*
Perisporiaceen.	(*2 families*)	4. Helvellineae	*Fam. 1. Erysipheen*	Sub-ord. Sphaeriaceae	*Ord. Perisporiaceae*
Erysipheen	Unterord. Hypocreaceae	5. Pezizineae	*Fam. 2. Aspergilleen*	Sub-ord. Dothidiaceae	*Ord. Tuberaceae*
Perisporieen	*Fam. Hypocreaceae*	*Pyrenemaceae*	*Fam. 3. Tuberaceen*	Ord. 3. Discomycetes	Fam. Pyrenomycetes
Tuberaceen	Unterord. Sphaeriaceae	*Pezizaceae*	Ord. 3. Sphaeriaceen	Sub-ord. Pezizaceae	Sub-fam. Hypocreales
Pyrenomyceten	(*18 families*)	*Ascobolaceae*	*Fam. 1. Sphaerieen*	*Fam. Phacidieae*	*Ord. Hypocreaceae*
Hypocreaceen	Unterord. Dothidiaceae	*Mollisiaceae*	*Fam. 2. Hypocreaceen*	*Fam. Pezizeae*	Sub-fam. Sphaeriales
Sphaeriaceen	*Fam. Dothidiaceae*	*Celidiaceae*	*Fam. 3. Xylarieen*	*Fam. Bulgarieae*	(*18 orders*).
Dothideaceen	3. Ord. Hysteriaceae	*Patellariaceae*	*Fam. 4. Hysteriaceen*	"etc., etc."	Sub-fam. Dothideales
Hysteriaceen	4. Ord. Discomycetes	*Cenangiaceae*	Ord. 4. Discomycetes	Sub-ord. Helvellaceae	*Ord. Dothideaceae*
Discomyceten	1. Hauptord. Pezizaceae	*Cordieritidaceae*	*Fam. 1. Pezizaceen*		Fam. Hysteriales
Phacidiaceen	1. Unterord. Phacidiaceae	*Cyttariaceae*.	*Fam. 2. Helvellaceen*		Fam. Discomycetes
Stictideen	2. " Stictideae	6. Phacidiineae			Sub-fam. Phacidiales
Tryblidiaceen	3. " Tryblidieae	7. Hysteriineae			Sub-fam. Stictidales
Dermateaceen	4. " Dermateaceae	8. Tuberineae			Sub-fam. Tryblidiales
Pezizaceen	5. " Pezizeae	8. Plectascineae			Sub-fam. Dermateales
Helotieen	*Fam. Mollisieae*	10. Pyrenomycetineae			Sub-fam. Pezizales
Mollisieen	*Fam. Helotieae*				*Ord. Helotiaceae*
Ascoboleen	*Fam. Eupezizeae*				*Ord. Mollisiaceae*
Pezizeen	*Fam. Ascoboleae*				*Ord. Pezizaceae*
Helvellaceen	2. Hauptord. Helvellaceae				*Ord. Ascobolaceae*
	Fam. Rhizineae				Fam. Helvellales
	Fam. Geoglosseae				*Ord. Helvellaceae*
	Fam. Helvelleae				
	5. Ord. Tuberaceae				
	Fam. Eutuberaceen				
	Fam. Balsamieen				
	Fam. Elaphomyceti-neen				

* Vergleichende Morphologie der Pilze, 1892.

† Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. **1**: II., III., V., Abtheilung, 1884–1896 (Abt. V., by E. Fischer).

‡ Engler-Prantl: Die natürlichen Pflanzenfamilien. **1**: 142–224, 1894–1896. The portion after p. 178 continued by G. Lindau, who justly criticizes Schroeter's blunder of arrangement whereby the highest orders are sandwiched between lower ones.

§ Die Pilze in Schenk: Handbuch der Botanik. **4**: 271–755, 1890.

‖ A Student's Text-Book of Botany, 294–303, 1894.

¶ Haandbog i den Systematiske Botanik, 1892. (Translated by M. C. Potter, 1895, with revision of the Fungi, by Dr. E. Knoblauch).

The systems adopted by both Zopf and Vines are manifestly incomplete and are inserted simply to show the conspectus given in two standard works that have an extensive circulation in this country.

Warming's system is in some respects the most consistently carried out, but he introduces too many intermediate groups for clearness and most unaccountably makes the group *order* subordinate to *family* or even in some cases to *sub-family*. His group name *series* is not to be recommended for a group subordinate to a class.

The systems in use have thus been made confusing: (1) By lack of uniformity in terminations so that the relative rank of a group name cannot be told from its termination; (2) By confusing the usually accepted sequence of group names, so that the usual order of phylum (series), class, order and family is varied or even inverted; (3) By the use of numerous and confusing intermediate group-names which may be adapted to a monograph where details are entered into more minutely, but are out of place for presentation in a general way where clearness and simplicity ought to prevail; and finally, (4) By attempting to preserve old group names that no longer have a place in the system because they represent heterogeneous groups co rdinate with nothing now recognized.

It would seem that certain fundamental principles of terminology could be adopted that would vastly simplify the matter of a system of plants and, once in use, enable a student to more intelligently grasp the relationships of plants without subjecting him to this irregular and confusing terminology. Groups will change their limits with our increasing knowledge; new groups will appear and the system of relationships be modified with each generation, but a set form of expression once adopted might become as easy of comprehension as the simple principle involved in binomial nomeclature. Among the features of such a form of expression are:

1. The two group names above the genus should be definitely fixed and their sequence rigidly maintained. The termination *aceae* should be reserved for families in accordance with well known and long existing usage among the higher plants. To

make this termination significant every time, it should appear nowhere in the system outside of family names.

2. For the ordinal name no termination could be better than that of *-ales*.* Long usage as a "Cohort" name, simplicity of affixing and pronunciation, clearness and brevity, all recommend it. If used it ought to be used *exclusively* for orders; it would then characterize at sight the rank of the group name as the termination *-idae* does the family in zoölogy.

3. The names should as far as possible be affixed to the names of representative genera or, if not, be derived from some striking characteristic or feature of the group. Family names, for obvious reasons, should always be of the former class.

4. Miscellaneous group names need not be retained after their usefulness in the system ceases to exist. Where an older name occurs which is practically an order, in the modern sense, it is desirable, where simplicity can be preserved, to so modify the old name as to conform in termination with the new system, but the rules of priority accepted for genera and species need not necessarily apply to either family or ordinal names. It would seem better to attain uniformity of usage by other means.

As a further means of illustrating this simplicity I append the ordinal groups that I am accustomed to use in presenting the relationships of the fungi to students. Nothing is claimed for it except an adaptation of the principles above recommended to the system believed to be nearest in accord with modern research.†

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* Compare the discussion of this subject, this journal, 22: 124–129. It is only fair to state that when that paper on the classification of the Archegoniates was written I had not seen Engler's *Syllabus der Vorlesungen*, which contains certain divisions similar to those suggested in my paper and necessarily antedating it. He uses the same termination *-ales* for orders, but not uniformly, nor exclusively for groups of that rank.

† At present I am using the following presentation of the leading groups of Algae:

Class BACILLARIAE—with one order: DIATOMALES

Class CYANOPHYCEAE — with 4 orders: CHROOCOCCALES, OSCILLARIALES, NOSTOCALES, SCYTONEMALES.

Class CHLOROPHYCEAE—with 6 orders: PROTOCOCCALES, CONJUGALES, SIPHONALES, CONFERVALES, COLEOCHAETALES, CHARALES.

Class PHAEOPHYCEAE—with 3 orders: PHAEOSPORALES, DICTYOTALES, FUCALES.

Class RHODOPHYCEAE—with 5 orders: BANGIALES, NEMALIONALES, CRYPTONEMIALES, GIGARTINALES, RHODYMENIALES.

Series FUNGI of the Phylum THALLOPHYTA.

Class PHYCOMYCETES (Algal-fungi).*

Order CHYTRIDIALES. (Algal parasites).

Order MUCORALES. (Moulds).

Order ENTOMOPHTHORALES. (Insect parasites.)

Order SAPROLEGNIALES. (Aquatic moulds.)

Order PERONOSPORALES. (Downy mildews.)

Class ASCOMYCETES. (Spore-sac fungi.)

Order HEMIASCALES.

Order PROTOASCALES. (Yeast fungi.)

Order GYMNOASCALFS. (Plum pockets.)

Order PERISPORIALES. (Powdery mildews, etc.)

Order HYPOCREALES.†

Order SPHAERIALES.
Order DOTHIDEALES. } Black-fungi (Pyrenomycetes).

Order LABOULBENIALES.‡

Order TUBERALES. (Truffles.)

Order HYSTERIALES.

Order PHACIDIALES.
Order PEZIZALES. } Cup-fungi (Discomycetes).

Order HELVELLALES. (Morels, etc.)

(Fungi Imperfecti.)§

Order HYPHALES. (Hyphomycetes.)

Order MELANCONIALES.

Order SPHAEROPSIDALES. (Spot fungi.)

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* Fischer's arrangement of these forms in the order of their simplicity of reproduction and structure seems highly satisfactory. The first order forms the sub-class *Archimycetes*, with usually asexual methods of reproduction. The second and third form the *Zygomycetes*, their sexual reproduction being by conjugation. The last two orders form the *Oomycetes* in which sexual reproduction is sufficiently differentiated, so that the egg forms the passive as the antherid forms the active element.

† It is with some misgivings that this group is left as a coördinate group with the next, since it differs from it chiefly in the color and consistency of the stroma.

‡ This remarkable group, whose development is one of the triumphs of American botany, is surely worthy of ordinal rank. It is remarkable that only one of the authors quoted, mentions this extensive group, and then only as an "Anhang" to the Pyrenomycetes. And still there are Germaniacs among American botanists who continue to claim that American botany is nothing.

§ This unfortunate group is the *bête noir* of the systematist. That some of these forms are not now connected with any ascigerous form is certain. That a considerable number of them have always had a complete autonomy is highly probable.

Class BASIDIOMYCETES.

Order USTILAGINALES. (Smuts.)

Order UREDINALES. (Rusts.)

Order TREMELLALES. (Gelatinous fungi.)

Order HYMENIALES. (Mushrooms, etc.)

Order GASTRALES. (Puff balls, etc.)

In case the slime moulds and Bacteria are not to be relegated to the domain of animal life, as has been time and again suggested, they would properly form classes lower than the Phycomycetes, *viz.:* MYXOMYCETES with the Order Acrasiales, Plasmodiophorales and Myxogastrales; and SCHIZOMYCETES with the Orders Eubacteriales and Myxobacteriales. *

There still remains the systematic position of the Lichens. Since the coördination of the orders of the entire phylum Thallophyta is far from being settled owing to the limitations of our knowledge, and since the two main series, separated from each other by physiological rather than structural or morphological characters, are held apart largely as a matter of convenience, it may be better to likewise hold the lichens apart as a separate group, though the reasons therefor are much less apparent than in the separation of the algae and the fungi. The lichens are distinctively fungi and there is no more real reason for holding them apart from the fungous orders with which they intergrade than there would be in separating other parasitic forms in distinct series because of some supposed mutualism between the parasite and its host. The fact that the lichens have been treated apart from their real alliances has doubtless been the cause of some part of the confusion relating to them. The orders Pyrenolichenales, Discolichenales, Hymenolichenales and Gastrolichenales may therefore be sandwiched in among their nearest alliances in the conspectus. If held apart in a distinct series it must be understood as a matter of expediency and convenience and not an indication of natural affinity among diverse groups such as they really are.

9 DECEMBER, 1896.

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* Cf. Thaxter, Bot. Gazette, 17: 389–406. D 1892.

A new Species of Nitella, belonging to the N. flexilis Series, with a Review of the allied Species.

BY T. F. ALLEN.

(PLATE 284.)

NITELLA LAXA n. sp.

Eunitella, monarthrodactyla, furcata, homoeophylla, gymocarpa monoica, apiculata.

Plants as long as thirty cm., or longer, diffusely branched, very flexible and translucent, bright green, of the habit and appearance of *N. flexilis.* Stem 500 μ in diam., verticils remote, becoming crowded above, of eight leaves. Leaves of lower sterile verticils long and flexible, once divided into two to four terminals. Leaves of the upper fertile verticils shorter, but still longer than the internodes, once divided; leaves vary from 300 to 430 μ in diam., once divided; terminals, one or two when fertile, two to four when sterile, one-celled, apiculate, about 250 in diam. Antheridia and oogonia single on the nodes of the leaves, the latter distinctly stipitate; coronula evanescent. Antheridium usually about 350 in diam., closely sessile. *Oospore, 410 to 485 long, 400 to 460 broad with six prominent ridges; membrane covered with a thick close felt (grumous),* yellowish red (usually mottled with red).

Collected in Yakushiji pond, Kyoto, Japan. (Plate 284.)

This species adds another to the "flexilis" group, which may be classified at present as follows:

N. flexilis, spore membrane smooth.

N. Californica A. }
N. Mexicana A. } spore membrane granular.

N. laxa A., spore membrane grumous.

Considered as to size.

N. Mexicana, a large coarse plant, has the smallest oospores, 275 long, with 5 prominent ridges.

N. flexilis, oospores 425, with 6 or 7 thin and sharp ridges moderately prominent.

N. laxa, oospores 485, with 6 prominent ridges.

N. Californica, oospores 585, with 6 or 7 thin and sharp ridges,

New Species of Nitella belonging to the monoecious acuminatae Group, with a Review of the allied Species.

By T. F. Allen.

(Plates 285, 286.)

Nitella stellaris n. sp.

This plant is moderately branched, suberect, about 25 cm. high. The stems are about one mm. in diam.; verticils remote below, becoming crowded above, consist of eight leaves, spreading and even recurved. The lower sterile leaves, two to three cm. long, are once divided into two to four short terminals, the upper fertile leaves are once divided into two rarely three terminals. The terminals are one-celled, gradually acuminate, 180 to 250 μ diam. at the middle, and, in the upper verticils, 700 to 1400 μ long. The oögonia are aggregated to the node of the leaf. The antheridia are about 215 in diam. The oöspore 230 to 240 long by 225 broad, with five or six sharp ridges, *its membrane quite smooth.* (Plate 285.)

This species differs from *N. subspicata* Allen, by the diffuse character of its fertile verticils, less condensed than in that species, and in forms of the related species, *N. sub-glomerata* A. Br.; from the latter it may be distinguished by the membrane of the oöspore, and its general habit of growth. The proportionate length of the terminal to the primary segments of the leaves is generally as two to five.

The cluster of small leaves at the ends of the longish primary segments of the fertile leaves give a stellate appearance to the ends of the upper leaves and suggests the name; these, while scarcely "condensed," as the term is usually applied to fertile verticils of *Nitella*, are somewhat suggestive of approximating the "*sub-glomerata*" series of this group, of which this may stand as the most diffuse, followed by *capitulifera* A., *subspicata*, *subglomerata*, and culminating in *glomerulifera*, which bears a dense "head" of fertile divisions.

The plant was collected by Mr. J. W. Blankinship, in a pond near Verdigris river, Creek nation, Indian Territory, August 21, 1895.

Nitella capitulifera n. sp.

Plants diffusely branched, spreading, ten to fifteen cm. long. stem flaccid, about 700 in diam. Verticils consist of eight leaves,

Leaves of the lower sterile verticils often simple, somewhat abruptly pointed; of the upper, once or even twice divided. First segment of the leaves 680 in diam., second 500, the terminals 320 to 340. The first segment nine-tenths the entire length of the leaf, the second segments usually terminal in sterile leaves, three to six, quite short (one tenth the length of the first segment). Fertile verticils *are usually somewhat condensed in small heads, quite similar to N. stellaris* A. The leaves are usually twice divided, the terminal segments, three to four in number, are quite unequal, generally with one, scarcely longer than broad, others six or more times as long, seeming to be somewhat inflated and not always very acuminate, often *somewhat apiculate*. Antheridia 240 in diam. Oögonia, one or two at a node, with oöspores 295 to 306 long and 272 broad, with *seven* prominent ridges. Membrane of the spore reddish, *quite smooth*. (Plate 286.)

This interesting species is similar to the American *sub-glomerata* in its general aspect, though apparently much smaller; its "capitulae" are much smaller and consist of small fertile verticils arising within the sterile verticils. It differs from *subglomerata*, also, by its more inflated terminals, which are usually quite short and unequal, as well as by the character of the oöspore. From *Bellangeri* (*acuminata* var. *Bellangeri* A. Br.) it is clearly distinct, though approaching that form in which the short terminal leaflets are described by Braun as "ventricosis, longe et acutissime acuminatis;" finally from all others of the *acuminatae* group except the preceding *stellaris* A. by the smooth membrane of the oöspore. From *N. stellaris* it differs by its more diffuse habit, its smaller stems and much larger and differently shaped terminals; its larger antheridia and oögonia. From *N. subspicata* A. it differs especially in its much smaller capitulae, the shape of terminal segments of the leaves and by its larger oöspores.

This plant was collected in Japan in 1895.

The "acuminatae" group as above amplified by these new species, may be classified as follows:

Monarthrodactylae, furcatae, homoeophyllae, gymnocarpae, monoicae, acuminatae.

† **Sterile divisions not exceeding the fertile verticals.**

(**Series of *N. subglomerata* A. Br.**)

* **Oögonia isolated.**

***a.* Divisions elongated.**	***N. subglomerata* var. *Indica* A. Br.**
***b.* Divisions abbreviated.**	***N. Mauritiana* A. Br.**

** Oögonia aggregated.

§ Terminal divisions elongated, much longer than the primary; oöspore 275 μ long, membrane reticulated. *N. subglomerata* A. Br.

§§ Terminals abbreviated, less than half as long as the primary divisions.

a. Terminals one-half to one-fifth the length of the primaries, oöspore 240 μ long. *N. stellaris* Allen.

b. Terminals unequal, scarcely more than one-tenth the length of the primaries, oöspore 300 μ long. *N. capitulifera* Allen.

†† Sterile divisions somewhat exceeding the contracted, fertile verticils; oöspore 225 μ long, membrane smooth. *N. subspicata* Allen.

††† Sterile divisions long overtopping the globular condensed, fertile verticils; oöspore 400 μ long, membrane coarsely granular. *N. glomerulifera* A. Br.

Internal Antidromy.

By George Macloskie.

Prof. W. J. Beal showed in the *American Naturalist* of 1873 that cones of opposite spirality grew on the same pine tree. Although for a time I failed to see matters in this way, I have, with the assistance, or rather the guidance, of Prof. G. L. Goodale, come to endorse all that Prof. Beal wrote; and furthermore, I find that the phyllotaxy as well as the conotaxy is two-fold on different parts of the same tree of the Coniferae. The branches of succeeding years appear to be often relatively antidromic, and also the side branches along one of the primary branches, and each cone appears to harmonize in its spirality with the branch which bears it, though there are apparent exceptions to this rule which may be due to the suppression of branches. Of course these phenomena cannot be observed in non-branching Gymnosperms, as the cycads, nor in tree ferns.

But in the London Natural History Museum I found a branching specimen of *Lepidodendron Sternbergii* (from Lanarkshire, Scotland) in which the leaf scars of stem and of one branch were dextrorse, whilst those of the other branch of the dichotomy were sinistrorse. This phenomenon strongly recalled the conditions of the forking rootstock of the water lily (*Nuphar*) and other plants.

The general outcome of these facts is that the law of antidromy is more complex than was first apparent; a result which was previously indicated by the internal antidromy of *Liquidambar*. I may add that the flowers on one plant of *Hibiscus Syriacus* show a tendency to twist in relatively opposite directions; and though the phyllotaxy of that species is not easily determined (the right and left spirals being almost similar), yet in some cases opposite orders of spirality can be found on neighboring branches.

My friend, Prof. F. E. Lloyd, informs me that in the cycadaceous species *Encephalartos Altensteinii* he finds the cones on the same tree relatively antidromic. This accords with the condition of the allied coniferous order.

PRINCETON UNIVERSITY, November 3, 1896.

Reviews.

Some Analogies in the Lower Cretaceous of Europe and America. Lester F. Ward. Reprinted from 16th Ann. Rept. U. S. Geol. Survey, Part I., 1894–1895 [Washington, 1896], pp. 463–542. *Plates xcvii.–cviii. and illust. in text.*

This important contribution is of interest to both the botanist and the geologist on account of the use which is made of palaeobotanical evidence in the correlation of geologic horizons. The comparisons are chiefly made between the Potomac formation of America and the Wealden of Europe, and the author has taken a very broad and liberal view of what should be included under the latter, giving it a wider range at each extremity than is usually conceded to it. In this connection a plea is made for dual nomenclature in geology, according to the point of view from which observations are made. From the standpoint of fossils alone the Wealden would be restricted to narrower limits than if considered stratigraphically, that is from the standpoint of origin and manner of deposition of sediments.

Stratigraphically the Wealden would have to include part of what we have usually regarded as Jurassic with some of the lower Cretaceous. The method of formation and lithologic characters of the Wealden, as thus defined, evidently correlate it very closely with our lower Potomac formation, that is to say the strata are largely of estuary or fluviatile origin and consist of alternating sands and clays, comprising a well marked geologic unit stratigraphically.

The author does not think that the lowest portion of the Potomac (equivalent to the Purbeck beds of the old world) have yet been found, and as the great angiospermous flora of the upper Potomac (Amboy clays, etc.) is not represented in England, a comparison of the English Wealden with any portion of our Cretaceous would be practically restricted to the middle and lower Potomac of the East as far as known, and to the Trinity and Kootanie of the West. In the table of distribution of the Wealden flora the range is extended geologically and geographically so as to include from the upper Jurassic to the middle Cretaceous in all parts of the world where the flora has been recognized, thus giving at once a complete list of the plants and a complete representation of their distribution vertically and laterally.

From the comparisons thus made it is evident that our lower Potomac flora has so much in common with that of the Wealden that the strata which contain it must be regarded as equivalent, whether we eventually decide them to be Jurassic or Cretaceous.

In any enumeration of this flora, cycads necessarily play an important part and cycadean trunks have received special attention from the author. Plate xcix. shows a group of twenty-one from the Purbeck beds of the Isle of Portland, England; plate c., fourteen from the Potomac formation of Maryland; plate ci., eight from the lower Cretaceous of the Black Hills, and plates ciii. and civ., two species from the scaly clays of Italy.

The fossil forests of the Isles of Wight and Portland are also described, and from the wood collected by the author sections were prepared from which two new species are described by Dr. F. H. Knowlton: *Araucarioxylon Wallacei and A. Webbii.*

In discussing the Mesozoic of Portugal, tables of geologic distribution of species for that country are given and interesting comparisons are made between the floras of certain localities and that of the Potomac.

The portion of greatest interest to the botanist, however, may be found under the chapter on Archetypal Angiosperms. It was long recognized by palaeobotanists that the highly developed angiosperm flora of the Dakota Group, Atone beds, Amboy clays, etc., and their equivalents, containing many genera identical with those now living, must have had a more simple ancestry, and in the lower Potomac and Wealden this ancestry seems to be represented, and on plates cvi. and cvii., figures are given of some of these plants from both foreign and home localities, in order that they may be compared. Such an eminent authority as Saporta was in doubt as to their precise affinities, and classed them all under a special group, which he called Proangiosperms. When the entire flora of the lower Potomac shall have been described, we may hope to have many more representatives of these archaic types which will be of absorbing interest to the student of plant development. A. H.

Grasses of North America. W. J. Beal, M.A., M.S., Ph.D., Professor of Botany and Forestry in Michigan Agricultural College. 2 volumes. Henry Holt & Co.

The first volume of this work appeared in 1887, and was devoted to a consideration of the physiological and economic part of the subject. The second volume, which has just been published, treats of the grasses from the standpoint of the systematist. A classification of all the forms growing wild and introduced in North America and Mexico is attempted, the inclusion of those from the latter country much increasing the difficulty of the undertaking. The value of the work is greatly marred by the treatment of the plants in too large and comprehensive groups. This applies both to genera and species. To illustrate this in relation to genera, *Andropogon* may be selected as an example. In this such good and well-marked genera as *Sorghum*, *Heteropogon* and *Chrysopogon*, natural groups that are altogether too distinct to be considered as mere parts of one group, are included. In *Panicum* this same plan of extreme aggregation has been followed, both generically and specifically. In *P. dichotomum* L. the objectionable feature of this method is particularly noticeable. Six or eight good and valid species are here treated as a polymorphous one. While there may be considerale trouble as yet with the forms which have been called *P. pubescens* of Lamarck, certainly such well-marked grasses as *P. ciliatum* Ell., *P. ensiflorum* Baldwin, and what is called *P. barbulatum* Mx. are clear and distinct enough from casual observation to be kept apart as specifically distinct.

They surely should not be made into one polymorphous species, as here treated, no attempt being made to separate them even as varieties, while *P. laxiflorum* Lam. is considered worthy of varietal rank, although its limitations are less distinct than those of the species referred to above.

The present volume is plainly though neatly bound, the type clear and distinct. Some of the figures, however, do not come up as clearly as might be desired. It is the only work in this country which attempts to cover the forms from Mexico, and is a welcome addition to the literature of this difficult family of plants.

G. V. N.

Sphagna Boreali-Americana exsiccata. Prepared by Daniel Cady Eaton and Edwin Faxon. Issued by George F. Eaton, New Haven, Conn., October, 1896.

We have received the first two centuries of these very interesting North American Peat-Mosses, and are much pleased with the number and variety of species represented, the neat manner in which they are put up and the wide geographical range of the collections distributed. The bulk of the collections have been made by Edwin Faxon and Prof. Eaton in the New England States, to which Prof. Farlow and Edward L. Rand have also contributed. Dr. Evans has gathered many species in New Jersey, and Dr. Small in the Southern States, Mrs. A. M. Nicholson and C. H. Baker in Florida, A. C. Waghorne in Newfoundland, and Sandberg and Leiberg in Washington. Besides this there are a few rare arctic species from Hudson Bay and Alaska, collected by George Comer and C. H. Townsend.

We have all felt the great loss that American bryologists suffered in Prof. Eaton's death, and are glad to learn that his work was so far completed that his son has been able to issue this most attractive and useful collection.

E. G. B.

Proceedings of the Club.

TUESDAY EVENING, NOVEMBER 24TH, 1896.

Vice-President Allen occupied the chair and there were 20 persons present.

Mr. P. A. Rydberg gave an account of botanizing in the Crazy Mountains.

Dr. J. K. Small described a case of teretology in *Saxifraga fallax.*

Field notes were also presented by Mr. Howe, interesting remarks being made on the subject Algae and Ferns in California.

Dr. Britton described a new species of *Crataegus* from Virginia and North Carolina.

TUESDAY EVENING, DECEMBER 8TH, 1896.

In the absence of the President and Vice-Presidents, Dr. Havard occupied the chair. There were 30 persons present.

Mr. Thomas A. Williams was elected an active member.

The following persons were elected corresponding members:

Dr. Manuel Urbina, Director of the National Museum aud Professor of Natural History in the National Preparatory School, Mexico.

Dr. Fernando Altamirano, Director of the National Institute of Medicine, Mexico.

Dr. José Ramirez, Professor of Botany in the National Medical Institute, Mexico.

Dr. Alfonso Herrera, Calle de Santa Maria, No. 6, Mexico.

Dr. G. Barroeta, Professor of Physiology, Zoölogy and Botany, San Luis Potosi, Mexico.

Dr. Manuel Godoy, Professor in the Civil College, Queretaro, Mexico.

Dr. Jesus Sanchez, Professor of Zoölogy in the National Museum, Mexico.

Dr. Britton spoke of the recent death of Mr. Rudkin and moved that a committee consisting of the President of the Club and two others be appointed to take appropriate action. The motion being carried, the Chair appointed as such committee the President, Dr. Britton and Mr. Ogden.

The announced papers of the evening were then presented. In the absence of Dr. T. F. Allen, his papers, entitled "Descripions of New Species of *Nitella*," was read by title by Dr. Britton. They are printed in this issue of the BULLETIN.

The paper of Mrs. Elizabeth G. Britton, entitled "Contribution to the Bryology of Bolivia," reviewed the more important collections of Bolivian mosses, the treatment which they had received and the present work in progress on this subject, and enumerated the bryological collections made by Dr. Rusby in Bolivia in the years 1885 and 1886. This collection contained 96 species in 39 genera, 42 of the species being hitherto undescrbied. The paper is printed in this issue of the BULLETIN.

Dr. H. H. Rusby spoke of "Botany at the Pan-American Medical Congress held in the City of Mexico, November, 1896." This paper contained brief references to the character of the flora observed on the journey to Mexico, an account of the scientific progress in the city, especially pertaining to applied botany, and referred to the botanical work organized by the Pan-American Medical Congress. It was supplemented by remarks upon the same subject by Mrs. Britton, who attended the Congress. A number of important publications by the Instituto Medico Nacional were exhibited.

Dr. N. L. Britton described a new species of *Geranium* hitherto confounded with *G. Carolinianum*.

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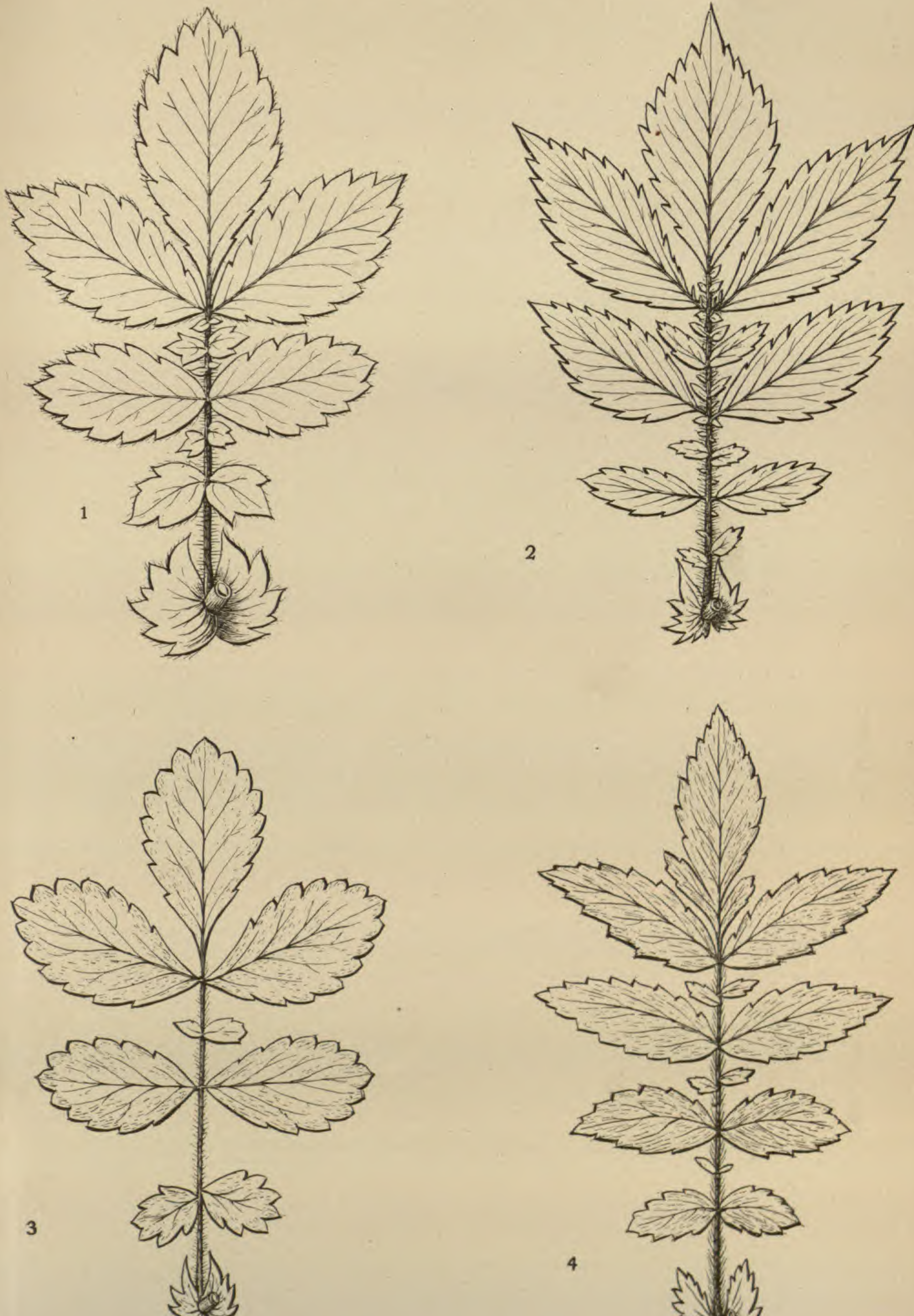

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