BULLETIN

OF THE

TORREY BOTANICAL CLUB.

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GENERAL INDEX.

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

ERRATA, VOLUME XV.

Page 5, 6th line from foot, for FEMALE FLOWERS WITHOUT bracts, read WITH BRACTS,
" 6, line 22, for style, read stigma.
" 15, " 15, for 32° 20′, read 52° 20′.
" 119, " 34, for Pucciinas, read Puccinias.
" 242, " 15, for *Zamourouxia*, read *Lamourouxia*.
" 249, " 6, insert *A. digitatum*, Presl., Sorata (159).
" 249, " 27, for 396, read 306.
" 266, " 11, for O-skwen-e-tah, Golden-rod, read snake-root.
" 275, " 13, for 4to, read 8vo.
" 351, last line, for Mapiri (348), read (349).

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, January 5, 1888. [No. 1.

Studies in the Typhaceæ.

BY THOMAS MORONG. *

I.—TYPHA.

Historically *Typha* and *Sparganium* have come down in unbroken descent from Tournefort. First collectively named Typhæ by Jussieu, next Typhinæ by Agardh, and finally Typhaceæ by De Candolle, they are divided by Bentham and Hooker into the two tribes, Typheæ and Sparganiaceæ, each represented by a single genus.

Typha is more nearly related to the Aroideæ than its congener *Sparganium*, because it possesses organs which represent both spadix and spathe. If the inflorescence is gathered when young, it will be found that the spikes are wrapped in a membranaceous sheath attached to their base and rising above the summit in a leaf-like blade. This is commonly called a bract, but in reality it is a spathe or answers the purpose of one to the young spikes. It encloses several thinner sheaths, one for each spike, and generally two or three others which spring at intervals from different points in the spikes, as though these were made up of successive joints. To be seen at all, the bracts must be taken in the early anthesis, as they are caducous, and wither and fall off even before the anthers are ready to shed their pollen. This habit of *Typha* in separating its spikes into several partitions by the intervention of bracts, shows a curious relationship between it and *Sparganium*. In the latter the process has gone farther, and there is a distinct separation of the spikes into small heads, some

* Special thanks are due to the botanists to whose courtesy I am indebted for much of the material used in the preparation of these papers. Dr. Gray and Dr. Watson, of Cambridge, have rendered invaluable aid in friendly counsel and encouragement, and in permitting the free use of the Harvard Herb. and botanical library. I am also much indebted for the loan of specimens to Dr. N. L. Britton, Mr. W. M. Canby, Prof. E. L. Greene and Prof. John Macoun.

distance apart, the pistillate below and the staminate above—each, except the very uppermost, subtended by a floral leaf or bract. As in *Typha* the division is most numerous in the staminate spike, so it is in *Sparganium*, where we find only from one to six pistillate heads, and from two to thirty or more staminate.

The inflorescence of *Typha* is much more complicated than that of any of the Aroideæ, or, at least, of any of the North American members of that order; and the inflorescence of *Sparganium* is simplicity itself in comparison.

It might be suspected, perhaps, that an arrangement of this type would be attended by various irregularities and monstrosities, and such is really the case. For one thing, the inflorescence varies indefinitely, even in the same species, in dimensions. Mature spikes not over an inch or two in length are found, and from this dwarfed condition they extend to a length of 12 or 14 inches, and the entire inflorescence varies from 5 inches to 3 feet long. A similar variation occurs in the diameter of the spikes; some of them are not as thick as an ordinary goose-quill, while others measure nearly an inch and a half through.

A naked space between the pistillate and staminate spikes was formerly regarded as a sufficient distinction between certain species, as, for instance, between *T. latifolia* and *T. angustifolia*, but here, too, a great variation exists, so that this mark cannot be relied upon at all as a ground of specific distinction. It is true that *T. angustifolia* does ordinarily exhibit such an interval, and perhaps thousands of plants in the same locality will be thus characterized, but in another locality the spikes will frequently be continuous. The same variation occurs in *T. latifolia*.

The inflorescence, also, is often interrupted in various ways. Two pistillate or two staminate spikes not rarely occur on the same plant, and even two of each kind on the same stem. When this takes place in *T. latifolia*, it is generally in the staminate spike, and the abnormal addition looks like a small Turk's-cap set on the end. In several instances I have seen a double spiked stem in which one of the spikes occupied only one-half the diameter of the rachis. Besides this irregularity, both kinds of flowers will not unfrequently be mingled in patches along the same spike, occurring generally in the pistillate spike.

Akin to such external eccentricities is a difference in the character of the pollen. Some of the species, like *T. angustifolia* and its near allies, have the pollen in single grains, varying in size from $\frac{1}{1200}$ inch to $\frac{1}{750}$ inch, while in *T. latifolia* and *T. Laxmanni* the pollen is united in fours. The outlines of the four cells may be readily discerned under the microscope; and in some cases the grains are partially and occasionally wholly disintegrated, showing that the union is merely mechanical.

The floral organs are curious structures. They consist of numerous hair-like bodies, fertile and sterile, and densely crowded together in a compact mass upon the rachis. The stamens are single or most commonly 2-7 anthers united upon a connate capillary filament (see fig. 1). By grasping the anthers when fresh, they may be pulled apart and the filament torn into separate threads, showing, as in the case of the pollen, that the union is mere adherence.

Surrounding the stamens in all the species which I have examined are what in our ignorance of their use are commonly called *bracts*, or sometimes simply *hairs*. (See figures 1, 8, 9). When much magnified, these bodies appear to be naked, loosely cellular threads or ribbons, expanding upwards cuneately, or with a small clavate or spatulate tip which terminates in one or more projecting hairs. (See figures 10 and 11). I confess that these so-called male bracts seem to me more like imperfect pistillate flowers, bearing spatulate-lanceolate stigmas, than like bracts. Similar bodies occur in the pistillate inflorescence of some of the species. They bear no appearance of being transformed leaves. They do not seem to serve a protective purpose. It would accord with our modern evolutionary ideas to regard them as disused and degraded organs, their former utility having passed to the fertile flowers of the pistillate inflorescence, owing to the superior advantages of the latter for cross-fertilization.

The fertile flowers consist of a single capillary pistil, the ovary more or less stipitate, the style short and terminated by a rhomboid, spatulate or linear stigma, as shown in fig. 4. The calyx is composed of numerous (20-40) white, delicate setæ girding the base of the stipe, and of different lengths in the different species. Very much magnified, these setæ present the appearance shown in fig. 7, tape-like bodies, having several rows of elongated cells, which are apparently knotted at their junction.

Mingled with the fertile flowers are many rudimentary flowers, if we may regard them as such, which in some instances resemble the fertile in shape and size, but generally much shorter and club-shaped at the summit, which also are surrounded at the base by perigonial setæ, but show no trace of an ovary. (See figures 2, 4 and 13). In many of the species mixed with the fertile and sterile flowers are very slender bracts like those described above as occurring in the staminate spike. (See figures 5, 14). The stigmas and ends of the bracts are of a rusty tinge, and their projecting tips impart the well-known hues of dark and light brown to the spikes.

So closely packed are the flowers, that I have counted, within the distance of an eighth of an inch, in a pistillate spike of *T. angustifolia*, over 1,500 ripe fruit, besides the accompanying sterile flowers and bracts. Therefore a fruiting spike 5 inches in length, an average size, must yield, at the lowest calculation, a crop of 60,000 seeds; and as spikes 7 and 8 inches long are not unfrequent, the yield in some cases will be half as many more. When taking to the air the perigonial setæ expand, as shown in fig. 3, and the seed sails away on a balloon like thistle down. Think, then, of one plant committing to the winds nearly 100,000 seeds; and try to estimate the enormous number that must be produced in the acres covered by a single *Typha* jungle like that on the Hackensack meadow, near the city of New York !

The plants of the *Typha* family serve several uses which are worthy of notice. Sir Joseph Hooker states that the inhabitants of Scind and New Zealand make bread from the pollen. As this is very abundant, falling like meal out of a bag at the time of fertilization, we can easily imagine it capable of such a use. The roots might perhaps be employed in a similar manner, if dried and ground into flour, as they are farinaceous and often quite long.

Prof. W. R. Dudley states that in central New York the long leaves are used quite extensively in the manufacture of chair-bottoms ; they are also woven into baskets, for which they are well fitted. In decorative art all are familiar with the panel pictures and the mantel ornamentation in which our common cattail plays so conspicuous a part.

The most natural classification of the species of *Typha* that I have seen is the arrangement of Dr. P. Rohrbach, of Berlin, published about the year 1870.* As this paper has never been translated into English, so far as I am aware, except in the abstract of it given by Dr. Engelman,† it may be new to most readers of the BULLETIN. I therefore reproduce Rohrbach's summary, so that our North American species may be assigned to their proper places:

A.—FRUIT WITH A LONGITUDINAL FURROW, BURSTING IN WATER; SEED WITH A SEPARABLE OUTER COAT.

I.—STIGMAS SPATULATE-LANCEOLATE.

a. Female flowers without bracts.
  1. Stigmas longer than the perigonial hairs.
     T. latifolia, L. *T. Capensis*, Rohrbach.
  2. Stigmas as long as the perigonial hairs.
     T. Shuttleworthii, Koch et Sond.

b. Female flowers with bracts.
  1. Stigmas longer than the perigonial hairs.
     T. Schimperi, Rohrb.
  2. Stigmas as long as the perigonial hairs.
     T. Muelleri, Rohrb.

II.—STIGMAS LINEAR.

a. Female flowers without bracts.
     T. glauca, Godr.

b. Female flowers with bracts.
  1. Bracts and perigonial hairs of the same length.
     T. angustifolia, L. *T. Domingensis*, Pers. *T. Javanica*, Schnitz.
  2. Bracts longer than the perigonial hairs, nearly as long as the stigmas.
     T. angustata, Bory et Chaub.

B.—FRUIT WITHOUT A LONGITUDINAL FURROW, NOT BURSTING IN WATER; SEED WITH OUTER COAT NOT SEPARABLE.

I. STIGMAS SPATULATE-LANCEOLATE—FEMALE FLOWERS WITHOUT BRACTS.
     T. stenophylla, F. et M.

II. STIGMAS LINEAR—FEMALE FLOWERS WITHOUT BRACTS.
     T. Laxmanni, Lepech.
     T. Haussknechtii, Rohrb.

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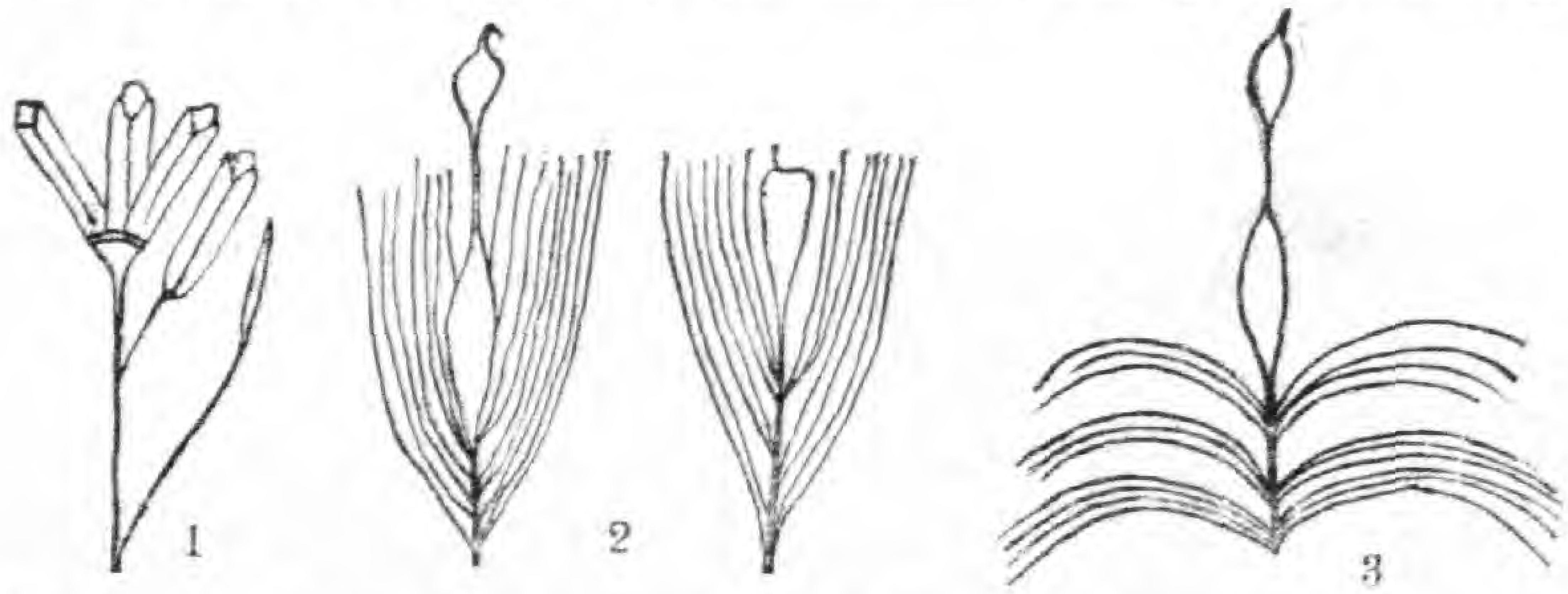
* Verhandl. Bot. Verein, Brandenb. xi., 67.

† Am. Jour. Sc. and Arts for Nov., 1871.

Of the species here enumerated only three are found within the limits of North America, the most widespread being:



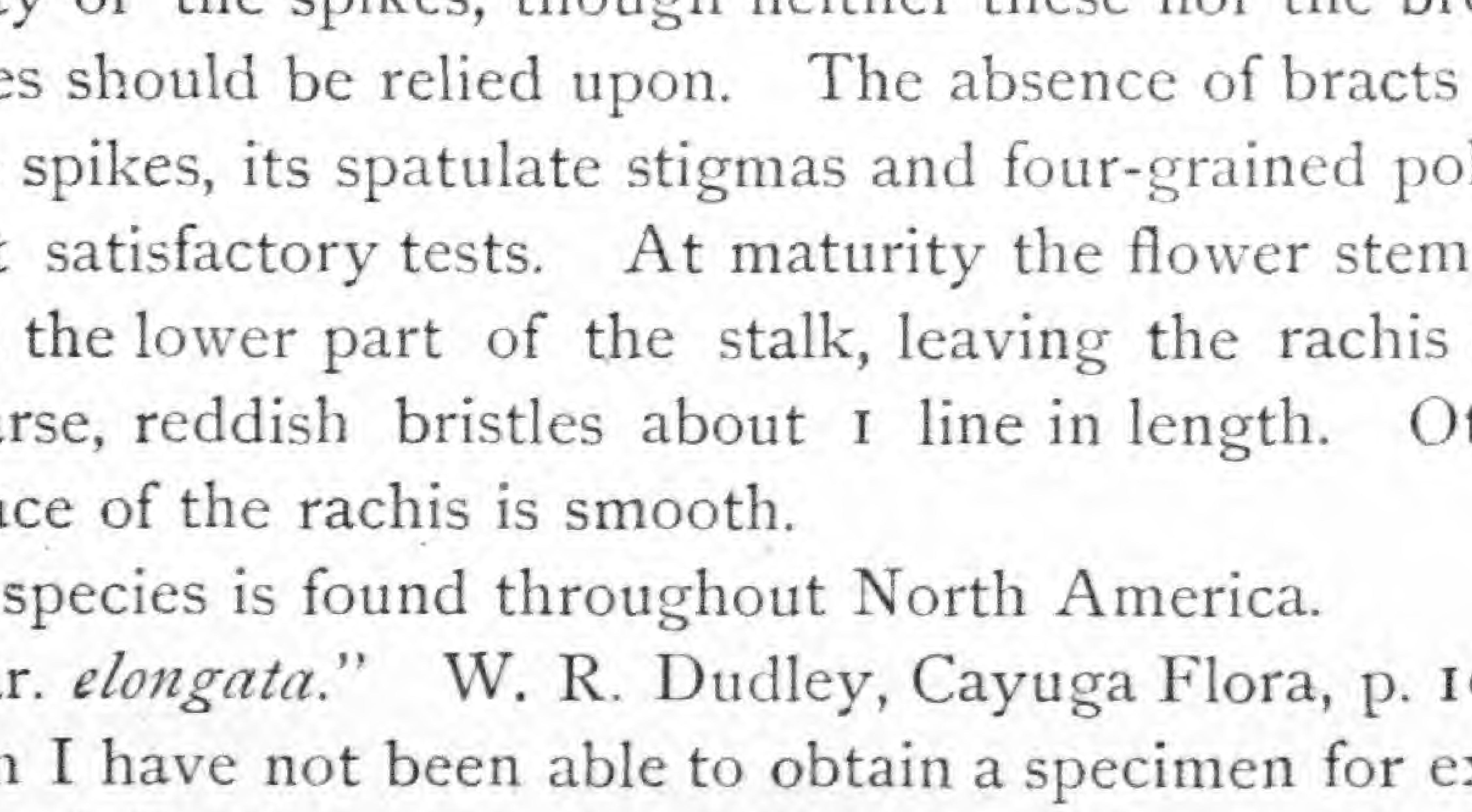
T. latifolia.—1. Staminate flower, with bract attached, X 3. 2. Fertile and sterile flower, X 3. 3. Ripe fruit of do. after leaving the spike, X 3.

1. *T. latifolia*, (L. sp. 1377). (Figs. 1 3).

This is too well known to need description. It may ordinarily be distinguished by its blackish color when ripe, and by the contiguity of the spikes, though neither these nor the breadth of the leaves should be relied upon. The absence of bracts from its pistillate spikes, its spatulate stigmas and four-grained pollen, are the most satisfactory tests. At maturity the flower stems separate from the lower part of the stalk, leaving the rachis covered with coarse, reddish bristles about 1 line in length. Otherwise the surface of the rachis is smooth.

The species is found throughout North America.

"Var. *elongata*." W. R. Dudley, Cayuga Flora, p. 102. Of this form I have not been able to obtain a specimen for examination. Prof. Dudley states that its fruiting spike is sometimes as much as 12 inches in length; but if only the length of the spike is considered, that would hardly warrant even a varietal distinction.

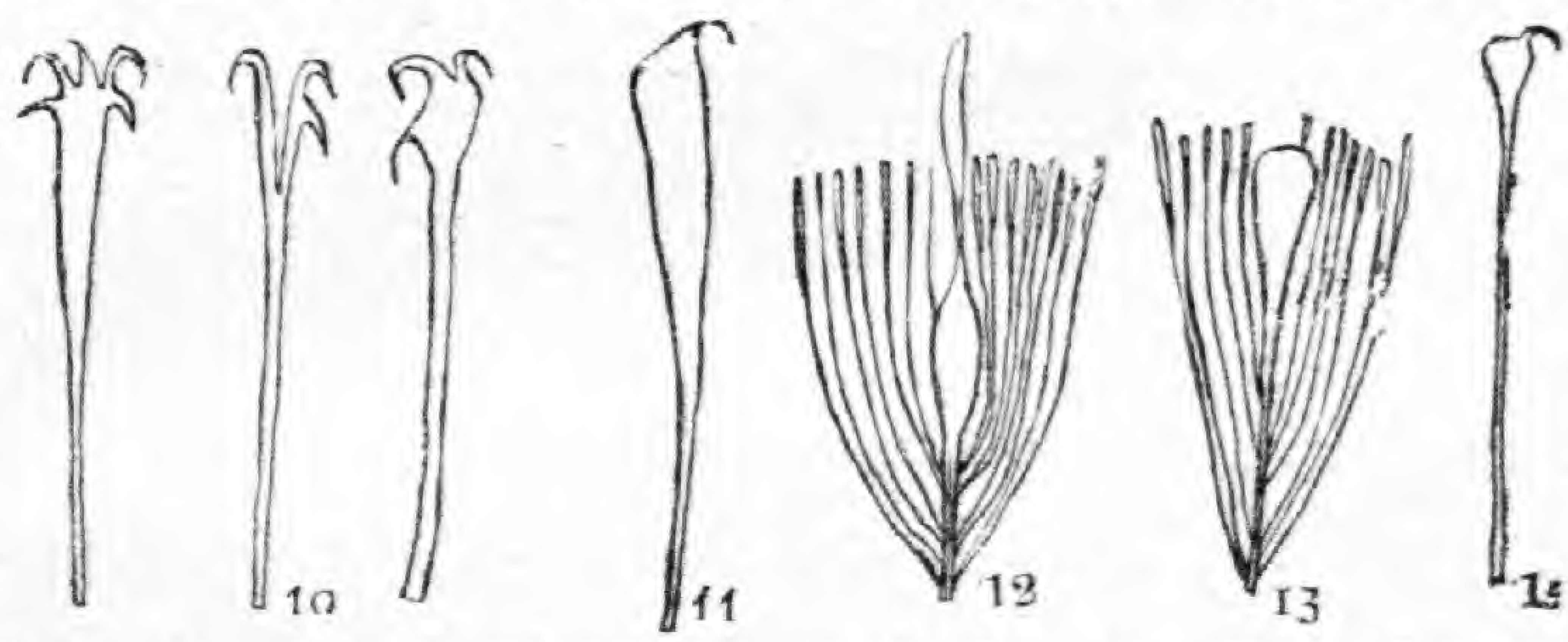


Typha angustifolia.—4. Fertile and sterile flower, X 10. 5. Pistillate bracts, X 10. 6. Style, highly magnified. 7. Perigonial seta, highly magnified. 8, 9. Staminate bracts, X 10.

2. *T. angustifolia*, (L. sp. 1377, Excl. var. β). (Figs. 4–9).

This species is much more limited in its range than the preceding. It is not reported north of the U. S. and Canada line, and in the South only in Louisiana, and westward to California. Personal observation and an examination of many local catalogues lead me to think that it is mainly a seaside species, and rather rare in the interior of the country. It covers extensive swamps along our northern Atlantic seaboard.

This species may be easily distinguished from *T. latifolia* by its light brown color, its simple pollen, its linear stigmas and female bracts. Rohrbach describes the bracts as shorter than the stigmas, but in our N. A. forms the two are frequently of the same length. (See fig. 5). The denuded rachis is rough, with stiff points, which are the bases of the fallen flowers.



T. Domingensis.—10. Staminate bracts, X 8. 11. Do. of a specimen from Buenos Ayres, X 8. 12, 13, 14. Fertile and sterile flower and pistillate bract, each X 10.

3. *T. Domingensis*, Pers. (Syn., ii, 532.) (*T. angustifolia*, L., sub.-sp. *Domingensis*, Rohrb.) (Figs. 10-14).

Though closely allied to *T. angustifolia*, yet this plant possesses some distinctive specific features. Pollen simple, often as small as $\frac{1}{1500}$ inch in diam.; male bracts often as long as the anthers, thick cuneate or broad spatulate at the summit, much larger than in *T. angustifolia* (figures 10, 11); female bracts delicate, with a small, rounded or spatulate head, as long as the stigmas (fig. 14); perigonial setæ shorter than the stigmas, thickened upward near the summit (figs. 12, 13). This is a very vigorous grower, and sometimes even gigantic in size. Prof. E. L. Greene describes specimens* (*T. bracteata*, Greene, Bull. Cal.

*The plant so named by Mr. Greene, although the monarch of its tribe, is clearly to be placed here, as it exhibits all the diagnostic marks, especially the strap-shaped male bracts and the club shaped setæ, ascribed by Rohrbach to *T. Domingensis*. The characters relied upon by Mr. G. in naming, are its spathaceous bracts, a feature common to all the species, and its great size, which in itself certainly cannot be a sufficient ground for specific distinction. There is a specimen from Guarajuato, Mexico, in Herb. Gray, which has an inflorescence measuring over all some 32 inches, nearly as long as that of the plant from Santa Cruz.

Ac. Sc., ii, 413) which he collected on the Island of Santa Cruz, coast of California, as being from 15 to 18 feet in height, and bearing an inflorescence which in the largest specimens measures 3 feet in the aggregate length of the spikes. In other respects, like *T. angustifolia.*

This form has been reported as occurring in Texas, and it is found in Mexico, throughout the West India Islands, and near Buenos Ayres, S. America.

New or Little Known Grasses, I.

Plate LXXVI.

The following species of grasses have been known for some years in herbaria, but have remained until this time without published descriptions.

1. MUHLENBERGIA ARIZONICA, Scrib. (A, figs. 1-6). Culms densely tufted, 15-35 cm. high, including panicle, which is from 8-18 cm. long, with a habit as represented in figure 1. Leaves 3-5 mm. long by 1-1½ mm. broad, flat, many nerved and minutely scabrous on the margins, especially near the very acute tips. Ligule short. Panicle ovate in outline, branches very slender and few-flowered, pedicels minutely scabrous. Spikelets about 3 mm. long, empty glumes nerveless, obtuse, nearly equal, slightly over 1 mm. in length; flowering glume finely pubescent on the margins and dorsal nerve near the base, minutely two-toothed at apex and bearing a short (½ mm.) awn.

Mesas, near the Mexican boundary, Pringle, 1884, and No. 402 Pringle, "*Plantæ Mexicanæ*," 1885.

2. SPOROBOLUS INTERRUPTUS, Vasey (B, figs. 1-5). Culms densely cæspitose from a strong fibrous root, usually about 40 cm. high, including the lead colored panicle, which is from 10-18 cm. long with a habit as represented in figure 1. Culm leaves two, the lower about 8 cm. long, the upper somewhat shorter; flat, 2 mm. wide or less, very finely scabrous above and along the margins, especially towards the narrow and somewhat pungent tips. Ligule a ciliate fringe with a few long hairs at the margins. Spikelets often glomerated along the ascending branches, 6-7 mm. long; empty glumes broadly lanceolate, acute, the first about 3 and the second about 5 mm. long; flowering glume a

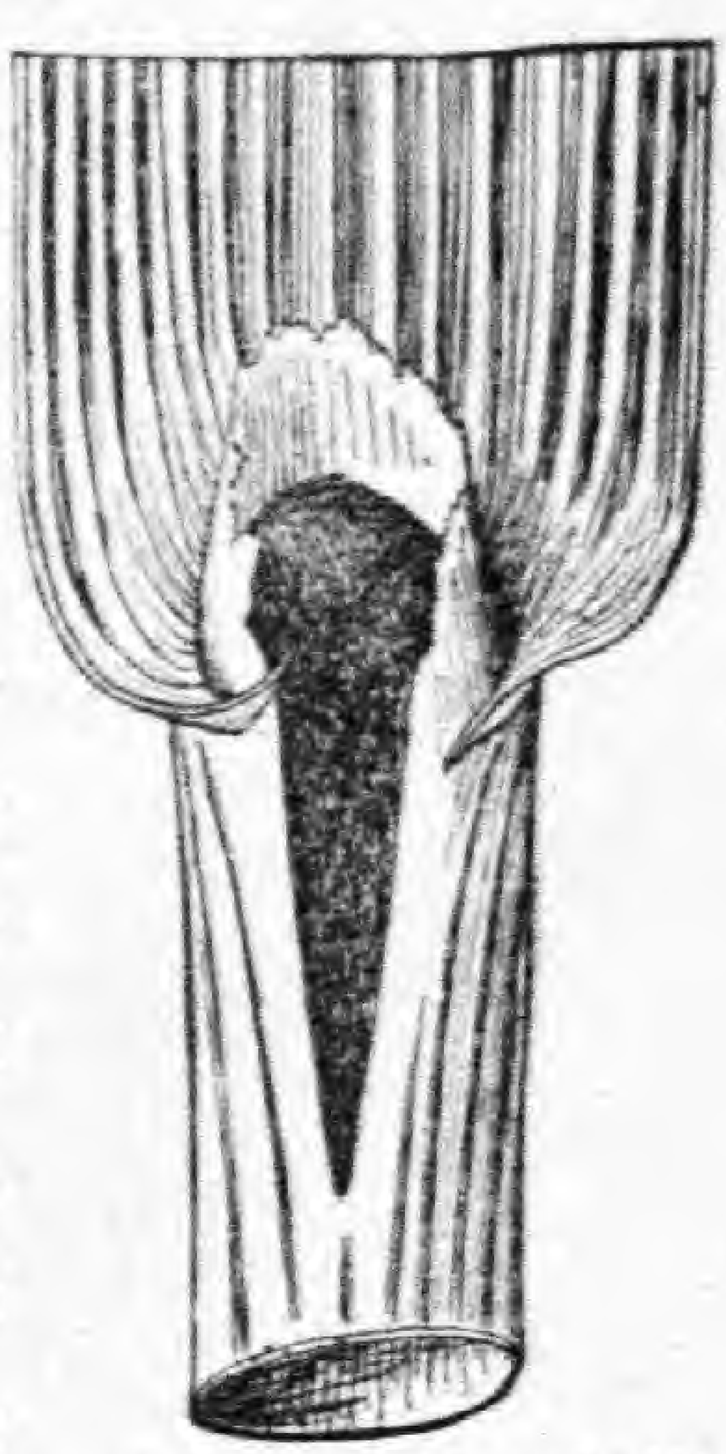
little shorter than its palet, which is slightly notched at the tip, with acute or rounded lobes and remarkably broad margins.

Allied to *S. heterolepis*, Gray. Arizona, No. 66, Coues & Palmer, 1866. San Francisco Forest, Arizona, No. 15, Rusby, 1883.* Has been named in some collections *Sporobolus Arizonicus*, Thurber.

3. DEYEUXIA SUKSDORFII, Scrib. (C, figs. 1-9). Culms 60-90 cm. high, growing in scattered bunches. Radical leaves 15-30 cm. long, 3-5 mm. broad, tapering into very long and slender points, many nerved, strongly scabrous upwardly on the under side, and strigose pubescent above; leaves of the culms usually three, sheaths shorter than their internodes. Ligule 3-5 mm. long, minutely scabrous. There is more or less pubescence at the juncture of the leaf with the sheath. Panicle pale straw color, 8-10 cm. long, strict and more or less interrupted, as illustrated in C; the longer branches sometimes 4 cm. long, all very densely flowered. Spikelets 3-4 cm. long; empty glumes lanceolate acute, sub-equal, about one-third longer than the floret, the second usually three-nerved at base, where the nerves are often more or less green; flowering glume and palea very delicate in texture, with the proportions and outlines as illustrated. Awn from near the base, geniculate, twisted below, about as long as the empty glumes.

Washington Terr., No. 26, Suksdorf, 1882. Oregon, Cusick, 1884. Montana, No. 364, Scribner, 1883, etc.

4. BROMUS PUMPELLIANUS, Scrib. (D, fig. 1-7). Culms from a creeping root-stalk, stout, 50-100 cm. high, according to location; usually standing singly. Sheaths strongly striate, smooth or clothed with a scattering pubescence, closed to near the summit. Ligule short. Leaves 4-8 mm. broad, flat, except at the involute and pungent-pointed tips, smooth on the back, scabrous above, and sometimes pilose, auricled at the base. (Auricles not always so prominent as in specimen from which the figure was drawn.) Panicle 8-20 cm. long; branches erect or ascending, 2-5 at each joint, one to three flowered, the longer ones 5-10 cm.



Bromus Pumpellianus, showing upper portion of sheath, ligule and leaf auricles.

* 15 provisional number=885 series number.—H. H. R.

(Panicle frequently more lax than represented in figure.) Spikelets 2-4 cm. long, four to ten-flowered, purplish in color; empty glumes unequal, the first 5-7 mm. long and one-nerved, the second 7-9 mm. long and three-nerved, nerves purple; flowery glume 9-12 long with a short scabrous awn, seven-nerved (three nerves much more prominent than the others), ciliate pubescent on the margins and prominent nerves below. (Often less acute than illustrated, and sometimes slightly notched at the scarious tip.) Palea shorter than, or sometimes nearly equalling, its glume, narrow and ciliate on the nerves.

Bromus ciliatus, L. var. *Coloradensis*, Vasey, in Bot. Wheeler.

Montana, No. 418, Scribner, and in various collections from the Rocky Mountain region. No. 518, Tweedy, 1885, from the Yellowstone National Park, is a smaller flower form, with only 3-5 florets in each spikelet, and with flowering glumes much more densely pubescent. F. LAMSON SCRIBNER.

WASHINGTON, D. C., Dec. 10, 1887.

EXPLANATION OF PLATE.

A. *Muhlenbergia Arizonica*. 1. Plant entire, much reduced. 2. Dorsal view of spikelet. 3. Anterior view of spikelet. 4. Floret. 5. Empty glumes. 6. Dorsal view of flowering glume, flattened.

B. *Sporobolus interruptus*, Vasey. 1. Plant entire, much reduced. 2. A branchlet with four spikelets. 3. A spikelet. 4. A floret. 5. Apex of palea.

C. *Deyeuxia Suksdorfii*. 1. Spikelet. 2 and 3. Empty glumes. 4 and 5. Dorsal and anterior views of the floret. 6. Apex of flowering glume. 7. Apex of palea. 8. Rudiment. 9. Anther. (The details all drawn to the same scale excepting fig. 9.)

D. *Bromus Pumpellianus*. 1. Plant entire, much reduced. 2. A spikelet. 3. Anterior view of floret. 4. Dorsal view of same. 5. Dorsal view of flowering glume, flattened. 6. A stamen. 7. Ovary, styles and lodicules.

NOTE.—All these figures drawn from nature and designed for Dr W. J. Beal's work on the "Grasses of North America." Used here by permission.

Nitella (not Tolypella) Macounii.

Since describing *Tolypella Macounii*, the description of which "had been delayed in the hope of obtaining more specimens," I have received from Prof. Macoun small specimens of the same plant from Lake St. Clair. An examination of these plants convinces me that the antheridia are terminal and not lateral; they, therefore, belong to *Nitella*. This species takes its place close to *N. Stuartii*, A. Br., from New Zealand, as follows:

Heterophyllæ, repetito furcatæ, monoicæ, macrodactylæ.

Segmenta ultima sæpe bicellularia, cell. ult. non mucroniform. long. nucl. 210-215 μ: *N. Macounii*, Allen.

Segmenta ult. unicellularia, long. nucl. 270 μ: *N. Stuartii*, A. Br.

T. F. Allen.

New Western Grasses.

By Dr. Geo. Vasey.

Poa macrantha.—Culms ascending from a thickish, creeping rhizoma, stout, smooth, 10 to 15 inches high, leafy, the lower leaves crowded, and with long, loose sheaths which are longer than the internodes, the blades rather rigid, involute and curving or recurved, 4 to 6 inches long, smooth; panicle 2 to 4 inches long, erect, close, lax and sometimes interrupted below, the branches short (½ to 1½ inches), in twos or threes, erect, flowering mostly to the base; spikelets large, 5 to 6 lines long, 3 to 4 lines wide, much compressed, about seven-flowered; empty glumes 4 lines long, equaling the adjacent flowers, the upper a little the longer, three-nerved, acute; flowering glumes 4 lines long, acutish, broad, five-nerved, the keel and lateral nerves coarsely ciliate below; palet about as long as its glume, sparsely ciliate on the keels; stamens 3; styles 2; lodicules 2, conspicuous, lobed, ½ to ⅔ line long.

Apparently diœcious, collected on sandy shores at the mouth of the Columbia River, Oregon, by Mr. Thos. Howell, also on the beach at Tilamook Bay in 1872 when it was distributed as *P. Douglasii*, which it resembles in habit, but has larger flowers, longer and less compact heads.

Poa argentea, Howell.—Culms loosely tufted, slender, 6 to 8 inches high, erect or somewhat decumbent at the base; leaves numerous and crowded below, sheaths loose and membranaceous, the blade conduplicate, narrow, 2 to 3 inches long, upper leaves, (1 or 2) with long sheaths and short blade; panicle about 1 inch long, oblong, loosely flowered, branches short, lower ones in twos, upper ones single, appressed, once subdivided or single; spikelets 3 to 4 lines long, three to five-flowered; empty glumes about 2½ lines long, lance-oblong or oblanceolate, obtuse, denticulate at apex, broadly scarious margined, smooth, nerved near the base; flowers somewhat distant on the smooth axis, the lower ones about 3 lines long, the upper shorter; flowering glumes oblong-lanceolate, five-nerved, acutish, scarious margined, smooth or minutely scabrous; palet nearly as long as its glume, scabrous on the keels. Panicle with a pale silvery hue. Collected by Mr. Thos. Howell on the Siskiyou Mts., Oregon.

ALOPECURUS HOWELLII.—Annual, 3 to 6 inches high; culms simple, erect or decumbent at the base, with two or three nodes; culm leaves about 3, sheaths about 1 inch long, striate, the lower shorter than the internodes, the upper one equaling or longer and enclosing the base of the panicle; ligule membranaceous, about ⅔ line long; blades narrow and elongated or filiform, the lower two exceeding the culm, the upper one short, lower surface strongly nerved and finely scabrous; spike an inch long or less, cylindrical-oblong, rather densely flowered; spikelets nearly 1½ lines long; empty glumes slightly united below, strongly ciliate on the keel and lateral nerves, obtuse, a little exceeding the flowering glume, which is smooth, oblong, obtuse, the sides united to the middle or higher, awn from near the base, about three times as long as the glume, bent at the middle. Growing in wet soil. Collected in Oregon by Mr. Thos. Howell.

ALOPECURUS MACOUNII.—Culms 4 to 6 inches high, mostly in clusters of two or three, erect or geniculate below; sheaths 2, narrow and not much inflated, the lower one ½ to 1 inch long, shorter than its internode, the upper one 1 to 1½ inches long and much shorter than the culm; ligule membranaceous, about 1 line long, blades very short, the lower 1 inch, the upper ½ to 1 inch long, narrow and acuminate; spike ½ to ¾ inch long, oblong-cylindrical, rather dense; spikelets 1½ lines long, empty glumes slightly united below, coarsely ciliate on the keels, the side smooth, obtuse, a little exceeding the flowering glume which is smooth, ovate-oblong, obtuse, the sides united to the middle or above, the awn from near the base, 2 or 3 times as long as its glume, bent at the middle.

Grows on dry rocks, at Oak Bay, Vancouver Island.

Collected by Prof. John Macoun.

This species has a close resemblance to the preceding, but seems sufficiently marked by the difference in the leaves and sheaths and in the details of the flowers.

ALOPECURUS GENICULATUS, var. ROBUSTUS.—Culms geniculate below, thick, simple or branching at the lower joints, 1 to 1½ ft. long, smooth; culm leaves 4 or 5, nodes black, smooth, sheaths loose and inflated, 3 to 5 inches long, the lower longer than the internodes, blade 3 to 6 inches long, 3 lines wide, ligule 2 lines long, acute; spike 2 to 3 inches long, 3 to 4 lines wide, cylindrical, dense, exserted when mature; spikelets little more than 1 line long, nearly half as wide; empty glumes little united below, the keels and lateral glumes ciliate-pubescent, obtuse and denticulate at the apex; flowering glume nearly equal to the empty ones, ovate-oblong, obtuse, smooth, the sides united to the middle, awn from the middle, slender and little exceeding the glume.

We have specimens from Alaska. Mr. J. Macoun collected it in Vancouver Island in 1875 and again during the present season.

ALOPECURUS CALIFORNICUS.—Under this name I indicate several forms from California and Oregon which have been referred to *A. pratensis*. They differ from that species in having smaller spikelets (about 1½ lines long instead of from 2 to 3), the empty glumes only slightly united at the base (one-fourth to one-fifth in *A. pratensis*), and obtuse or obtusish (not acute as in *A. pratensis*) at the apex. In the different forms there is considerable difference in the length and thickness of the spike, and in the height and thickness of the culm. Further study of these forms is needed.

Re-discovery of Nymphæa elegans, Hook., at a new Station.

In June, 1849, "in a pond near the head of the Leona" river, Dr. Charles Wright collected a number of specimens of a rare and beautiful water-lily. These were doubtfully referred by Dr.

Gray to *Nymphæa Mexicana*, Zucc. One of the specimens, however, was sent to Sir William Hooker, and the plant raised from seed accompanying it Hooker described and figured as a new species under the name of *Nymphæa elegans.* Before or since, except a single doubtful specimen, collected by Berlandier near Palo Alto, Mexico, the native plant has never been reported. Neither Lindheimer, Fendler, nor any other Texan collector or botanist, has ever detected it,* and *Nymphæa elegans* has stood for nearly forty years in the North American flora on the strength of a single collection at a single vaguely described station on the broad prairies of Southwestern Texas.

These preliminary remarks are necessary to explain the unusual interest attached to some specimens of *Nymphæa* received the past autumn, almost simultaneously, from two correspondents† at Waco, in east central Texas. Upon the first inspection I took these for a small form of *N. odorata*, approaching the variety *minor.* Closer examination showed two strong marks of distinction. The seeds were globular instead of oblong, and the sepals were very distinctly marked with slender, broken, longitudinal brown lines. Reference to the check-list and the Columbia College herbarium led me directly to *N. elegans*, of which I could find no specimen in the herbarium, but, instead, a memorandum slip stating that this species has petals "tipped with blue." Examination as to this point showed a single petal, with a distinct bluish tip; the others were so faded that the original color could not be ascertained. I then consulted the Plantæ Wrightianæ, and found my plants agreeing closely with Wright's in the few particulars there noted, such as the size, slenderness, shape of leaf, and particularly the globular, smooth seeds. The prominent sepal markings, however, were unmentioned. After long search, I discovered in Walpers' Annales, Vol. III., a specific description, and was more than pleased to find the brown-lined sepals ("sep. fusco-lineatis") especially mentioned. The petals were described as white with a purple-blue tinge ("pet. albis purpureo-cœruleo-

*Dr. Sereno Watson is my authority for this statement.—E. E. S.

† It is an act of justice to name the two ladies, both enthusiastic observers of the flora of their region, who were thus instrumental in the re-discovery of *N. elegans*. They are Miss Sarah A. Trimble and Miss M. Judith Wright, the latter now of Lorena, Texas.—E. E. S.

tinctis"). The identification appeared to me tolerably certain, but to make assurance doubly sure, I dispatched to Wacó a particular inquiry as to the color of the fresh blossoms. The reply ran in this satisfactory manner: "The tips to the petals of the water-lily were decidedly purplish; the half-open buds were deep lavender, lighter at the base. The lines on the sepals are purple instead of brown. The plant is plentiful in one place near Waco." Upon the whole, therefore, I feel fully justified in announcing the re-discovery, after nearly forty years, of one of the rarest and most beautiful plants in the whole North American flora.

E. E. STERNS.

Botanizing in the Strait of Magellan.

BY W. E. SAFFORD, U. S. N.

The latitude of Cape Virgin, at the eastern entrance to the Strait of Magellan, is 32° 20′ south, or only two hundred miles farther away from the Equator than the boundary line between the northwestern portion of our country and British Columbia. The distance in a straight line between the eastern and western extremities of the strait is two hundred and forty miles; but, owing to the crookedness of the channel, which is somewhat V-shaped, the length of the route which a vessel must travel in passing through it is a little greater than three hundred miles. The climate of the region, though remarkably mild, if compared with that of the same latitude on the east coast of North America, differs but little from that of the corresponding region on the west coast, either in its equable temperature or its excessive dampness. Snow and hail often fall even in mid-summer, yet this is owing to the effect of the high snow-capped mountains of the region upon the moisture-laden winds from the west. The average temperature of the winter months is higher than the freezing point of water, although, of course, the thermometer often falls much below this.

Shortly after leaving the estuary of the Plata we encountered large floating patches of the giant kelp, *Macrocystis pyrifera*, which plainly indicated a current from the south. This species, so abundant on the Pacific coast of the United States, is the most common alga in the Strait of Magellan and in the channels which border the western shore of Patagonia. It is widely spread in antarctic waters, and extends northward along the coasts of Chili and Peru at least as far as Ancon. It may be described as consisting of a long, round, leathery stem, bearing alternate, simple, flat fronds, the petioles of which (if I may so term them) dilate into hollow pear-shaped floats.

We sighted Cape Virgin at one o'clock on the afternoon of November 20th. We stood in for the entrance of the strait, and before sunset were snugly at anchor behind Point Dungeness.

On the ledges of this point many cormorants, gulls, petrels and other sea-birds were perched; at its base a heavy surf was breaking, and with a glass we could see a line of penguins drawn up as though in battle array, stationed to defend the entrance to the strait.

The following morning we proceeded up to Gregory Bay, where we were detained for several days by a strong wind from the westward. At this place the scenery is neither picturesque nor in any way striking. From the water's edge a broad plain extends back for several miles to a line of flat-topped hills, which form the escarpment of the great Patagonian plateau. Not far from the shore a number of fresh-water ponds, or lakes, occur, which are frequented by numerous water-fowl. Not a tree was visible. With the glass we could make out a few bushes and some dark green patches of vegetation, which here and there interrupted a monotonous expanse of brown grass. A number of sheep were feeding on the plain, and to the left of our anchorage there was a dwelling-house surrounded by several sheds, evidently erected for their protection in winter.

We soon formed a party for visiting the shore, some of the officers taking their shot-guns, others carrying rifles, and I with my botany case. As we approached the shore the hills in the background appeared to recede from us. Along the beach pretty gray plovers and noisy black and white oyster-catchers were running, and when we landed a number of song-sparrows and a red-breasted meadow-lark started up from the grass, singing as they flew. Spread over the plain were thousands of silky-fleeced sheep with long thick tails, each ewe with one or two newly born lambs. It was a bright springlike day, with only one or two small rain clouds in the sky, yet the wind was blowing a moderate gale.

From the very water's edge the ground was covered with myriads of beautiful flowers—patches of pink-tipped sea-thrift, fragrant drooping lilies, yellow violets and Calceolarias, white *Cerastium*, daisy-like composites, and clumps of a prickly-leaved plant not yet in bloom. The sea-thrift, *Armeria vulgaris*, I at first mistook for a composite. It has a globular head of "everlasting" flowers, bearing a general resemblance to *Gnaphalium*, supported on a slender stem which rises from a mass of linear grass-like leaves. It belongs to the Plumbaginaceæ, the family including the *Statice* of our sea-shore. The lily-like plant proved to be an ally of *Sisyrhinchium*. It was *Symphyostemon narcissoides*: its flowers, like those of a day-lily in shape, drooped in a graceful umbel; some of them were pure white, while others were delicately penciled with purple. The *Calceolaria* (*C. nana*) is a fragile little plant, bearing a comparatively large flower, somewhat like a *Cypripedium*, on a short herbaceous stem which rises from a rosette of radical ovate leaves. The lower edge of the opening in its yellow corolla is bordered by a white waxy lip, and the inner surface is speckled with brown. The *Cerastium* proved to be the common *C. arvense*; the daisy-like composite was probably a dwarf Erigeron; and the prickly-leaved plant is, I think, *Homoianthus echinulatus*, a species which Professor Cunningham collected on the opposite Fuegian shore. I collected also a yellow *Senecio*, very much like *S. Chilensis*; and close to the shore grew a plant not yet in bloom, with large leaves covered with white wool, which I think is a second species of the same genus (*S. candicans*).

A little further inland I found a yellow *Geum* (*G. Magellanicum*), a vetchling (*Lathyrus Magellanicus*), *Valeriana carnosa*, a small crucifer (*Draba ?*), *Phacelia circinata*, a Hydrophyllaceous plant also occurring in North America, and *Acæna adscendens*, a species widely distributed in antarctic regions.

Climbing in a barberry bush, I found a *Galium*, and at its base the common Shepherds-purse, the widely-spread *Anemone decapetala*, L. (*A. Caroliniana*, Walt.), and a delicate *Oxalis* (*O. enneaphylla*) with rose-tinted corolla, closed when I found it, like the gentian, and with leaves not three parted as in all the species of the genus which I had before seen, but divided into nine or ten narrow segments which radiated into the form of a pretty star.

I had now reached a gentle slope covered with a green carpet of low heath-like shrubs, bearing fruit very much like cranberries and small, stiff glossy leaves. These were of three species: *Pernettya mucronata* and *Pernettya pumila*, ericaceous plants belonging to the same tribe as *Arctostaphylos;* and *Empetrum nigrum*, var. *rubrum*, a red variety of the common crow-berry, the typical form of which is widely spread in arctic and alpine regions in Europe, Asia and North America. I found but two other shrubs at Gregory Bay; *Berberis dulcis*, var. *buxifolia*, and *Chilobothrium amelloides*, a composite growing about eight feet high, with large white-rayed heads of flowers, which were beginning to bloom at the time of our arrival.

On reaching the top of the slope I stopped and concealed myself behind a bush; for only a few yards away from me were two young foxes playing before the entrance of their den. As I stood watching them their mother came up with some object in her mouth, which she laid down before them. The little creatures could not have been more than a month old, yet, young as they were, they immediately began snarling and fighting for the possession of the object. When I started toward them, however, to see what it was, they both dropped it and scampered into their hole. It was a small mole-like animal with fine, soft fur, *Ctenomys Magellanica*, which Darwin, in his Journal, calls "Tucutuco." I afterwards noticed many acres which were undermined by its burrows.

From the knoll on which I was standing, two small lakes could be seen, one of them gleaming in the sunshine like burnished silver, the other stretching out like a sheet, its surface ruffled only by the swallows which were skimming above it. Around the shores several pairs of wild geese were feeding on the crow-berries, wild celery, and other plants. They allowed me to approach quite near to them, but suddenly a pair of lap-wings flew up from a bed of rushes, screaming so loudly that the geese were frightened away.

The lake which shone so brightly was nearly dry. I found that its luster was due to the reflection of the sunlight from the smooth, glossy leaves of a species of *Ranunculus* or *Caltha*, somewhat like *R. Ficaria*. In the second lake I collected several marsh plants: the common mares-tail (*Hippuris vulgaris*), a water mil-foil (*Myriophyllum elatinoides*), *Limosella aquatica*, a small yellow-flowered *Ranunculus*, and a species of *Sphagnum* not in fruit. Around the lake grew a number of sedges, rushes and a handsome grass, from which some wren-like birds flew up, as I waded through it. Near by in a barberry thicket a jet black starling or troupial was hopping restlessly about, and a pair of fly-catchers were building their nest, the male jet black, with a mantle of russet-red, the female with a much lighter, faded-looking dress.

On returning to the boat, which had been drawn up on the beach, I found that our sailors had been amusing themselves by killing a skunk. This they had accomplished without unpleasant consequences by keeping well to the windward while they stoned the animal to death. A fire was now started under the lea of the boat, the dried *Macrocystis* strewn upon the beach making excellent fuel, and while some of the sailors were preparing coffee, I busied myself collecting algæ along the beach.

Among the red foliaceous forms were a handsome *Delesseria*, the brightly colored *Callophyllis variegata*,, so abundant on our Pacific coast, and *Ptilonia Magellanica*, which is somewhat similar. I collected also an exquisitely delicate *Plocamium*, a dense feathery *Ptilota*, *Ceramium rubrum*, *C. diaphanum*, *Codium tomentosum*, and the coarse *Durvillæa utilis*, which somewhat resembles a giant *Laminaria*. Among the green species were the common *Ulva lactuca*, *Enteromorpha compressa* and a tufted *Cladophora*; and to complete the list I will mention *Porphyra laciniata* and the common *Rhodomenia palmata*, both of which were abundant.

The hunters now returned loaded down with as much game as they and their men could carry. They had killed quantities of geese, ducks and snipe, besides a number of smaller birds and several foxes. Lieutenant Garvin, our navigator, brought me also a few plants from the distant hills. The most interesting of them was *Embothrium coccineum*, a shrub belonging to the Proteaceæ, bearing dense terminal clusters of crimson tubular flowers.

We had all spent a most delightful day, and were well satisfied with the results of our expedition. I could not help regretting, however, in going back to the ship, that the shortness of our stay would not permit me to thoroughly explore a field so inviting. I almost envied the shepherd who lived in the little cottage; yet, strange though it may seem, the good man was very anxious to leave it for the haunts of civilization.

On the 25th we weighed anchor and proceeded up to Sandy Point.

(To be continued.)

Anthophyta for Phænogamia.

In view of the general adoption of a uniform terminology in the great classes of plants, and to make the names uniform throughout, I would suggest that the term ANTHOPHYTA be used instead of the old *Phænogamia*. We should then have Protophyta, Zygophyta, Oöphyta, Carpophyta, Bryophyta, Pteridophyta and Anthophyta. Dr. Bessey informs me that Oken first suggested the term about seventy years ago, for the Dicotyledons, and that Luerssen, in 1882, used it as a synonym for Phænogamia. I was not aware of these facts when I suggested the term to Dr. Bessey. He says he would be in favor of the change. The word suggested is more appropriate than the old one.

JOSEPH F. JAMES.

MIAMI UNIVERSITY, OXFORD, O.

Index to Recent American Botanical Literature.

Asperifoliæ.—Some West American. III. Edward L. Greene. (Pittonia, i., pp. 107-120).

This part deals with the genus *Cryptanthe* of Lehmann, 1832, antedating *Krynitzkia* of Fischer and Meyer by nine years. The species written up under the latter generic name by Dr. Gray in the supplement to the Synoptical Flora all become *Cryptanthæ*. Professor Greene describes, as well, seven new ones which have never had any names at all, making the total number known to him forty-six, including six from Chili.

Big Trees of California.—Age of the. (Gard. Mon., xxix., p. 376).

Mr. Meehan presents damaging evidence against the notion that the growth rings of *Sequoia* are not an index of age. His measurement proved that they could be relied on.

Botanical Laboratory: Plan for. Lillie J. Martin. (Bot. Gazette, xii., p. 273).

Botany of the Roraima Expedition of 1884. By E. F. Im Thurn. Part I.—*List of the Species of Plants collected and Determinations of those that are new.* Prof. Oliver. Part II. (Trans. Linn. Soc., London, ii., pp. 249-300. Plates xxxvii-lvi).

Roraima is a mountain of Guiana which was ascended for the first time by E. F. Im Thurn. The Roraima district is isolated in its botanical character, and has afforded fifty-three new species and three new genera, which are described and figured in this monograph. The contributors include such specialists as Prof. Oliver, J. G. Baker, G. S. Jenman, H. N. Ridley, Dr. Engler, Mr. Mitten, and others. The region has been but little visited, and only in certain months of the year (November and December). Owing to the excessive dampness of the climate and the difficulty experienced in drying plants, fewer specimens were preserved than would have been under more favorable conditions. The following foot-note by the Secretary of the Linnæan Society explains itself.

"During the delay requisite to prepare the plates, Mr. Im Thurn has taken the unprecedented course of printing the whole of the unrevised draft at Demerara in Timehri the Journal of the Royal Agricultural and Commercial Society of British Guiana, vol. v., pp. 145-223, Dec., 1886), thus forestalling the present publication. Sec. L. S."

Check List of North American Orchids.

Mr. J. F. Poggenburg has prepared a useful check list of our orchids, which may be obtained from him at 447 E. 57th St., New York City.

Compositæ.—Fertilization of Flowers in. Thos. Meehan. (Gard. Month., xxix, pp. 373, 374).

Referring to a series of recent articles in the "Country Gentleman," Mr. Meehan takes occasion to rebuke the loose way of popular writers of ascribing all fertilization to cross pollination, the Compositæ being for the most part self-fertilized. He further annihilates the author scientifically by referring to him as "a writer of the Grant Allen type."

Cultivation of Saccharomycetes. W. E. Stone. (Bot. Gazette, xii., p. 270).

Echinocystis § Megarrhiza. Edward L. Greene. (Pittonia, i., pp. 143-145).

This is mainly in continuation of the argument of which Dr. Watson's paper in the August BULLETIN was a part. The most important point of the present note is the statement that the generic name *Mara*, which has precedence over *Megarrhiza*—in case that is regarded as distinct from *Echinocystis*—was not published "in the columns of a daily newspaper." But Professor Greene does not tell us where the publication was made.

Flora of the Coast Islands of California in relation to recent changes in Physical Geography. Joseph Le Conte. (Amer. Journ. Sci., xxxiv., pp. 457-460).

Referring to the interesting results of Professor Greene's explorations on the islands of Santa Cruz, San Miguel, etc., already noted in this BULLETIN, Professor Le Conte concludes that their peculiar flora is probably the remnant of one once widely dispersed over all southern California west of the Sierras, saved from the general destruction of plant life in the Glacial Epoch by its isolation. The islands were certainly connected with the mainland during the Pliocene Era and separated by submergence during the Quaternary; indeed, they are the summits of a partially engulfed mountain range.

Fungi from Kansas.—New Species of. J. B. Ellis and W. A. Kellerman. (Journ. Mycol., iii., pp. 126, 127).

Six new species described.

Fungi from various Localities.—New Species of. J. B. Ellis and B. M. Everhart. (Journ. Mycol., iii., pp. 127-130).

Sixteen new species described.

Geaster.—The Genus. A. P. Morgan. (Amer. Nat., xxi., pp. 1026-1029; two figures).

Mr. Morgan reviews Dr. De Toni's recent revision of the "Earth-stars" in the Revue Mycologique, and describes, with illustrations, two new species from Lincoln, Neb.

Geographical Botany.—Maurice Thompson. (15th Ann. Rep. Dept. Geol. and Nat. Hist Indiana, pp. 242-252.

Mr. Thompson is State Geologist of Indiana, and writes this as introductory to the paper by Professors Coulter and Thompson in the same volume.

Indiana Flora.—Origin of the.—John M Coulter and Harvey Thompson. (15th Ann. Rep. Dept. Geol. and Nat. Hist. Indiana, pp. 253-282).

This is a very interesting paper and one which must be consulted by all who are interested in following up the literature of this subject. The State is divided into seven botanical regions and lists of their most characteristic plants are given, the migrations of plants and the causes of migration are discussed. Under "the Origin of the North American Flora" we find a list of 342 species from Gray's Manual which are indigenous also in Europe, while the similarity of the Siberian and Japanese floras to our own is also commented upon. The paper closes with a general discussion of the origin of the Indiana Flora. It is here remarked that the State in its northern central position has been the "common meeting ground of migrations from various directions," and lists of the species which seem to have come from the several directions are given. These are numerically tabulated. The total indigenous flora of Indiana includes 1191 species.

Kellogg, Dr. Albert.—Biographical Notice of. Edward L. Greene. (Pittonia, i., pp. 145-151).

This venerable botanist died at Alameda, Cal., March 31st, 1887, in his 74th year. The latter part of his life was mainly occupied in making drawings of Californian trees and shrubs in leaf, flower and fruit, over four hundred of which he left.

Lichen Flora of Florida.—A Catalogue of Species, with Notes and also Notices of new Species. John W. Eckfeldt, M.D., and W. W. Calkins. (Journ. Mycol., iii., pp. 120-125 and 132-137; also reprinted).

A list of 330 species, several of which are new, named by Nylander. No descriptions are given, however.

Monograph of the Genus Lycoperdon, (Tourn.), Fr., is the original paper in the October issue of the Journal of the Royal Microscopical Society, prepared by Mr. G. Massee, who has for a long time interested himself in the critical study of puff balls. 129 species are recognized, 40 of them American, though of these many are reported from various parts of the Old World and a few are quite cosmopolitan.

Movement in Cucurbita, Vitis and Robinia. Mechanism of.—D. P. Penhallow. (Trans. Roy. Soc. Canada, iv., section 4, pp. 49-83; three plates).

North American Flora.—Origin of the.—Joseph F. James. (Amer. Nat., xxi., pp. 1009-1011).

Professor James uses the "deadly parallel column" to indicate the similarity of the second part of the paper by Professors Coulter and Thompson above noted, to one published by him in Volume iv. Journal of the Cincinnati Society of Natural History in 1881, and complains that these authors have not referred to it. It seems to the writer that this is considerable ado about a small matter. On page 269 of the Indiana Report, Professor James is referred to. Indeed, this is one of the subjects the discussion of which can only reach similar results. The main facts are all in; only the numerical details can be modified. The Chestnut and many other species have long been known to inhabit all three continents. It is not at all strange that similar passages occur in the two articles, as Dr. Gray and several others have discussed the subject at considerable length, and we cannot regard the implicated charge of plagiarism as sustained.—N. L. B.

Pacific Coast Plants—Collection of 1887. Thomas Howell. (Pamphlet, pp. 8, Arthur, Oregon, 1887).

As this list contains descriptions of new species by Mr. Howell it becomes necessary to note it. *Lepidium Oreganum, Rhamnus occidentalis, Trifolium Harneyensis, Horkelia latiloba, H. Hendersoni, Epilobium glaucum* and *Peucedanum microcarpum* are briefly characterized.

Plant Odors.—Arthur J. Stace. (Bot. Gazette, xii., p. 265).

Polemoniaceæ.—Some American. Edward L. Greene. (Pittonia, i., pp. 120-139).

After eighteen years of field experience Professor Greene concludes that the calyx offers the best characters in defining Polemoniaceous genèra. *Polemonium filicinum* is a new species from the Pinos Altos Mts., placed next to *P. flavum* recently figured in the Botanical Magazine; *P. Brandegei* is the *Gilia Brandegei*, Gray. He restores *Collomia* to generic rank and describes one new species. *Navarretia*, Ruiz and Pavon, is also recognized, and 24 former *Giliæ* named under it, including eight new species.

Preparation of Agarics for the Herbarium.—James E. Humphrey. (Bot. Gazette, xii., p. 271).

Silphium perfoliatum and Dipsacus laciniatus in regard to insects—A study of.—W. J. Beal and C. E. St. John. (Bot. Gazette, xii., p. 268).

Species—New or Noteworthy.—Edward L. Greene. (Pittonia, i., pp. 139-143).

Sidalcea Hickmani, Clarkia Saxeana, Phacelia nemoralis and *Allocarya scripta* are new. Two species of *Eucharidium* are given names under *Clarkia; Phlox gracilis=Gilia gracilis*, Hook.; and the specific name of Dr. Watson's recent *Cuphea viridostoma* is objected to as ungrammatical and made *C. mesochloa.*

Tricothecium griseum.—J. B. Ellis. (Journ. Mycol., iii., p. 126).

Uromyces—A new.—Byron D. Halsted. (Journ. Mycol., iii., p. 138).

Description of *U. digitatus*, found on *Leersia Virginica* near Ames, Iowa.

Botanical Notes.

Etude sur les Algues Parasites des Paresseux.—Mme. A. Weber van Bosse. (Nat. Verhand., Holland, Maatsch. der Wetenschappen, Haarlem, 1887; two plates).

This is a very interesting account of a symbiotic alga inhabiting the hairs of the Sloths and giving to their fur its frequent green coloring. As these animals live in the warm, moist, tropical forests, the algæ multiply immensely in the spongy tissue of the hairs, crowding the cells and penetrating even to the horny centres. After giving a resumé of the work and methods of investigation, the author describes two new genera and three new species: *Trichophilus Welckeri, Cyanoderma Bradypodis* and *C. Cholæpodis.*

A Botanical Section of the Biological Society of Washington has recently been established, holding its first meeting on Jan. 4th, when papers were read by Professors Burgess, Knowlton, Tracy and Miss Southworth. Mr. Crozier is Secretary. We wish the new organization success and permanence.

Proceedings of the Club.

The regular monthly meeting was held at Columbia College on Tuesday evening, Dec. 13; Vice-President Hogg in the chair and forty-nine persons present.

Messrs. Henry Edwards and Smith Ely Jelliffe were elected Active Members.

Dr. T. J. W. Burgess, of London, Canada; Prof. John Macoun, of Ottawa; Isaac Holden, of Bridgeport, Conn.; Prof. Byron D. Halsted, of Ames, Iowa; O. F. Cook, of Syracuse; James Vroom, of St Stephen, New Brunswick; C. E. Smith, of Philadelphia; Rev. Dr. Geo. E. Post, of Beirut, Syria, and Prof. J. F. James, of Oxford, Ohio, were elected Corresponding Members.

Dr. Britton introduced the subject of the preparation of a new list of the plants of New York City and vicinity to serve as a basis for a local descriptive Flora. He advocated the printing at once of a bare check-list of the species and varieties known to grow within the circle of 100 miles radius from the city, which should be freely distributed to all botanists of the region, with a request for their notes on the distribution of the plants and for additions to the list. On motion the following committee was appointed to prepare and issue such a list: Messrs. J. F. Poggenburg, Addison Brown, Thos. C. Porter, E. E. Sterns, E. B. Southwick, Arthur Hollick and N. L. Britton.

The Secretary read a communication from Dr. Rusby containing a plea to the Postmaster General to exercise his power in recommending to Congress a change in the existing postal laws by which it shall be made legal to send through the United States mail together with Natural History specimens and without thereby increasing the rate of postage, written labels bearing the name, place and date of collection, and name of the collector of the specimen with which they are associated. The desirability of this change was made the subject of remark by several members and the plea was endorsed by a unanimous vote. It read as follows:

To the Hon. Postmaster General U. S. A., Washington, D. C.:

DEAR SIR.—Of two four lb. packages of dried plants now before me, marked for transportation, the one to a post-office in Oregon, the other to a suburb of this city, the former will be transported by your department at a heavy loss; the latter, which you could transport at a handsome profit, will go by express.

Five thousand Botanists throughout the United States are more or less continuously engaged in the forwarding of such parcels, and always choose their mode of transportation in the manner above indicated. I, myself, have probably a ton of such matter to forward during the coming year. The same statement applies to thousands of Ornithologists, Entomologists, and other Natural History collectors.

It is clear that your department suffers the annual loss of an appreciable amount of revenue:

1st. By the excess of expenses over receipts from such packages as it transports;

2d. By the loss of that portion of such packages which it could profitably transport but which now go forward by express.

Upon the side of the people the evils of the present system bear much more heavily. Natural History collectors are, almost without exception, people of very limited means, working in their several departments for the benefit of science, for the most part without pecuniary recompense. They must therefore, practice every economy, and are especially worthy of every liberal consideration which can justly be extended to them. At the same time they are, as a class, greatly overworked, and must practice even a more rigid economy in the matter of time, than in the matter of money. Yet under the existing postal laws, they must choose between suffering injustice in one of the two directions above pointed out. In sending parcels by mail they must do one of three things:

1st. Print their labels at a great expense;

2d. Send written labels with their specimens and subject the parcel to letter-postage.

3d. Make out two sets of labels, one, bearing a number, to go with the specimens, the other, the authentic label, defaced with a number corresponding to that accompanying a specimen, to go separately by letter-post.

Any one of these alternatives is so injurious, that, except where great distance is to be covered, senders prefer to forward by express, to the great disadvantage both of themselves and the Postal Department.

Now the essence of my plea lies in the fact that to a collector an authentic label forms just as truly a part of his specimen as does one of the leaves of his plant or one of the wings of his bird. For this reason I say the present law works real injustice.

The remedy is such a simple one that it seems to me to rest easily within your hands.

I, therefore, most respectfully and earnestly pray you to properly recommend and urge upon Congress, during its present session to so modify the existing postal laws as to make it legal to send through the United States mails, together with natural history specimens, and without thereby increasing the rate of postage on the same, of written labels bearing in addition to the name or names of the specimen to which its label is attached, or with which it is associated, such information regarding its identity, locality, date of collection and name of collector as may without being descriptive serve to properly indicate its position in the natural series to which it belongs.

Respectfully yours,

HENRY H. RUSBY.

Mr. H. Mintorn, representing Mrs. Charles Mogridge, described the methods of modelling sections of plants practiced by them for the British Museum of Natural History.

A model in wax was exhibited of the English primrose, showing longitudinal section of pistil much enlarged.

A paper by Dr. O. R. Willis on the history of the Weeping Willow was read by the Secretary.

Mr. E. E. Sterns read a paper on the rediscovery of *Nymphæa elegans* at a new station in Texas (see p. 13). He also exhibited seeds of *Lithospermum arvense* from Missouri and remarked on their peculiar markings; also the fruit of a species of *Calycanthus* from the Tennessee mountains reported as very poisonous to cattle and sheep and locally known as "bubby." He distributed the pods, and stated that Dr. T. F. Allen had tried them on a dog and obtained only negative results.

Professor Schrenk remarked on his successful use of Wickersheimer's preservative fluid in retaining the leaves on herbarium specimens of plants from which they generally separate in drying, and showed *Diospyros Virginiana* and several conifers to illustrate its efficiency for that purpose.

A paper by the Rev. W. M. Beauchamp, of Baldwinsville, New York, entitled "Onondaga Ferns" was read by the Secretary.

The Chairman remarked on the very serious illness of Dr. Asa Gray, who has been prostrated by a stroke of paralysis. On motion the Secretary was instructed to communicate the sympathy of the Club to Mrs. Gray, and the hope that Dr. Gray would soon be restored to health.

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On the Histology of the Vegetative Organs of Brasenia peltata, Pursh.*

BY. JOSEPH SCHRENK.

Plates LXXVII and LXXVIII.

In October, 1884, while examining the structure of the stem and petiole of *Brasenia peltata,* I found some peculiar hairs projecting into the wide intercellular air-passages, which were entirely different from the so-called ' internal hairs ' of *Nymphæa, Nuphar* and *Limnanthemum.*†

About two years later, similar hairs were noticed by J. F. A. Mellink in some petioles of *Nymphæa alba* collected by DeVries in Amsterdam, and described in Botanische Zeitung, Nov. 5. 1886.

Since that time I have carefully examined these structures, and, finding other remarkable peculiarities about this common water-plant, I thought them of sufficient interest to be placed on record.

What is described in the manuals as the creeping rootstock, is really a system of runners that proceed from the rhizoma proper. This must be rarely fully developed, for although I repeatedly searched for it carefully, I could find only few specimens. They were only from two to four cm. long and up to one cm. thick, and had very short internodes, so that they appeared covered with the scars caused by the falling off of petioles and stems of former seasons. From the rootstock proper grow the leaves and in their axils the stems. Many of the latter develop into stout runners, creeping on the surface of the ground, with internodes

* Read at the meeting of the A. A. A. S., at New York, Aug. 15 and 16, 1887, to which a few more recent observations have been added.

† I briefly described them at the October meeting of the Torrey Botanical Club (as appears from the report of that meeting in the BULLETIN), and exhibited some slides with mounted specimens. Mr. P. H. Dudley had the kindness to photograph one of the sections, showing an air-passage with some of these hairs.

up to 35 cm. long and 8 mm. thick. At the nodes the runners send out roots, usually in two lateral groups, also leaves, and vertical stems bearing leaves and flowers, besides, branches that develop into runners, forming frequently an extensively ramified system.

The secondary roots, arising at the nodes, are slender and long, often reaching 30 cm. The older branch into numerous, finally very thin rootlets provided with root hairs. At the tip of every rootlet there is a sheath or case which looks exactly like the finger of a glove. (Fig. 1.) When placed in glycerin the cells of the root contract somewhat, and the sheath becomes more plainly visible. It consists of a single layer of elongated, oblong cells, forming a distinct, firm membrane with an unbroken, smooth rim, and extends on the main roots for a distance of over 2 mm. above their growing ends. The sheath is fully developed at the tip of the forming rootlet, before it breaks through the epidermal layer, which is raised, then bursts, and persists at the base of the root, similar to the coleorrhiza of grass-seedlings.

Although there can be no doubt that this sheath has to perform the same office as an ordinary root-cap, viz., to protect the tender meristematic tissues of the root-end, its peculiar structure tempts me to ascribe to it an additional function. The upward strain exerted upon the stems and the entire root-system of our plant by the agitated surface of the water and the buoyancy of the plant itself with its floating leaves must be very great indeed. It seems to me that the innumerable sheaths at the ends of the roots and their branches must assist the plant a great deal in resisting that upward pull by acting somewhat like anchors. They are easily pushed forward and downward into the loose muddy soil along with the growing root-ends, but when pulled upward they will evidently resist the strain in a most effective manner. The fact that other aquatic plants have very similar root-caps seems to corroborate this view.

Otherwise the roots present no peculiarities. There is a central, very thin plerom surrounded by thin-walled endodermis cells; the other root-tissues are very loose, with large intercellular canals, and a thin epidermis.

What is most remarkable in the structure of the fully developed stem is the total absence of lignified tissue in all the internodes. It is true that in all aquatic phanerogams there is a considerable reduction of the vascular tissue, but in related plants, such as *Nymphæa* and *Nuphar*, we still find some very distinct tracheal ducts, besides the numerous "internal hairs," the thick walls of which are decidedly lignified. As in most other aquatic plants, a large portion of the stem is occupied by a number of very large intercellular canals, (Fig. 2, ic), which, on the cross section, have an ovate, oval, or sometimes circular outline. They are separated by partitions consisting usually of one layer of cells only. The cortical portion is made up of three or four rows of more densely arranged, large parenchyma cells, and the epidermis of one layer of cells with a well-developed cuticle. Many of the last-named cells bear peculiar hairs, to be described hereafter.

The central portion of the stem is invariably occupied by two fibro-vascular or mestom bundles (Fig. 2, m). (As there are no vessels nor fibres proper in these bundles, the new term "mestom" is doubly preferable to the old "fibro-vascular bundle"). The two mestom bundles are separated by parenchymatous tissue and groups of intercellular canals. Each is composed of two large bundles of sieve-tubes with their accompanying cells, (Fig. 2, l). The sieve-tubes are very wide, with finely perforated, oblique septa. The sieve or "leptom" bundles have, on the cross-section, an ovate outline, the pointed ends being directed towards a large circular intercellular canal, that takes the place of the vascular or "hadrom" element of the mestom, (Fig. 2, h). This canal, as well as the leptom bundles, are strengthened at their circumference by a row of thick-walled cells. The whole mestom bundle is surrounded by an endodermis which plainly shows the "black dots" on the radial walls. At any height of a given internode the cross-sections are alike: nowhere could be found any anastomosis between the two separate bundles of an internode, as is the case in related plants.

When we arrive at the immediate proximity of the node, the large intercellular canals come to an end. The peripheral ones are closed with a spongy tissue of stellate cells, through the meshes of which the canals below the node are in open communication with those of the next internode. In the central intercellular canal of the mestom we see, as we approach the node (Fig. 3, h), the free, pointed ends of some spiral tracheæ projecting from the sides and from above into the open space of the canal (Fig. 3, sd). The higher we proceed the more crowded with such free ends of tracheæ do we find the interior of the canal, until, at last, we have in place of it, a solid bundle of spiral ducts. We now trace, on longitudinal sections, the course of this bundle through the node, and observe how it divides into anastomosing branches, leading to the leaf of the node, to the axillary buds, eventually to the secondary roots, and to the succeeding internode. Above the node the tracheæ terminate as abruptly as they started below it; their free, tapering ends crowd into the end of the canal that belongs to the mestom of the next internode, forming a concave bottom for it just as their opposite ends form a concave roof for the canal in the next lower internode. In the meristematic tissue of the youngest internode we can trace an exceedingly delicate annular vessel, which, however, very soon disappears and is replaced by the rapidly widening canal of the mestom. The leptom elements are continuous through the node.

The structure of the petiole is like that of the stem, but in place of two mestom bundles there is only one descending to the stem, being, however, in all respects like those of the stem. The connection between the homologous parts of petiole and stem is effected in exactly the same manner as just described.

The thick, oval, peltate leaf, sometimes almost 4 in. long, has, at most, twenty principal veins, converging at the center, over the petiole. The spiral vessels of all these veins empty, as it were, into the central intercellular canal of the petiole, or rather, draw the supply of water for the leaf from it, just like a number of distributing pipes that are connected with a large reservoir. The leaf has a smooth, cuticularized upper epidermis with very numerous breathing pores, about 325 on a square millimeter. In the region above the petiole, however, on a oval surface of an average diameter of 2.5 mm. there are no stomata at all.

The cells of the upper epidermis have a peculiar structure. They are two or three times as high as they are wide; in thin sections their vertical walls at first present the appearance of deeply indented wavy lines, but on closer examination we perceive that this appearance is caused by very large and deep hollows in the cell walls, distributed in such a manner that the depressions in the wall of one cell correspond to elevations or projections in that of the contiguous one, and vice versa, (Fig. 4); besides, deep pits are found abundantly in the thick walls of these cells. The palisade tissue underneath the epidermis is composed of two or three, sometimes even four tiers of cylindrical, narrow cells, with numerous air-spaces between them, and containing, on their vertical walls, large chlorophyll grains. The air cavities under the breathing pores are very large and deep, on account of the great height of the epidermis and palisade layers. The arrangement of the palisade cells into distinct groups is very striking. The upper layer of each group is joined to a group of epidermis cells (which is determined by the position of the surrounding stomata or, rather, their air cavities), while the lowest tier connects with some large "collecting cell" of the spongy tissue or of the conducting bundle.

The leaf structure is greatly modified in the central zone. The absence of stomata mentioned above causes the absence of the corresponding air-cavities, and the palisade tissue is reduced to one or two layers of cells; in the very center there are no typical palisade cells at all. Besides, the epidermis cells of this zone have almost perfectly straight walls which do not bulge outward and inward. This seems to justify the assumption that the peculiar structure of the epidermis cells has something to do with the breathing process. Supposing that the undulating walls of these cells could be straightened out, or that the elevations could even be changed into depressions and reversely, by changes in the turgor or the atmospheric pressure, we could easily infer that, according to circumstances, either a powerful suction or pressure would be produced. Such pressure seems certainly to be necessary to keep all the numerous large passages in leaf, stem and root filled with air in order to resist the great pressure of the surrounding water, and to renew the same constantly, so that the chlorophyll, which is met with almost all over the plant, may do its work of assimilation.

In connection with these considerations, I might mention that such contrivances as are supposed to assist the plant organs in resisting positive and negative radial pressure, e. g., diaphragms, "internal hairs," as in *Nymphæa*, *Limnanthemum*, etc., are entirely wanting in *Brasenia*. As mechanical or stereom elements are to be considered only the outer walls of the epidermis cells, the walls of the cells which bound the intercellular canals and at the circumference of the mestom, all of which are somewhat thickened in the manner of collenchyma.

Returning to the description of the leaf, I have to mention that the spongy tissue underneath the palisade cells fully deserves its name, as the spaces between the "arms" or rays of the stellate cells are very large. The cell walls enclosing these spaces are thickly covered with a granular, crystalline layer of calcium oxalate. Even the elongated cells of the conductive tissue of the fibro-vascular bundles show this calcium oxalate coating wherever they border upon the air spaces; the inner walls of the lower epidermis cells, however, are free from it. The conductive system of the leaf is well developed. On a cross-section through one of the strong radiating veins, we see that the bundle is surrounded with a starch sheath. The hadrom contains two or three annular or spiral vessels, while the leptom occupies the bulk of the mestom. Very numerous smaller veins, similar in structure, branch off from the principal ones, anastomosing with one another, and forming the typical wavy curves at the margin.

Over the middle of many of these curves I found, on the lower epidermis, groups of very small water-pores, the number in each group varying from 10 or 15 to as many as 50. (I have also lately noticed water-pores on the lower side of the leaves of our two common species of *Nuphar;* in *Limnanthemum* I had seen them long since.) The occurrence of water-pores in these plants seems to furnish additional evidence that, even in aquatic plants, the conduction of water is effected chiefly, if not exclusively, through the vascular ducts. The water-pores in *Brasenia*, being in direct communication with the finest ramifications of the tracheal system, do most likely perform the same office as the water-pores in terrestrial plants, namely: the rapid removal of an excess of water from the conductive tissue—the lower epidermis is made up of flat cells of irregular, deeply sinuate outline, and is covered with numerous hairs.

The above description refers to the floating leaves. There are, however, thin, bright green, submerged leaves produced by *Brasenia*, which I noticed and reported some years ago. They grow at the base of the stem in limited number (I never found more than two or three on the same stem). In outline they resemble the floating leaves, but they are not longer than one inch, usually much smaller. Their blade is quite thin compared with that of the floating leaves, consisting of only four layers of cells. The upper and lower epidermis both have flat cells with wavy outlines. Both are, of course, destitute of breathing pores, but the lower epidermis is provided with very small water-pores at the margin, also with hairs like those on other parts of the plant. The assimilatory layer, under the upper epidermis, has oval cells, elongated parallel to the leaf surface; the chlorophyll occupies the lower and upper horizontal walls. Chlorophyll grains are also seen in the other layers, especially in the third, which is a very much reduced spongy parenchyma. The conductive tissue is likewise only poorly developed, but slender annular vessels and very narrow leptom elements can be plainly distinguished.

Of the peduncle I will only mention that it possesses three mestom bundles, each of which, however, has only one leptom group and only one intercellular (hadrom) canal, all of the latter facing the center of the peduncle.

Every collector, no doubt, has found it a rather difficult task to prepare good herbarium specimens of *Brasenia*, on account of the thick layer of mucilage that coats nearly all the parts of the plant in contact with the water, causing it to adhere to the drying paper.* As I do not know of any published investigations in reference to this mucilage, permit me to state my observations as to its origin and nature. If we examine the epidermis of parts which are in contact with the water, we find it thickly beset with hairs. I counted as many as 560 on one square mm. of leaf surface. On the older parts of the rhizoma and the stems the hairs occur neither in such abundance nor are they as active as on all the younger organs, especially the growing apex of the

* To obviate this difficulty I placed the fresh specimens between sheets of muslin, from which they can be detached much more easily when dry than from paper.

axis, and on the lower surface of the leaves. They are absent altogether on the upper leaf surface, and also on the lower surface within a narrow zone bounded by the leaf margin and the anastomosing curves of the marginal veins; most likely, in order not to obstruct the water-pores situated there. The cells bearing the hairs are smaller than the surrounding epidermis cells, and usually wider toward the surface. In the stem and petiole they are nearly square, and each is wedged in between four of the elongated epidermis cells, while on the leaf their cross-section parallel to the surface is nearly circular, and each is bounded by from 5 to 8 of the surrounding wavy cells. Each hair has a very short pedicel, formed of two flat and low circular cells (Figs. 10-14). In one single case I observed a pedicel consisting of three cells. In the much thickened outer wall of the epidermis cell there is a wide canal tapering toward the first pedicel cell, so that the latter is separated from the former only by a small, thin, circular septum. The walls separating the pedicel cells are very finely perforated membranes, resembling the plates of sieve-tubes. The vertical walls of both flat cells are cutinized: chloriodide of zinc will show this very plainly. Concentrated sulphuric acid will dissolve the cellulose elements and leave the cutinized portions of these walls as well defined rings on the cuticle of the epidermis of which they are a continuation.

The hairs themselves are all unicellular, but vary very much in size and shape (Figures on Plate lxxviii). Their most common form is that of a slender cylinder with a tapering blunt end, and their ordinary length is from .1 to .2 mm., the width uniformly about .04 mm. On young, growing parts, especially, we find very slender, thinner hairs, that are often as long as one millimeter. The typical form of the hairs is very often greatly modified; some are club-shaped, globular, scythe or sickle-shaped; many divide, either directly at the base, or more frequently above, into two equal or unequal branches; others again, particularly on the leaf-blade, expand horizontally in the upper portion, either to the right or left, with or without a stalk—in the latter case the hair assuming the shape of a T. By these differently shaped hairs, the mucilage peculiar to *Brasenia* is produced. We cannot fail to discover, especially on the younger parts, some hairs which are surrounded by an inflated, bladder-like sac, often three or four times as wide, and twice as long as the hair, very frequently much longer. The bladder commences at the line of insertion of the hair on its pedicel (Figs. 12-14); in fact, it is a film of cuticle continuous with the cuticle of the epidermis, and raised from the cellulose body of the hair by a mass of mucilage accumulating under it. Chloriodide of zinc will show that the wall of the hair inside the bladder really consists of cellulose, while the membrane of the sac is stained bright yellow. This reaction will take place still more readily if applied after short treatment with sulphuric or nitric acid. While examining the effect of these reagents, there will be noticed a great many hairs, the sacs of which have burst at the top, after having elongated often to five times the length of the hairs (Figs. 13, 17). In other cases the entire sac has been torn off and carried away by the increasing mass of mucilage, which is still kept together by the thin but firm membrane of the sac.

The mucilage itself is a viscid, coherent and very slippery substance. It is colorless but highly refractive, so that it can easily be noticed around thin sections examined in water. It coagulates in alcohol, boiling water will not dissolve it, but potassic hydrate, sulphuric and nitric acids soon destroy it. Chloriodide of zinc gives it a faint grayish color; potassic iodide and sulphuric acid color it yellow. Nigrosin, an important reagent for vegetable mucilage, stains it blue; corallin slightly red, and osmic acid very light brown. Hanstein's aniline and methylene blue color it red and blue, respectively. But these aniline dyes have a still more intense effect on the numerous small and large fragments of the sacs of cuticle mixed with the mucilage, and also upon the countless hosts of a peculiar kind of *Bacterium*, of the *Bacillus* form, that are to be seen in every particle of mucilage. We might even be led to consider this substance as the product of some zoöglœa form of *Bacterium*, if we had not watched the process by which it is formed.

Returning to the examination of the hairs that secrete the mucilage, we select one of the very youngest, involute leaf buds, a transverse section of which will exhibit all the stages of development of the hairs. Nearest to the margin of the leaf we discover that some of the epidermis cells are slightly higher than the others; some bulge out considerably above the level of the leaf surface (Fig. 8). Soon this protrusion is separated from the mother cell by a cross-partition (Fig. 9), and is afterwards raised still higher by the intercalation of two (rarely one or three) pedicel cells (Fig. 10). At the earliest stages all the cells are filled with turbid, granular protoplasm, which, as the hair increases in size, is replaced, or rather, crowded to the wall of the cell by a yellowish white mass of mucilage, which makes its appearance in the interior of the cell (Fig. 10).

This coherent, bulky, homogeneous, slightly translucent substance keeps increasing with the growth of the hair, closely surrounded by the layer of protoplasm, in which currents become plainly visible. As the hair gradually elongates, either horizontally or vertically, globular vacuoles are formed at various places in the cell. They finally merge into one or two, sometimes three or four, each occupying the entire width of the hair, and confining the mass or masses of mucilage between them (Figs. 11, 12, 14). Besides the parietal layer, thin strands and plates of very actively streaming plasma may be noticed, which extend all over the cell, carrying with them smaller and larger globular microsomata (Figs. 11, 12). Streaming protoplasm is also seen in the narrow space between the cell wall and the mucilage. In hairs in which the plasma is at rest, the microsomes at first create the impression of being imbedded in the mucilage; but even then exact focussing will destroy this illusion. The nucleus is found only with difficulty.

In some of the hairs, at various points of the surface, a slight swelling or bulging of the outermost layer of the epidermis may be noticed; in others the swelling has extended over a considerable portion of the hair (Fig. 11), and with a great many others, a complete, closed, bubble-like sac, as described above, surrounds the entire hair (Figs. 12, 14, 16). The sac, when examined without the application of any reagents, appears filled with an almost transparent, homogeneous, mucilaginous substance. It keeps increasing in size until it reaches, in many instances, several times the length and width of the hair, and at last it bursts, usually at the top.

While the inflation of the sac is progressing, the size of the mucilage masses in the hair is perceptibly diminished; in many of the ruptured sacs, however, the mucilage is still present in considerable quantities, enclosed as before by actively circulating protoplasm. But it continues to diminish, the vacuoles become larger and larger, compressing, as it were, the mucilage between their convex poles: the edges of the corresponding concavities of the mucilage mass become irregular and jagged (Fig. 15), and finally, in older hairs, the mucilage has disappeared altogether. The plasma has now ceased to live, and appears in irregular, granular masses and particles scattered through the cell (Fig. 13).

Whether, after the bursting of the sac, a second layer of cuticle is formed and raised or not, I could not decide to my entire satisfaction. The question would not have suggested itself to me, had I not, in one single case, quite distinctly seen that, a very short time after I had observed the bursting of a sac, the collapsed film of cuticle expanded again, and that in a few minutes a complete second sac was formed within the first one, the shreds of which surrounded the upper part of the new bladder (Fig. 16). The latter persisted for six days longer, when it also burst (Fig. 17). The motion of the protoplasm had continued for three days after the formation of the second sac. A small remnant of mucilage stayed at the upper end of the hair, gradually assuming a dark brown color, and had not been secreted a week later, when the observation of the hair was given up.

With the exception of this one instance, I could not discover, among the large number of hairs examined, a single one that showed the least vestige of a ruptured sac outside of a new one. Besides, a hair which has once produced a sac seems to be deprived of a cuticular layer, for concentrated sulphuric acid or chromic acid will destroy the wall of the hair entirely, leaving only the cuticle of the pedicel cells, and the sac of the hair.

In order to learn something about the homogeneous, whitish substance in the hairs, designated as "mucilage" thus far, several reagents were applied. Glycerin, sugar and alcohol cause the plasma sac to contract in the usual manner. That portion of the parietal plasma layer which adjoins the mucilage, barely leaves the wall, while the other part, above and below, will retire to the median line of the hair. The mucilage also contracts somewhat, but otherwise remains unchanged. If the plasmolysis caused by glycerin and sugar be interrupted at the proper time by the addition of water and the removal of the reagents, the protoplasm expands again and resumes its activity. Chloriodide of zinc produces the contraction of the plasma and colors it yellow; the included mucilage becomes pale red or pink, the wall of the hair blue, the membrane of the sac yellow, and the mucilage in the sac faintly gray, of about the same tinge as the mucilage that has escaped from the sacs. On application of iodine in potassic iodide with sulphuric acid, the mucilage takes a reddish color. The same color, only of a darker, brownish hue, is produced by concentrated sulphuric acid. Vacuoles appear in the mucilage, the plasma sac contracts and remains undissolved with the mucilage enclosed, while everything else, except the membrane of the outer sac, disappears. Diluted chromic acid also stains the mucilage red. Caustic potash dissolves the mucilage rapidly, leaving a network of protoplasm, which also soon disappears.

Osmic acid (1%) stains the mucilage masses in the hair dark blue, which soon turns into an intense black, and the plasma layer becomes very light brown. In many of the sacs the mucilage assumes a blackish color, dark enough to make them almost opaque, while in others it becomes only faintly gray, of about the same tinge as the loose mucilage outside of the sacs. Bichromate of potash in some cases causes the mucilage drops at first to expand and dissolve, and then produces a deep orange-yellow, finely granular precipitate; in other hairs the mucilage masses do not change their shape, but assume a uniformly deep orange hue. Ferric chloride and sulphate give the tannin reaction for the mucilage in the hairs, not, however, for that outside of them. Acetate of copper and acetate of iron* also show plainly the presence of tannin in the mucilage of the hairs; the latter salt stains the mucilage in the sacs and outside of them a deep orange-yellow. Strong sulphuric acid applied for a short time after the acetates of copper and of iron, imparts to the mucilage in the hairs and, in some instances in the sacs, an intense olive-

* Cf. J. W. Moll, Maandblatt voor Natuurwetenschappen, 1884

green color. Sections mounted in water several weeks ago have retained this color thus far.

Corallin colors the mucilage a dull pink or red, and nigrosin stains all the large drops in the hairs steel-blue, the surrounding plasma faintly yellow, and the mucilage in the sacs, as well as outside of them, blue also, but its color usually disappears after it has remained for several weeks in glycerin, while the mucilage in the hairs has not thus far (for about one-half a year) lost its color. The stained mucilage masses may be forced out of the hair by pressure on the cover-glass, when it will be noted that the crushed wall of the hair invariably breaks up into a continuous spiral band. It takes considerable time to stain the mucilage with nigrosin, for as long as the cell lives the coloring matter is not admitted. I observed repeatedly that hairs placed in a nigrosin solution, so dark that it was almost opaque, stayed alive for several days, i. e., their plasma kept moving and the mucilage remained unstained.

Methylene blue, on the other hand, passes through the cell wall and the living plasma.* A drop of the concentrated solution was diluted with 5 cc. of water and some living hairs with well defined mucilage drops were placed in it. After two hours most of the mucilage masses had become distinctly blue, while the motion of the colorless plasma had ceased in nearly all the hairs. Some of these sections were then placed in water, and after a short while the plasma again became active, and after three days the mucilage in most of the hairs had lost its blue color; in some of the hairs, however, it was permanently stained, and the plasma did not recover.

Very interesting observations were made when some young hairs were treated with acetic acid. As soon as the acid was applied, the mucilage began to expand rapidly, and simultaneously a swelling of the entire hair was noticed; the mucilage crowded back the vacuoles and the strands of protoplasm towards both ends of the hair, until the entire cavity was filled with an almost transparent mass; then, sometimes at one point, sometimes at several, a slight swelling of the outer layer of the wall took place, which gradually increased until, at length, there was an entire

* Cf. W. Pfeffer, Unters. a. d. bot. Inst. zu Tübingen, II, 2. Hft.

sac formed all around the hair, in all respects similar to those formed by natural growth, with the one exception that these artificial sacs did not elongate much, but, on the contrary, usually had their upper ends adhering to the corresponding extremity of the hair. Osmic acid, nigrosin and methylene blue stained the contents of these sacs much more intensely than those of the natural ones, and the hairs themselves presented the same appearance, as to color, as their sacs.

In various parts of the plant there are very many cells filled with red-colored cell-sap. They occur either singly, or in vertical rows in the stem and petiole, or in horizontal layers in the leaf, giving the surface its red appearance. The hair-bearing cells of the epidermis also frequently contain red sap. While the surrounding parenchyma cells usually contain a great deal of large-grained starch, there is little of it, more frequently none at all, in these cells. Its place is taken up, in the cells of the youngest parts, by mucilage similar to that in the hairs. Besides, there is always the most lively circulation of the plasma to be seen in them. Reagents act on the mucilage in these cells in exactly the same manner as on that in the hairs. Sections from a very young leaf were treated with acetic acid. Along the upper epidermis, the cells of which contained mucilage drops, bubble-like excrescences make their appearance just as on the young hairs treated with the same reagent. Methylene blue causes the red coloring matter to gather in one large globular drop in the middle of the cell and stains it blue, while the plasma is still living. Plasmolysis can be started and interrupted repeatedly, just as in the hairs.

The true nature and chemical composition of the mucilaginous secretion and the contents of the hairs still remain to be investigated more closely. It seems to me, however, that the reactions described positively demonstrate the presence of large quantities of tannin in the mucilage of the hairs. Furthermore, the nigrosin and corallin tests * as well as the optical inspection entitle us to call the bulky, whitish masses in the hair " mucilage." Finally, the behavior of these masses on the application of chloriodide of zinc, of sugar and of sulphuric acid, permit us to infer that nitro-

* Cf. Strasburger, Bot. Pract. pp. 106, 129, etc.

genous matter must be present in them. We might, therefore, for the present, consider this peculiar substance as a mixture of mucilage and protoplasm, impregnated with tannin.

As to the question whether the mucilage is produced in the interior of the secreting cells, or in the outer layer of their walls, we have to refer to the statements of DeBary in his Comparative Anatomy (p. 93, Engl. Ed.) where, in treating of glands, including glandular hairs, he says: "The anatomical peculiarity of the glandular parts of the epidermis consists in the appearance in the *cell wall* of that body, which is termed the secretion of the gland, as a part sharply defined from the cellular layers. The wall grows in thickness at the glandular spot by intercalation of a layer between its outer and inner side. The intercalated mass differs in material from the cellulose and cuticular wall and is termed a secretion."

Another passage on the same page reads as follows:—"More careful investigations are necessary to answer the question as to the appearance and origin of the secretion. But in any case it is incorrect to imagine a "perspiration" in the sense of a passage of large optically determinable masses formed in the interior of the glandular cells through the membrane." And on page 99 the author mentions one single exceptional case known to him: "The bases of the young leaves of *Osmunda* are covered with a rich amorphous mucilage. This originates from long septate hairs with large bead-like cells, each of which in the stages of development observed, is completly filled with a mass of mucilage. The origin of the latter remains to be investigated." *

I venture to suggest that the hairs of *Brasenia* may form another exception. In the first place we do observe "large optically determinable masses" in the interior of the hair which are similar to the secreted masses, diminishing as the secretion—in the sac—increases, and which finally disappear. Moreover we have seen that by destroying the restrictive power of the enclosing

* Since this paper was read, No. 1, Vol. I, of the Annals of Botany, has reached us, in which W. Gardiner and Tokutaro Ito discuss the structure of the secretory cells of *Osmunda regalis*, L., and *Blechnum occidentale*, L. According to their investigations, "the cell-contents usually escape by means of a small localized rupture of the wall" (p. 40), or "the whole wall through disorganization breaks down on all sides and the swollen drops quietly escape" (p. 41).

protoplasm, we can cause the rapid passage of those masses through the cellulose layer of the cell wall; for we cannot well believe that in the very short time during which this passage is completed, a transformation of a portion of the cell wall into mucilage has taken place. As another proof for the direct passage of the mucilage through the wall must be considered the absence of any swelling or striation of the cellulose layer after the rupture of the sac and while the mucilage in the hair continues to diminish and disappear. We may, therefore, assume that the increasing turgor inside of the hair forces the mucilage through the surrounding protoplasm and through the cellulose layer of the wall.

If, finally, we ask ourselves of what possible use the mucilage might be to *Brasenia*, we can only suppose that it must serve the plant as a protection against the attacks of water animals which are prevented by its slippery and yielding, but at the same time firm consistency, to crawl on its surface and to eat the tender growing parts. Moreover, the numerous kinds of larger water Algæ cannot attach themselves to the growing stems and buds, although, as mentioned before, Bacteria and also Diatoms seem to thrive in the mucilage.

In the intercellular air-canals we often meet with projecting hair-like structures. Sometimes they are simply slight protuberances from the cells lining the canal, but usually they are large outgrowths of those cells, of a cylindrical, sac-like shape, or they are inflated and widening from the base toward the rounded end (Figs. 5, 6, 7). The interior is most commonly continuous, but occasionally one to three cross-partitions may be noticed. These hairs are often found in groups of three or four, seldom singly (Fig. 7), but most frequently occurring in large numbers, all around the canal, pressing against one another and, at some points, effectually closing the entire cavity. For a considerable but varying distance from such a point many cells bordering upon the canal send such outgrowths into the open space, diminishing in number as the distance increases, and the interstices between them are usually filled with mucilage (Fig. 5).

A lining of mucilage of varying thickness is also found in such parts of the canal where there are only a few hairs or none at all (Fig. 5, mu, upper canal). The lining does not always extend all around the canal, but often covers only patches of its wall; it frequently passes over some of the hairs, covering and enclosing them entirely. In cross-sections the outer edge of the lining is firm and smooth, assuming a distinct yellow color in chloriodide of zinc, or in potassic iodide and sulphuric acid: it is, in fact, a thin layer of cuticle raised in a coherent film from the wall of the canal by the mucilage forming under it. Wherever the mucilage occurs calcium oxalate is nearly always found in abundance; not, however, inside the cells or in separate receptacles, but imbedded in the mass of the mucilage in the form of crystals, usually octahedral, which are frequently of extraordinary size and beauty. Quite often large crystalline conglomerates cling to the sides of the canals, which are always coated besides with a dense crystalline layer of this salt.

The internal hairs have a thin membrane, and most of them bear on their surface numerous bubble-like excrescences, which sometimes attain considerable size (Fig. 6). Some rest on the hair on a broad circular base, others barely touch it at one point (Fig. 6). In the former case, when their elevation is very slight, an exceedingly thin membrane, the continuation of the outermost layer of the wall of the hair, seems to cover them. This may be noticed after treatment with nitric acid and subsequent application of chloriodide of zinc. I was unable to discover, with any degree of certainty, the least trace of a membrane around the globular bubbles. Other bubbles of exactly the same appearance and structure are frequently found on the sides of the canals, clinging to the walls of cells that have not grown into hairs.

Mellink* noticed "small hemispherical,† or more rarely pediceled bubble-like elevations" on the hairs of *Nymphæa*, and reaches the conclusion that the cuticle of the hair is thickened in some places so as to cause them. The bubbles on the hairs of *Brasenia* are not stained by chloriodide of zinc, potassic iodide, or nitric acid‡ (while the cuticle of the epidermis and the suberized parts of the endodermis react beautifully); they are evidently

* l. c.

† "Halbkreisförmige," which I suppose ought to read "halbkugelförmige."

‡ Mellink does not report the application of reagents to prove that the bubbles are really a thickening of the cuticle, but simply says that they are not hollow, because acetic acid-rosanilin will stain them uniformly red.

drops of mucilage. I frequently saw two or more of them flowing together or clinging to one another like drops of any viscid, semi-fluid substance. In some instances it can be demonstrated that the mass of mucilage filling the space between some hairs which are not in close contact, is formed of these drops, for not having perfectly coalesced they can be made out individually. How these mucilage drops are formed remains to be investigated; the internal hairs do not contain any mucilage masses as the external ones do. In many of them active protoplasmic currents and large nuclei may be observed, and others contain a great deal of starch (Fig. 7). These hairs are sure to be found in such intercellular canals as, by some agency or other, have been injured, and it is evident (as Mellink has pointed out in reference to *Nymphæa alba*) that the formation of the hairs is an effort of the plant, and in most cases a very effectual one, to repair the damage by closing up the canal. The wounds healed in this way may be caused by various mechanical forces. In several stems were found egg or larva cases suspended in the intercellular canals nearest to the surface of the stem. The animal had punctured the superficial layer of cells and deposited its eggs inside in longitudinal rows, which were plainly marked on the outside by distinct dots. These cases or sacs were obliquely suspended in the air-passage and connected with the outer world by a short narrow canal. The plant had promptly surrounded the intruder by numerous hairs of the kind described. It is not improbable that the larvæ when they leave their temporary abode, cause at least some of the wounds found on the stems.

Internal hairs are often met with, as stated above, quite far from the wound. As this was also the case with *Nymphæa alba*, Mellink thinks that these outgrowths are caused by a certain "irritation," proceeding from the wound and conducted through considerable distances by the protoplasm, which he assumes to be continuous through the cells of the affected tissues. Without doubting in the least the importance of the doctrine referring to the continuity of the protoplasm, I cannot help thinking that in our case the expansion of cells into an air-canal is rather vaguely explained by the "irritation" theory. Assuming, as above, the existence of a high pressure in the air-passages, we must admit that the opening of one of them by some mechanical injury would temporarily diminish that pressure. The turgor in the cells bordering upon the canal would cause them to grow in the direction of the least resistance, i. e., into the open space of the canal, until the hairs thus formed would close the opening. That the portion of the canal near the wound was most likely filled with water may be concluded from the fact that in all sections, both from fresh and alcohol material, the mucilage filling the spaces between the hairs, even at some distance above the wound, abounds in bacteria, and even sometimes diatoms, of the same kind as those that are found on the outer surface of the plant. Should these observations and conclusions prove correct, the same arguments might be applied with equal force to account for the origin of the curious formations known as tylosis, with which the hairs in question have many analogies.*

EXPLANATION OF PLATES.

Plate LXXVII.—Fig. 1—Rootlet with enveloping sheath, sh. × 20. Fig. 2—Cross-section of stem; c, cortical portion; ic, intercellular air-canals; m, mestom; h, hadrom canal; l, leptom (The shaded part between the leptom bundles—parenchyma cells—takes up more space than the tissue it represents really does.) × 20. Fig. 3—Longitudinal tangential section of stem near node, through mestom (m, Fig. 2); h, hadrom canal; sd, spiral ducts: st, sieve-tube. × 220. Fig. 4—Cross-section of floating leaf near upper epidermis; e, epidermis cells; p, palisade cells; a, large air-cavity under stoma × 500. Fig. 5—Cross-section of intercellular air-canal in petiole, almost filled with internal hairs, hr, and mucilage, mu; one of the canals bordering on it is lined with a thick layer of mucilage, mu. × 130. Fig. 6—Internal hair beset with mucilage drops. × 430. Fig. 7—Internal hair containing starch. × 220.

Plate LXXVIII.—Fig. 8—Epidermis cell beginning to produce a hair; e, adjoining epidermis cells. × 600. Fig. 9—the same, after the formation of a cross-partition. × 600. Fig. 10—Young hair; pc, pedicel cells; pr, protoplasma layer; mu, mucilage. × 600. Fig. 11—Hair with incipient mucilage sac, ms; mu, mucilage; pr, protoplasm (in circulation); pc, pedicel cells. × 500. Fig. 12—Hair with mucilage sac × 500. Fig. 13—Hair with sac burst; mucilage has disappeared, and granular dead plasma remnants are left. × 500. Fig. 14—Hair with two large mucilage drops. × 230. Fig. 15—Portion of hair with mucilage much reduced; the dotted curves are to indicate the double-concave shape of the drop (cf. text). × 500. Fig. 16—Hair with remnants of first sac and entire new one. × 230. Fig. 17—Same hair after bursting of second sac (cf. text, p. 39). × 230.

* Cf. Mellink, l. c.

New or Rare Grasses.

BY DR. GEO. VASEY.

In the last number of this journal were described several new Pacific coast grasses. A considerable number of other new or interesting forms have been received as the result of the collections of different explorers, and I wish here briefly to give a short account of them. Mr. J. Macoun botanized in Vancouver Island the past season, and, in addition to the *Alopecurus* described in the January number, he sends the following: *Deyeuxia Vancouverensis*, a small species, 10 or 12 inches high, with spicate panicle 1 ½ to 2 inches long, approaching *D. strigosa*, Kth.; also *Deyeuxia breviaristata*, 2 to 3 feet high, radical leaves very long, panicle 4 inches long, narrow, loose, with short erect branches; narrow glumes equaling the flower, the awn shorter than its glume or nearly absent; hairs sparse, ⅓ to ½ as long as the flower. *Deschampsia cæspitosa*, variety *maritima*, 6 to 8 inches high, growing on the seashore; *Deschampsia atropurpurea*, variety *minor*, culms 10-12 inches high, slender, panicle few-flowered, spikelets much smaller than the type; *Glyceria pumila*, about 4 inches high, panicle small, mostly of three to five approximate sessile spikelets with a lower branch ½ to 1 inch long; *Bromus Macounii*, closely resembling *B. erectus*, Huds., but with a smaller, purplish panicle; *Elymus Vancouverensis*, culms stout and rigid, leaves involute and rigid, spike thick and dense, 4-5 inches long, spikelets rigid, crowded, merely mucronate or very short awned. With this are several peculiar forms or varieties, probably of *Elymus Americanus*.

Mr. Thos. Howell, of Oregon, in addition to the two species described in the January number, sends *Melica Harfordii*, variety *minor*, from the Siskiyou Mountains, 10-12 inches high, with a much reduced panicle; also the first introduction into this country, so far as I know, of *Elymus Caput-Medusæ*, Linn.; *Glyceria angustata*, which is the *Atropis angustata*, Gris. in Ledeb., *Poa angustata*, R. Br., and *P. Nootkaensis*, Rupt. It is properly a *Glyceria* by its convex—not keeled—glumes, and by its aquatic habit. Also *Glyceria festucæformis*, Heyn., which seems abundantly distinct from *G. distans*.

Mr. G. C. Nealley, who has made a thorough exploration of Western Texas, has discovered several new species, among which are *Triodia Nealleyi,* of similar aspect to *T. avenacea,* and another *Triodia* of which, unfortunately, too little for full characterization was collected and which may be called *T. repens*; also *Bouteloua stricta,* 2-3 feet high, with rigid, erect culms, and panicle of 4-6 short, appressed spikes; *Stipa flexuosa,* a species resembling *S. avenacea,* but distinct, with larger panicle, longer and more capillary branches and much smaller spikelets; *Sporobolus Nealleyi,* a dwarf, erect species, with small, open panicle; also a remarkably large, robust, heavy-panicled variety of *Sporobolus cryptandrus,* Gr., also good specimens of *Muhlenbergia monticola,* Buckl., and of what is probably *M. spiciformis,* Trin., and two other new species or varieties of *Muhlenbergia.*

Prof. S. M. Tracy collected in New Mexico, Arizona, S. California, Nevada, Utah and Western Colorado, over 200 species of grasses, many of them interesting, particularly the *Oryzopsis Webberi,* collected at Reno, Nevada, the first specimens which have been collected since those by Mr. Lemmon, on which the species was founded by Dr. Thurber, as *Eriocoma Webberi.*

The following appear to be new: *Poa Tracyi,* from mountain sides near Raton, New Mexico. It is of the *flexuosa* group, 2 to 3 feet high, with short leaves, panicle 4 to 6 inches long, spikelets large, flowing glumes strongly five-nerved, scabrous-pubescent, hairy at the base; *Diplachne Tracyi,* near *D. fascicularis,* 1½ to 2 feet high, erect, and narrow, leaves equaling the culm, panicle long, branches appressed, spikelets seven to nine-flowered, flowering glumes with two acute lobes at the apex and a short awn between them. In clumps growing in ditches at Reno, Nevada.

The Proposed Botanical Exchange Club.

The committee appointed by the Botanical Club of the A. A. A. S. at the New York meeting, to act for the Club in the formation of a Botanical Exchange, after considerable correspondence and the consultation of the rules and regulations of similar organizations abroad, is now in a position to submit to the members of the Club certain tentative propositions, on which individual opinion is solicited.

The Regulations of the Botanical Exchange Club of the British Isles, published in pamphlet form at Manchester in 1886, seem applicable to our needs with certain necessary modifications. In order to bring these before the botanists of the country, a synopsis of them is here presented, arranged with reference to America instead of Great Britain.

(1.) The object of the Club will be to facilitate the exchange of herbarium specimens of American plants, specially of rare species and varieties. The conditions of membership to be that each member shall furnish a parcel of specimens annually and pay a yearly subscription of a sum not to exceed ($3.00) three dollars, to meet the expenses. Members will be entitled to a share in the distribution of specimens made in the early part of the year following that in which their subscriptions and parcels were sent.

(2.) The annual list of Desiderata will be made up by combining those of all the members of the Club, and then be printed and sent to every member. Each individual list must not exceed a certain number of species annually, for if unlimited the printed list would be too voluminous for practical use with our very extensive flora, at any rate for a number of years. The determination of the annual number of desiderata will require further consideration. Other plans will probably be proposed.

(3.) Some member will have to act as distributor each year, either voluntarily or, if no one is found willing to act without recompense, provision will have to be made for employing a distributor at a small salary. The plan as here outlined would not necessitate very much work, and it certainly would be of an interesting nature. The Committee will be pleased to receive communications relative to this.*

(4.) It will be necessary to adopt some one check-list as the official one of the Club, and this must either be used in sending lists of desiderata by marking the species desired, or if a reliable numbered check-list can be procured, the list of numbers might be sent. This is also a question for further consideration. It

*Dr. Vasey writes that Commissioner Colman has consented, if it be deemed advisable, that the Botanical Division of the Department of Agriculture take charge of the exchanges and distribution without expense to the members of the club.—N. L. B.

has been the experience of the British Club that manuscript lists of desiderata should not be received.

(5.) Each species should be represented by a number of specimens to be determined when the probable number of members shall be ascertained. It is not necessary to emphasize at this time the necessity for complete and satisfactory specimens being furnished, with appropriate labels.

The British Club had in 1886 a membership of fifty-eight, and has been in successful operation for a number of years. It would seem certain that at least an equal number of American botanists would consider it advantageous to join a similar organization.

Suggestions regarding the matter here presented and applications for membership should be sent to the chairman of the Committee, Dr. George Vasey, U. S. Department of Agriculture, Washington, D. C. THE COMMITTEE.

Castalia versus Nymphæa.

It may be of interest to those concerned in the discussion of *Nymphæa* and *Nuphar*, brought up in the pages of the BULLETIN, to know that Sir James Edward Smith, in his "Introduction to Physiological and Systematic Botany," published in 1807, refers as follows (p. 385) to *Castalia:* "I believe Mr. Salisbury's *Castalia* is well separated from *Nymphæa,* see *Annals of Botany, v.* 2, 71." It would appear from this that, whatever Smith may have done the year following, in 1807 he accepted *Castalia* and credited Salisbury with it. JOSEPH F. JAMES.

Notes on Smilax pumila, Walt.

The division of *Quercus* into two sections, one annual-fruited and the other biennial-fruited, is familiar to botanists, but it is not so well known that the genus *Smilax* might be similarly divided. Most of our Atlantic coast species flower in spring or early summer and ripen fruit the same year. *S. laurifolia,* L., flowers in July and August, and Chapman notes (Fl., p. 476) that its berries mature "in the fall of the succeeding year." *S. pumila,* Walt., does not bloom till October, but neither Chapman nor Wood mentions the time its berries ripen, nor does Walter in his original description. A fruiting specimen, collected in South Carolina during the last week of December, affords conclusive evidence that this interesting species, as might have been expected, is to be classed, in this respect, with *S. laurifolia*.* The main branch of the specimen bears discolored reddish leaves, evidently of two years' growth. A single lateral branch has leaves still fresh and green in appearance. On the main branch are several clusters of ripe red fruit, while on the other the berries are still very small and green, in fact scarcely more than ovaries from which the perianth has but recently fallen. No one examining this specimen could doubt that the immature fruit resulted from the flowers of last October (1887) and that the full-grown red berries must be the fruit of the preceding year (1886). If any confirmation were necessary it is afforded by a specimen from Wm. M. Canby's herbarium, collected in March, 1869, at Hibernia, Florida, which shows the fruit still small and green but somewhat farther advanced than the young berries in this December specimen.

Wood's description of *S. pumila* appears more correct than Chapman's in two or three particulars. Chapman says, "berry whitish,"—Wood, "red when ripe." The latter is strictly correct, although it is quite probable that the berries may be whitish before fully mature. Chapman says, "leaves five-ribbed,"—Wood, "three to five-veined." In my specimen the leaves are very strongly three-veined, the intra-marginal veins being too slight to deserve notice. Finally, Chapman has "peduncles about twice as long as the petioles,"—Wood, "peduncle as long as the petiole." Here, again, Wood is right, the peduncle being, if anything, slightly shorter than the petiole. Students of *Smilax* are aware that these points of difference are all of specific value in this difficult genus, and it is therefore well to put upon record the close agreement of the specimen examined with Wood's description.

I may note in conclusion that the ovoid berries are distinctly and strikingly acute, a peculiarity of shape unmentioned by Wood, Chapman or Walter. E. E. STERNS.

*It is interesting to observe that these two species are also closely allied by the fact (fide Gray, F. F. & G. Bot., p. 337) that each has a one-celled ovary, a notable variation from the trilocular ovary almost universal in this large genus.

Index to Recent American Botanical Literature.

Asclepiads—Insect relations of Certain.—Chas. Robertson. (Bot. Gazette, xii., pp. 207-216 and 244-250). Illustrated.

In these papers the writer records a series of observations on several species of *Asclepias* and *Acerates* with regard to bees, wasps, flies, butterflies and moths, tabulating the number of pollinia carried by each and comparing the results of their visits.

Calopogon parviflorus, Lindl.—Fertilization of.—Chas. Robertson. (Bot. Gazette, xii., pp. 288-291).

Catalogue of North American Plants. J. H. Oyster. (2d Ed., Pamph., 8vo., pp. 125, Paola, Kansas, 1888).

This check-list is a great improvement on the original one of Dr. Oyster, both in completeness and in typography. Indeed we note really few errors. The paper is poor, however, and the font of type used was old and dull. The number of species enumerated reaches 10,123, contained in 1665 genera. A good feature of the list is the appended index. The alphabetical arrangement adopted by Patterson is followed both as to genera and species; now let Mr. Patterson adopt the plan of numbering both species and varieties—with an index.

Cinchona in Bolivia—The Cultivation of.—H. H. Rusby, M.D. (Reprinted from the Pharmaceutical Record, Oct. 1, 1887).

This is one of the most important botanical papers read at the New York meeting of the American Association, when it was elaborately illustrated by a fine series of the bark and mounted specimens of the various species and hybrids collected by Dr. Rusby during his visit to the Cinchona plantations. After making an interesting comparison between the pure stock Cinchonas cultivated in India and the mixed hybrids cultivated in South America, the author proceeds to state some of the fallacies in characterizing species and concludes the essay with brief descriptions of the fifteen species, varieties and hybrids, in cultivation in the Mapiri District.

Food-Plants of Lepidoptera.—Wm. Beutenmueller. (Entomologica Americana, iii., pp. 157-159 and 180).

Lists of plants observed supporting three species of moths, one of which was noted feeding on no less than seventy-three different trees and shrubs.

Fungi from Various Localities—New Species of. J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., pp. 9, 10).

Eight new species of *Phyllosticta* described.

Fungi—New Iowa. J. B. Ellis and B. D. Halsted. (Journ. Mycol., iv., pp. 7, 8.)

Seven new species in the genera *Cercospora, Cylindrosporium, Vermicularia* and *Phoma.*

Fungi.—Some exotic. M. C. Cooke. (Grevillea, xvi., pp. 25, 26).

Cucurbitaria Ravenelii from Aiken, S. C., *Cylindrocolla quercina* from New Jersey, and *Hypocrea Amazonica* from Para, are described.

Guide to the Student in Botany. Edw. S. Burgess, A.M., (Pamph., 12mo. pp. 44, 1887). Syllabus of the course in Botany, Washington High School, 1887-1888.

Injuries produced by Parasitic Fungi upon their Host-plants. A. B. Seymour. (Amer. Nat., xxi., pp. 1114-1117).

Jamaica.—Bulletin of the Botanical Department. (No. 4, Nov. 1887).

The table of contents contains eight titles, including the Cultivation of Coffee and the Grape Vine, Orange Seedlings and Sugar Cane Manures, Cinchona Bark, Coco Nut Palm Disease, Plants in flower or fruit in the Gardens, Notes on some recent Acquisitions and the value of the Cultivation of Timber.

Jamesia Americana. (Garden, xxxii., p. 522; one figure).

Leaf Prints.—Horace M. Engle. (Bot. Gazette, xii., pp. 83-85).

We have received from the author a series of impressions of leaves in green ink, similar to those used on plates x, xi, and xii of the BULLETIN, the method having been described by him in the Gazette as quoted above. The process seems most successful with thin, well pressed specimens of ferns.

Life Histories of Plants.—Contributions to the. Thomas Meehan. (Proc. Acad. Nat. Sci., Phila., 1887, pp. 323-333; four figs.)

Mr. Meehan has discovered that *Amphicarpæa monoica* occasionally fruits as well above ground as from its cleistogamic flowers, and is eminently fitted for self-fertilization. He has also watched *Cephalanthus occidentalis* in order to see the opening of the flowers and the extension of the pistil, and found that they "open rapidly soon after dark and never during the day-time," and that they are "most completely adapted for self-fertilization;" the homology with the Composites is carefully traced. *Amorpha canescens*, Nutt., and *Oxybaphus hirsutus* were watched during anthesis and some interesting observations are recorded. It is also noted that the stamens in *Echinocactus* are irritable and that the flowers of *Magnolia glauca* open at 4 p.m. three days in succession and then remain open till they fade.

List of Flowering Plants and Ferns found in Charlotte County, New Brunswick. James Vroom and others. (Pamph., 8vo., pp. 12, St. Stephen, 1887).

An enumeration of the Phanerogamia and Pteridophyta hitherto found in the county. Localities for rare species are indicated.

Many Idle Weeds.—W. W. Bailey. (Swiss Cross, ii., 1887; illust.).

During the year Prof. Bailey contributed a series of articles of a popular character illustrated by himself. They included special papers on Compositæ and Ferns, as well as directions for field and herbarium work.

Orchids—Native.—E. S. Gilbert. (Vick's Ill. Month. Mag., xi., pp. 12-14; illustrated.)

This is an interesting popular article on our native species, and is well illustrated, with the exception of *Habenaria fimbriata*, which is poorly figured as *Orchis grandiflora.*

Papaw—A new hardy. (Gard. Chron., ii., pp. 716, 717; two figs.)

This is a hybrid between *Carica porphyrocarpa* and *C. Candemarcensis;* the figures illustrate the germination of the seeds within the fruit.

Phragmidium mucronatum, Lk., var. Americanum, Peck.—The Rose Brand.—J. L. Zabriskie. (Journ. N. Y. Micros. Soc., iv., p. 80; one figure.)

Phyllactinia guttata, Lev., on Leaves of Celastrus scandens, L.—J. L. Zabriskie. (Journ. N. Y. Micros. Soc., iv., p. 80; one fig.)

Plants of Economic Value as Food for Man and Stock in Texas and New Mexico.—Clifford Richardson. (Agric. Sci., i., pp. 269-275.) Notes and analyses of two species of *Opuntia.*

Pollen grains—Three Nuclei in.—Byron D. Halsted. (Bot. Gazette, xii., p. 285; illustrated.)

The observations were made on twigs of *Sambucus racemosa* forced in the house on the 3d of March.

Ramularia and Cercospora—Additions to.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., pp. 1-7.)

Twenty-six new species characterized, with notes on others.

Rhododendron punctatum.—Asa Gray. (Gard. Chron., ii., 1887; also reprinted in Gard. Month., xxx., pp. 26, 27.)

Thallophytes in Medicinal Solutions.—R. G. Eccles, M.D. (Journ. N. Y. Micros. Soc., iv., pp. 19-28; five cuts.)

An interesting account of the development of various Fungi and Bacteria in solutions used as medicines, such as Phosphoric Acid, Muriate of Morphia, Sulpho-cyanide of Potassium. The remarkable fact is recorded that some of these organisms still evidenced vital action after being hermetically sealed in a cell for over two years and three months! Observations and experiments on the same and many additional fluids are described in the Transactions of the Botanical Society of Edinburg, xi., pp. 312-318, with three plates, by Dr. James Cumming.

Umbelliferæ of E. United States—Notes on.—Development of the Umbellifer Fruit.—John M. Coulter and J. N. Rose. (Bot. Gazette, 1887; a series of articles continued through the volume; nine plates.)

As we suppose that all readers of the BULLETIN have also access to the Gazette, it has been our custom to note the papers of the latter by title only, and we will content ourselves in this case by recording only the changes in nomenclature made by the authors of the one here reviewed from those used in recent general systematic works.

Archangelica hirsuta, T. & G., becomes *Angelica hirsuta,* Muhl.; *A. dentata,* Chapm.,=*Angelica dentata; A. atropurpurea,* Hoffm.,=*Angelica atropurpurea,* L., and *A. Gmelini,* DC., =*Cœlopleurum Gmelini,* Ledeb. *Archemora ternata,* Nutt., and *A. rigida,* DC., are referred to *Tiedemannia* under the same specific names. *Hydrocotyle Canbyi,* n. sp., is the *H. umbellata,* var. (?) *ambigua,* Gray. *H. repanda,* Pers., is *H. Asiatica,* L.; *Thaspium* is divided, *T. trifoliatum,* Gray, becoming *T. aureum,* Nutt., var. *trifoliatum;* and the var. *atropurpureum* also placed as a variety of *aureum*; *T. barbinode,* Nutt., var. *angustifolium,* n. var. has narrower and more sharply cut leaflets, and comes from Illinois, Pennsylvania and Indiana; the apterous forms are referred to *Zizia*, Koch; *T. aureum*, Nutt., var. *apterum*, Gray, becoming *Z. aurea*, Koch, with a new variety *Bebbii*, from the southern mountains of the Appalachian system, and *T. trifoliatum*, Gray, var. *apterum*, is *Z. cordata*, Koch. *Chærophyllum Tainturieri*, and its var. *dasycarpum*, Hook., are referred to *C. procumbens*, Crantz, as varieties under the same names; *C. sativum*, L., is *Anthriscus Cerefolium*, Hoffm. *Discopleura Nuttalii*, DC., is referred to *D. capillacea* as a variety. *Leptocaulis* and *Ammoselinum*, which have been included in *Apium*, are both kept up as genera, *Apium Butleri*, Engelm., becoming *Ammoselinum Butleri*. The difficult genus *Eryngium* is not monographed.

Proceedings of the Club.

The regular meeting of the Club was held on Tuesday evening, Jan. 10th, 1888, at Columbia College, the President in the chair and thirty-two persons present.

Messrs. N. O. Wilhelm, W. C. Peckham and Geo. Rignell were elected Active Members.

Miss Grace E. Cooley, Miss Clara E. Cummings, and Messrs. F. L. Harvey, Walter Deane, E. S. Bastin, Henry M. Ami and Chas. B. Plowright were elected Corresponding Members.

Reports of officers for the past year were read and accepted.

The following officers were elected for the ensuing year: President, Dr. J. S. Newberry; Vice-President, Thos. Hogg; Treasurer, J. F. Poggenburg; Recording Secretary, Arthur Hollick; Corresponding Secretary, Miss H. C. Gaskin; Librarian, Dr. N. L. Britton; Curator, Miss M. O. Steele; Editor, Mrs. N. L. Britton; Associate Editors, Jos. Schrenk, C. H. Kain, H. H. Rusby, Miss Emily L. Gregory and Arthur Hollick.

Prof. Byron D. Halsted read a paper upon "Trigger hairs of the thistle flower (*Cnicus altissimus*)."

Dr. N. L. Britton remarked on a small collection of plants, made by Mr. W. S. Rusby in June, 1887, in the Black Hills of Dakota. Among the species represented are the following not recorded in the list by Dr. Gray in the Report on the Geology of the Black Hills by Newton and Jenney:

Actæa spicata, L., var.; *Arabis hirsuta*, Scop.; *Arenaria lateriflora*, L.; *Ceanothus ovatus*, Desf.; *Astragalus glabriusculus*, Gray (determined by Professor Porter); *Potentilla Norvegica*, L.; *Saxifraga Jamesii*, Torrey (on high limestone ridges): *Heuchera hispida*, Pursh; *Sanicula Marylandica*, L.; *Thaspium aureum*, Nutt.; *Aralia nudicaulis*, L.; *Antennaria plantaginifolia*, Hook.; *Troximon glaucum*, Nutt.; *Asclepias ovalifolia*, Dec.; *Veronica Americana*, Schwein.; *Dracocephalum parviflorum*, Nutt.; *Lilium Philadelphicum*, L.; *Smilacina stellata*, Desf.; *Smilax herbacea*, L., var. *pulverulenta*, Gray; *Cypripedium parviflorum*, Salisb.; *Maianthemum Canadense*, DC.; and a species of *Sisyrinchium* collected in fruit.

Mr. E. E. Sterns read a paper upon "The fruit of *Calycanthus*," and some brief notes on *Smilax pumila*, Walt. He also exhibited a nearly cylindrical mass of fibrous roots, about fifteen inches in length, which had been taken from a four-inch drain pipe five feet under ground, the entire mass having developed from three roots of *Pyrus Japonica*, which had penetrated through a crack in the pipe and completely choked it. He also showed a number of Southern fruits, among them those of *Ilex cassine;* also *I. opaca*, with extreme forms of leaves, among them those with entire margins as figured in the BULLETIN, viii, p. 113, and the fruit of the *Sabal palmetto*.

DEATH OF DR. GRAY.

It is with the deepest sorrow that we record the death on Monday evening, January 30th, of our master and leader, Professor ASA GRAY. Stricken with paralysis on the morning of Nov. 28th, he lingered between life and death, while the hopes and prayers of all botanists went forth for his restoration to health, though from the first it was understood that all human effort to preserve his invaluable life would be of no avail. To American Botany his loss is irreparable.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

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Asa Gray.*

BY WALTER DEANE.

With Portrait.

Asa Gray died in Cambridge, Mass., on the 30th of January, 1888. The world has lost a most distinguished botanist, and all, who knew him, a cherished friend. No words are needed to sound his praises, and he himself would not have desired it.

His early life was spent in the State of New York, where his love for botany was first developed. Born in Paris, Oneida Co., N. Y., one of his earliest occupations was to feed the bark-mill and drive the horse at his father's tannery. He attended the Clinton Grammar School and from there went to Fairfield Academy, entering later the Medical College of the Western District of Fairfield; and, though he graduated with the degree of M.D. in 1831, yet he never practiced medicine. This was an important period of his life, for it was in the winter of 1827-8 that his interest in botany was awakened by reading an article on the subject in Brewster's Edinburgh Encyclopædia. The next spring he eagerly watched for the first flower and, with the aid of Eaton's Manual, arranged on the old Linnæan System, he found it to be the little *Claytonia Virginica* or Spring Beauty.† During this time, he studied with Dr. Priest in his native town and was a pupil of Dr. John F. Trowbridge, of Bridgewater. The correspondence which he carried on with Dr. Lewis C. Beck, an eminent botanist, in regard to the botanical specimens which he had been collecting and studying, led to his going to New York and making the acquain-

*In writing this article, I have consulted the various notices of Dr. Gray that have been written hitherto, and I would especially acknowledge the kindness of Mrs. Gray in giving me a sketch of Dr. Gray's journeys in Europe and America.

†This plant proved to be *Claytonia Caroliniana*, Mx., a species not recognized at the time.

tance of Dr. John Torrey, with whom he had already entered into a correspondence which lasted through the latter's life.* Dr. Torrey was, at that time, undoubtedly the most distinguished botanist in America, and his strong and marked character impressed itself firmly upon the mind of young Gray.

Dr. Gray's early interests were not confined to botany alone, for, about this time, he delivered lectures on chemistry, mineralogy and geology,† as well as botany, at Mr. Bartlett's school in Utica. In 1833 Dr. Gray became the assistant of Dr. Torrey, who held the position of Professor of Chemistry and Botany in the N. Y. College of Physicians and Surgeons, and from this time Dr. Gray's life was entirely devoted to his favorite science. While

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*The earliest letter preserved, of Dr. Gray's botanical correspondence with Dr. Torrey, is dated January 1st, 1831, Gray being at that time twenty years of age. It is in answer to a letter from Dr. Torrey with reference to some plants sent him by Gray a short time before. The letter here follows:

BRIDGEWATER, ONEIDA CO., N. Y., Jan. 1st, 1831.

DEAR SIR :—

I received your letter through Prof. Hadley a few weeks since, and I embrace the earliest opportunity of transmitting a few specimens of those plants of which you wished a further supply. I regret that the state of my herbarium will not admit of my sending as many specimens of each as I could wish, or as would be desirable to you. I shall be able to obtain an additional supply of most of them during the ensuing summer, when it will give me pleasure to supply you with those, or any other interesting plants which I may meet with. I send you a few Grasses, numbered, also a few Mosses, etc. When you have leisure, you will oblige me by sending the names of those numbered and rectify any errors in those labelled. If you should be desirous of additional specimens, please let me know it and I will supply you in the course of next summer. You ask me whether I am desirous of obtaining the plants peculiar to N. Y., New Jersey, etc., or of European plants. I should be highly gratified by receiving any plants you think proper to send me, and will repay you, so far as in my power, by transmitting specimens of all the interesting plants I discover. I know little of Exotic Botany, having no foreign specimens. I am particularly attached to the study of the Grasses, Ferns, etc. If you have any specimens to transmit to me, please leave them with Mr. Franklin Brown, Atty. at Law, Inns of Court, Beekman St., who will forward them to me by the earliest opportunity. During the next summer I intend to visit the western part of this State, also Ohio and Michigan. I shall devote a large portion of my time to the collection of the plants, etc., of the places I visit. If you know of any interesting localities, or where any interesting plants could be procured, please inform me, and I will endeavor to obtain them for you.

Respectfully yours,

PROF. JOHN TORREY, New York. ASA GRAY.

†When he went to Cambridge in 1842 he presented to Harvard College the collection of minerals that he had made previous to going to New York. The collection, which contains some valuable specimens, is still in the possession of the university.

there, he issued the first century of his *North American Gramineæ* and *Cyperaceæ*. A second century was issued shortly after, but the work was never completed. He stayed with Dr. Torrey till the spring of 1834, and then returned to Mr. Bartlett's school, intending to resume his work at the college after the summer vacation. The financial condition of the college, however, prevented this, much to his disappointment, but, shortly after, in 1836, through Dr. Torrey's kindness, he received the appointment of Curator of the New York Lyceum of Natural History. His first botanical papers were read before the Lyceum, in December, 1834, and were entitled *A Monograph of the North American Rhyncosporæ* and *A Notice of Some New, Rare, or Otherwise Interesting Plants from the Northern and Western Portions of the State of New York.* In 1836 he published his first text-book, *Elements of Botany*, a work conspicuous for its clear and sound reasoning and original thought. It treats of the principles of morphology, histology and vegetable physiology, and prepared the way for the Botanical Text-Book.

In 1835 or 1836 Dr. Gray was appointed botanist of the exploring expedition to the South Pacific, under Capt. Wilkes. During the long delays which attended the setting out of the expedition, preliminary work on the North American Flora, which had been many years before planned by Dr. Torrey, was begun. When the Wilkes expedition finally started, Dr. Gray resigned his position as botanist, and became Dr. Torrey's assistant in the new Flora. The work was arranged according to the Natural System, and in its scope was to be far ahead of anything that had hitherto appeared.

In 1838, Dr. Gray received the appointment of Professor of Botany in the University of Michigan, though he never filled the chair. He continued to work with Dr. Torrey in New York and, in July and October, 1838, Vol. I, Pts. 1 and 2 of the *Flora of North America* were published. In November of this year he sailed for Europe, to consult the various herbaria, which contained large collections of American plants made by foreign collectors. He visited England, Scotland, France, Germany, Switzerland, Italy and Austria, and met all the eminent botanists of the day, forming life-long friendships with some of them. His acquaintance with Sir J. D. Hooker dates from this time. He worked incessantly wherever he went and returned to America well stored with information for the continuance of the Flora.* Vol. I, Pts. 3 and 4 of the Flora were published in June, 1840, completing the volume of 711 pages. Vol. II., Part 1, appeared in May, 1841, Pt. 2 in April, 1842, while Pt. 3, completing the volume of 504 pages, was not published till February, 1843, after Dr. Gray had gone to Cambridge. Here the work was stopped, till it was resumed long after, single-handed, by Dr. Gray. The pressing professional duties of the two associates, besides the constant work required in elaborating and publishing the large collections that were constantly being brought in from different parts of our country, necessitated the suspension of the work, at least for the time.

In 1842, while visiting Mr. Benj. D. Greene in Boston, he accepted an invitation from President Quincy, Mr. Greene's father-in-law, to take the chair of Fisher Professor of Natural History in Harvard University, a position which he occupied till his death. Under him have grown up the vast herbarium and botanical library and garden, which, at the time of his going to Cambridge, were still in their infancy. At that time there was a single greenhouse, no herbarium, and but few botanical works. For eight years there had been no head at the Botanic Garden, since Thomas Nuttall resigned his position as curator, in 1834, to which he had been appointed in 1822, on the death of William D. Peck, the earliest and only professor before Dr. Gray. The Cambridge Botanic Garden was established in 1805, and Prof. Peck was appointed to direct it, as well as to give botanical lectures in the University. Through lack of funds, however, but little material of value for research was collected till Dr. Gray's accession.

Mr. Peck built the house in Garden Street which has been the home of Dr. Gray for so many years and from which have come so many valuable works. The large and comfortable study, added in 1848, faces the south and east and looks out upon the garden, blooming with plants all through the growing season,

*A detailed account of this trip is given by Prof. C. S. Sargent, in the New York Sun for January 3d, 1886.

while especially prominent is the great family of the Compositæ, to which Dr. Gray has been so devoted. You were almost always sure, on going past the house to the herbarium, to see him either working at his study table, which was in the centre of the room, or bending over his microscope, which stood in the east window. A fireproof building, annexed to the house in 1864, contains the Library and Herbarium, both the gift of Dr. Gray, who said to the writer not long ago, "I have been all my life accumulating this library for you younger botanists to work with." The library now contains about 8,000 books and pamphlets, while the Herbarium ranks among the leading herbaria of the world.

In 1842 appeared the first edition of *The Botanical Text-Book*, comprising an Introduction to Structural and Physiological Botany and the Principles of Systematic Botany, with an account of the chief natural Families of the vegetable Kingdom, and notices of the principal officinal or otherwise useful plants. This work was published shortly after his removal to Cambridge, having been written previously in New York, in the midst of his other engrossing labors. This work, so ably written in that clear and lucid style that characterizes all his writings, quickly passed through the first edition, and a second, third, fourth and fifth edition appeared in the years 1845, 1850, 1853 and 1857. Volume I of the sixth and last edition, published in 1879, under the same title, was entirely new, the other editions having been rewritten in good part. This edition it was decided to divide into distinct volumes, to better treat of the wide range of subjects, Dr. Gray writing the first part, which treats of Structural Botany or Organography on the Basis of Morphology, to which is added the principles of Taxonomy and Phytography and a Glossary of Botanical Terms. Volume II, on Physiological Botany, by Prof. Geo. L. Goodale, was published in 1885. Volume III, on Cryptogamic Botany, by Prof. Wm. G. Farlow, is soon, it is hoped, to appear, while Volume IV, on the Natural Orders of Phænogamous Plants, Dr. Gray, said nearly ten years ago, that he rather hoped than expected himself to draw up. It is certainly not to be wondered at that he never accomplished it.

In 1846 he published, in the Memoirs of the American Academy, *Chloris Boreali-Americana*, being illustrations of new, rare or otherwise interesting North American plants, selected chiefly from those brought into cultivation at the Botanic Garden of Harvard University, Cambridge. This work was illustrated with ten plates. Only the first decade appeared. In 1848 was published his *Genera Americæ Boreali-Orientalis Illustrata*, beautifully illustrated with figures and analyses from nature by Isaac Sprague. A second volume appeared in 1849. These two volumes contained one hundred and eighty-six plates, but unfortunately the work was not continued.

Dr. Gray's wonderful power of making botany interesting to the young is shown in his Botany for Young People. The first book on this subject is entitled *How Plants Grow*, and was published in 1858. It gives a simple introduction to Structural Botany, with a popular flora of common plants, both wild and cultivated, profusely illustrated. Many a botanist of the present day looks back with grateful recollections of the first impulse given to him in his botanical infancy by this book. The other book of this series is *How Plants Behave*, published in 1872, being a description in the very simplest language of how plants move, climb, employ insects to work for them, etc.

In 1868 was published *Field, Forest and Garden Botany*, being a simple introduction to the common plants of the United States east of the Mississippi River, both wild and cultivated. Those who have used this book know how useful and indispensable it is in studying the plants of the garden. Dr. Gray was never satisfied with this work, and hoped to entirely revise it within a few years. In 1848 appeared a work, which, perhaps, more than any other, has been the constant companion of botanists of the Northeastern United States, both at home and in the field. To all those interested in a knowledge of our plants, the *Manual* is a household word. This book was entitled *A Manual of the Botany of the Northern United States*. It has passed through five editions, the last appearing in 1867. Of this there have been eight issues. The first edition included the region from New England to Wisconsin, and south to Ohio and Pennsylvania, inclusive. It afterwards embraced all the country east of the Mississippi River and north of North Carolina and Tennessee.

In 1857 he published his *First Lessons in Botany and Vegetable Physiology*, with a glossary of botanical terms, largely used as a text-book for educational purposes. This book Dr. Gray entirely revised and published in 1887, under the title *Elements of Botany*, and it is a very interesting fact that he should have given to this, his last text-book as well as his last published work, the same name that he had previously given to the first one, published over fifty years before. The two books are a most fitting Alpha and Omega to his industrious life. He always spoke with much enthusiasm in regard to this revised work and seemed much pleased with the result. It is interesting to compare the two editions and to see how many of the definitions Dr. Gray found it impossible to improve upon, though thirty years had elapsed since the publication of the first edition. The greater part of the work, however, is much changed to keep pace with the advance of the science.

For thirty years following Dr. Gray's assuming the professorship at Cambridge, he was constantly engaged in his professional duties, beside building up the library and herbarium and taking charge of the garden. His former pupils are now scattered far and wide, many of them among our leading botanists, who cherish the warmest remembrances of a man who so patiently and skillfully guided them in their early studies. During all this period our country was being explored farther and farther to the west, and fresh material, collected by botanists on government expeditions and surveys, was pouring in to the Botanic Garden. The careful elaboration and publishing of these collections was done with a masterly hand, and appear, with the many contributions to botanical science which Dr. Gray was constantly making till his death, in the Proceedings and Memoirs of the American Academy of Arts and Sciences; American Journal of Science, of which he was associate editor in 1871; Annals of the New York Lyceum of Natural History; Smithsonian Contributions to Knowledge; North American Review; Journal of the Boston Society of Natural History; Proceedings of the Philadelphia and California Academies of Natural Science; The American Naturalist; Government Reports; Botanical Gazette; in the BULLETIN, beside Hooker's Journal of Botany and the Journal of the Linnæan Society.

Among them may be mentioned accounts of collections of plants made in 1846 by Fendler, in New Mexico; in 1849 by Chas. Wright, near the Texan boundary of the U. S.; in 1851 and 1852 by Geo. Thurber, botanist to the Mexican Boundary Survey; and in 1845-6 and 1847-8 by Dr. F. Lindheimer, in Western Texas, in which Dr. Gray was aided by Dr. Geo. Engelmann; *Forest Geography and Archæology*, delivered in 1878 before the Boston Natural History Society, and published in the American Journal; *Science and Religion*, delivered before the divinity school at Yale College, on the subject of the Darwinian theory and published in book form in 1880, and many others. His botany of the Wilkes expedition, published in 1854 with one hundred handsome plates, is alone a monument to him.

Dr. Gray's position in regard to Darwinism is a very interesting one. A man of the deepest religious convictions, thoroughly imbued through his whole life with a firm and reverent belief in the Divine Creator of all things, he accepted scientifically and in his own fashion, he said, the theory of Charles Darwin, while philosophically he was a convinced theist. His paper on the *Diagnostic Character of Certain New Species of Plants*, collected by Chas. Wright in Japan, with *Relations of the Japanese Flora to that of North America*, remarkable for its clear and lucid reasoning, shows plainly his ideas on the theory of distribution, while in the next year, March, 1860, was published in the American Journal his *Review of the Origin of Species by Chas. Darwin, published in London in* 1859. In this article he refers to Robert Chambers as "The shadowy author of the Vestiges of the Natural History of Creation," a work which appeared in 1844 and found little favor with Dr. Gray, who says, "He would explain the whole progressive evolution of Nature by virtue of an inherent tendency to development, thus giving us a word in place of a natural cause." Of Darwin's treatment of the question he speaks with enthusiasm, though he thinks there are still many important questions unsolved. He does not consider the Survival of the Fittest in the Struggle for Life by Natural Selection incompatible with devout theism, and he says, "We leave it for profounder minds to establish, if they can, a rational distinction in kind, between his (the Creative Mind) working in Nature, carrying on operations, and in initiating those operations."

September 5, 1857, Dr. Gray received a letter from Darwin, explaining briefly his theory of Natural Selection, so that he must have been seriously considering these views before the publication of the Origin of Species. Darwin, in a letter to A. R. Wallace, dated May 18, 1860, says of this work, "Asa Gray fights like a hero in defence," while Francis Darwin, in the Life and Letters of Chas. Darwin, London, 1887, says, "Asa Gray fought the battle splendidly in the United States." His various essays and reviews pertaining to Darwinism were collected and published in 1876, in a book entitled *Darwiniana*, and include papers from the American Journal, Atlantic Monthly, The Nation, Nature, New York Tribune, a paper on *Evolutionary Teleology*, and a paper on *Sequoia and its History; the Relations of North American to Northeastern Asian and to Tertiary Vegetation*, read before the American Association for the Advancement of Science, at Dubuque, Iowa, August, 1872, on the occasion of his retiring from the Presidency. In this able paper, he explains the isolation of these giant trees on the theory of the Survival of the Fittest, and refers back to past geologic times, when Sequoias played a more important part on the surface of our globe. To show how Dr. Gray's mind was stored with information ready to be called into use at any moment, he said, on presenting a printed copy to the writer, that he wrote it in the cars while on his way from California to Dubuque.

In 1873 Dr. Gray was relieved from active duties in the college, beyond the care of the herbarium, while retaining his professorship, and enabled to devote much more of his time to his literary work. And now he began the continuance of the old Torrey and Gray Flora, but on quite a different plan. Over thirty years had passed since the last volume of the Flora was published and, during that time, a rich fund for the prosecution of the work had accumulated, in the shape of the many valuable botanical contributions written by Dr. Gray and others, and the richly-stored herbarium at Cambridge. The old Flora being now antiquated and rare, it was determined not only to complete the work, but to re-write entirely the older portion. Dr. Gray brought to this great work the experience gathered by close application and study during his whole life, and published in 1878, Volume II, Part 1, of *The Synoptical Flora of North America* (Gamopetalæ after Compositæ.) In 1884 appeared Volume I, Part 2 (Caprifoliaceæ Compositæ), thus completing the great division of the Gamopetalæ. This last publication covers the same ground as Volume II of the old Flora, and may well be called the crowning work of his life. It is almost entirely devoted to the Compositæ, an order to which Dr. Gray had given the closest attention, both in this country and in the herbaria of Europe. The interest awakened among American botanists by his *Studies of Aster and Solidago in the Older Herbaria*, published in the Proceedings of the American Academy in 1882, shows how eagerly the publication of the volume was awaited. In 1886 supplements were published to each part and bound with the two parts in a single volume. This great work at once raises Dr. Gray to the highest rank among the systematic botanists of the world.

On the occasion of Dr. Gray's seventy-fifth birthday, the 18th of Nov., 1885, the botanists of North America, led by the editors of the Botanical Gazette, presented to the distinguished botanist a handsome silver vase, with the inscription, "1810, November eighteenth, 1885. Asa Gray, in token of the universal esteem of American Botanists." The vase, a full account of which appeared in the Gazette at the time, was beautifully embossed with flowers peculiarly appropriate to the occasion. Prominent among them and fitly commemorating the name of our beloved friend and teacher, were *Grayia polygaloides*, *Lilium Grayi* and *Notholæna Grayi*.

A silver salver, accompanying the vase, received the cards of the givers, and was marked with the inscription, "Bearing the greetings of one hundred and eighty botanists of North America to Asa Gray on his 75th birthday, Nov. 18, 1885." It was a beautiful tribute to a man so universally loved and honored.

Dr. Gray was married in 1848 to Jane L. Loring, the daughter of the late Hon. Chas. G. Loring, one of the most distinguished lawyers of the Boston bar. She was a most devoted companion and assistant in all his labors, and accompanied him on most of his journeys. After assuming the Professorship at Cambridge, he made five trips to Europe, the first time being in June, 1850, when he and Mrs. Gray went to England by a sailing vessel, the principal reason for the trip being to work up the plants of the Wilkes expedition. They travelled in Switzerland, and at Geneva Dr. Gray worked for a while in De Candolle's herbarium. From there they went to Munich and saw Von Martius, the distinguished naturalist and traveller, whose work on the palms is one of the most valuable contributions to science. This was the renewal of a warm friendship formed in 1839. They returned by Holland to England and, early in October of the same year, went into Herefordshire to the country place of George Bentham, where they spent two months, Mr. Bentham going over, with Dr. Gray, the collection which he had taken out with him from America on this visit. At Christmas time they went to Kew, where Dr. Gray worked in Sir William Hooker's herbarium, which was then in his own house; and also in the British Museum, Robert Brown being at the time there. Dr. Gray says of this distinguished man, that he, "Next to Jussieu, did more than any other botanist for the proper establishment and correct characterization of natural orders." From Kew they proceeded to Paris, where for six weeks Dr. Gray worked at the Jardin des Plantes and in P. Barker Webb's herbarium, and then, returning to England, they sailed for America by steamer in August, 1851.

The second trip to Europe was a short one, occupying from August to September, 1855, when Dr. Gray went to Paris to bring home his brother-in-law, who had been ill there with typhoid fever. He saw, however, some of his old friends. In September, 1868, Dr. Gray again sailed for Europe with his wife, and spent the autumns of 1868 and 1869 at Kew, hard at work. He also worked in Paris, Munich and Geneva, and visited herbaria over a large part of the continent. On this trip, however, he took more holidays than in any journey except the last. In December, 1868, they went up the Nile in Egypt, and returned to Cairo in March, passing twelve weeks in a "dahabeeah" with a family party. Dr. Gray did a little botanizing, but said that a land that had been cultivated 5,000 years was a poor land to botanize in. However, when the desert was within reach, as it occasionally was, and they landed for a walk, he made some specimens and he would say that the desert had more plants in half an hour, than cultivated Egypt in a week. They ascended the river as far as Wady-Halfa, in Nubia, where the cataracts stop navigation. They returned home to America in November, 1869. Again, early in September, 1880, Dr. and Mrs. Gray went to Europe, and this time Dr. Gray saw the Herbarium at Madrid and worked for some time in Paris, and for a long time at Kew, the British Museum, etc. Plants were also sent to him from German herbaria and the Jardin des Plantes, etc., to assist his studies at Kew. He worked also in some of the Italian herbaria. They sailed for home by the end of October, 1881.

The last trip to Europe was taken in April, 1887. This journey was mostly a holiday one, though Dr. Gray did some work at Kew, besides going over the Lamarck herbarium at the Jardin des Plantes in Paris. Three universities honored themselves by conferring degrees upon Dr. Gray at this time. When the University of Cambridge bestowed the degree of Doctor of Science, Dr. Sandys closed his address, which was written in Latin, in the following words, "This man who has so long adorned his fair science by his labors and his life, even unto a hoary age, 'bearing,' as the poet says, 'the white blossoms of a blameless life,' him, I say, we gladly crown, at least with these flowerets of praise, with this corolla of honor (His saltem laudis flosculis, hac saltem honoris corolla, libenter coronamus.) For many, many years may Asa Gray, the venerable priest of Flora (Floræ sacerdos venerabilis), render more illustrious this academic crown!" The University of Edinburgh conferred the degree of LL.D., and the University of Oxford that of D.C.L. He was also at this time elected an honorary member of the Literary and Philosophical Society of Manchester, England.

There was scarcely a society of note, either in this country or in Europe, that did not claim Dr. Gray as an active, foreign, honorary or corresponding member. His name is connected with seventy different societies, from many of which he received distinguished honors. His first degree was an M. D. in 1831, from the College of Medicine and Surgery, at Fairfield, N. Y. Among others, were an A.M. in 1844 and a LL.D. in 1875, both from Harvard University. He was elected a Fellow of the American Academy in 1841 and was its President from 1863 to 1873. In 1850 he became a Foreign Member of the Linnæan Society of London and, in 1852, a Corresponding Member of the British Association for the Advancement of Science. In 1878 he was elected a Corresponding Member of the Academy of Science of the Institute of France.

Dr. Gray made three trips to California, the first one in 1872. The next one lasted nearly four months, beginning in July, 1877. Mrs. Gray and Sir J. D. Hooker were of the party. They travelled a good deal in Colorado and the Sierra Nevada Mts., going as far north as Mt. Shasta in Northern California. The third trip was in 1885, by way of New Orleans, New Mexico and Southern California, as far north as Chico. From El Paso the party made a detour into Mexico. They left in February, returning early in May. Dr. Gray visited the Alleghany Mts. four times, the first trip being in the summer of 1841, when he visited Grandfather and Roan Mts. in North Carolina. On the second trip, in 1843, he was accompanied by Mr. W. S. Sullivant of Ohio, and on the third trip, in 1876, by Mrs. Gray, Mr J. H. Redfield, Mr. Wm. M. Canby and Dr. and Mrs. Geo. Engelmann. On the last occasion, in 1879, a large party was formed, who visited Roan Mt. and other localities and, especially, the interesting spot where *Shortia galacifolia*,* with its romantic history which identifies the little plant so closely with Dr. Gray, still grows.

After Dr. Gray's last return from Europe, he pressed on with renewed zeal, to complete Vol. I, Part 1, of the Synoptical Flora, which was to embrace the Polypetalæ. The work had been far advanced already through his own labors and those of his able co-workers, Dr. Sereno Watson and others. Much had been done, but much remained to be done. All the botanists of North America, in particular, were anxiously waiting and praying

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*Gray in Am. Journ., Jan., 1872, and Dec., 1878. Wild Flowers of No. Amer., by Geo. L. Goodale, M. D. with colored plate, Vol. I, p. 107.

that the life of their master might be spared to complete this his last monument. It was ordained otherwise. On the 28th, of Nov., 1887, while working on the Grape Vines of North America, included in the order Vitacæ, he was stricken with paralysis, and for just nine weeks, he lingered between life and death. His recovery was impossible, and on the 30th of Jan., 1888, he quietly breathed his last. His death is a great blow to American botanists and a sad loss to his wide circle of friends. His light step and cheery voice will be sadly missed from the Cambridge Herbarium. Ever ready to assist and counsel those who came to him for advice, he leaves behind him many sad but grateful hearts. But he still lives in his works, and as long as the science of botany is studied, his name will be a familiar one.

The funeral services took place on Feb. 2nd, in Appleton Chapel, Harvard University, and were conducted by the Rev. Alex. McKensie, who made an impressive address, and by the Rev. F. G. Peabody, who read passages from the Bible. The floral decorations were very simple but beautiful, consisting of evergreens and wreaths of white flowers, which were arranged on and around the pulpit. On the coffin lay two palm leaves. The music was sung by a choir of boys, and the last hymn, a favorite of Dr. Gray's, and one which he had requested might be sung at his funeral, was as follows :

O thou true life of all that live!
Who dost, unmoved, all motion sway;
Who dost the morn and evening give,
And through its changes guide the day;

Thy light upon our evening pour,
So may our souls no sunset see;
But death to us an open door
To an eternal morning be.

The pall-bearers were Dr. Morrill Wyman, Mr. Epes Dixwell, Dr. Sereno Watson, Prof. Jos. Lovering, Prof. Fred. G. Putnam and Prof. D. C. Eaton. The interment took place at Mt. Auburn with a prayer at the grave. Dr. Gray's influence on the science of American Botany can hardly be over-estimated, and the world is richer for his having lived in it.

Studies in the Typhaceæ.

BY THOMAS MORONG.

II.—SPARGANIUM.

Plate LXXIX.

Taking the three orders, Aroideæ, Typhaceæ and Pandaneæ, as the descendants of a common ancestor, to which, among surviving species, *Arum* bears the greatest likeness, *Sparganium* and *Pandanus* appear to have diverged the most widely of all the groups. Indeed, as Sir J. D. Hooker observes, the two might, were the inflorescence alone considered, be regarded as belonging to the same genus. In aspect and habit, however, they differ greatly, and *Sparganium* still retains the monœcious character of *Arum*.

The floral leaves or bracts of *Sparganium*, referred to in a previous paper as the representatives of the former spathes, are variously situated as regards the heads. Some of them are immediately underneath, and others remote from the heads, while in other cases the heads stand upon peduncles. The uppermost, which subtend the staminate heads, are small, thin and caducous, like the spathillas in *Typha*, or, at the extremities of the inflorescence, obsolete.

The perianth is composed of scales which have a linear limb somewhat broader at the base and spreading at the summit into a flat, rounded or spatulate, dentate apex. The male flowers are apparently arranged in clusters that consist of five stamens on thread-like filaments with about three scales intermixed, the scales thus occupying a place similar to that of the male bracts in *Typha*.

CORRECTIONS.—In the paper on *Typha* in the January number of the BULLETIN, 1888, on p. 6, under the figures of *T. angustifolia*, No. 6 is erroneously printed "*style;*" it should be "*stigma.*"

On p. 5, in the table of classification, under B II., is quite a serious error. The heading should read "Stigmas linear, female flowers *with* bracts," not, as printed, "*without* bracts."

My attention has also been called by a friend to the statement on p. 3, third line from the bottom, "setæ girding the base of the stipe" as being inconsistent with the figures delineated, which represent the setæ as running up the whole length of the stipe. It would have been more accurate had I said that the setæ which are, for the most part, attached to the lower portion of the stipe, frequently run nearly up to the ovaries in clusters. The figures were drawn from examples of the latter kind. in which the ovaries occur a considerable distance up the stipe: they are often low down.

In the female heads the scales are larger than in the male heads, and form a well marked calyx, from four to seven being attached to a single flower. The normal number of pistillate scales is four or five, corresponding with the number of the angles on the fruit, but often two or three others occur outside of these.

The pollen consists of single grains which are globular, with a smooth surface, and very similar to those of *Typha angustifolia*, being in *S. eurycarpum* $\frac{1}{1000}$ to $\frac{1}{800}$ inch in diameter, and somewhat smaller in *S. simplex*.

The stigmas are unilateral, lying along the upper portion of the style for a considerable distance from the apex. When the style is cleft, as is often the case, both divisions bear stigmas on the ventral side, and when the style is simple the stigmatic portion is on the upper side. The simple styles as they project from the heads curve slightly upwards so that the pollen falling from the anthers is more easily caught by the stigmas.

Most of the species bear double stigmas, either frequently or occasionally, and, of course, in such the ovaries are two-celled and two seeds are formed. One of them, however, is generally suppressed by abortion so that the perfected fruit is single. The number of stigmas, therefore, is not a safe character to use in specific distinctions, except when taken in connection with other characters. The length of the stigmas, also, is variable, even in the same form, and but little reliance can be placed upon it in classification. The fruit-characters must form our chief ground of distinction in any accurate determination of the species.

These points should be kept in mind in estimating the attempt made in this paper to classify the members of this genus comprehensively. I am not aware that any effort has been made to do this heretofore. Dr. Geo. Engelmann, whose lamented death has left a large void in our list of American naturalists, divided most of the North American species into groups for the 5th edition of Gray's Manual; but his division is, of course, limited, and founded upon subordinate characters. The summary now presented is based upon an examination of our North American forms, all of which, so far as known, have been carefully studied. Some of the foreign species, however, are not contained or not well represented in any trans-Atlantic herbarium, and consequently this summary must be considered as, to a certain degree, provisional, which a broader knowledge of the species may modify.

I have been compelled reluctantly to differ from Dr. Engelmann as to the relations and proper names of some of the forms. It does not seem to me possible to include *S. androcladum* under *S. simplex* as a variety, although they are undoubtedly closely allied. Not only does the former reach stouter proportions, but its inflorescence is branching, and sometimes almost as widely branching as that *S. eurycarpum*, and its fruit is larger and coarser. Besides this, *S. androcladum* is more aquatic in its habits than the other. I was fortunate enough during the last summer to light upon a very interesting proof of the relationship existing between this form and the deep water plant known as *S. simplex, var. fluitans, Engelm.* On the edges of a pond in the neighborhood of my home, and in several widely separated localities, *S. androcladum* grew in abundance. From the banks the plants ran down into the water until they reached a depth of four or five feet, the leaves gradually increasing in length and thinness and finally becoming floating, while the stems became more and more slender, and the inflorescence, which ceased at a depth of two or three feet, manifested a decided approach to the "*fluitans*" condition. This was not a case of submergence by flood, as the water was lower than usual by several feet, showing that the plants sought the water spontaneously. One step further and the plant becomes so much altered as to appear quite distinct from the parental form, warranting us in distinguishing it as a variety.

Nor am I able to agree with Dr. Englemann in regarding the distance of the floral leaves from the pistillate heads, or the proportionate length of the styles and stigmas as affording good varietal distinctions, these variations being very common and very inconstant. Judging by them alone, I have been continually perplexed to decide what is *S. simplex type*, and what "v. *Nuttallii*," what "v. *fluitans*," and what "v. *angustifolium*."

In separating the species, the simple or branching inflorescence might at first view seem to sufficiently designate the larger groups, but such a grouping is unnatural as it associates species which in reality are quite dissimilar. A more natural character is found in the shape and basal termination of the fruit. The form of the inflorescence may be used subordinately, after this the comparative number of the stigmas, and finally the terrestrial or floating habit, and the size of the fruit and styles.

Embodying these principles I am led to adopt the following classification, and to give afterwards a more detailed description of the American forms.

A.—FRUIT SESSILE AND COMPARATIVELY BROAD.

I.—INFLORESCENCE SIMPLE.

S. subglobosum.

II.—INFLORESCENCE BRANCHING.

1. Stigmas commonly 2, occasionally 1.
   S. eurycarpum, Engelm.
2. Stigmas commonly 1, occasionally 2.
   S. ramosum, Curtis, *S. Greenei*, *S. neglectum*, Beeby.

B.—FRUIT STIPITATE AND COMPARATIVELY NARROW.

I.—STEMS ERECT OR FLOATING, INFLORESCENCE BRANCHING.

S. androcladum, Eglm.; var. *fluctuans*. Possibly the true *S. natans* of Linnæus and Fries belongs here.

II.—INFLORESCENCE SIMPLE.

1. Erect or floating, styles and fruit conspicuous, leaves triangular except when floating.
   S. simplex, Huds., var. *angustifolium*, (Michx.), Engelm. *S. fluitans*, Fries, if really a distinct species, would belong here, but perhaps it is nothing more than a form of *S. simplex*.
2. Usually floating, stems very slender, fruit and styles small, leaves flat.
   S. minimum, Fries. *S. hyperboreum*, Læst.
   S. oligocarpon, Angstr., as figured and described in Fl. Dan. Supp., Tab. 172, might belong to *S. minimum* or *S. hyperboreum*. It seems to be very rare, and its rank not fully established.
   S. Greenei and *S. neglectum* are evidently transition forms, as the more sloping summit and narrower outline of their fruit show. (See Figs. 3 and 4 in the plate.)

The North American species are as follows:

1. *S. eurycarpum*, Engelm. (Gray. Man., Ed. 5, p. 481.)

The largest member of the family, 9dm.–15dm. high. Prof. E. L. Greene sends a specimen which he has named *S. Californicum*,* but which I am unable to separate from *S. eurycarpum*, which measures 26 dm. in height and the leaves over 26 dm. long. The heads are numerous on the widely branching inflorescence—the staminate from six to fourteen on a branch, the pistillate

*Paper read before the Cal. Acad. Sci., Feb. 4, 1884, p. 4.

usually two and sessile or more commonly on peduncles 1½-5 cm. in length; when ripe the fruiting heads 2-3 cm. in diameter; mature nutlets thick, hard, 8-10 mm. long, irregularly and obtusely four to five angled, wedge-shaped, truncate at the apex, the top rounded, flattened or depressed, abruptly tipped with the style; scales as many as the angles on the fruit, and often several exterior ones, half as long as the fruit or more, expanding into a spatulate apex, which is commonly eroded on the edges.

As stated by Dr. Engelmann in Gray, Man., Ed. 5, p. 481, this species has often been confounded with the European *S. ramosum*, Curtis, which does not occur in this country. It differs from that not only in the greater size of the plant, which would not be of much importance in itself, but in the magnitude of the fruit (as may be seen in fig. 2 in the plate, where the two are represented in contrast), and also in the number of the stigmas. *S. eurycarpum* differs still more widely from the European *S. neglectum*, the fruit of which is outlined in fig. 4.

Virginia to California and northward to Lower Canada. I have seen no specimens from our Southern States or north of Ontario.

2. S. Greenei, n. sp.

Quite similar to *S. eurycarpum* in general appearance. Stem 9-15 dm. in height; inflorescence about 3½ dm. long, rather narrower in outline than in *S. eurycarpum*, and the branches rising at a sharper angle. Pistillate heads two on a branch and sessile, the staminate 10-17; ripe fruiting heads 15-23 mm. in diameter; nutlets fusiform, 9 mm. long by 5 broad, widest part a little more than a quarter of the length from the summit, obscurely angular, tapering to the base; about one third of the stigmas in a head are double and they are as long as the styles, and both together not far from 4¼ mm. in length; leaves similar to those of *S. eurycarpum*, triangular, channelled and partly clasping at the base and flattened towards the apex, the largest 12 mm. wide by 16 cm. long. The fruit is shown in fig. 3.

This interesting plant was collected by Prof. E. L. Greene, in Sept., 1887, at Olema, Marin Co., California. It gives me great pleasure to name it for the acute and enthusiastic botanist to whom we owe its discovery.

3. S. ANDROCLADUM, (Engelm.) (*S. simplex*, Huds., v. *androcladum*, Engelm., in Gray, Man., Ed. 5, p. 481. *S. ramosum*, Chapm. South. Fl., 443.)

Stems erect, slender, 2½-6 dm. high; the inflorescence 10-25 cm. long, usually close and narrow and bearing but few branches, but sometimes branching extensively. A specimen kindly given me by Dr. C. W. Swan, which was collected by Mr. L. L. Dame on the island of Nantucket, has seven branches and thirty-two heads, all but one of which are staminate. Pistillate heads three to seven, sessile or the lowest peduncled, axillary, or the peduncles and branches axillary; ripe fruiting heads 12-25 mm. in diameter; nutlets fusiform, the body 5-6 mm. long by 3 broad, usually smooth but sometimes obtusely angular at the summit, oftentimes contracted strongly in the middle; with a style and stigma 6 mm. long, the stigmas as long as or shorter than the styles, and occasionally double; stipe nearly 3 mm. long. The plant grows in bogs or shallow water. Sometimes intermediate forms between this and the following are found, reference to which is made on p. 75. This species, as well as *S. eurycarpum*, has often been confounded with *S. ramosum.*

Canada and New England to Florida, and northwest to Vancouver's Island.

Var. FLUCTUANS. (*S. simplex*, Huds., v. *fluitans*, Engelm. in Gray, Man., Ed. 5, 481, *non S. fluitans*, Fries.)

Floating in deep water, with long, slender stems and thin, flat leaves, 3-8 mm. in width. The inflorescence is usually short and close, 6-10 cm. long and 3 or 4 cm. broad, but sometimes quite long and slender, as in a specimen from New Brunswick, belonging to Prof. John Macoun, where the axis of the inflorescence and the lowest branch are each 15 cm. in length and only 2·5 cm. in breadth; ripe fruiting heads 8-12 mm. in diameter.

Much as I dislike to multiply synonyms, it seems necessary to change Dr. Engelmann's name of this plant, for two reasons; first, because it is allied to *S. androcladum* rather than *S. simplex*, and secondly, because Dr. E. named it "var. *fluitans*," under the impression that it is identical with *S. fluitans*, Fr.; but unless that species is something very different from the plants so called which are contained in our great Herbaria, or as described to me by European authorities, our plant is not the same, and it only creates confusion to employ the name.

Pennsylvania, White Mountain ponds and northward.

4. *S. simplex*, Huds. (Fl. Ang., Ed. 2, p. 401.)

Leaves more or less triquetrous, 5-8 mm wide; stems slender, erect, 1½-6 dm. high; inflorescence 5-20 cm. in length; staminate heads 4-6, pistillate 2-4, sessile or the lowest peduncled, supra-axillary or axillary (v *Nuttallii*, Engelm.); ripe fruiting heads 12-15 mm. in diameter; nutlets fusiform or narrowly oblong, obtusely angled at the apex, the body about 4 mm. long, more or less contracted in the middle; stigmas linear, equal to or shorter than the styles; stipe about 2 mm. long.

This is often found in a dwarf state with a stem only 10 or 12 cm. high, leaves short and 2 or 3 mm. wide, and the inflorescence 2 or 3 cm. in length.

Canada to the Middle States, California and northward to British Columbia. (Eu.)

Var. MULTIPEDUNCULATA, n. var,

A form sent from Great Falls, Montana, by Mr. R. S. Williams, which has the heads aggregated, most of them on simple or branching peduncles; nutlets very slender and long-beaked; scales long, slender and toothed; and not infrequently double stigmas.

Var. *angustifolium*, (Michx.), Engelm., in Gray, Manual, Ed. 5, p. 481. (*S. angustifolium*, Michx., Flor. Bor. Am., ii., p. 189;* *S. affine*, Schnizl. Nat. Pfl. Typh., 1845, p. 27.)

Floating in deep water; stems slender; leaves long and narrow, 1-5 mm. wide, flat, with sheaths often inflated at the base; inflorescence 3-10 cm. long; staminate heads 1-4, pistillate 1-4, sessile, supra-axillary or the lower on supra-axillary peduncles, the lowest often remote as a peduncle 4-7 cm. in length; ripe fruiting heads 7-15 mm. in diam.; nutlets often contracted in the middle; stigmas linear or oval, equal to or shorter than the style. In European specimens of this which I have examined the inflorescence is sometimes as much as 20 cm. long, the lowest fertile

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*Dr. Engelmann writes in a manuscript note in my possession that he, himself, has seen Michaux's specimen at Paris. To this name, therefore, belongs the right of priority.

head on a peduncle 10 cm. in length, but I have seen no American specimen equal to this. European specimens, also, sometimes have the lowest peduncle axillary, showing a variation in this respect. Mr. W. H. Beeby, of London, in a letter to the writer, suggests that our plant may be *S. simplex, v. longissimum*, Fries, which greatly resembles *S. affine*, Schnizl., and perhaps some of the forms included here may belong to that variety, a form with which I am unacquainted.

As stated by Engelmann, this plant sometimes occurs in dwarf states, growing nearly out of water, with shorter erect leaves.

Mountain lakes and slow streams, New York, New England and northward, also California and Washington Territory. (Eu.)

5. *S. minimum*, Bauhin. (C. Bauhin, pin. 16 Raji, Herb. Norm. XII., n. 71. Fries, Summa veg. Skand., p. 68, 1845. Called *S. natans* by most of the older writers, but not the true *S. natans* of Linnæus.)

Stems more slender than any of the preceding, varying in height according to the depth of the water in which it grows, 1-10 dm.; leaves thin and lax, 1-5 mm. in breadth; inflorescence 15-40 mm. in length; staminate heads 1 or 2, pistillate 1-3, sessile and axillary, or the lowest on an axillary peduncle 3-20 mm. long; ripe fruiting heads 5-10 mm. in diameter; nutlets top-shaped, (vid. fig. 9) 2½-3½ mm. long, or sometimes elongated to 4 mm.; stipe ½-1 mm. long, or now and then apparently none; styles about 1 mm. in length, of which the oval stigma occupies from ⅓ to ½.

The flowers usually rise to the surface in order to effect fertilization, but sometimes this appears to be done and the fruit perfected when submerged. Occasionally dwarf plants are found growing erect out of the water.

Pennsylvania and New England to Canada and northward; also westward to Oregon and Washington Territory. (Eu.)

6. *S. hyperboreum*, Læst. (In Wikst. Arsberätt, 1850.)

Stem similar to that of *S. minimum*, 20-30 cm. high; leaves usually shorter and narrower, 1-3 mm. broad; inflorescence only 15-25 mm. in length; staminate heads 1 or more, pistillate 1-2, sessile or the lower on a short peduncle which is often supra-axillary; ripe fruiting heads 5-10 mm. in diameter; nutlets oblong, obscurely triangular at the summit; stipe very short; the oblique, oval stigma minute and sessile, or nearly so.

All the North American specimens which I have seen bear imperfect seeds which are so much contracted on the lower half as to appear flat. Outlines of these are given in fig. 10 in the plate, c. exhibiting the thin edge and d. the flat side of the contraction. This species seems much addicted to this imperfection, as in Herb. Gray are quite a number of European specimens showing the same malformation. a. and b. exhibit perfect seeds from European specimens. The fruit of the American plant seems a trifle smaller than that of Europe.

In the drawing there is more of a style represented than there should be, and the stigma is a little too oblique.

Southern Shore of Hudson Bay. J. M. Macoun. Labrador. J. A. Allen. According to Lange (Consp. Fl. Grœn., p. 116), this plant has been collected in Greenland. (Eu.)

To the above should be added an undescribed species from New Zealand, contained in Herb. Asa Gray, which I have called S. SUBGLOBOSUM. It appears to be a floating species, the stem nearly 3 dm. high; leaves longer than the stem, 2-4 mm. wide, in texture much like those of *S. androcladum*, var. *fluctuans;* the simple inflorescence is short, consisting of two pistillate heads which are sessile and axillary; staminate heads lacking on the specimen, but apparently were only two; ripe fruiting heads 8-10 mm. in diameter; fruit subglobose, obscurely angular at the summit, not quite 4 mm. long. by 3 mm. broad; stigma oval, about one-third as long as the style. (See fig. 1.)

The specimen is erroneously labelled "*S. simplex*, Huds., v. *angustifolium*, Engelm."

Coll. at Bay of Islands, N. Zealand, in the U. S. Exploring Expedition under command of Capt. Wilkes.

EXPLANATION OF THE PLATE.

The figures show the fruit of different species, all X 5. 1. *S. subglobosum*. 2. *S. eurycarpum*, enclosing *S. ramosum*. 3. *S. Greenei*. 4. *S. neglectum*. 5. *S. androcladum*, one nutlet showing constriction. 6. *S. androcladum*, var. *fluctuans*. 7. *S. simplex*, one nutlet showing a scale. 8. *S. simplex*, var. *angustifolium*, one nutlet showing constriction. 9. *S. minimum*, one nutlet showing a scale. 10. *S. hyperboreum;* a and b, perfect seeds from European specimens; c and d, imperfect seeds from American specimens; c showing the thin edge, and d the flattened side of the lower half.

Trigger-Hairs of the Thistle Flower.

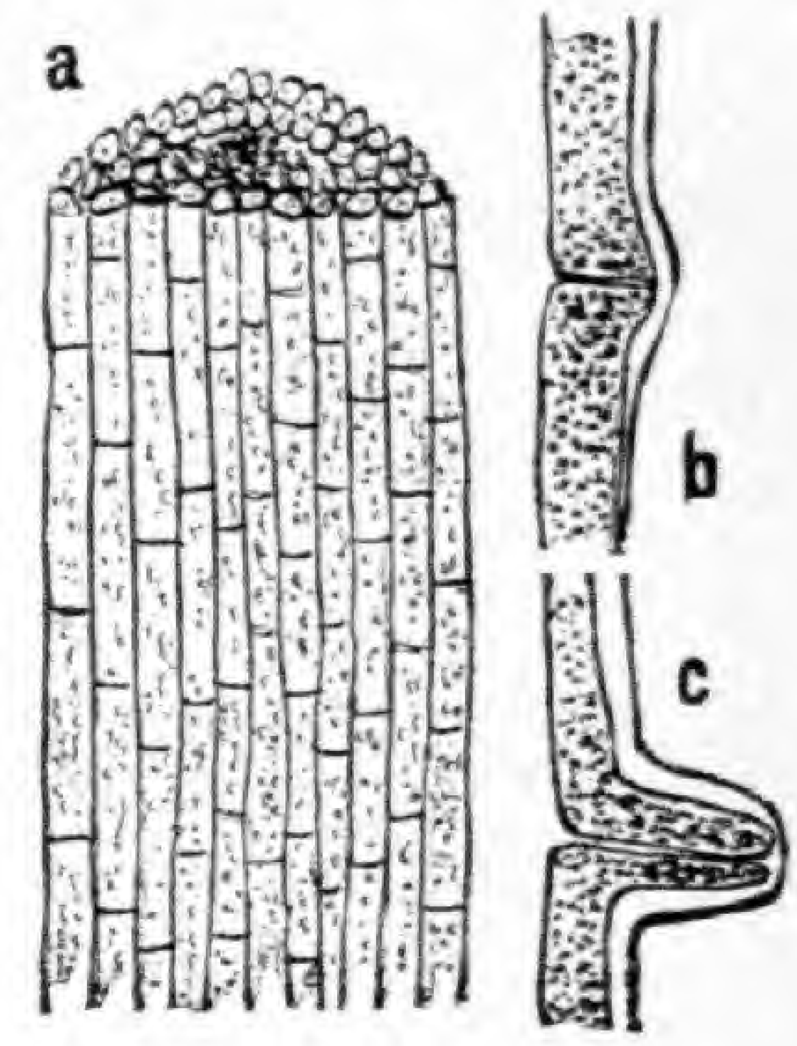
The common pasture thistle (*Cnicus altissimus*, Willd.) is a good subject for the study of sensitive stamens. It is needless to remind the readers of the BULLETIN that the stamens in the thistle flower are five in number and are united by their anthers so as to form a tube, which surrounds the upper portion of the slender style. The filaments are free from each other for some distance below the anther-ring, and in these parts is the seat of the characteristic movements.

A freshly opened flower has the tip of the style within the anther-ring. When such a blossom is touched by a pencil point or needle, the anthers are drawn down and the upper end of the style may be brought through the ring of anthers along with a quantity of pollen adhering to the spinose surface. If, after a few minutes, the flower is touched again, the motion is renewed and the ring is pulled still further down. By irritating the andrœcium upon one of the filaments and then upon another opposite it, the blossom may be caused to sway from one side to the other. In short, those slender filaments are sensitive, and when touched will contract and thereby pull the united anthers downward.

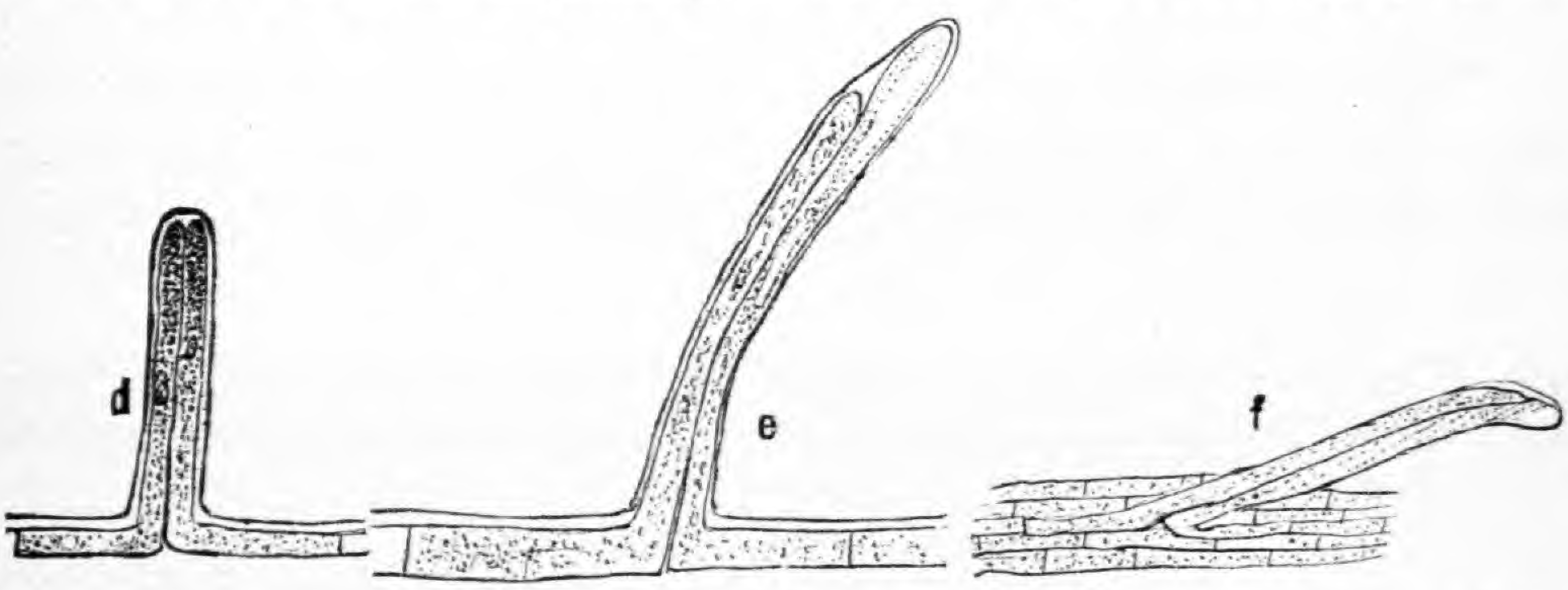
The peculiarities of the movements have led to a microscopic examination of the filaments. They consist of colorless cells, two or three times as long as broad, placed end to end and surrounding a small central bundle of six to ten closely coiled spiral vessels. In transverse section the filament is nearly triangular, the broader side being placed nearest the style. A portion of a young filament is shown at *a*, in the engraving.

Many hairs are found upon the surface of the older filaments, and exhibit a peculiar structure. Each trichome consists of two nearly parallel cells, which extend side by side to nearly the end of the outgrowth. Usually, one of these cells takes the lead, and in an old hair it forms the end, which is somewhat enlarged. The other cell is closely applied to the first and a little below the extremity of the trichome. There is a hyaline outer layer common to the two cells.

It is not difficult to determine the origin and development of these twin-celled hairs, if the filaments are taken for study while young. The surface is at first smooth, as indicated at *a*, and not unlike the exterior of ordinary filaments and similar plant structures. In slightly older stamens it is easy to recognize small enlargements at certain places, where the surface cells meet end to end. Such a minute swelling is indicated in side view at *b*. The ends of these two cells take on a lateral growth and soon become bent at right angles to the surface of the filament. The protoplasmic contents of each cell flow into the free, extended portion, and leave the old epidermal part comparatively empty. The nucleus is plainly visible in the lateral portion, when the hair is not more than half grown.



These trichomes, therefore, originate by the lateral extension of the ends of two adjoining cells, and they evidently play an



important part in the movements of the filaments. The additional figures in the engraving show older stages in the development of the hair. At *c* and *d* the young outgrowths are rapidly developing, and the protoplasmic contents are quite dense near the tips of the cells. Two mature hairs are shown at *e* and *f*, the former in side view, while the latter is looking down upon the surface, and indicates the relative lengths of the cells. From the beginning of the development of the hair, there is an evident common layer over the two specialized cells. This is most apparent when the trichome attains full size, that is when about a millimeter long and 20 to 25 μ broad. The protoplasm was frequently found in rapid circulation in the full-grown cells, and was as favorable for the investigation of this phenomenon by students as any of the standard subjects.

For the lack of a better name, that of "trigger-hairs" is given to these outgrowths. This seems to be descriptive of their use, for when they are touched by the slender legs of insects the impulse is communicated to other parts, and a downward motion of the anther-ring results. This liberates a quantity of pollen at a time and place when it will be most likely to get upon the insect's body and be thereby transferred to some other flower. The structure and the movement are undoubtedly provisions for wide fertilization, and the trigger-hairs are the means by which the visiting insect springs the trap and catches the pollen.

BYRON D. HALSTED.

Bibliographical Notes on well-known Plants.—VII.

BY EDWARD L. GREENE.

CASTALIA and NYMPHÆA.

The learned editor of the Journal of Botany has already * well taken the initiative in that work of readjusting the names of the water-lilies, which the priority of Salisbury's monograph, lately shown in this Journal † has rendered necessary.

Several North American species, not known to Salisbury, and therefore not taken up by Mr. Britten, remain to be named.

NYMPHÆA POLYSEPALA.—*Nuphar polysepalum*, Engelm. Trans. St. Louis. Acad., ii, p. 282 (1865).

NYMPHÆA RUBRODISCA.—*Nuphar rubrodiscum*, Morong. Bot. Gaz., xi, p. 167 (1886).

CASTALIA TUBEROSA.—*Nymphæa tuberosa*, Paine Catal. Pl. Oneida, p. 184 (1865). It can scarcely be doubted that certain specific names, far older than *tuberosa*, were meant for this commonest and most widely dispersed North American water-lily; some published in the latter part of the last century, by Walter and by Willdenow, and others early in the present century, by Rafinesque; but, owing to the meagre descriptions and the lack

* James Britten, Journ. Bot., Jan., 1888, p. 6.

† E. L. Greene, BULL. TORR. BOT. CLUB, xiv, pp. 177 and 257.

of authentic specimens, nothing can be done in the way of restoration, and I adopt here the earliest name which, as it appears to me, can with certainty be applied to this species.

CASTALIA FLAVA.—*Nymphæa flava*, Leitner in Audub. Birds, p. 411 (1838): *N. lutea*, Treat in Harp. Mag., lv, p. 365, (1877), not of Linn.

CASTALIA ELEGANS.—*Nymphæa elegans*, Hook. Bot. Mag. t., 4604 (1851); E. E. Sterns, BULL. TORR. BOT. CLUB, xv, p. 13 (1888).

While it was confessedly Salisbury's privilege, as a post-Linnæan author, to name the two genera of northern water-lilies whose respective characters it may either be that he discovered independently or that he learned them from the pre-Linnæan, Boerhaave, it is not shown, and I think no one will contend that he had a right to coin new specific names for plants which were neither new nor in want of names as species. Yet, without the least excuse he set aside several which had been in constant use by all Linnæan botanists, and one which had been familiar to, and almost universally employed by, all authors for some centuries before Linnæus. This was Salisbury's offense against one great rational principle of nomenclature; this *his* unfaithfulness to his predecessors and contemporaries. Why need we, in our attempts to restore to him his rights, stand by him in his own wrong-doing? The following names and synonyms will illustrate my meaning:

CASTALIA ALBA.—*Nymphæa alba*, Mathiolus, Comm. Diosc. (1558); Valerius Cordus, Hist. (1561); Pena & Lobel, Adv. (1570); Dodoens, Pempt. (1585); Camerarius, Epit. (1586); Tabernæmontanus, Icones, (1590); Gerarde, Herbal, (1633); J. Bauhin, Hist. (1651); Plukenet, Alm. (1691); Ray, Syn. (1696 and 1724); Blackwell, Herbal, (1737); Linnæus, Sp. Pl. (1753); thence all authors, almost to *Castalia speciosa*, Salisb. (1805); Britten (1888).

CASTALIA ODORATA.—*Nymphæa odorata*, Dryander, in Hort. Kew., ii, p. 237 (1803): *Castalia pudica*, Salisb. (1805); Britten (1888).

Proposed Revision of North American Smilaces.

A careful examination of the authorities on *Smilax*, Tourn., and of the Columbia College specimens of this genus, convinces me that no sound and satisfactory revision of the North American species, subspecies and varieties, some thirty in number, can be made without new and complete specimens of most of the forms, and accurate field notes concerning many of them. A complete specimen of *Smilax* includes the base of the stem (at least a foot of it) with enough of the rhizome and root attached to show clearly whether there is any tuberous development; two flowering branches not less than two feet long—one staminate and one pistillate—and a fully matured fruiting branch of equal length. The field notes should state distinctly the habitat, degree of abundance, size, duration of leaf, time of flowering and fruiting, exact color and odor of flowers, and color of fruit while ripening and also when mature; in the case of all anomalous (perhaps hybrid) forms the names of other species growing near should be noted. Anything, however meagre, relating to the genus will be welcome, and I venture to hope that botanists and amateurs throughout the country will aid me in obtaining from their respective sections the necessary material for an adequate (and much needed) revision of our *Smilaces*. Fresh specimens, snugly rolled in newspapers, will be even preferable to exsiccatæ, and will be much less trouble to the sender.

It is believed that *Smilax* is always entomophilous, and accurate observations as to the insects by which fertilization is effected are especially desired.

E. E. STERNS,
23 Union Square, New York.

Reviews of Foreign Literature.

Ueber künstliche Vergrünung der Sporophylle von Onoclea Struthiopteris, Hoffm. By K. Gœbel. (From the Berichte der deutschen botanischen Gesellschaft, Dec. 16, 1887.)

This short paper contains an account of an experiment tried in the botanical garden at Marburg. It begins with a reference to some previous experiments of the author, to show that in a number of organs metamorphosis is a real transformation which may be experimentally proven, and not the ideal, indefinite con ception which has so long been the prevailing notion in regard to plant metamorphosis. In one of these experiments the effort was made to prove that the sporophyllum (fruit leaf or fertile leaf) of *Botrychium Lunaria* was the result of the transformation of a foliage leaf.* Failing to prove this experimentally, the attempt was afterward repeated with *Onoclea struthiopteris* and satisfactory results obtained.

He explains what may be considered experimental proof as follows: It is necessary to show that the beginnings of the sporophyllum and foliage leaf agree, and that it is possible to cause such foundations, as by undisturbed growth would have developed into fertile leaves, to develop into foliage leaves. It is also especially desirable to cause transition forms between foliage and fertile leaves to appear. This is the case because the beginnings of both kinds of leaves, until a relatively late period of development, are so similar that it is only by transition forms that it is possible to determine with certainty whether the organ in question is really a fertile leaf changing to the form of a foliage leaf, or only a common foliage leaf.

Among those ferns which show a difference between fertile and foliage leaves, the genus *Onoclea* is the most striking. The examples chosen for the experiment were large, healthy, well-developed plants. At different times all the foliage leaves were removed, thus causing an abnormally rapid growth of those undeveloped foundations of both foliage and fertile leaves which were already formed.

Naturally, only those plants in which the fertile leaves were already started and whose sterile leaves were unfolded, were of use in the experiment. For example, one whose leaves were removed the 10th of May, before all the foliage leaves had unfolded and probably before any fertile leaves had started, in the course of the summer produced eleven sterile and one perfectly normal fertile leaf. In the other examples the leaves were removed later in the season, after the foliage leaves had unfolded and the beginnings of the fertile ones formed. In these cases the

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*Vergleichende Entwicklungsgeschichte der Pflanzenorgane: Schenks Handbuch III., page 111.

transformation of the fertile to the foliage leaf appeared in the plainest manner and in different stages.

The most marked middle or transition stages, referred to above as so desirable to produce, were shown in the tip or upper half of the leaf becoming green like the real leaf, while the lower part of it was supplied with more or less sori. This is easily understood if we remember that the point of vegetation or growing point of the fern frond remains apical during its entire growth, so the tip might change its character, owing to outside circumstances of too recent date to affect the growth of the lower part. Furthermore, the pinnules of the frond instead of rolling under as in the ordinary fertile leaf, were spread out flat at the tip, this tendency diminishing regularly toward the base. The amount of chlorophyll in the leaf tip was equal to that of the ordinary leaf. At the same time a very remarkable change in the position of the frond occurred. That portion on which the spores had developed retained the usual upright position, while the upper part took on the oblique direction of the sterile leaves. In one case, where the line between fertile and sterile parts was sharply defined, the upper part bent so strongly as to form almost a right angle with the lower. The venation of the fertile leaf was modified somewhat, making it agree more or less closely with that of the foliage leaf. The author holds the most remarkable result of the experiment to be, that as the "vergrünung" advances the development of sori is hindered. When a leaf division changes over to the sterile form before the sori begin to be developed, they are never formed; but when the formation of sori has begun before the leaflet has been subjected to this outward change, then from the apex to the base all the different stages of sorus building can be found. In one extreme case only an indusium was found, indicating that this organ is the first to originate. Other sori had sporangia pretty well developed, but none produced ripened spores. It must be added here that the season proved a very unfavorable one, so that other ferns of the same genus failed to produce ripe spores.

The interpretation of the results of the experiment is confirmed or supported by similar developments occurring on plants growing wild and entirely uninjured by artificial treatment. Such examples have been described by Milde, Luerssen and others, occurring especially on young plants producing spores for the first time.

Onoclea Struthiopteris is said to occupy a high place among vascular cryptogams as regards the variety of leaf development, producing three different kinds, viz.: "Niederblätter," or "Cataphylla," foliage leaves and fruit leaves. The "Cataphylla" have been proven by the author, in other cases, to be transformed foliage leaves, and the same fact is confirmed by the stunted blade of the cataphyllum which is visible to the naked eye. Therefore, the structure of this plant is reduced to a much simpler matter than appearances would indicate. The plant forms only one kind of leaf-rudiment, and this is that of foliage leaves from which, according to certain fixed influences, a certain number are developed into cataphylla, certain others into fruit leaves and the remainder into foliage leaves.

This simple experiment is only one from a long list of morphological investigations carried on by the author, who is best known to us through his text-book, "Outlines of Classification and Special Morphology of Plants." It is of special interest, owing to its simplicity, and at the same time the important bearing it has on the subject of plant morphology.—E. L. G.

Allii Species Asiæ Centralis.—By E. Regel. (Pamph., pp. 8vo. 87, 8 plates; St. Petersburg, 1887.)

This is an enumeration, with descriptions of new species and varieties of the genus *Allium*, as represented in Central Asia, with full localities of the specimens examined. It includes 138 species, most of them restricted in distribution to the region. A conspectus of the species precedes the main portion of the work, five sections of the genus being recognized. Twenty-nine of the species are represented on the plates, which are excellently done.

On the Present Position of the Question of the Sources of the Nitrogen of Vegetation—Preliminary Notice.—By Sir J. B. Lawes and J. H. Gilbert, LL.D. (Proc. Royal Soc., xliii., pp. 108-116.)

The question of the source of nitrogen in plants has long been a subject of discussion and experiment at the several centres of study of agricultural chemistry, and the results reached by the authors of the paper here reviewed are among the most interesting and valuable of any recorded. The present article concisely presents the facts gained and hypotheses suggested by recent observations. While the assimilation of free nitrogen by chlorophyllous plants may be disposed of as not proven, it is assumed by some that it is brought into combination in various ways within the soil under the action of electricity, fungi or micro-organisms, and among the latter the mycorhiza hyphæ of Cupuliferæ, made known by Frank, and the nodules on the roots of certain Leguminosæ have been suspected as agents of nitrification. Drs. Lawes and Gilbert are not inclined to attribute any considerable action to the structures mentioned, but, pointing out that while even the feebly nitrogenous sub-soil of Rothamsted (containing only 0.04% of nitrogen) carries some 20,000 pounds of the element per acre, suggest that the Fungi, etc., may serve the crops by in some way bringing this large store of combined nitrogen into a soluble condition for assimilation.—N. L. B.

Index to Recent American Botanical Literature.

Agricultural College of Michigan—Annual Report, 1887.—L. H. Bailey, Jr. (Bulletin No. 31, pamphlet, 96 pp.; illustrated.)

This contains a good deal of interesting and valuable information on practical horticulture.

Bacteria from a Botanical Standpoint.—Wm. Trelease. (Weekly Medical Review, xvii., pp. 88-92 and 127-131.)

A brief and clear account of these organisms as studied in the botanical rather than the pathological laboratory, though the paper concludes with some pretty strong advice to the physicians of St. Louis regarding the water-supply of the city.

Botanical Institute at Tübingen.—Douglas H. Campbell. (Bot. Gaz., xiii., pp. 1-4; with portrait of Dr. W. Pfeffer.)

Characeæ of America—Part I.—Dr. T. F. Allen. (Pamph., large 8vo., pp. 64, 55 illustrations; New York, 1888; published by the author.)

The very welcome and long expected results of Dr. Allen's prolonged studies of this neglected class of plants come to us in the form of a beautifully printed and illustrated work which must stimulate their investigation, and for the first time affords a ready reference to their structure and classification. It gives explicit directions for their collection, an historical sketch of their location in the system from the time of Vaillant (1719), a detailed account of their morphology and anatomy and the development of their organs, and a synopsis of the species, which is to be followed by complete descriptions in the second part of the work. This synopsis was prepared with the co-operation of Dr. O. Nordstedt, and includes the discoveries down to September, 1887. To give an idea of the number of species known, we note that North America affords thirty-one species of *Nitella*, eight of *Tolypella*, and twenty-eight of *Chara*. There is a still larger number of Old World species, while South America has as yet yielded but few, doubtless because they have not been systematically collected. The genera *Lamprothamnus* and *Lychnothamnus* have not been detected in America. Reference is made to the four valuable sets of Exsiccatæ distributed by the author, and a fifth one is promised. We trust that the publication of this work will cause collectors to search carefully for these plants and communicate specimens to Dr. Allen. Such labors are apt to be well repaid, for there are certainly still many forms unknown to science.

Contributions to the Botany of the State of New York.—C. H. Peck. (Bull. N. Y. State Mus Nat. Hist., i., No. 2, May, 1887; pamphlet 8vo., 66 pp., 2 plates.)

This is mainly devoted to the fungi, with descriptions of fifty-seven new species, of which thirteen are figured. A synopsis of the New York species of *Paxillus, Cantharellus, Craterellus* and viscid *Boleti* is given, and the nomenclature of the New York pyrenomycetous fungi is revised to agree with the system of Saccardo. The following phanerogams have been added to the State flora: *Hieracium Pilosella*, L., *Atriplex hortensis*, L., and *Rhodora Canadensis*, L., the last collected in flower by Mrs. Sampson at Thirteenth Pond, Johnsburgh, Warren Co. Its occurrence on Sam's Point, Ulster Co., is reported in the BULLETIN, vol. x., p. 105. It has also been collected by Prof. T. C. Porter at Succasunna, N. J., thus showing a more southern range than Dr. Torrey attributed to it in the New York Flora.

Distribution and Physical and Past Geological Relations of British North American Plants.—A. T. Drummond. (Canad.

Rec. Sci., ii., pp. 412-423, 457-469, and iii., pp. 1-21.)

This is an extremely minute and laborious study of the geographical botany of Canada, with the relations of the flora of various regions to that of Northern Europe and Asia. The question of the origin of these floras is discussed in great detail. We fail to see that any very important facts are added to the sum of knowledge on this question, but the minutiæ of the investigation are of the greatest interest. Our space forbids a proper presentation of these, and we must merely refer those interested to the above cited journal.

Elements of Botany.—Asa Gray. (Revised Edition, 8vo., pp. 226, Ivison, Blakeman and Company, New York, 1887.)

The preface states that Dr. Gray chose for his first and last school book the same name, with an interval of over fifty years between them. This last one leaves little to be desired, unless the illustrations in sections xvi and xvii had been made entirely anew, while the simplicity and clearness of the style and the comprehensiveness of the plan and glossary will make it the most popular of school books. The first fifteen "sections" look and sound very familiar, but in sections xvi., on Vegetable Life and Work, and section xvii, Flowerless Plants, will be seen the greatest number of changes, so that a pupil having carefully mastered this little book will come to the high schools and colleges amply prepared to do some advanced work in botany. The fact that the preface is dated March, 1887, explains why the mistake on page 168, tenth line, should have escaped Dr. Gray. It is hoped that the publishers will remedy this in the next edition by substituting the Fresh-Water Algæ of the United States, by Francis Wolle, for a book now entirely out of print and much behind the present state of knowledge of the subject.

Erigeron Tweedyi, n. sp.—W. M. Canby. (Bot. Gaz., xiii., p. 17.)

An interesting new species from Montana, collected by Mr. Frank Tweedy.

Forestry and Arboriculture in Massachusetts.—John Robinson. (Annual Report Mass. Board of Agric., xxxv., 1887; pamphlet, pp. 24; reprinted.)

Garden and Forest.—A Journal of Horticulture, Landscape Art *and Forestry.* Conducted by C. S. Sargent (Vol. I, No. 1, 12 pp., illustrated.)

The first number fulfills its promise of being a most interesting addition to Botanical journals. The plan of illustrating unfigured American plants, alone, commends it as a long-felt want. This number contains a figure by C. E. Faxon of *Iris tenuis*, with description by Sereno Watson. Plant notes on a half-hardy Mexican *Begonia* and the northern limit of the *Dahlia*, from C. G. Pringle, and some inquiries by W. Trelease as to hybrids between *Ceanothus Americanus* and western species are interesting. An editorial laments the loss of so valuable a friend as Dr. Gray, and Prof. Goodale reviews Gray's "Elements of Botany" and "Kellerman's Kansas Forest Trees."

Mission Viticole en Amerique.—Pierre Viala. (Rapport au Ministre de l'Agriculture, pamph., pp. 24, Montpellier, France, 1888.)

After a visit of six months spent in various parts of New Jersey, Maryland, Virginia, North Carolina, New York and Ohio, the Professor of Viticulture in the National College of Agriculture pronounces *Vitis Berlandieri*, *V. cinerea* and *V. cordifolia* as being the most likely to succeed in the calcareous soil of southern France as stock for grafting.

Mycologic Flora of the Miami Valley, Ohio.—A. P. Morgan. (Journ. Cincinnati Soc. Nat. Hist., x., pp. 188-202; continued.)

New or Noteworthy Species.—II.—Edward L. Greene. (Pittonia, i., pp. 159-164; advance sheets.)

Trifolium scabrellum, Saxifraga Marshallii, Potentilla daucifolia, Cryptanthe Rattani, Allocarya hirta, Arabis purpurascens, Howell, *Cardamine gemmata, Cedronella rupestris* and *Triteleia Hendersoni*, are new species; and interesting notes are given on *Rhamnus rubra*, Greene, *Astragalus Magdalenæ*, (*A. candidissimus*, Watson, not Ledeb.), and *Viscainoa geniculata*, a new genus founded on the *Staphylea geniculata* of Kellogg; *Potentilla Utahensis* is the *Ivesia Utahensis*, Watson.

New Species from Mexico.—Edward L. Greene. (Pittonia, i., pp. 153-159; advance sheets.)

Professor Greene describes the following new plants collected by Mr. A. Forrer, in 1881, on the Sierra Madre back of the city of Durango:—*Dalea cyanea; Astragalus Daleæ; Sedum diver-*

gens, (this name altered to *S. Forreri*, l. c., p. 162, as the former was already used by Dr. Watson for an Oregonian species); *Hypericum parvulum ; Ranunculus Forreri ; Valeriana rhomboidea ; Achætogeron Forreri ; Gentiana superba ; Lithospermum tubuliflorum ; Verbena subuligera ; Hedeoma jucunda ; Salvia Forreri ; Stachys venulosa ; Cedronella coccinea ; Zebrina* (?) *pumila* and *Calochortus venustulus. Salvia aliena* is characterized from specimens in Herb. Cal. Acad., collected on Maria Madre Island.

Parafine-imbedding method in botany—The application of.—J. W. Moll. (Bot. Gaz., xiii., p. 5.)

Peppers—Notes on—Capsicum.—E. Lewis Sturtevant. (Agric. Sci., ii., pp. 1-4.)

The writer cultivated during 1887, fifteen sorts from Brazil, fifteen from Mexico, one from Africa and twenty-five varieties from seedsmen, besides keeping notes on 49 others grown in previous years. Observations are recorded on the variations in color, shape, position of fruit and rapidity of drying when mature, though the author defers "till a later period the consideration of specific relations within the genus" concluding that the "number of species accepted by botanists will be few."

Potamogeton fluitans, Roth.—G. Tiselius. (Nordstedt's Botaniska Notiser, 1887, pp. 260 264.)

"American specimens of *P. lonchites*, Tuckerm., show also that they are nothing else than *P. fluitans*, Roth., an opinion shared by the Rev. Thos. Morong, who has occupied himself a good deal with the family in question and is well acquainted with them. *P. lonchites*, Tuckerm., must accordingly be received as synonymous with *P. fluitans*, Roth." Dr. Tiselius concludes also that *P. Illinoensis*, Morong, is only a form of *P. natans.*

Seeds and how they travel.—Byron D. Halsted. (Chatauquan, viii, p. 275.)

Taphrina.—Notes on the Genus.—Benjamin L. Robinson (Annals of Bot., i., pp. 161-176, reprinted).

Thomas Bridges, Botanist.—R. E. C. Stearns. (West American Sci., iii., pp. 223-227.)

Tumble-weeds again.—C. E. Bessey. (Amer. Nat., xxii., p. 66.) This time it is *Corispermum hyssopifolium, L.*

University of California Agricultural Experiment Station. Bulletin No. 76.

Among the reports of the distribution of seeds and plants conducted by this most admirable institution, we note that the Camphor Tree (*Cinnamomum camphora*) has proved a hardy and rapid grower in many parts of California; that there are now cork oaks of bearing dimensions in five counties of the State; that the true Gum Arabic Tree (*Acacia Arabica*) may be grown in the thermal belts, and that the Tea Plant thrives in many sections, and in some cases the leaves are gathered for home use.

Proceedings of the Club.

The regular meeting of the Club was held on Tuesday, Feb. 14, at Columbia College, the President in the chair and 42 persons present.

Miss Isabel S. Arnold, Dr. J. W. Eckfeldt, Rev. Francis Wolle, Thos. Meehan, and John Donnell Smith were elected Corresponding Members.

Miss Emily L. Gregory was elected an Active Member.

The following standing committees for the year were appointed:

Finance, J. L. Wall, W. H. Rudkin; Admissions, Benjamin Braman, Jos. Schrenk; Herbarium, Louise M. Stabler, Alice B. Rich.

Dr. Britton called attention to the proposed collecting tour of Rev. Thos. Morong, in South America, and, on motion, the Secretary was instructed to prepare a letter of indorsement on behalf of the Club, under which he will be authorized to act in the name of the Club during his travels.

On motion the President appointed Hon. Addison Brown, Mrs. N. L. Britton and Benjamin Braman a committee to take suitable action on behalf of the Club in regard to the death of Dr. Asa Gray. Remarks upon Dr. Gray and his works were made by Dr. Newberry and Dr. O. R. Willis. Dr. Britton exhibited a photograph, taken shortly before his death, and read some of his early letters to Dr. Torrey, which were preserved among Dr. Torrey's correspondence.

The Committee framed the following preamble and resolutions:

Whereas: Professor Asa Gray, Honorary Member of the Torrey Botanical Club, departed this life on Monday, January the thirtieth, 1888,—

Resolved: That the members of this Club have learned of his death with profound sorrow. Devoting his life to our beloved science, he not only raised himself to the foremost rank of botanists in any age or country, but has won for our land a place in the annals of science that sheds a lustre upon the American name.

Resolved: That not alone for his magnificent work in the strict paths of science will he be ever memorable, but for his labors in the cause of education, for the charm which his enthusiasm and literary skill have imparted to his popular works of instruction and to his essays on scientific themes, thereby alluring thousands of students to the zealous pursuit of this branch of knowledge, our countrymen owe him a debt of gratitude.

Resolved: That through his early association with Dr. Torrey, one of the chief founders of this Club, his friendly connection with us and our work, and his contributions to our publications, the Club have felt a special relationship with him that makes his loss come to us as a deep personal bereavement.

Resolved: To her who has been his constant companion for forty years, to whom so much of his success is due, we hereby tender our sincerest sympathy.

Mr. E. E. Sterns read notes on the genus *Smilax*, proposing a revision of the N. American species and requesting material and memoranda.

Dr. R. G. Eccles read a paper upon the results obtained in the chemical examination of seeds of *Calycanthus*, supplied by Mr. Sterns at a former meeting. Notes by Miss Isabel S. Arnold upon the Flora of the upper Chemung Valley, were read and illustrated by herbarium specimens. After adjournment an exhibition of microscopic preparations was given by the section of Histology and Cryptogamic Botany.

[The following has been received for publication.—Eds.]

At the regular meeting of the *Hamilton Literary and Scientific Association*, held in its rooms, Hamilton, Ontario, Canada, February 9th, 1888, the following resolution was unanimously adopted.

Whereas: This Association has heard with deepest sorrow of the death of Dr. Asa Gray,—

Resolved: That as a mark of respect to the memory of the deceased, there be transmitted to his family a record of our profound regret at such a calamity to the botanical world. That in his life he furnished a shining example of devotion to science and thoroughness of investigation which will always command our admiration and respect, and that, though of another nationality, we cherish and revere his memory, inseparably interwoven not only with American Botany but with the development of botanical science itself.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, April 2, 1888. [No. 4.

New or Noteworthy North American Phanerogams.—I.

BY N. L. BRITTON.

Plate LXXX.

Aquilegia Canadensis, L., var. FLAVIFLORA, n. var. (*A. flaviflora*, Tenney, Amer. Nat., i., 389). On the 15th of May, 1866, Prof. Sanborn Tenney, of Vassar College, found a yellow-flowered Columbine on the high ground west of the Hudson, and opposite the city of Poughkeepsie, which he described in the first volume of the American Naturalist as *Aquilegia flaviflora*. On May 17th of the succeeding year he collected the same variety near the same place, and proposed to try to raise the plant from the seed. Of his farther observations I find no record.

On May 24, 1885, during a Club Field Excursion at Seabright, Monmouth County, New Jersey, the plant was found in considerable abundance on the south bank of the Navesink River, along the top of a bluff some twenty feet above the water level. It grew there with the ordinary red-flowered, typical form, with which its showy flowers formed a marked and beautiful contrast, both being remarkably luxuriant. Associated with them was *Cerastium arvense*, L., and near by grew *Smilacina stellata*, Desf., neither of which had been noted so far south along the coast. I removed a plant of the yellow *Aquilegia* to a garden where it has since bloomed every year, maintaining its character. I have not been able to detect any other differences between it and the type except that the whole plant is of a light yellowish green instead of the usual reddish purple hue of the young plants of the ordinary form.

CERASTIUM TEXANUM, n. sp. Stem slender, 15-20 cm. high, pilose, especially towards the base, branching dichotomously above; leaves two to four pairs on the lower part of the stem, spatulate with an acute apex, sparingly pilose on both surfaces, 8-15 mm. long, 3-4 mm. wide; flowers few, small, terminating the branches; calyx lobes ovate, acute, 4-5 mm. long, nerved, minutely hairy; petals apparently linear, slightly longer; capsule about 7 mm. long, its ten teeth revolute; seeds numerous, angular, roughened with minute points.

Habitat: "Hills, Blanco, March, April," C. Wright, Mexican Boundary Survey Collections, No. 69.

This very distinct species is represented in the Torrey Herbarium by half a dozen fragments, and does not appear to have been distributed. It adds another member to the section *Streptocarpi*, and seems nearest to *C. pilosum.*

Astilbe decandra, D. Don, var. CRENATILOBA, n. var. Leaflets obtuse, crenate, mucronate, the upper one somewhat three-lobed; follicles about 2 mm. long, ovate; calyx lobes obtuse. Collected on the slope of Roan Mt., East Tennessee, along the trail from "Cloudland" to the Roan Mt. station of the E. T. & W. N. C. R. R.

The plant differs markedly from the typical *Astilbe decandra* in its shorter and stouter pods and blunt crenate leaves. It may be more than a mere variety, but I do not feel warranted in describing it as a species. The fact of collection is noted in this BULLETIN, Vol. xiii, p. 74.

Juncus filipendulus, Buckley, Proc. Acad. Nat. Sci. Phila., 1862, p. 8. (*J. Buckleyi,* Engelm., Trans. Acad. Sci. St. Louis, iii., p. 435; *J. leptocaulis,* Torr., apud Engelm., l. c., p. 454.)

Mr. Buckley's name has distinct priority over Dr. Engelmann's and should be restored. The plant was collected in 1887 by Mr. Nealley.

CYPERUS MARTINDALEI, n. sp. Culms erect, very slender, smooth, 50 to 60 cm. high; leaves very narrowly linear, nearly smooth with a prominent midrib, about half the length of the culm; involucre of about 3 leaves, 4 to 10 cm. long, the longest overtopping the inflorescence; umbel of a sessile head of numerous spikes and 1 to 3 smaller heads on slender peduncles; spikes linear, about seven-flowered; scales ovate, obtusish, about nine-nerved; achenium linear-oblong, triangular, about 1 mm. long, acute. Bases of the culms hard and corm-like, as in *C. strigosus*, L.; rootstocks very slender, with delicate scales.

Florida, from the herbarium of Dr. Ferdinand Rugel, now incorporated with that of I. C. Martindale, an enthusiastic collector and patron of botany, for whom the species is named. Collected also by Chapman at Appalachicola, and marked in his herbarium at Columbia College, as *C. ovularis*, Torr., with which it has but little affinity. In habit it resembles *C. filiculmis*, Vahl.

CYPERUS ECHINATUS (Ell.) (*Mariscus echinatus*, Ell., Sk., i, 75, 1821; *Cyperus Baldwinii*, Torr., Ann. Lyc., iii., 270, 1836.) This species, not hitherto reported from beyond the limits of the United States, though from its collection by the botanists of the Mexican Boundary Survey, and by Buckley in the Valley of the Rio Grande, we may suspect its occurrence in northern Mexico, comes now from Jamaica (J. Hart, No. 1034.)

Var. MULTIFLORA (Chapm.), n. var. Spikelets ten to even twenty five-flowered, the latter elongated to 20-25 mm. (*C. Baldwinii*, var. *multiflora*, Chapm., in Torr. Herb.)

Cyperus ferax, Richard. Not reported from Mexico nor Central America, in Hemsley's Botany of the Biologia Centrali-Americanæ is 1980, 1979 Müller from Orizava, 438 Bernouilli from Mazatenango, Guatemala, and also from Chihuahua (E. Wilkenson, in Herb., J. Donnell Smith.)

Cyperus ochraceus, Vahl, is also omitted from the Botany of the Biologia. It appears to be quite widely distributed, however, having been collected by Botteri, as already noted by me, and is represented in Müller's collections from Orizava by Nos. 1981 and 1982, and was collected by Türckheim at Coban, Guatemala, in 1887, and distributed by Capt. J. Donnell Smith as No. 1262.

Cyperus humilis, Kunth, var. ELATIOR, n. var. Culms erect, 12 to 15 cm. high; cauline leaves about equalling the culm; those of the involucre about 3, the longest 15 cm. in length. Otherwise nearly as in the type, which we have in C. Wright, Plantæ Cubanæ, No. 700.

Collected by H. von Türckheim, on the river-bank, near Coban, Guatemala (Distr. J. Donnell Smith, No. 705).

WEBSTERIA SUBMERSA (Sauvalle.) (*Scirpus submersus*, Sauv., Flor. Cubana, p. 176 (1868); *W. limnophila*, S. Hart Wright, BULL. TORR. CLUB, xiv, p. 135 (1887).

When examining the specimens of this plant kindly sent me by Mr. Wright, in June, 1887, I was much occupied with other matters and failed to recognize them as the same as Charles Wright's No. 3775, which had already received a name as cited above. I do not question the validity of the genus established by him, but would suggest its nearer affinity to *Heleocharis*, as indicated by Sauvalle, than to *Dulichium*, as supposed by Mr. Wright.

Heleocharis Engelmanni, Steud., Syn. 79. This species was described from specimens collected by Dr. Engelmann, at St. Louis, Mo., and labelled by him: "*E. obtusa*, Schult? var. *setis brevioribus*." It has an elongated, sub-cylindrical, often acutish spike and bristles only about the length of the achenium, or even shorter. In looking over a quite extensive suite of specimens of *Heleocharis ovata* (Roth), R. Br. (*H. obtusa*, Schultes), I find considerable variation in the relative lengths of bristles and achenium, while many which would fall under *H. ovata* through this character have heads elongated. The specimens most nearly according with Steudel's description of *H. Engelmanni* are from St. Louis (Engelmann, Riehl), Oquawka, Illinois (Patterson), (the var. *detonsa*, Gray), Tinicum, Delaware Co., Penn. (Porter) and "hills in Waltham, Mass.," (B. D. Greene) the last being the *H. obtusa*, var. *β*, Torrey, Ann. Lyc., iii., 303. The material at command indicates that Steudel's species is a variety of the wide-spread *H. ovata*, as remarked by Dr. Watson, in Bot. Cal., ii, p. 222, but more material is needed to settle this beyond dispute. The *Eleocharis diandra*, C. Wright, in BULL. TORR. CLUB, x., p. 101, seems clearly to belong here, and was so placed by Dr. Gray in Bot. Gaz., iii., p. 81, before Mr. Wright's description was published.

DICHROMENA CEPHALOTES (Walt.) (*Scirpus cephalotes*, Walt., Flor. Car., p. 71 (1788); *D. leucocephala*, Michx., Flor. Bor. Am., i, p. 37 (1803).)

Dichromena pubera, Vahl. Specimens collected by Dr. Watson in Guatemala (No. 166 a) are markedly proliferous, after the manner of some other sedges, the peduncles rooting at their apices.

Dichromena Watsoni, n. sp. Culm stout, sulcate, nearly smooth, 40 to 50 cm. high; leaves of the stem about 5, 15 to 20 cm. long, 5 to 7 mm. wide at the base, tapering to an acute apex, about seven-nerved, the nerves impressed on the upper surface and prominent on the lower; leaves of the involucre about nine, resembling those of the stem; spikes about nine, acute, 12 to 15 mm. long, sessile, forming a capitate cluster at the summit of the culm; scales ovate-lanceolate, acute and mucronate with the excurrent tip of the mid-nerve; achenium obovate, much shorter than the scale, transversely rugose, tipped with a broad, depressed tubercle; style very slender, two-cleft.

A remarkably large species, the cauline leaves arising from loose sheaths, and those of the involucre differing from other species of the genus in being green to their bases.

Collected by Dr. Sereno Watson in Guatemala, February to April, 1885 (No. 153.)

Dichromena nivea, Bœckl., under *Rhynchospora nivea*, Bœckl., Linnæa, xxxvii., p. 528 (1871.) (*D. diphylla*, Torr., Herb. and l. c.; *D. Reverchoni*, S. Hart Wright, Bull. Torr. Club, ix., p. 86 (1882.)

Although this plant was collected by Lindheimer in Texas, as long ago as 1847, and known to Dr. Torrey about that time, I cannot find any publication of his name until Bœckeler's paper above cited. It does not appear in the published lists of Lindheimer's collections. Bœckler, referring it to the genus *Rhynchospora*, gave it another name, citing Torrey's as a synonym. It appears to me that this is ample publication and that the later name of Mr. Wright cannot stand. As regards the names of Bœckeler and Torrey, both are cited as manuscript synonyms by the former, with *D. nivea* one line before *D. diphylla*—a nice point in nomenclature but sufficient for priority. The species is represented by Lindheimer's No. 718, Berlandier's 2089, Reverchon's 1233, and by a specimen collected by Wright, all from Texas. Also from Arkansas (Beyrich, Leavenworth.)

Psilocarya nitens (Vahl.) (*Scirpus nitens*, Vahl, Enum. Pl., ii., 272 (1806); *P. rhynchosporoides*, Torr., Ann. Lyc. N. Y., iii., p. 361 (1836); *Rhynchospora nitens*, Gray.)

The relationship of this species to the *P. scirpoides*, Torr., cannot yet be regarded as established. True *P. nitens* has a transversely rugose achenium and a short tubercle; true *P. scirpoides* a smooth or but slightly rugose achenium and a long tubercle. A specimen in Herb. Torrey, collected by Leavenworth in East Florida and written up by Dr. Torrey as *P. intermedia*, has a strongly rugose achenium and a tubercle intermediate in length, indicating that they may all be but forms of one species, to which Vahl's specific name must be applied. *P. Texensis*, Torr. & Hook., seems not much more distinct than the others. The fourth member of the genus (*P. corymbiformis* (Wright), Benth. & Hook., Gen. Pl., iii., 1048; *Scirpus corymbiformis*, Wright, in Sauvalle Flor. Cubana, 176), has much more claim to specific rank.

Fimbristylis capillaris (L.), Gray, must include a large number of forms differing slightly in the amount of bearding at the mouths of the sheaths, the acute or obtuse apices of the scales and the size, markings and color of the nut. Besides the synonomy cited in Hemsley's Biologia, we must add *Isolepis ciliatifolia*, Torr., which appears hardly separable even as a variety, while the following may perhaps stand as varieties or marked forms:

Var. PILOSA, n. var. Culms densely pilose throughout; scales dark brown, acute. (Guatemala, Santa Rosa, Türckheim, 1887, No. 1283; Orizava, Müller, 1853, No. 1966.)

Var. COARCTATA (Ell.) (*Isolepis coarctata*, Torr.) Umbels contracted; spikes linear-oblong.

Fimbristylis Vahlii, Link., Hort. Berol., i, 287, is the older name for *F. congesta*, Torr., Ann. Lyc., iii., p. 345, as noted by Bœckeler, Linnæa, xxxvii., p. 9.

Fimbristylis monostachya (Vahl), Hassk., Pl. Jav. Rar., p. 61 (1848), is the name for *Abilgaardia monostachya*, Vahl, following Bentham and Hooker in reducing the genus to *Fimbristylis*.

Fimbristylis schœnoides, Vahl., has been collected by A. H. Curtiss, in Walton Co., Florida, as I have recently been informed by Dr. Watson. I do not find any record of its occurrence otherwise nearer than southern Asia, but there is a marked tropical distribution of Cyperaceæ of which this is perhaps only another example.

SCIRPUS PRINGLEI, n. sp. Annual, cæspitose, 1 to 2 inches high. Leaves capillary, all radical, about equalling the culm; spikes terminal and also radical, the latter surrounded and much overtopped by the leaves; terminal spikes oval, many-flowered, the lowest bract resembling the leaves, and an inch or so in length, the next 3-6 mm., the others lanceolate, very acute, about 2 mm. long, midribs slightly darker than the margins, every bract fertile; achenia sharply trigonal, broadly obovoid, the angles slightly ridged, the summit truncate, style three-cleft, its base persistent, stamens two. Basal spikes fewer flowered, otherwise nearly as the upper ones. Whole plant yellowish green.

Chihuahua, near Guerrero, C. G. Pringle, 1887, Nos. 1400 and 1399, the latter specimens without terminal spikes.

An interesting little species related to *S. heterocarpus*, S. Wats., which was also collected by Mr. Pringle at the same place (No. 1398), and in aspect resembling *Fimbristylis apus* (Gray), Wats. *S. heterocarpus*, is, however, coarser, its terminal spikes longer and narrower and dark brown; the achenia of its basal spikes twice as large as those of the upper. The two species form a marked group of the genus. *S. heterocarpus* is also now to be admitted into the United States lists, having been collected by Mr. Pringle, Aug. 29, 1884, on sandy plains south of Tucson, Arizona, near the Mexican boundary. Its range is also to be extended to the Bolivian Andes, Mandon's No. 1410 being referable to the species, differing only in the slightly coarser surface markings of the achenium.

EXPLANATION OF PLATE LXXX.

Fig. 1. *Scirpus Pringlei*, Britton, plant natural size; Fig. 2. Upper spikelet, X 2; Fig. 3. Pistil, X 8; Fig. 4. Achenium, X 8.

Fig. 5. *Scirpus heterocarpus*, Watson, plant natural size. Fig. 6. Upper spikelet, X 2. Fig. 7. Achenium, lower spikelet, X 8, swollen in water; when dry it is slightly shorter and broader. Fig. 8. Style and stigma, upper spikelet, X 8. Fig. 9. Achenium, upper spikelet, X 8. Fig. 10. Scale, upper spikelet, X 8.

Scirpus mucronatus, L. This old world species was collected over twenty years ago in Delaware County, Penn., by Mr. C. E. Smith and Dr. Geo. Smith, and appears to have since lain unnoticed in our herbaria, which is to a certain degree my own fault, for there is a specimen in the Torrey Herbarium dating back to 1864. Mr. Smith has sent me the following note on the locality: "It is in a small patch of *Sphagnum* in a field, 300 feet above tide-water." Mr. Martindale has it from the ballast grounds at Camden, but there seems no doubt that the Delaware County plant is a native. It is not quite as stout as the plants from Asia and Mauritius, but agrees very well with French specimens in Herb. Torrey.

Scirpus stenophyllus, Ell. (*Isolepis stenophylla*, Torr.), appears to be a true *Scirpus*, and is nearly related to *S. barbatus*, Rottb., to which it has been referred by Bœckeler, Linnæa, xxxvi., p. 792, as var. *Americanus*. It seems to me specifically distinct, but if reducible to a variety of Rottboll's species, a result by no means impossible when more material is obtained, it must bear Elliott's name.

HEMICARPHA MICRANTHA (Vahl.) (*Scirpus micranthus*, Vahl, Enum. Pl., ii., 254 (1806); *H. subsquarrosa*, Nees, in Mart. Flor. Bras., ii., Pars. i., p. 61 (1842.)

RHYNCHOSPORA AXILLARIS (Lam.) (*Schœnus axillaris*, Lam., Encyc., i., 137 (1791); *R. cephalantha*, Gray, Ann. Lyc., N. Y., iii., 218 (1836.)

In taking up the name I am guided by Bœckeler in Linnæa, xxxvii., p. 572, who states that he saw a specimen named by Lamarck in Willdenow's Herbarium.

SCLERIA GRAMINIFOLIA, n. sp. Culms 35 to 40 cm. high, slender, erect, triangular in section; leaves 3 or 4, 12-15 cm. long, all cauline, narrowly linear, attenuate to an acute apex, upper reaching to the inflorescence but not overtopping it; panicle terminal, loose and quite simple, 4 to 5 cm. long, subtended by a linear bract, 2 to 6 cm. long; heads androgynous, sessile, or on peduncles 1 to 2 cm. long, of from 2 to 5 flowers, the fertile and sterile about equal in number. Achenium globular, 2 mm. in diameter, obtuse, minute apiculate, roughened, with short projecting processes, supported on a triangular perigynium, whose angles are prolonged upwards as ridges nearly to the apex of the achenium. Rootstocks fibrous.

Collected by C. G. Pringle in wet places, pine barrens, base of the Sierra Madre, Chihuahua, Sept. 28, 1887 (No. 1401.)

Botanizing in the Strait of Magellan—II.

BY W. E. SAFFORD, U. S. NAVY.

(Continued from page 20.)*

The treeless pampa-like scenery continued until we reached Cape Negro, about one hundred miles from the entrance to the strait. There it changed abruptly, trees began to make their appearance, and the country became mountainous. As we passed along, the channel would at times become contracted into a narrow strait, through which the tide ran with great force, and then it would widen out into a broad lake-like expanse, the Fuegian shore becoming faint and hazy in the distance. Shortly after reaching Sandy Point we experienced a heavy fall of hail and snow; but it melted almost immediately, and in going ashore we found several of the houses in the settlement surrounded by bright beds of pansies and daisies, which seemed to have suffered in no way from the inclement weather. Some of these beds were bordered by an edging of sea-thrift, and I noticed in the gardens many other plants indigenous to the region: *Calceolarias*, the lily-like *Symphyostemon*, yellow violets, currants and Fuchsias growing over trellises, and the same shrubby composite (*Chilobothrium amelloides*) that I had collected at Gregory Bay. In the kitchen gardens were patches of lettuce, radishes, cabbages and onions. Potatoes are also raised, but on account of the dampness of the climate the cultivation of cereals is not practicable.

In the vicinity of the settlement I found, in addition to nearly all the plants occurring at Gregory Bay, a second species of *Berberis*, a currant, two species of beech, the Winter's bark, a Fuchsia, a handsome *Ranunculus*, and several other plants. The little *Calceolaria nana* was here replaced by a taller species, also herbaceous and acaulescent, *Calceolaria plantaginea*, with several pure yellow flowers, smaller than in that species, borne on a common peduncle, about a foot high, and with leaves somewhat like those of the common plantain. The barbery (*B. empetrifolia*) grew in the form of a trailing under-shrub, with narrow fascicled

* P. 15, line 15, for 32° read 52°. This error should be rectified in the first part of Mr. Safford's paper.

leaves and axillary clusters of yellow flowers. The same *Anemone* and *Acæna* as at Gregory Bay were abundant. The currant (*Ribes Magellanica*), the barberry bushes and the *Pernettyæ* were thickly covered with festoons of a gray lichen (*Usnea barbata?*), which gave to the vegetation somewhat the aspect of that of the Oregon coast region; and as the northern barberries are often attacked by fungi, so here the young leaves of *Berberis buxifolia* were of a bright scarlet color, and much distorted from the attacks of a parasitic *Æcidium.*

The woods behind the settlement were made up chiefly of two species of beech and the Winter's bark, a tree very much like a *Magnolia.* *Fagus antarctica*, the antarctic beech, is here fast becoming extirpated. I saw hundreds of trunks of this species, and dead trees, like whitened skeletons, still standing, some of which were very large. Two saw-mills have been erected at Sandy Point, but I was glad to see they were not in operation. *Fagus antarctica* is by far the largest and most valuable tree for timber in the region of the Straits. In the western part it grows higher up the mountain side than the *Fagus betuloides*, and there it never attains the size that it does near Sandy Point. *Fagus betuloides*, the "evergreen beech," is a much smaller tree. It has a whitish gray trunk which branches many times, the ultimate divisions bearing a flat dense crown of small, glossy, comparatively stiff leaves.

From our anchorage we had a grand view of the western mountains. Beyond Sandy Point there arose on every side a wild combination of rock and tree and hill. When it was clear, we could even see the snowy crest of Mount Tarn.

I will venture here to give a short extract from Darwin's Journal, describing his ascent of Mount Tarn, in which he presents an excellent picture of the country: "The forest commences at the line of high water mark, and during the first two hours, I gave over all hopes of reaching the summit. So thick was the wood that it was necessary to have constant recourse to the compass; for every landmark, though in a mountainous country, was completely shut out. In the deep ravines, the death-like scene of desolation exceeded all description; outside, it was blowing a gale, but in these hollows not even a breath of wind stirred the leaves of the tallest trees. So gloomy, cold and wet was every part that not even the fungi, mosses or ferns could flourish." In another place, when describing the vegetation of the Chonos Archipelago, he says: "Cryptogamic plants here find a most congenial climate. In the neighborhood of the Strait of Magellan, I have before remarked that the country appears too cold and wet to allow of their arriving at perfection."

It was a pleasant surprise for me, after reading the above description, to find a wealth of cryptogamic plants on the shores of Fortescue Bay, which is only a short distance from Mount Tarn. The ground was covered in places with a carpet of *Cystopteris fragilis*, delicate filmy ferns (*Hymenophyllum*), and a rich growth of mosses, liverworts and lichens. There also I found a third species of *Berberis* (*B. ilicifolia*), with spiny holly-like leaves and clusters of orange-colored flowers. The two species of *Pernettya*, the *Embothrium*, *Empetrum*, and the shrubby composite, which I had before collected, occurred, associated with a number of other shrubs and small trees, which I have not yet been able to determine.

At Port Tamar the vegetation was luxuriant. There, beneath a dense canopy formed by the flat-topped beeches, shielded alike from the snow and the sun, growing in a damp spongy soil, and surrounded by an atmosphere laden with moisture, grew a number of plants of exquisite delicacy. Filmy ferns crept up the mossy trunks of the trees, mingled with the beautiful scarlet flowers of *Mitraria coccinea*, and an endogenous plant, *Philesia buxifolia*, occurred, allied to *Smilax*, with handsome trumpet shaped flowers of a delicate rose color. Many other plants were common which I had not seen before, and I collected, besides three species of *Hymenophyllum*, a coarse simply pinnate fern with dense fruiting fronds somewhat like those of *Osmunda cinnamomea*. and a fern with a brittle glossy stem bearing a horizontally expanding umbrella of radiating fronds not unlike our *Adiantum pedatam* in its manner of growth (*A. radiatum*, L.) Extending above the flat tops of the beeches I saw half way up the mountain's side a conspicuous yellow plant. In order to get it I was obliged to walk nearly half a mile literally on the tops of the trees, as it was impossible to advance in any other way. The plant proved to be

Mysodendron punctulatum, a parasite allied to the mistletoe, growing on the living branches of the evergreen beech.

On the morning of December 2d, we left the Strait of Magellan, and turning northward entered Smythe's Channel, which skirts the western coast of Patagonia. The vegetation of its banks differed scarcely at all from that which I have just described. In addition, however, to the plants which I had collected I found a handsome shrub, *Desfontainea spinosa*, with beautiful scarlet tubular flowers lined with yellow and with glossy, prickly, holly-like leaves. And I also collected here a conifer, whlch I neglected to mention before, *Libocedrus tetragona*, belonging to the Cupressineæ.

The *Desfontainea* belongs to the Loganiaceæ, a family which, together with the Proteaceæ, the genera *Libocedrus*, *Araucaria* and a few others, constitute the element in the South American flora which allies it with that of Australia and New Zealand.

In conclusion, I may mention that as in the Northern Hemisphere, many arctic plants reappear in the Alpine regions of Europe, Asia and America, so among the plants which I afterward collected in the higher regions of the Andes of Peru there were several which in the Strait of Magellan and on the shores of Terra del Fuego grow at the level of the sea.

As we advanced northward the channel would sometimes be so dotted with islands that we would almost be bewildered, scarcely knowing which was our path, which was island or which was the shore of the mainland; and then it would contract into a straight, narrow "reach" down which we could see for miles, the flanking mountains fading to a deep purple in the distance. Thus we continued on our way, vista after vista opening before us as we advanced, until reaching Trinidad Channel, when we turned once more to the westward, and, leaving behind us the sheltered inland waters, glided out upon the heaving bosom of the Pacific Ocean.

At Sea, making passage between Callao and Honolulu, Oct. 10, 1887.

Capsicum umbilicatum.

Last season, in the garden of the New York Agricultural Experiment Station, I grew from some *Capsicum* seed received through the kindness of Professor Orville A. Derby, of Rio Janeiro, a number of plants which I think are to be referred to *Capsicum umbilicatum*, Vellozo. As this pepper seems never to have been described from specimens, and as our plants differ somewhat from the description by Dunal, the following communication may be of service:

CAPSICUM UMBILICATUM, Vell., Fl. flum., ii., t. 7. Dunal in DC., Prod., xiii., 428. Vernacular name, "Pimentao fundo de garraba. Bottle-bottomed." Shrub about 2 feet tall or more, erect, branches deep green, distinctly four-angled, minutely pubescent on younger growth, especially about nodes. Leaves deep green above, paler below, ovate, shortly acuminate, much rounded at base, extending slightly into petiole often unequally, much puffed, largest ones 5 in. long by 3⅛ in. broad, but usually about 2 in. long by 1⅞ in. broad, sparingly pubescent, on margins minutely ciliate, solitary below, in twos and threes above. Petioles rather short, in general ½-¾ in. long, ciliate. Peduncles solitary or rarely geminate, subangular, pendant, evenly enlarging towards calyx end, in young specimens sub-hairy. Corolla about ⅝ in. diameter, greenish. Calyx lobes very flat, lacerated, border thin and membranaceous, five to six-toothed, the teeth acute, ten-nerved, the five shorter nerves being somewhat obscure. Berry seated on the calyx, about 1⅛ in. long by ⅞ in. diameter, turbinate, broad at the apex, scolloped, with a usually projecting nipple or boss from the center, at first green, then brown on side next the sun, finally red, cells 3-5, usually 4, acrid.

The plant set out with other peppers in the spring, ripened its fruit before frost, and was reasonably prolific. The puffed surface of the leaf gave it a quite distinct aspect. In some of the fruits the boss was depressed within the scolloped border; in most, however, it was projecting. Whether this is a distinct species I do not care yet to decide, as I have three other varieties of a common aspect, but differing in the fruit. At any rate it is an extremely well marked variety.

E. LEWIS STURTEVANT.

SO. FRAMINGHAM, MASS., Feb. 2, 1888.

Bibliographical Notes on well known Plants.—VIII.

By Edward L. Greene.

Gleditschia inermis, Mill. Dict. ed. 8 (1768.)
Gleditschia triacanthos, β Linn. Sp. 1057 (1753.)
Gleditschia aquatica, Marsh. Arb. 54 (1785.)
Gleditschia Carolinensis, Lam. Encycl. ii. 465 (1786.)
Gleditschia monosperma, Walt. Carol. 254 (1788.)
Acacia Abruæ folio triacanthos, capsula ovali unicum semen claudente, Catesb. Carol. i. 43 (1741.)

In last November's issue of the Bulletin I had the pleasure of exhibiting what I then understood to be Humphry Marshall's right of earliest authorship in the specific name of this southern honey locust, as being three years earlier than that imposed by Walter and commonly accepted as the correct one. It did not occur to me at the time to look up authors intermediate between Linnæus and Marshall, to whom the tree might have been known; and now, in pondering some of the pages of that monumental work, the eighth edition of Philip Miller's Gardener's Dictionary, I discover to my amazement that that renowned author knew both species of *Gleditschia*, and that to him belongs the honor of having given a specific name, under the Linnæan law, to the one-seeded species. Marshall's name has but three years of priority over that of Walter, but Miller's is seventeen years earlier than that of Marshall!

Hesperochiron nanus (Lindl.)

Nicotiana nana, Lindl., Bot. Reg. x., t. 833 (1824.)
Ourisia Californica, Benth., Pl. Hartw., 327 (1849.)
Hesperochiron Californicus, S. Watson, Bot. King, 281, t. 30 (1871.)

The late Mr. Bentham in publishing his *Ourisia Californica*, did not identify it with Lindley's *Nicotiana nana*. Until long after the year 1849 that was believed to be truly a *Nicotiana*. The occasion of raising the species to the rank of a new generic type was the best time to have taken up the old specific name; but it does not appear to have been then known or suspected that this was really Lindley's supposed dwarf tobacco; although this might have been inferred from a glance at the figure in the Botanical Register, by any one who had seen the plant growing.

The ordinal place for the genus should not be considered as settled. Eminent systematists have believed it to be of the Solanaceæ, of the Gentianaceæ and of the Hydrophyllaceæ. The very first impressions, like first glances at doubtful words in a piece of bad handwriting, are very apt to be correct in cases of this kind. And Mr. Lindley recorded that the envelope which held the seeds from which the plants were raised in the garden of the Horticultural Society in 1823, bore the statement that it was from this plant that the Indians prepared the finest of their tobacco. *Hesperochiron*, alive or dead, looks Solanaceous enough, and if it be true, and we have no reason to doubt it, that the Indians used it for tobacco, this would go far to indicate that with the Solanaceæ are its affinities.

Cryptogamia versus Heterophyta.

The term Anthophyta, as an equivalent and substitute for the Linnæan Phænogamia (or Phanerogamia), seems likely to come into general use in the near future. Its adoption will make necessary a corresponding word to designate collectively the Pteridophyta, Bryophyta and other plants heretofore included under the name Cryptogamia. I suggest for this purpose the term Heterophyta, which seems to me simple, convenient and significant, and exactly in accordance with the previous terms of the series and with the genius of the language. It is so appropriate, in fact, that I shall not be surprised to learn that it has already been proposed.

E. E. STERNS.

A New Variety of Erythronium, L.

Erythronium albidum, Nutt., var. COLORATUM, n. var. Pink Dog-tooth Violet. Sepals white, more or less suffused with rose purple, varying to bright red; leaves more strongly mottled with green and brown than in the type. Shaded woods near streams, McLennan county, east central Texas; not rare; flowers in February.

The suffusion of red extends even to the ripening capsule, but the variety is mainly founded upon the color of the flowers, which are said* to have, when first gathered, the "delicate fragrance of the cultivated sweet violet, but in the course of an hour or two this odor passes entirely away." E. E. STERNS.

Index to Recent American Botanical Literature.

Algues Magellaniques Nouvelles.—M. P. Hariot. (Journ. de Bot., i., pp. 55-59 and 72-74; illustrated.)

Siphonocladus, Ectocarpus, Sphacelaria, Ceramium, Callophyllis and *Hildebrantia,* illustrated by six cuts in the text, are figured and described from Orange Harbor and the Falkland Isles.

Aquilegia longissima, Gray.—Sereno Watson. (Garden and Forest, i., p. 31, fig. 6.)

Azolla et Salvinia dans la Gironde. (Journ. de Bot., i., p. 29.)

Two more of our water weeds are causing trouble among the millers and death among the fishes in France. Instead of *Anacharis,* however, it is *Salvinia natans* and *Azolla Caroliniana* which have spread near Bordeaux so as to become a nuisance.

Bœria gracilis, Gray. (Gartenflora, xxxvi., p. 392; fig. 96.)

Calochortus flavus, Schult. f., and Milla biflora, Cav.—C. G. Pringle. (Garden and Forest, i., p. 20.)

Cladoniées Magellaniques.—M. P. Hariot. (Journ. de Bot., i., pp. 282-286.)

Twenty-two species of *Cladonia,* with two new ones and two varieties, are listed and described.

Ferns—Preparation and Mounting of.—J. D. King. (The Microscope, viii., pp. 78-81.)

A detailed account of the method of mounting microscope slides of pinnules used by one of the most successful manipulators.

Florule des Isles Saint-Pierre et Miquelon.—E. Bonnet. (Journ. de Bot., i., pp. 180-186, 219-221, 234-239, 249-253, 260-266.)

This is an interesting list of plants found in the last of the French possessions in North America, the islands of Saint-Pierre and Miquelon off the southern coast of Newfoundland. It is mainly a compilation from the collections of La Pylaie, Delamare and Beautemps-Beaupré.

Geraniaceæ—A Study of North American.—William Trelease.

*By Miss S. A. Trimble, of Waco, who collected the specimens.

(Mem. Boston Soc. Nat. Hist., iv., pp. 71-104; plates 9-12.)

We have the pleasure of noting another of Professor Trelease's valuable monographs. The present one is both systematic and biological. The new species and varieties established are *Limnanthes Macounii*, from Vancouver; *Oxalis corniculata*, L. var. (?) *macrantha*, a large southern form; *O. Suksdorfii*, from Oregon; *O. Acetosella*, L., var. *Oregana*, (*O. Oregana*, Nutt.); and *Geranium Carolinianum*, L., var. *Texanum*. The methods of pollination and seed-dissemination are discussed and a very large number of references to literature given.

Irises—Note on our Native.—Sereno Watson. (Garden and Forest, i., p. 18.)

Dr. Watson, after classifying the group and describing in a few words the geographical distribution, appeals to florists to cultivate our native species and solicits seeds and roots from the South and West for Prof. Michael Foster, Oxford, England, who is making a critical study of the genus.

Lichenology—Recent Contributions to American.

Enumeratis Lichenum Streti Behringii.—Exposuit W. Nylander. (Caen, 1888.)

Pyrenocarpeæ Cubenses a cl. C. Wright lectæ.—Auctore Dr. J. Müller, (Botanischer Jahrbücher, Leipzig, 1885.)

Graphideæ Feeanæ.—Auctore Dr. J. Müller. (Mem. de la Societé d'Histoire Naturelle de Genève, 1887.)

These three publications are of interest to students of American lichens. The first gives the names of the species collected by the Nordenskiöld expedition in the region referred to, in 1878-79. It enumerates 400 species, of which about 80 are new, and is the fullest list of the lichens of this region ever published. At the end is a revision of the lichens collected by Dr. Bean in 1880, a list of which was published in the Proceedings of the U. S. National Museum, Washington, 1884; Vol. vii., No. 1.

The second publication contains the determinations of Wright's Cuban Verrucariaceæ, which were distributed several years since, many of which may be expected to occur within the southern limits of the United States.

The third is a revision of the Graphidaceæ of Feè's Essai sur les Cryptogames des Ecorces Exotiques Officinales and Supplement. It is of special value because the spore characters were in his time little known, and Dr. Müller has studied the original specimens of Feè, and of Acharius, Fries and others.

HENRY WILLEY.

Lilium Grayi, Watson.—(Garden and Forest, i., p. 19, fig. 4.)

Loganiaceæ—The Natural Order of.—R. G. Eccles, M.D. (Pharm. Record, viii, pp. 41-44.)

This is an interesting review of this important order and its allies from a medical standpoint, with much that is readable in geographical distribution and descriptive pharmacy.

Micrasterias Americana, Ralfs, and its Varieties.—W. M. Maskell. (Journ. Roy. Micros. Soc., 1888, pp. 7-10; plate II.)

Musci Cleistocarpici Novi.—Carolo Müller. (Flora, lxxi., pp. 1-13.)

This includes 26 species of *Acaulon, Phascum, Archidium, Astomum, Bruchia, Ephemerum* and *Lorentziella*, of which ten are South American from Paraguay, Montevideo and Brazil.

Outlines of Lessons in Botany—Parts 1 and 2.—Jane H. Newell. (Pamphlets, 8vo, pp. 45. Salem, Mass., 1887.)

These are intended as aids to teachers and mothers studying with their children, and as elementary guides will be found most practical and clear. The series is to consist of six, by which a practical acquaintance will be made with: 1—plants and their uses; 2—seedlings; 3—roots; 4—buds and branches; 5—stems; 6—leaves. They are intended to be used in connection with Gray's First Lessons or How Plants Grow, and are planned to cover the winter season, so that the pupils may be ready to study the flowers when they appear. We heartily commend the plan and effective methods of illustration.

Parmelia perlata et quelques Especès affines.—W. Nylander. (Journ. de Bot., ii., 33-34.)

Phacelia heterosperma, n. sp.—S. B. Parish. (Bot. Gazette, xiii., p. 37.)

Pinus insignis, Dougl. (Gartenflora, xxxvi, pp. 120-122; fig. 37.)

Pogogyne nudiuscula, Gray. (Gartenflora, xxxvi., p. 114; t. 1242.)

Polyporus abietinus, Fr., et Irpex fusco-violaceus, Fr.—Note sur l'identité Specifique du. (Journ. de Bot., ii., pp. 30-32.)

Rhododendron Kamtschaticum, Pall.—E. Regel. (Gartenflora, xxxvi., t. 1260.)

Structure de la racine et disposition des radicelles dans les Centrolépidées, Eriocaulées, Joncées, Mayacées et Xyridées.—M. Ph. Van Tieghem. (Journ. de Bot., i., pp. 305-315; illustrated.)

A brief comparison of the roots of grasses and sedges, as described in a former essay, is followed by a description of their structure in these orders.

Symphoricarpus—The Genus.—H. Zabel. (Gartenflora, xxxvi., pp. 603-606, 629-631 and 658, 659.)

Herr Zabel gives in the first part of his paper a review of Dr. Gray's arrangement of the genus, followed by an account of the forms cultivated at Münden, in which he claims that the name *S. orbiculatus*, Mœnch, used by Koch in 1794, has priority over *S. vulgaris*, Michx. He also recognizes a new variety *glaucus* of *S. racemosus*, Michx.

Thistles—Some Common.—L. H. Pammel. (Colman's Rural World, March 9, 1888,)

Mr. Pammel gives a popular account of *Cnicus altissimus*, var. *discolor*, *C. arvensis* and *C. lanceolatus*, with directions for their identification and eradication, illustrated with figures of each species.

Uncinula polychæta, B & C.—S. M. Tracy and B. T. Galloway. (Bot. Gazette, xiii., pp. 29-32; illustrated.)

Undescribed Plants from Guatemala—II.—John Donnell Smith. (Bot. Gazette, xiii., pp. 26-29.)

Chrysochlamys Guatemalecana, *Harpelyce rupicola*, *Bauhinia Rubeleruziana*, *B. Pansamalana*, *Anneslia Quetzal* and *Triolena paleolata* are characterized and the name *Myriocarpa heterospicata* is corrected to *M. heterostachya*.

Vaccinium de France—Sur les Variations de Structure des.—Paul Maury. (Journ. de Bot., i., pp. 104-108, 115-117; illustrated.)

Of species common to America and Europe are *V. uliginosum*, *V. Oxycoccus* and *V. Vitis-Idæa*, of which figures are given showing the upper and lower epidermis. The author concludes that he can distinguish generic and specific microscopic characters.

Vinegar Plant—Growth of, in Fermented Grape Juice.—N. L. Britton. (Trans. N. Y. Acad. Sci., vi., pp. 66-70; reprinted.)

Describes the gelatinous, stratified cylinders formed by an organism identified as *Saccharomyces cerevisiæ*, Reess, and the appearance of *Penicillium* and other moulds on exposure of these to the air.

Willows—Two Beautiful North American.—H. Zabel. (Gartenflora, xxxvi., pp. 410-412, figs. 98-100.)

This paper gives minute descriptions of *Salix lasiandra*, Benth., var. *lancifolia*, (Anders.), Bebb, and *S. nigra*, Marsh., var. *falcata*, (Pursh), Gray. In regarding Andersson's *S. lancifolia* as a variety of *S. lasiandra* the author takes occasion to remark: "I follow in the naming the profound connoisseur of the North American Willows, Michael S. Bebb, of Illinois, to whom Greene has recently dedicated a new genus of Compositæ."

Zannichellia palustris—Le mode de Fécondation du.—M. E. Roze. (Journ. de Bot., i., pp. 296-299; illustrated.)

Reviews of Foreign Literature.

Notes on Hackel's Monograph of Gramineæ.—Prof. E. Hackel, of St. Pœlten, Austria, who is one of the best living agrostologists, has recently published as a part of "Engler and Prantl's *Naturliche Pflanzenfamilien*," a monograph of the order Gramineæ, which is of particular interest as representing the views of European botanists as to the subdivisions of this vast order. The primary divisions are the same as those of Bentham and Hooker, although not in the same relative order. But in the distribution into genera, there are many changes. Sometimes these changes are in the reduction of genera to sections, and sometimes in the elevation of sections to genera.

The whole number of genera recognized by Prof. Hackel is 313, whereas the whole number given by Bentham and Hooker is 298. There are a few new genera established since the publication of the "*Genera Plantarum*" of Bentham and Hooker, which accounts partly for the increased number. It may be interesting to note such of the changes as relate to the grasses of the United States.

Hemarthria is reduced to a section of *Rottbœllia*. *Sorghum*, *Chrysopogon* and *Heteropogon* are made sections of *Andropogon*. *Zizania miliacea*, Michx., becomes *Zizaniopsis miliacea*, Dœll. and Acherson. *Calamagrostis* includes two sections, *Epigeos* and *Deyeuxia*. *Ammophila* he recognizes as having but one species, *A. arundinacea*. This excludes three North American species which Bentham and Hooker included in *Ammophila*, viz.: *A. longifolia*, *A. brevipilis* and *A. Curtisii*, Vasey. These belong to Dr. Gray's section *Calamovilfa* of the genus *Calamagrostis*, as defined in the Manual, and characterized by the hard parchment-like, one-nerved glumes, and the absence of the sterile flower or pedicel. They differ from *A. arundinacea*, Host, in the spicate panicle, and the five-nerved rather scabrous glumes of the latter. If, therefore, our species be placed in the genus *Ammophila*, they must constitute a section *Calamovilfa*. They might very well form a new genus.

Dactyloctenium, Willd., included by Bentham and Hooker in *Eleusine*, is here retained as a genus.

The genus *Eremochloë*, Watson, receives the name *Blepharidachne*, Hack., because the name *Eremochloa*, Büse., given to an East Indian grass allied to *Hemarthria*, antedates the name of Watson. *Triplasis*, Beauv., is reduced to a section of *Triodia*, Br. In this place I may remark that our *Triodia seslerioides* has an earlier name, i. e. *Triodia cuprea*, Jacq., Ecl. ii., 21. *Arctophila*, Rupt., is here made a section of *Colpodium*, Trin., and the genus *Atropis*, Rupt. reduced to a section of *Glyceria* by Bentham and Hooker, is here again raised to generic rank.

GEO. VASEY.

New Contributions to our Knowledge of Sieve-Tubes.—By Alfred Fischer.*

The author has introduced a simple method which enables us to obtain a more correct knowledge of sieve-tubes than we have had heretofore. When a part of a plant is cut off, the fluid in the sieve-tubes will partly flow out, and the current produced in them will cause an entirely new arrangement of their contents. The well-known illustrations of the sieve-tubes of *Cucurbita*, etc.,

*Ber. d. K. Sächs. Ges. d. Wiss. zu Leipzig, Math.-phys. Cl., 1886, iii., iv., pp. 291-336, 2 pl.

in all our text-books, with their accumulations of mucilage above or below the sieve-plates, ("Schlauchköpfe") etc., must therefore be considered as representations of entirely artificial conditions.

The author simply immerses the entire plant, or a portion of it, (while still in connection with the plant) in hot water; thereby the contents of the sieve-tubes will be fixed and the changes mentioned almost entirely prevented.

According to their contents the sieve-tubes are divided into three groups: first, such as contain sap which coagulates when heated, and which is surrounded by a thin parietal plasma sac (*Cucurbita*); second, sieve-tubes containing mucilage masses closely in contact with the parietal plasma, and clear sap which does not coagulate (*Humulus*); third, sieve-tubes with starch grains, with only little mucilage in the parietal plasma, and with sap which does not coagulate. This differentiation of the contents is met with only in active tubes, *i. e.* in such as have their plates open.

The sieve-plates of active tubes are lined with a thin layer of callus which, in its turn, is covered with mucilage either entirely or only at the edges of the perforations. The parietal protoplasm most likely lines the sieve-plates and also the short canals piercing the same, so as to effect a connection of the plasmatic layers of the contiguous members of the tube.

When a plant is injured accumulations of mucilage are formed at the plates by the streaming of the sap through the pores. At the same time the mucilaginous lining of the plates disappears, while the callus increases in thickness. Both the callus plates and the aggregations of mucilage, therefore, are artificial products, for in the living, active sieve-tubes there is only very little callus on the sieve-plates. In the living plant the pores of the sieve-tubes are not filled with mucilage as long the sieve-tube is active, but with coagulable sap in *Cucurbita*, and probably with watery sap in other plants.

The obliteration of the cribrose tubes begins with changes of the contents and the plates. In *Cucurbita* there appear in the sap some drops of mucilage and a coarse coagulum. Then the sap becomes quite rigid, but soon separates into small portions which are again dissolved and removed, or the sap gradually loses its coagulable ingredients without becoming rigid, and finally the protoplasm and mucilage disappear also. The plates always obliterate by the thickening of the callus layer and the narrowing of the pores. The effect of the latter change is that the mucilage lining the pores is changed into massive threads (*Cucurbita*) which become thinner and thinner until they disappear, being most likely transformed into callus. When the obliterating sieve-tubes are injured no accumulation of mucilage at the plates can be formed, because the mucilage contained in them is not fluid but rigid like caoutchouc.

The sieve-tubes are in direct communication with one another and with their accompanying cells by means of delicate threads; not, however, with the cambiform cells, which, in their turn, are connected by threads of protoplasm. J. S.

Observations on Diatomaceæ from the Neighborhood of Hertford.—Isaac Robinson. (Trans. Hertfordshire Nat. Hist. Society, vol. iv., part 7.)

The writer alludes to the fact that after a heavy rain the coloring matter of rivers often consists largely of diatoms. He also records his observations of cysts containing young diatoms in various stages of development. Appended is a list of 154 species found in Hertfordshire, mostly in the vicinity of Hertford.

C. H. K.

Botanical Notes.

Botanical Section of the Biological Society of Washington.—We have received a brief abstract of the papers delivered at the first meeting, from the Secretary. Prof. Burgess spoke on the Fresh-water Algæ, reviewed the literature of the subject, and called special attention to the work of American botanists. Prof. F. H. Knowlton followed with some remarks on "A Case of Sewer Obstruction by the Roots of Trees." Prof. S. M. Tracy described some Fungi from the Arid Regions, collected during a recent trip, including twenty-five species of *Erysiphe*. Several new *Pucciinas* and *Æcidiums* were also collected. Miss E. A. Southworth read a paper on the *Gleosporium* of the Wax Bean (*G. Lindemuthianum*), as a result of some studies carried on under the direction of Prof. F. L. Scribner.

At the second and third meetings, papers were read by Dr. Vasey, Dr. Riley, Mr. Galloway, Mr. Fernow, Mr. Crozier, Prof. Foster, Prof. Van Deman and Mr. Hopkins on various botanical topics.

Proceedings of the Club.

Owing to the severity of the storm, for the first time in its history the Club failed to hold its regular meeting. On Tuesday, March 20th, a special meeting was held, at which the president presided and thirty persons attended.

A letter from Joseph Jackson was read, giving an account of the botanical work of the Worcester Natural History Society, stating that Mr. J. Chauncey Lyford was delivering a course of lectures illustrated with lantern slides, duplicates of which he would be pleased to loan or exchange; also a letter from Miss Jane H. Newell, accompanied by pamphlets entitled "Outlines of Lessons in Botany," which she will be glad to send to any teacher who will use them and give her the benefit of the results attained, with criticisms and suggestions. Price, 15c. each.

Miss Steele reported on behalf of the Herbarium Committee the completion of the work on the herbarium of the late Wm. H. Leggett, and stated that all material received up to date had been mounted and put in order.

The secretary read a letter from Mrs. Gray, acknowledging the receipt of the resolutions of sympathy and condolence from the Club.

Dr. Newberry remarked on the geological history of *Liriodendron*, and exhibited drawings of a new species from the Laramie of Colorado.

The following papers were read as announced:

"A Preliminary Notice of the Pteridophyta Collected by Dr. H. H. Rusby in South America during the years 1885 and 1886." By Mrs. N. L. Britton.

"On a New Variety of *Erythronium*." By E. E. Sterns.

The Rev. Thomas Morong complimented Dr. Rusby on the excellence of his specimens and the number of species of ferns represented in the collection, and gave an outline of his proposed trip to the Argentine Republic and Chili and the headwaters of the Parana and Uruguay rivers.

BULLETIN

OF THE

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White Mountain Willows.—I.

By M. S. Bebb.

Plate LXXXI.

It has been my good fortune for seven consecutive summers to receive from Mr. Edwin Faxon, notes and critical observations on the White Mountain Willows, accompanied by specimens which for completeness have never been equalled except by those of Mr. Oakes. No other botanist has given these plants so much study afield, no one has ever before, by persistent exploration, continued year after year, become so familiar with their growth and development under different conditions and the extent of their distribution throughout the limited area which they occupy. Having obtained my friend's permission to make use of these notes, I trust the readers of the BULLETIN will commend my judgment in allowing them to retain all that interesting fullness of detail which they received originally in the unreserve of private correspondence.

If while editing them I am able at the same time to contribute somewhat to a better understanding of the species to which they relate, it will readily be seen how far I am still indebted to Mr. Faxon for the advantage derived from his satisfactory and instructive collections.

Salix balsamifera, Barratt.

While looking over the Willows in the herbarium of the Philadelphia Academy of Natural Sciences, in the spring of 1879, I came most unexpectedly upon a specimen of this species which had been collected in the White Mountains more than half a century ago! The whole mount was curious and antiquated. The sheet of hand-made paper was stained and yellow with age. The specimen, a mere fragment of leaves only, was held securely in place by a single thrust of one of the round-headed, hand-made pins of our grandmothers, which ran through the ticket under specimen and sheet and back through the ticket again. "Salix ——? Bank of Ammonoosuc, White Hills, N. H., H. Little, Aug., 1823!" Here we have, I doubt not, the oldest herbarium specimen extant of *S. balsamifera*. The collections of Drummond and Dr. Richardson, which gave Barratt his types, were made later, though only by a few years, and those of Bourgeau (upon which Andersson founded his *S. pyrifolia*) belong to our own day.

I immediately wrote Mr. Pringle, who was at this time giving to the exploration of the White Mountains the same energy and intelligent sharp-sightedness which have since distinguished his herborizations in Mexico, telling him what I had found. By return mail came the confident assurance that the plant would be rediscovered, followed in a few days, sure enough, by fresh specimens for verification.

On June 13th, 1879, Mr. Pringle, in company with Mr. C. E. Faxon, found *S. balsamifera* on the Saco, near the Crawford House, after having searched for it in vain along the Ammonoosuc. About a fortnight later, in the same summer, Mr. E. Faxon went over the ground very carefully and "succeeded in finding another clump of females on the south branch of the Ammonoosuc, about three-fourths of a mile from Mr. Pringle's habitat, and a very fine cluster of males on the east branch of the same stream, about four miles further north, very near the railroad from Fabyan House to the base of Mt. Washington."

As late as 1885 Mr. Faxon writes: "Although I have made frequent visits to the White Mountains since that year, I have not found any other habitats for this species," adding, "The pistillate cluster near Saco Lake and the plant north of Crawfords are in not quite so wet ground. They are both within a few feet of the carriage-road, and I think have been much injured in the winter by being broken down by snow, or by being driven over when partly covered by snow. One is very near a little brook that flows into the Ammonoosuc, and the other near a little pond, originally a mere bog-hole, but now by damming converted into a pond and dignified with the name of 'Lake.' The height of all three localities is about 1,900 feet above the sea."

It was during this season, 1885, that Mr. Faxon found "a very much battered alpestrine form on Mt. Lafayette, alt. 4200 feet, beside the bridle · ı near Eagle Lake."

On the fourth oı June of the following year our friend started from home for a tour of the White Mountains and returned on the 29th. The first few days were spent on the southern shore of Squam Lake, at Holderness, N. H., south of the whole range of White and Franconia Mountains. Here, at an elevation of about 500 feet above the sea, he found a little bush of *S. balsamifera*, that had been cut off near the ground and then sent up new shoots. Others doubtless occur in the same neighborhood but none could be found. In the Franconia Notch, 30 miles further north "three good clusters were found in a grassy meadow near the carriage road."

We come now to last summer, when the search for this willow, which Mr. Faxon has carried on year after year with unabated enthusiasm, was rewarded by the discovery of the plant in abundance. He writes as follows:—" Franconia, N. H., June 21, 1887. I have been here a fortnight and have found the *Salix balsamifera* quite common in and around the Larch swamps. I came too late for the male flowers, as the altitude is not more than 1,000 feet and the valley is quite warm in summer. With just now the fertile capsules opening and coalescing into huge, soft balls of whitest wool, almost hiding the beautiful red and maroon leaves of the growing tips, it is certainly the handsomest willow I ever saw."

S. balsamifera, Barratt. A much and irregularly branched shrub, 4 to 10 feet in height, sometimes growing in clumps of thickly-set, straight, upright stems, 1 to 2 inches in diameter at base, not much branched till near the top; bark of old stems rather smooth, dull gray; branches olive, recent twigs reddish brown, or on the sunny side shining chestnut; leaves ovate or ovate-lanceolate, 2 to 3 inches long, 1 to 1½ inches wide, broadly rounded and usually subcordate at base, acute or acuminate, at first very thin, subpellucid, and of a rich reddish color; at length rigid, dark green above, paler or glaucous beneath and beautifully reticulate-veined, glabrous on both sides or with a few scattered silken hairs when just expanded; margin glandular-serrulate, petioles long and slender, stipules noticeably absent throughout, or on the most vigorous shoots minute and evanescent; aments borne on slender leafy peduncles; the male densely flowered, very silky, obtuse cylindrical, 1 to 1½ inches long, scales rosy, anthers at first reddish, becoming deep yellow; female ament less silky, becoming very lax in fruit, 2 inches or more long; capsules rostrate from a thick base, the conspicuously long and slender pedicels six to eight times the length of the nectary; style short, bifid, stigmas spreading, thick, two-lobed. "No. 53, Herb. H. B. and T." (v. s. in Herb. Torrey). *S. cordata*, var. *balsamifera*, Hook., Fl. Bor.-Amer. 2, p. 149 (teste Herb. Hook.) *S. pyrifolia*, And. Monog., p. 162. DC. Prod., xvi., 2, 264 (v. s. Herb. A. Gray.)

The following will serve better than any comprehensive description to indicate the range of variation.

typica. Leaves ovate, 2 to 3 inches long, short pointed or the lower obtuse, rounded at base, at length rigid and glaucous beneath, with raised reticulate veins, minutely glandular-serrulate; fertile aments very loose, leaves of the peduncle few and large. This is the prevailing northern form.

vegeta. Leaves broadly lanceolate, 4 to 5 inches long, acute or acuminate, truncate or cordate at base, coarsely and irregularly repand-toothed, paler beneath; aments less spreading, not so leafy at base.

lanceolata. Leaves lanceolate, 2 to 4 inches long, ½ to ¾ inch wide; aments more slender, otherwise as in *f. typica.*

alpestris. Low bush, 2 to 4 feet high; leaves small, 1 to 2 in. long, lanceolate, pointed at both ends, rather coarsely and irregularly serrate, green both sides; male ament slenderly cylindrical, less silky. Eagle Lake, Mt. Lafayette, alt. 4,200 feet; also on the coast of Labrador.

In open swamps and along streams from Labrador and Nova Scotia west to the Saskatchawan Valley. Chateau and Squaw Islands, Labrador, "a small shrub, 1 to 2½ feet high, growing near rivulets in wet, peaty soil," *J. A. Allen.* Truro, Nova Scotia, *J. Macoun* and *Burgess.* Kent Co., New Brunswick, *Rev. James Fowler.* White Mountains, N. H., *H. Little*, 1823; rediscovered by *Mr. Pringle* and *Mr. C. E. Faxon*, afterwards found in abundance at Franconia by *E. Faxon.* Holderness, N. H., and Westmore, Vt., *E. Faxon.* Province of Quebec, *Prof. Dudley.* Flint, Mich., *Dr. Clarke.* Nepigon River, Ontario, and in various places north of Lake Superior, *Professors Macoun* and *Bailey.* Vermilion Lake, Minn., *Bailey.* Manitoba, *J. M. Macoun.* Cumberland House, *Drummond* (1825). Lake Winnipeg and the Saskatchawan, *Richardson, Bourgeau.* A well defined species not shading off into any other, not even into its nearest congener, *S. cordata*, from which it is always distinguished by the peculiar texture and veining of the leaves, absence of stipules and very loosely flowered fertile aments.

EXPLANATION OF PLATE LXXXI.

1–5. *Salix balsamifera, forma typica;* 1. leaf, 2-3 aments, 4, capsule × 8, 5 stamens × 8; 6. var. *vegeta;* 7. var. *lanceolata;* 8. *alpestris*.

Linnæus and his Genera of Plants.

BY EDWARD L. GREENE.

In the October number of this journal I have said that Linnæus "now and then seemed affected by a singular blindness to generic characters in plants." The remark was not thrown out at a venture, nor yet with any thought of making a sensation in circles where there might be supposed to linger a shade of that Linneolatry which, up to not more than two generations ago, ruled so largely the mind and the soul of the world botanical.

Before saying more I must do myself the justice of expressing my deep and sincere admiration for some sides of the character of Linnæus, and for much of his work in botany. Without scholarship, as compared with a goodly number of his botanical forerunners and contemporaries, and not scrupulous regarding the rights of others, he was still a great man, and a prince among naturalists; and no true botanist can ever fail to have something like veneration for the name of him who gave to the all important subject of scientific nomenclature its most immortal treatise, the first edition of the Species Plantarum, and who furnished us, in his Flora Lapponica, the most charming book of botany ever written. For their Linneolatry our forefathers are excusable, and we name not their ruling passion by way of reproach; but, as a scientific cultus, it is dead, or nearly so, and it has entailed consequences not always wholesome, which it will take some labor of future generations to correct.

In considering what were the gifts of Linnæus* regarding in-

*I have been accustomed to write Linné rather than Linnæus, following the usage of most modern writers, even the Scandinavian. But that is the French writing of the name, and Dr. Asa Gray, it is well known, objected to it in English. His objections seem to me well taken. The Swedish name, which was Lind, has never been used, and between the French Linné and the Latin Linnæus the latter seems the better choice for us who write English, notwithstanding that usage more and more favors the former.

[NOTE.—In justice to the author of this paper we must state that it has been in type since last November, having been since then revised and abbreviated by him.—EDS.]

sight into genera, we naturally look first to the matter of the number which were founded by him. If he was really an able expositor of generical relations in the plant world we shall expect to see his name appended, as the author of them, to a large number of the genera accepted by the majority of botanists to-day. This rational method of giving honor to whom honor is due in systematic biology, was in use in botanical literature before Linnæus, and he adopted it, although in a partial manner which called forth severe criticism from juster men than he among his contemporaries. But, looking into almost any treatise on the genera of plants for the solution of our question, we are sure of being misdirected from the start, unless forewarned, by the long array of familiar generic names which are therein most wrongly credited to him. This is one great incubus of error which has fallen upon our science, historically considered, largely through that inordinate zeal which our forefathers had for this great man.

Let us consult, in evidence, the pages of Bentham and Hooker's celebrated work. The very first order—Ranunculaceæ—will illustrate our point well enough. These authors recognize in the order thirty genera. Of these no less than eighteen, or three-fifths of the whole number, are credited to Linnæus. But, in sober truth, sixteen out of the eighteen genera ascribed to Linnæus by Bentham and Hooker had been well defined and named by competent botanists before Linnæus was born; and all but one of the sixteen bore the same names as now. Linnæus founded two of the Ranunculaceous genera, and no more; and one of these two, namely, *Cimicifuga*, he reduced to *Actæa* as early as the year 1753. So that when his work in botany was done there was in this great family of plants one genus, *Isopyrum*, among all those which he recognized as true genera, of which he could say that he had been the founder of it. Over and above *Isopyrum* and *Cimicifuga*, which must always in justice be credited to Linnæus, there remains *Actæa*, which, at least under that name, is his. But the pre-Linnæan botanists had defined it, and knew it well, though by another name, and one which is neither as polysyllabic nor as ill-sounding as several which have been made and received within the present century, *Christophoriana*.

So much for that grave falsity to history, and that injustice to good botanists of earlier times, which blemish the pages of the most useful of our books, and misinstruct the unwary student regarding who, in generations past, have been blind to generic characters and who have not.

And now to come down to the real matter of Linnæus' skill, or want of it, in setting limits to genera. We have been understood as saying that he did not always approve himself a skilful workman in that special line of botanical labor. That is what we meant to be saying, precisely. Nor did we suppose that any man well versed in the history of genera could question it.

I am not making myself the judge of Linnæus in this particular; but the opinion which I may have been the last to voice was pronounced quite unanimously, in fact if not in word explicit, by two successive generations of botanists who were dead before I was born. What was the general task which claimed the time and energies of men like Adanson, Mœnch, La Marck, Joseph Gærtner, Robert Brown, Haworth, Salisbury, the elder De Candolle, and other worthies of the first post-Linnæan epoch? That of bringing order out of the Linnæan confusion of genera. They had both to restore old genera of Tournefort, Plumier, Dillen and many more which Linnæus had demolished, because he had not eyes to see that they had been rightly founded; and they had to propose new genera upon plants which, as new, had fallen into Linnæus' hands, and so failed to obtain at first correct generical determination.

A few illustrations out of the many pages of them which could easily be adduced, will suffice.

Bentham and Hooker and their Ranunculaceæ, already cited on a point leading up to this, may here directly serve us. Take *Helleborus*. It was adopted by Linnæus as a generic name; but with him it embraced the three genera, *Helleborus*, *Coptis* and *Eranthis*. Not ignoring here what was adverted to in a previous paper, that is to say the Linnæan *Nymphæa*, compounded of true *Nymphæa* and two other genera, we may pass, for brevity's sake, to the Fumariaceæ, where a whole order, as known at that time, consisting of species of *Fumaria*, *Corydalis*, *Dicentra*, *Sarcocapnos* and *Cysticapnos* were jumbled together by him under the old generic name *Fumaria*. The Linnæan genus *Rudbeckia* was made up of three, including *Echinacea* and *Heliopsis ; Gnaphalium*, of four, taking in *Antennaria, Anaphalis* and *Leontopodium ; Pinus* of five, embracing *Abies, Picea, Tsuga* and *Larix ;* all pines, firs, spruces and hemlocks and larches being, in his eye, pines. His *Vaccinium* comprised also such different genera as *Gaylussacia, Oxycoccus* and even *Chiogenes*, and his *Pyrola* was not a full genus without *Moneses* and the species of *Chimaphila*. The order of Cactaceæ before his time was allowed to consist of a number of genera, and *Melocactus, Opuntia, Cereus* and *Pereskia*, with types of *Mamillaria* and *Echinocactus* in the bargain—all six made up his new genus *Cactus*, which latter name, I cannot but remark, has lost its place, notwithstanding its having had Linnæus for its author. Nor are these which I have given the most striking evidences of his blindness regarding genera. His *Polemonium* comprised not only all that was then known of the genus *Gilia*, but also a *Phacelia ;* his *Ipomœa* included also a Hydrophyllaceous plant, i. e., *Ellisia*. And, last of all which I will take time and space to tell of these multitudinous Linnæan confusions of genera, he combined under the name of *Lonicera* (pirated from Father Plumier), the old *Caprifolium* and *Xylosteum* to begin with, then added *Symphoricarpus* and *Diervilla* (of the same natural order), and finished, worthily of himself, by bringing in a "*Lonicera Marilandica*" (*Spigelia Marilandica*) from the Loganiaceæ and the genus *Cephaelis* from the Rubiaceæ ; so bearing away under his trophy of a name *Lonicera*, five or six genera, according to the most approved authors, and representing three natural orders.

I am persuaded I need not further illustrate Linnæus' weakness on the subject of plant genera, the greatest botanists of the present century being judges.

Diatoms of Atlantic City and Vicinity.

BY C. HENRY KAIN.

There is a popular belief that it is quite useless to attempt to collect diatoms in the winter, and while this is mainly true as regards fresh water species, it is not so with the marine forms. The only fresh water species that the writer ever collected in abundance during the winter was *Meridion circulare*, which was gathered from under the ice in January; but some marine species may be found in greater abundance during the winter months than at any other time. In order to know a locality thoroughly, however, it should be inspected both in summer and in winter.

The visitor to Atlantic City who is hunting diatoms, may always be gratified by taking the street cars and riding to the inlet. Two or three hundred yards before reaching the terminus of the road, a number of large, brackish pools may be observed on the meadows just south of the railway. These pools are quite shallow and are prolific collecting-grounds at all seasons of the year. If a day be chosen when the sun shines brightly, the surface of the mud is coated a rich brown by the myriads of diatoms which rise to the light, and if a gentle wind is blowing, the scum which is driven to the far shore by the wind is often composed entirely of diatoms without admixture of sand. On Christmas day, 1886, I collected in this way a very pure lot of *Nitzschia epithemioides*, and in another pool only a few yards away, an equally pure gathering of *Navicula veneta*. Sometimes very bright brown patches of diatoms cover the surface of the mud, and the collector, in his anxiety to secure a large gathering, is tempted to collect mud and all with the expectation of separating the diatoms from the mud by washing and whirling. The following plan will be found much better: Half fill a bottle with water; touch one of these brown patches lightly with the tip of the finger and the diatoms will adhere; then place the finger over the mouth of the bottle and shake; the diatoms are of course washed off and remain. By repeating this process again and again, the water finally becomes quite brown. By the time the collector reaches home the diatoms will have settled to the bottom, and the water may be poured off and the diatoms cleaned. It is worth while to examine under the collecting lens every promising patch of brown mud, for very pure gatherings of quite different species may often be collected within a few feet of each other. The species of which pure gatherings may be had in these pools are *Nitzschia epithemioides*, *Navicula veneta*, *Epithemia musculus* and *Scoliopleura tumida*.

A few rods south of the landing at the inlet is a flat which is uncovered at low water. Here may be collected *Schizonema*

Americanum, Schizonema Grevillii and *Berkleya fragilis;* and lodged upon the shells and growing upon the piling, specimens of algæ may be obtained which are often loaded with *Cocconeis* and other diatoms.

Out in the bay may be found flats, often acres in extent, where eel-grass is abundant. The grass is often loaded down with alga, which is parasitic upon it, and the alga in turn is often full of diatoms. As the water is shallow, a crab-net answers very well for dredging purposes, a single haul often furnishing a large lot of interesting specimens. I do not know what a visit to these flats in winter would reveal, but in August they are rich collecting-grounds.

It is also worth while to visit Longport, south of Atlantic City, for here, when the wind is west, quantities of algæ are blown over and stranded upon the shore of the thoroughfare. It may be mentioned, in passing, that the red species of algæ are the most prolific.

The pools that are so frequent upon the vast meadows that lie between Atlantic City and the mainland are also excellent collecting-places. On sunny days the surface of these pools is often almost covered with diatoms. *Scoliopleura tumida* and *Pleurosigma Balticum* may often be obtained here in great quantity. Other species of *Pleurosigma* and *Amphiprora pulchra* are not uncommon. In visiting these pools it is best to leave the train at Absecon station and visit those nearest the mainland, as those near Atlantic City are much contaminated with sewage.

In the brackish ditches, the curious and ever interesting *Bacillaria paradoxa* may often be obtained in abundance, sometimes clinging to the stems of water plants, but oftener in little patches upon the surface of the water.

Appended is a list of the species observed mostly during the spring and autumn months :

IN THE MEADOW-POOLS NEAR THE INLET.

Amphora costata, Gregory, *A. lanceolata*, Cleve, *A. lineata*, Greg., *A. plicata*, Greg., *A. rectangularis*, Greg. ; *Biddulphia rhombus*, W. Smith. ; *Coscinodiscus omphalanthus*, Ehrenberg, *C. eccentricus*, Ehr., *C. lineatus*, Ehr. ; *Epithemia musculus*, Kutzing; *Navicula amphisbœna*, Bory, *N. peregrina*, Ehr., *N. permagna*, Bailey, *N. prætexta*, Ehr., *N. veneta*, Kutz.; *Nitzschia bilobata*, W. Sm., *N. epithemioides*, Brebisson, *N. marina*, Grunow, *N. Sigma*, W. Sm., *N. vivax*, W. Sm.; *Pleurosigma Balticum*, W. Sm., *P. fasciola*, W. Sm.; *Rhaphoneis amphiceros*, Ehr.; *Scoliopleura tumida*, Rabenhorst; *Stauroneis aspera*, Ehr.; *Triceratium alternans*, Bailey, *T. favus*, Ehr.

ON ALGÆ IN THE BAY.

Achnanthes brevipes, Agardh; *Berkleya fragilis*, Greville; *Biddulphia aurita*, Breb., *B. lævis*, Ehr., *B. pulchella*, Gray; *Cocconeis scutellum*, Ehr.; *Grammatophora marina*, Kutz.; *Licmophora flabellata*, Ag., *L. tincta*, Grun.; *Melosira nummuloides*, Kutz.; *Rhabdonema Adriaticum*, Kutz., *R. arcuatum*, Kutz.; *Schizonema Americanum*, Grun., *S. Grevillii*, Ag.; *Striatella unipunctata*, Ag.; *Synedra fulgens*, W. Sm.

IN POOLS ON THE MARSHES NEAR THE MAINLAND.

Amphiprora pulchra, Bailey; *Bacillaria paradoxa*, Gmelin; *Melosira nummuloides*, Kutz.; *Pleurosigma Balticum*, W. Sm., *P. fasciola*, W. Sm., *P. hippocampus*, W. Sm.

IN BRACKISH DITCHES AND MARSHES NEAR ABSECON.

Actinoptychus undulatus, Ehr.; *Amphiprora pulchra*, W. Sm.; *Cocconeis scutellum*, Ehr.; *Coscinodiscus subtilis*, Ehr.; *Cyclotella operculata*, Kutz.; *Navicula elegans*, W. Sm., *N. didyma*, Kutz., *N. peregrina*, Ehr., *N. pusilla*, W. Sm., *N. Smithii, Breb.*, *N. forcipata*, Grev.; *Nitzschia dubia*, W. Sm., *N. fasciculata*, Grun., *N. granulata*, Grun., *N. Scalaris*, W. Sm., *N. Sigma* (W. Sm.) var. *rigidula*, Grun.; *Rhaphoneis amphiceros*, Ehr.; *Rhoicosphenia curvata*, Grun.; *Stauroneis salina*, W. Sm.; *Surirella angusta*, Kutz.; *S. Febigerii*, Lewis, *S. gemma*, Ehr., *S. Molleriana*, Grun., *S. ovata*, Kutz.; *Tryblionella levidensis*, W. Sm.

Notes on the Flora of the Upper Chemung Valley.

Unless otherwise specified, all the plants mentioned are found in the vicinity of Painted Post, Steuben Co., N. Y., which is situated at the junction of the Canisteo and Conhocton, the two streams that form the Chemung.

Ranunculus ambigens, Watson. Found in two localities, in one of which it is plentiful.

Hypericum Ascyron, L. Not uncommon.

Hypericum corymbosum, Muhl. Occasional.

Malva moschata, L, Scarce.

Linum Virginianum, L. Not common.

Polygala Senega, L. Plentiful in one locality.

Trifolium agrarium, L. Frequent.

Melilotus officinalis, Willd. Rare.

Vicia Americana, Muhl. Abundant in a meadow near Erwin Centre.

Hydrangea arborescens, L. Not uncommon in shaded, rocky places.

Gaura biennis, L. Not uncommon.

Œnothera fruticosa, L. Scarce.

Thaspium barbinode, Nutt. Locally abundant.

Aralia quinquefolia, Gray. Occasional.

Linnæa borealis, L. Frequent.

Lobelia spicata, Lam. Rare; seems to be disappearing.

Calystegia spithamæus, L. Not uncommon.

Campanula Americana, L. Several specimens along "The Narrows" of the Chemung River above Elmira

Penstemon pubescens, Solander. Grows in great profusion along the river banks.

Veronica Virginica, L. Scarce.

Gerardia pedicularis, L. Slope of West Hill, Elmira.

Castilleia coccinea, Spreng. With yellow variety, abundant in one station.

Monarda didyma, L. Frequent.

Monarda Clinopodia, L. Occasional specimens near Painted Post, and a number near "The Narrows" above Elmira.

Monarda fistulosa, L., var. *mollis*, Benth. Not uncommon.

Galeopsis Tetrahit, L. Occasional in gardens, Painted Post and Elmira.

Asclepias tuberosa, L. Grows abundantly on rocky hillside east of Painted Post.

Blitum capitatum, L. Rare; Mulhollen.

Euphorbia corollata, L. In July, 1887, was found growing abundantly in "The Narrows" above Elmira.

Corallorhiza multiflora, Nutt. Scarce.

Calopogon pulchellus, R. Br. Scarce.

Cypripedium spectabile, Swartz. Scarce; Beartown.

Erythronium albidum, Nutt. Two specimens; but the locality has never been revisited at the proper season since the plant was discovered there.

Chamælirium luteum, Gray. Not uncommon.

Allium cernuum, Roth. Frequent on the rocky banks of the upper Chemung.

Panicum xanthophysum, Gray. Rare.

In a peat bog in Beartown grow *Sarracenia purpurea*, L., *Drosera rotundifolia*, L., *Menyanthes trifoliata*, L., *Calla palustris*, L., and *Arethusa bulbosa*, L.

On the borders of this swamp are found *Coptis trifolia*, Salisb., *Geranium Carolinianum*, L., and *Viburnum cassinoides*, L.

ISABEL S. ARNOLD.

Capsicum fasciculatum—sp. nov.

Stems smooth, green, round, subverrucose, swollen at the branchings and purple, dichotomous or trichotomous. Branches angular, few, erect-spreading, green, purple at insertion of petioles, subpubescent, bearing the leaves for the most part clustered or bunched at the swollen summits. Leaves spreading, crowded into bunches, nearly of one size, the larger ones 3¾ in. by 1⅛ in., usually 3 in. by ¾ in., elliptical-lanceolate, pointed at both ends, from the base extending equally into the petiole, deep green above, paler below, the middle nerve distinct; slightly scabrous, entire or subrepand; borne almost entirely in a confused mass along with the berries at the summit of branches, very rarely lower down. Petioles smooth, nearly as long as, or sometimes even longer than the leaves, slender, margined by the extension of the leaf blade. Peduncles smooth, angular, thickish, erect, enlarging towards calyx end, rather long, 1½ in., grouped in clusters rather confusedly with the leaves, but the tendency of the grouping seeming to be in twos or threes, axillary or extra-axillary. Calyx cyathiform, embracing base of fruit, obscurely ten or twelve-nerved (5 or 6 distinct), subpentagonal, subtruncate, five or six-toothed, the teeth acute, erect, smooth. Corolla white, quite large, about 7/8 in. in diameter, the divisions very long and narrow, often twisted. Berry cylindro-conical, straight or curved, about 3 in. long, by 1/4 in. diameter, or smaller, usually rugose, sometimes smooth, at first a shining green, then red; two-celled; the placenta thick at the base; acrid.

This species differs principally from *Capsicum annuum*, Fingerhuth, by the round stem; pubescent and dichotomous or trichotomous branchings; freedom from lower leaves; the leaves clustered at summits; all of one size and nearly or quite lanceolate; petioles as long as the leaves; the clustered peduncles; the white corolla with deep and narrow lacineæ, and the shining green of the unripe berry. The aspect of the plant is very distinct, the dark green lanceolate leaves closely clustered and so dense as to overlap, the low and spreading compact, bush-like appearance, the fruit crowded with the leaves, the bare and knobby-looking stems where exposed to view. As grown by me the plant was 1-1 1/2 ft. high, and ripened its berries in September of the year when sown.

This variety was in Vilmorin's sale catalogue of 1886. Its French garden name is Bouquet rouge; its American name Red Cluster. It is, however, well figured under the name *Tenjiku-mamori* in a Japanese botanical work, published in 1874, the "So-Mokou," vol. 3, t. 38.

I do not find any published descriptions which can possibly refer to this plant, and in my judgment its distinctive appearance and the closeness to type of the plants from seed received from different sources, entitles us to the presumption that it is a true species. I have hence ventured upon giving to the public a name and a description, the specific name *fasciculatum* referring to the peculiar clustering or tufted appearance of the foliage.

E. LEWIS STURTEVANT.

SO. FRAMINGHAM, MASS., April 6, 1888.

Flora Temiscouatensis.

During the early part of last September my labors in connection with the Geological Survey of Canada took me into that very charming and delightfully picturesque district surrounding

Lake Temiscouata, in the Province of Quebec, Canada, where I was enabled, during a few leisure moments, to jot down lists of the easily recognized and common forms of plants occuring there and to obtain a collection of specimens unknown to me, or of rare occurence, for study and determination. On returning from the field last October, these lists and the plants mentioned were submitted to Prof. Macoun, the Dominion Botanist, who very kindly revised the one and identified the others. I feel under great obligation to Prof. Macoun therefor.

In the November issue of this BULLETIN Mr. Northrop published an interesting paper giving a "catalogue" of the plants collected by him in Temiscouata County, from the shores of the Saint Lawrence on the north to Edmunston and Grand Falls, New Brunswick, on the south. Having recently compared Mr. Northrop's lists with mine I find that his lists contain a large number of species which were not contained in my completed list which made my "Flora Temiscouatensis." But I find also that a goodly number of species are comprised in mine which it may not be deemed out of place to present now. These additional species were all collected and recorded from the shores of Lake Temiscouata, of the Tuladi River and of Tuladi Lake, as also the other species contained in my lists, also contained in Mr. Northrop's "Catalogue" which it is needless here to repeat.

Clematis Virginiana, L.
Actæa alba, Bigelow (in fruit).
Anemone Pensylvanica, L.
Nymphæa microphylla, Pers.
Capsella bursa-pastoris (L.), Mœnch.
Oxalis corniculata, L., var. *stricta* (L.), Sav.
Acer Pennsylvanicum, L.
Negundo aceroides, Mœnch (introduced).
Rhus toxicodendron, L. (climbing or trailing variety.)
Lathyrus palustris, L.
Cratægus sp. (a form with small orange-yellow fruit).
Epilobium coloratum, Muhl.
Cicuta maculata ? L.
Lonicera ciliata, Muhl.
Viburnum acerifolium, L.

Solidago latifolia, L.
S. lanceolata, Ait.
S. rugosa, Mill.
Aster acuminatus, Michx.
A. cordifolius, L.
Cnicus lanceolatus (L.), Willd.
C. muticus (Michx.), Pursh.
Gnaphalium decurrens, Ives.
Prenanthes altissima, L.
Taraxacum officinale, Weber.
Chiogenes hispidula (L.), Torrey and Gray.
Pyrola secunda, L.
P. rotundifolia, L., v. *asarifolia* (Michx.), Hooker.
Plantago major, L.
Trientalis Americana (Pers.), Pursh, (in fruit).
Lycopus Virginicus, L.
Polygonum Persicaria, L.
P. amphibium, L.
Alnus incana (L.), Willd.
Habenaria Hookeriana, Torrey.
Cypripedium acaule, Ait.
Trillium erythrocarpum, Michx.
Smilacina racemosa (L.), Desf.
Pinus Strobus, L.
P. resinosa, Ait.
Picea alba, Link.
Abies balsamea (L.), Miller.
Larix Americana, Michx.
Pteris aquilina, L.
Onoclea Struthiopteris, Hoffm.
O. sensibilis, L.

NOTE.—The following interesting species were also collected by the writer, but at Rimouski, on the south shore of the Saint Lawrence. *Viola tricolor*, *Erodium cicutarum*, *Matricaria inodora*, *Salsola Kali*, *Cakile Americana*, *Mertensia maritima*, *Achillæa Ptarmica*, besides others of more common occurrence.

HENRY M. AMI,
Cor. Mem. Torr. Bot. Club.

Geological Survey of Canada,
Ottawa, Canada.

Botanical Notes.

Cypress Knees.—Accumulated facts render it much more easy to "put this and that together" and form reasonable deductions than in past times, yet nothing but shrewd guesses have been offered in explanation of the habit the *Taxodium* has, of throwing up the excrescences known as "Cypress Knees." The generally accepted guess is that they serve to supply the submerged roots with air, but just how this tough woody tissue can act in this manner is not clear to the vegetable physiologist. This guess was in a measure supported by the statement that the tree produced knees only when in very swampy ground. I once believed this, but recently an instance came before me where on a dry bank, though near a lake, the knees were abundant. I have seen them in dry places in Mississippi and Louisiana, but I fancied the situations were once wet, when the knees were first formed. A writer in an English horticultural journal hazards a wholly novel guess that they are abortive suckers, and in support of this states that a tap-root is always found beneath a knee. This last statement of fact is wholly new to me, and I should be glad to know whether it can be confirmed by observations in our country. THOMAS MEEHAN.

Specimens of our North American Roses of every species, variety and form, from all parts of the country, but more especially from the west coast, are greatly desired by M. F. Crèpin, to aid in the preparation of his forthcoming "Monograph Général." Packages may be sent for this purpose to Dr. G. N. Best, Rosemont, Hunterdon Co., New Jersey. M. Crèpin will give due credit to all contributors in the pages of his monograph.

British Uredineæ and Ustilagineæ. Chas. B. Plowright, F. L. S., 8vo., about 270 pp. Price, *7s., 6d.*

The above work, which will be published as soon as the requisite number of subscribers has been obtained, besides containing descriptions of the British species of these fungi, will also give a full account of their Biology, so far as this is at present known, including the methods of observing the germination of their spores, and of their experimental culture. Subscriptions should be sent to Messrs. Kegan, Paul, Trench & Co., 1 Paternoster Square, London, England.

Notes on Medicinal Plants.

The various "Loco-weeds," *Astragalus molissimus*, Torr., *A. lentiginosus*, Dougl., *A. Mortoni*, Nutt., and other species of *Astragalous*, with *Oxytropus Lamberti*, Pursh, have periodically attracted notice in the medical press for many years. Of late they have received considerable attention from experimenters. The Homœopathic Recorder, in its issue of September last, devotes eleven pages to a detailed account of experiments made with the homœopathic preparations of *O. Lamberti*, under the direction of Prof. Wm. S. Gee, by five of his students, covering a period of nearly three weeks. From the very first, an infinity of symptoms were noted. We remember once taking, while collecting in central Arizona, at a single experimental dose, many times more than all these experimenters took in the course of the entire three weeks, but without result except a slight nausea, due to the unpleasant taste of the plant. Studies made at the University of Pennsylvania have failed to find in the plants any poisonous principle whatever, though it is admitted that their long continued and excessive consumption produces important destructive mental, followed by nutritive, changes in stock.

Prof. Nagai, of Japan, reports the discovery in *Ephedra vulgaris*, Rich., of the alkaloid Ephedrin, which is an efficient mydriatic. The American species are now being examined for the presence of this compound.

A new anthelmintic is the Mysinaceous plant *Embelia Ribes*, Burm., of the East Indies.

Lallemantia Iberica, F. & M., a very near relation of *Cedronella*, indigenous in Asia Minor, seems likely to become an important source of a new commercial oil.

The Magnoliaceæ are furnishing the market with a new febrifuge bark from *Michelia Nilagirica*, Zenk., of India.

The *Anchietea salutaris*, St. Hil., a violaceous vine of Brazil, whose properties have long been known to the aborigines of its own country, is attracting some attention in Europe, in the treatment of diseases of mucous membranes.

A species of *Pterocarpus*, described by Aublet as *Vatairea Guianensis*, is found to be of service in skin diseases. It would now be of great interest to secure satisfactory specimens of this plant, in order that the doubt concerning its classification might be set at rest.

Announcement of the A. A. A. S. Committee on a Botanical Exchange.

To the Members of the Botanical Club of the A. A. A. S.:

Your committee, appointed in August last to devise a method for the exchange of specimens among American botanists, have, after consultation with other botanists, decided that the most practical method is through the herbarium of the Department of Agriculture, at Washington.

A classified stock of duplicates belonging to the Department is available as a basis of an exchange herbarium.

Those desiring to exchange specimens should address, for rules and other information, Dr. Geo. Vasey, U. S. Department of Agriculture, Washington, D. C.

GEO. VASEY, N. L. BRITTON,
SERENO WATSON, B. D. HALSTED,
THOMAS MORONG, Committee.

Reviews of Foreign Literature.

Experimentelle Untersuchung über das Wachsthum der Zellmembran. By F. Noll. (Abhandlung der Senckenbergerischen Naturforschenden Gesellschaft, Bd. xv, 1887.)

A short review of this paper, describing some interesting experiments in respect to the manner of growth of cell membrane, is given in the Centralblatt, Vol. 33, No. 4, 1888. The following is a brief abstract of the review:

The author first gives a historical sketch of the opinions held, at different times, of the manner of growth of the cell membrane. The first generally adopted theory was that of growth by apposition. Naegeli, in his work on starch grains, almost entirely overthrew this theory, establishing in its place that of intussusception. Gradually doubts arose regarding this mode of growth and the opposition theory gained new adherents, until at the present time the two theories stand opposed to each other, and the question is left for future investigators to decide.

The author undertakes to solve the question experimentally, by causing a difference in color between the old and new growth of membrane. As the new membrane will not take up aniline or similar coloring stuff, the old membrane was colored and the new left colorless. The method used has already been successful in solving questions in animal physiology. Living specimens were colored with either Prussian or Turnbull's blue. The plants experimented with were sea Algæ, mostly from the family Siphonaceæ, such as *Caulerpa*, *Derbesia* and *Bryopsis*, obtained at the zoölogical station at Naples.

The method of coloring consisted in putting the plants for a few seconds into a solution of potassium-ferrocyanide, then rinsing well in sea-water, then dropping them for an instant only into a freshly prepared solution of ferric chloride. This process was repeated till the plants assumed a light blue color.

In order to prove what effect this might have on the life energies of the plants so treated, colored specimens were compared with uncolored ones. No difference could be detected between the two classes as to rapidity of growth, motion of protoplasm, or form assumed by growing parts. The cell membrane was colored uniformly; the cuticularized layer a dark blue, the cellulose a lighter color.

This color disappears in living plants after a few hours, but may be called back again by putting them into a solution of potassium-ferrocyanide, acidified with pure hydrochloric acid. That the coloring process had produced no change in the qualities of the membrane was shown, in that no change could be detected in form, elasticity, ductility, etc. The ability to assume other forms, wood, cutin, etc., was not changed.

By watching the disposition of the new particles as the new uncolored membrane was formed, the author believes to have proven beyond controversy that in these sea Algæ, both apical growth and growth in thickness of wall takes place by apposition.

By apical growth is meant here the extension of a wall at the extremity of a cell, by which means the cell is lengthened in that direction. He says this growth takes place as follows: "When the colored plants grow on farther, the points of the young shoots break through the old colored membrane." That is, the old membrane grows thinner at that point or surface where the new is to appear, a new colorless membrane is laid on by apposition, grows gradually thicker, while the old grows thinner, the original thickness being thus preserved till at last, the old membrane bursts and the new grows on. This, he says, is the so-called eruption growth, the old membrane having burst, the young shoot is built out of entirely new material.

In a similar manner the growth of the cell wall in thickness proceeds, by new layers added on to the old blue membrane. As these new layers were added it was proven that foreign substances, like balls of dead protoplasm, could be enclosed in the cellulose of the wall, and the author believes this to be the origin of the nitrogen supposed by Wiesner to be an essential part of the wall.

The increase of the wall in surface, so far as it is not brought about by the apical growth referred to above, is said to take place by means of the stretching rendered possible by the influence of the protoplasm; this extension, he says, is not as great, however, as Naegeli affirms.

The growth of the leaf-like organs of *Caulerpa* takes place by new pieces of membrane, periodically breaking through the upper edge of the old. Occasionally the point of vegetation was seen to divide and two leaflets were formed, whose junction he supposed might be the place where the reproductive organs were formed.

These observations were particularly well confirmed in the nearly transparent structures of *Bryopsis* and *Derbesia*, while exact measurements showed that no supplementary increase of the thickness of the blue zone had appeared, or, what is the same, that no growth by intussusception had taken place at the same time apposition was going on. That this was not due to the iron in the coloring matter was proven by comparison with uncolored plants.

The manner of origin of the new layers is represented by the author in the following manner: The outer layer of protoplasm becomes gradually more and more laden with particles of carbohydrates, while the proteid matters retreat from the outside, until at last, instead of the outer layer of protoplasm, a cellulose lamella is formed, which sits firmly upon the old wall. This is, indeed, a process of intussusception, but it takes place in particles of living protoplasm and not in those of a dead wall.

Some examples are given of membranes which do not appear to be a regular formation, but occurring now and then. Such are partition walls occurring with no dependence upon division of nucleus, also the threads or beams (balken), as they are called in German, which are thrown across from wall to wall, apparently as supports. These appear first as protoplasm strings, and are afterward transformed into cellulose. *Caulerpa* is not the example referred to.

Other plants submitted to this test were *Codium tomentosum* and *C. Bursa*, *Dasycladus clavæformis*, *Udothea cyathiformis*, *Polysiphonia variegata* and a few out of the Cladophoraceæ, all of which gave similar results as to the question of apposition.

The author concludes from these results that, in general, the growth of cell membrane depends on apposition, and that there remains no longer any direct proof of growth by intussusception.

Not having access to the original article, it is impossible to determine from the review just what the author means in reference to the manner of growth in surface of a cell wall after the foundations are once laid. This is one great difficulty in the apposition theory, which offers no satisfactory explanation of the phenomenon called surface growth, that is, growth in the other two dimensions before growth in thickness begins. The only reference to this point is the one quoted, in which the author refers such growth to the stretching of the wall caused by the influence of the protoplasm. Also at the end of the review it is stated that the author believes with Sachs and de Vries that all growth is dependent upon turgor, and holds Krabbe's view essentially wrong; further, that the acceptation of turgor as the necessary condition to growth excludes the necessity of the notion of growth by intussusception.

How this excludes such necessity is not made clear in the review. Neither does it appear by this experiment that growth by intussusception is, with absolute certainty, disproved in the case of surface growth. For allowing that it does take place, that new uncolored particles of cellulose are shoved in between the old colored particles, the only visible effect of this would be to render the color of the old membrane lighter blue and it seems this is exactly what does take place of itself, as he states, in living plants—the color fades in a few hours.

There is also one other point of interest not referred to, that is, the manner of growth in the "balken" of Caulerpa. This seems especially desirable to determine, inasmuch as it has been made the means of supporting both theories, first by Naegeli, as proving intussusception, afterward by Strasburger, as evidence of the opposite theory. It would seem that the test of coloring the old membrane might have thrown light on this question, but the author expressly states Caulerpa was not the plant in which the origin of the balken was traced.

It is quite possible the weight of these remarks would be removed by a perusal of the original, and their only excuse is, the interest awakened in the old question by these experiments, and the hope that the same or similar methods may be of use in helping to a knowledge of the mystery of the manner of growth of the cell wall. E. L. G.

Index to Recent American Botanical Literature.

Agarics of the United States.—Genus Panus.—Edward J. Forster. (Journ. Mycol., iv., pp. 21-26.) Fourteen species described.

Aquilegia longissima, Gray. (Garden and Forest, i., p. 31, fig. 6.)

Archæan Plant from the White Crystalline Limestones of Sussex County, New Jersey.—N. L. Britton. (Annals N. Y. Acad. Sci., iv., pp. 123, 124, plate vii.; reprinted.)

Asa Gray. Among the many memorials which have been published, the following are worthy of record:

"In Memoriam," containing the funeral services as held in Appleton Chapel, Harvard College, Feb. 12, 1888 (pamphlet 8vo, 49 pages, Cambridge University Press); "Asa Gray, 1810-1888," by Prof. J. D. Dana (Am. Journ. Sci., xxxv., pp. 181-202, reprinted); and reviews by J. D. Hooker (Nature, xxxvii., pp. 375-377), C. S. Sargent (Garden and Forest, i., Nos. 1 and 2, accompanied by a fine photogravure reproduction of the St. Gauden's bronze medallion), W. G. Farlow (Bot. Gaz., xiii., pp. 49-52), Thos. Meehan (The American Garden, ix., p. 100), Edson S. Bastin (Western Druggist, x., p. 42, with portrait), Fr. Hoffman (Pharm. Rundsch., vi., pp. 49-56, with portrait and chronological list of works), M. T. Masters (Gardeners' Chronicle, iii., p.

144), and resolutions by the New York Academy of Sciences, (Trans. vii.) Memorial services were also held by the Biological Society of Washington, April 5th, when J. W. Chickering, Jr., Dr. Geo. Vasey, Prof. L. F. Ward and C. V. Riley reviewed Dr. Gray's various services to science.

Botanical Works of Geo. Engelmann. Collected for Henry Shaw, Esq. Edited by Wm. Trelease and Asa Gray. (4to, pp. 548, 102 plates. Cambridge, 1887.)

This elegant tribute to Dr. Engelmann's memory, has been widely distributed to institutions and societies through the intelligent liberality of Mr. Shaw. It contains his complete works, reprinted from the various reports, journals and transactions of societies where they originally appeared, prefaced by a fine portrait and interesting biographical sketch by Dr. Gray, from the Proceedings of the American Academy. The table of contents "will excite the surprise of those who thought themselves well acquainted with Dr. Engelmann's work." Many of the plates and cuts have been reproduced only with much trouble and expense. Mr. Shaw has conferred a great service to botanical science by this magnificent monument to his friend and associate.

A few unbound copies may be had from Prof. Wm. Trelease, at the Shaw School of Botany, St. Louis, Mo., at cost price, $12.00.

Botany as a Recreation.—F. LeRoy Sargent. (Pop. Sci. News, xxii., pp. 3, 17-18, 35-36, 51-52.)

Brodiæa (Triteleia) Howellii. J. D. Hooker. (Bot. Mag., t. 6989).

California dry-winter flowers.—Byron D. Halsted. (Pop. Sci. Month., xxxii., pp. 770-776.)

Carex—Notes on, IX.—L. H. Bailey. (Bot. Gazette, xiii., pp. 82-89.)

Still the genus yields new forms, indeed two new species, ten new varieties and a hybrid are here proposed.

Chionophila Jamesii, Benth.—Sereno Watson. (Garden and Forest, i., pp. 79, 80, fig. 15.)

Collection of Ferns made by Baron Eggers in St. Domingo.—J. G. Baker. (Journ. Bot., xxvi., pp. 33-35.)

Nephrodium myriolepis, Acrostichum Eggersii and *Lygodium gracile* are here described.

Doassania, Cornu.—Revision of the Genus.—J. B. De Toni (Journ. Mycol., iv., pp. 13-19.)

Eleven species are recognized, five of them American.

Flora Peoriana.—Frederick Brendel. (8vo, pp. 89, Peoria, 1887.)

This is a very interesting essay on the results of thirty-five years' observation on the vegetation of an area of about three hundred square miles. It contains, besides the enumeration of 835 Phanerogams and Pteridophytes, partial lists of Bryophytes and Thallophytes, accounts of the geographical distribution of the plants, a list of Illinois plants not found at Peoria, and much other valuable information.

Forest Trees of the far Northwest—Geo. M. Dawson. (Garden and Forest, i., pp. 58, 59.)

Forests of the South—The hard wood.—Karl Mohr. (Garden and Forest, i., pp. 34, 35.)

Forests of Vancouver Island—John Macoun. (Garden and Forest, i., pp. 46, 47.)

Fungi from Western Kansas.—Notes on.—W. T. Swingle. (Journ. Mycol., iv., pp. 27-29.) A list of species collected by Mr. E. Bartholomew in Rooks County.

Fungi, Kansas Parasitic.—Second List of, together with their Host Plants.—W. A. Kellerman and M. A. Carleton. (Trans. Kansas Acad. Sci., x., pp. 88-99; one plate.)

Two hundred and sixty-six species are enumerated; the spores of the *Pucciniæ* are figured.

Fungi—New Kansas.—J. B. Ellis and W. A. Kellerman. (Journ. Mycol., iv., pp. 26, 27.)

Six new species in *Vermicularia, Æcidium, Phleospora, Septoria and Phyllosticta.*

Fungi, North American—Index of Habitats Centuries, XI to XX. Compiled and published by W. C. Stevenson, Jr. pp. 4.

Fungi, Nova Scotian.—Additions to the List of.—J. Somers. (Proc. and Trans. Nova Scotian Inst., Nat. Sci., vii., pp. 18, 19.)

Grass Flora of the Nebraska Plains.—Chas. E. Bessey. (Amer. Nat., xxii., pp. 171, 172.)

Hairs of the Plane Tree. (Gard. Chron., iii., p. 370.)

The writer records that the stellate hairs of *Platanus occidentalis* and *P. orientalis* are the cause of irritation to the mucous membranes of the throat and nose, and calls attention to the fact that this was known to Galen, Dioscorides and Plato.

Heleocharis prolifera, Torr.—Arthur Hollick. (Proc. Nat. Sci. Assoc. Staten Island, March 10, 1888.)

Mr. Hollick describes the occurrence of a plant in a deep spring on Staten Island, provisionally referred to this species.

Hydrophyllum Canadense.—Etude anatomique.—M. Garcin. (Bull. Trimes., Soc. Bot. Lyons, v., pp. 77-85.)

Indigenous plants, Pharmacopœial.—R. G. Eccles, M. D. (Western Druggist, x., pp. 43-46, 79-81.)

Iowa Peronosporæ and a dry Season.—Byron D. Halsted. (Bot. Gaz., xiii., pp. 49-59.)

Iris bracteata.—Sereno Watson. (Garden and Forest, i., p. 43, fig. 8.)

Isoetes.—The distribution of.—L. M. Underwood. (Bot. Gaz., xiii., pp. 89-94.)

Prof. Underwood enumerates the species of Europe, Africa, Asia, Australasia, South America and North America, quoting freely from Baker and Engelmann; reaches some interesting general conclusions and describes two new species, *Isoetes Mexicana,* collected by C. G. Pringle, Oct., 1887, and distributed as No. 1447, and *I. maritima,* from Vancouver Island, collected in August, 1887, by John Macoun.

Kansas Forest Trees, identified by Leaves and Fruit.—W. A. Kellerman and Mrs. Kellerman. (Trans. Kansas Acad. Sci., x., pp. 99-111; also reprinted.)

Lentinus lepideus, Fr., and Trametes Pini, Fr.—Notes on. P. H. Dudley. (Journ. N. Y. Micros. Soc., iv., pp. 118, 119.)

Lichen new to the United States.—E. A. Rau. (Journ. Mycol., iv., p. 20.) *Trypethelium heterochrous* (Mont.), Tuck., from Lake Osceola, Fla.

Lichenology—Recent Contributions to American.

Lichenes Fuegiæ et Patagoniæ.—Exposuit W. Nylander, Paris, 1888.

Greenland's Lichen-Flora.—By J. S. D. Branth and Chr. Grœnlund, Copenhagen, 1888.

The first of these works contains an account of the Lichens of the region mentioned from the collections of C. Spegazzini in 1882, of Cunningham in 1868, and other collectors. But the author does not seem to have known of the collection of the Hassler Expedition of 1872, the lichens of which were collected by Rev. Thomas Hill, and a few of them (new species) were described by Tuckerman in Abs. Lich., No. 4, 1877. The number of species in Nylander's list is nearly 100, several of which are new. Other additions would probably be made by a competent student of the Hassler collection.

The second work is the fullest list of Greenland Lichens yet made. It is preceded by an interesting account of the Greenland Lichen literature and collectors. The number of species is about 150. The work is in Danish, except a few notes in Latin.

H. W.

List of Plants collected by Miss Mary B. Croft, at San Diego, Texas, during the years 1885 *and* 1886.—N. L. Britton and H. H. Rusby. (Trans. N. Y. Acad. Sci., vii., pp. 7-14; reprinted.)

An enumeration of 175 species, including *Houstonia Croftiæ*, n. sp. *Anemone heterophylla*, Nutt., is reduced to a variety of *A. dichotoma*, L., and several changes are made according to the principle of using the oldest specific or varietal names.

Local Floras.—The study of—Gerald McCarthy. (Journ. Elisha Mitchell Sci. Soc., iv., pp. 25-30.)

Loganiaceæ.—The natural order of.—R. G. Eccles, M. D. (Pharm. Rec., viii., pp. 41-44.)

Mahonias or Ash Barberries.—W. Goldring. (Garden, xxxiii., pp. 198, 199; illustrated.) *M. repens*, *M. nervosa*, *M. fascicularis* and *M. Aquifolium* are figured.

Manual of the Microscope in Vegetable Histology. By Edward Strasburger, translated from the German by Rev. A. B. Hervey. (8vo., pp. 382, Boston, S. E. Cassino, 1887. Price, $2.50).

This is the second English translation of Strasburger's Kleine Botanischer Practicum. As the original, it contains thirty-two chapters beginning with the use of the microscope, proceeding to the examination of cells and tissues, the epidermis being treated separately, passing to the study of vegetative organs, and next to the various groups, beginning with protophyta and ending with angiosperms. The volume is well illustrated and handsomely printed. The appendix treats of various re-agents recommended for use.

Marah over Megarrhiza, Torr.—Priority of Dr. Kellogg's Genus. —Mary K. Curran. (Bull. Cal. Acad. Sci., ii., pp. 521-524.)

It appears that the generic name *Marah,* Kellogg, was published in the Proceedings of the California Academy, Vol. i., p. 38, in 1855, while Dr. Torrey's *Megarrhiza* came in the following year. If the reference of these plants to *Echinocystis* by Bentham and Hooker and Professor Greene is to obtain, the relative age of the other two generic names has no special importance.

Mimicry among Plants.—J. T. Rothrock. (Proc. Acad. Nat. Sci. Phila., 1888, pp. 12, 13.)

Professor Rothrock groups the cases of mimicry under two heads: 1. Resemblances between plants in groups clearly distinct. 2. Resemblances between plants in the same natural family, and gives interesting examples of both.

New or rare Plants.—Asa Gray. (Bot. Gaz., xiii., p. 73.)

This is a paper found on Dr. Gray's study-table, and contains notes on *Hibiscus incanus,* Wendl., *Blepharipappus lævis, Hieracium Howellii,* n. sp., and *Troximon barbellulatum,* Greene.

Pathology of Pollen in Æstivis or Hay-fever. Samuel Lockwood. (Journ. N. Y. Micros. Soc., iv., pp. 99-105, one plate.)

Prof. Lockwood, presents an illustrated paper on the relations of pollen in hay-fever. His most pertinent suggestion is as to its action as a "pseudo-parasite." Referring to the well-known disposition of pollen to send its tubes down into moist surfaces, he thinks that this action may be induced when it comes into contact with the mucous membrane of the nose, thus causing the acute stinging pain which is such a persistent symptom of the disease. The plate illustrates pollen of *Ambrosia* and *Solidago*.—

Plants—The earliest. Sir Wm. Dawson. (Pop. Sci. Month., xxxii., pp. 787-795; illustrated by six figures.)

Relation of Sarracenia purpurea to S. variolaris.—W. P. Wilson. (Proc. Acad. Nat. Sci. Phila., 1888, pp. 10, 11.)

Professor Wilson concludes from the facts that the first leaves of these species "are perfect miniatures of each other," and that the abundant nectar secreting glands of *S. variolaris* are represented by inactive or rudimentary structures in *S. purpurea*, that the latter is a retrograde development from the former.

Typha.—J. Schneck. (Bot. Gaz., xiii, p. 98.)

The author calls attention to the use of the leaves when dried for making tight the joints of headings and between the staves of barrels.

Uredineæ.—New Western.—S. M. Tracy and B. T. Galloway. (Journ. Mycol., iv., pp. 20, 21.)

Eight novelties in *Uromyces, Puccinia* and *Æcidium.*

Vegetable Histology.—E. S. Bastin. (Western Druggist, x., Nos. 1-4, continued.)

Vegetable Cell.—Recent contributions to our knowledge of the.— G. L. Goodale. (Am. Journ. Sci., xxxv., pp. 341-344.)

Yucca filifera.—C. S. Sargent. (Garden and Forest, i., pp. 78, 79, figs. 13, 14.)

Proceedings of the Club.

The regular monthly meeting was held in Hamilton Hall, Columbia College, April 10, 1888, President Newberry in the chair and eighteen persons present.

Mrs. Annie Chambers-Ketchum, Mrs. Edw. Heylyn, Rev. Geo. D. Hulst, Prof. Thos. C. Porter and Wm. Bryce, Jr., were elected active members.

Miss Isabel Mulford, of Vassar College, Miss H. J. Biddlecome, of Columbus, Ohio, Miss Cutter, of Lee, Mass., and Edwin Faxon, Cambridge, Mass., were elected corresponding members.

The following Field Committee was appointed: J. F. Poggenburg, Miss A. B. Rich and Arthur Hollick.

Dr. H. H. Rusby presented a letter from H. B. Harris, Third

Assistant Postmaster General, in reply to his application printed in this BULLETIN, January, 1888, p. 27, in which the decision is made by the Department THAT NATURAL HISTORY SPECIMENS WITH WRITTEN DESCRIPTIVE LABELS ARE ADMISSIBLE TO THE MAILS AT THE FOURTH-CLASS RATE OF POSTAGE, WHICH IS ONE CENT AN OUNCE.

The following amendment to the By-Laws was adopted:

VII. There shall be appointed upon the adoption of this by-law and at each regular annual meeting thereafter two distinct Flora Committees, of three members each,—one for Phanergamia and one for Cryptogamia—whose duty it shall be to prepare complete and accurate lists of all the plants, native, naturalized and adventive, occurring within 100 miles of New York City, and to have such lists published with as much description and illustration as they shall deem best, and the funds obtainable for the purpose shall warrant.

The President appointed J. F. Poggenburg, N. L. Britton and E. E. Sterns, Committee on Phanerogamia; Mrs. N. L. Britton, M. O. Steele and S. E. Jelliffe, on Cryptogamia.

Miss Steele exhibited a specimen of *Pentstemon lævigatus*, var. *Digitalis*, collected by Miss P. A. McCabe, at White Plains, Westchester Co., a plant not previously reported as growing wild east of the Hudson.

Mr. Sterns exhibited specimens of *Laurus nobilis, L.*, from Edisto Id., S. C., where it is thoroughly naturalized and known as "Sweet Bay." This adds a new plant to the North American flora. He showed that a lighted match held beneath the leaves causes a series of explosive ruptures of the epidermis, probably resulting from the vaporization of the oil globules.

The papers announced for the evening were read: 1. On some peculiarities of the fruit of *Smilax*, by E. E. Sterns. 2. On White Mountain Willows, by M. S. Bebb, read by the Secretary, and illustrated by specimens.

Dr. Britton exhibited a specimen of *Quercus Muhlenbergii*, Engelm., var. *humilis*, from Lake Grinnell, N. J., in which the scales of the acorn cups were transformed into leaves over an inch long, showing their homology with an involucre.

Miss Rogers presented duplicates of a number of Long Id. mosses for distribution.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, June 2, 1888. [No. 6.

The Development of Symplocarpus fœtidus (L.), Salisb.

By Aug. F. Foerste.

Plate LXXXII.

Among the most interesting studies in animal or vegetable morphology are the homologies of aborted or almost obsolete organs which once had a purpose, but now are cast aside as entirely useless. Although the existence of such organs in vegetable life is not so much a matter of general information, it is here that some of the most curious and readily understood examples are to be found.

It has already been noted that *Apios tuberosa** rejects entirely the terminal part of each panicle, and all but the lower two or three buds of each of the remaining racemes, using the scars left by the rejected buds as nectar-glands. Usually, however, rejection does not take place in this literal fashion, but consists merely in a decrease of size and loss of function. Thus in *Symplocarpus fœtidus* † most of the "flowers" are aborted, only a few of the earlier formed developing to maturity. Which shall be the flowers of the next season is already evident during the previous summer. ‡ As many as three or four flowers may blossom in the spring. Since at this time of the year the comparative morphology of the plant is most readily studied, the following notes may be considered as referring chiefly to plants as they appear in the spring:

The outer covering of the growing portion consists of two or three large enfolding scales representing petioles; these are very much decayed. Under favorable conditions small aborted membranaceous spathes may be detected apparently in the axils of

* Bulletin, XI., 1884, p. 123.

† Am. Nat., 1883, p. 1109.

‡ Am. Nat., 1885, p. 301.

alternate scales. These, however, are frequently absent, probably having been decomposed. Following these are healthy scales untainted by decay, the later forms of which develop at their tip, more or less gradually, small leaf-blades, which increase in size in succeeding scales until the normal leaf-form is attained (figs. 6, 7, 8). Apparently in the alternate axils of these scales are from one to four fully developed flowers (fig. 5), succeeding which in regular order are only aborted flowers, apparently in alternate axils of the later scales and in the alternate axils of all true leaves (figs. 9, 10), until a few scales have been formed to serve as an external covering for next spring, when again a few flowers will develop to full maturity. It was stated that one or two aborted flowers produced previously to those which develop normally are membranaceous; the same is true of the first two or three aborted flowers succeeding those of normal development. The remaining aborted flowers cannot at this season of the year be distinguished from those which shall develop in the succeeding season (figs. 16, 17).

Examining these specimens a second time more carefully, it will be found that the flowers are not in the axils of leaves or scales, as at first supposed, this place being occupied by a small leaf bud (fig. 13). These leaf buds are quite small, even in the earlier scales, and decrease rapidly in size until finally they can be detected only by the expert dissector (fig. 17). In this they offer a marked contrast to the flower, which can readily be seen even in the aborted state, long after the detection of the leaf buds has become difficult. The flowers, on the other hand, will now be seen to be situated towards the right or left of the leaf bud (their position being variable in different plants, but continuous for the same specimen), and to be enfolded by the basal edges of a scale, whose axil is on the opposite side of the plant, and never subtends a bud; so that there are alternately scales (or leaves) with and without leaf buds. The flowers are in the axils of neither scales nor leaves.

At this point, when everything seems to be in confusion, all the materials are at hand for the ready understanding of the structure of this plant. The flower in each case represents the end of the entire stem, to which all succeeding parts are but axial in position. The scale or leaf in whose axil the flower at first seemed to be, is but the first leaf on the stem represented by the flower. The scale or leaf, the basal part of whose lateral edges slightly enfold the flower, is the second leaf of this stem, in whose axil all the succeeding growth of the stem is but a bud which has never been arrested in its development. The spathe of the flower is the third leaf of this axis, and a second spathe which is occasionally present is the fourth leaf. Both the buds which are arrested and those which are not arrested in development are alike in the fact that the first leaf of the new axis is always opposed to the subtending leaf in whose axil they are found (fig. 13). Thus all the parts of a plant are brought back into a normal method of arrangement.

When it comes, however, to a consideration of the phyllotaxy of the plant, the question presents more difficulties. The first two leaves of each axis seem very much to be opposed to each other, the meeting of the basal edges of second leaf at the flower (instead of the buds defining the axil of the first leaf) alone suggesting that this opposition is more apparent than real. It will also be noticed that the spathe is turned in such a way as to suggest that its axis lies at a right angle to a line connecting the axils of the first and second leaves.* When a second spathe (fig. 12) occurs, it seems to fall almost above the axil of the first leaf (fig. 13). So that it has seemed reasonable to consider this a case of a one-third phyllotaxy. In that case we meet the difficulty of always finding the first leaf of each new axis not directly opposed to the subtending leaf, but a little to one side and always in a definite direction.

This could be explained by the assertion that it is not unusual in monocotyledons to find a slight lateral displacement of this first leaf, or by an equally valuable suggestion that the phyllotaxy may be far more complicated than here represented, but approaching the one-third arrangement. It seems, however, just as well to adopt the simpler view, especially since much displacement must necessarily take place in such a complicated structure as the apex of this crowded root stock.

* The folding of the edges of the spathe gives the appearance that the midrib of the same lies between the spadix and the rest of the plant, rather than to one side as more careful dissection would indicate.

Considering now the true flowers, no arrangement on the spadix consistent with the ordinary views of phyllotaxy can be made out. The flowers are arranged vertically along the axis of the spadix in such a way as to form diagonal rows. In one specimen at hand at present writing, there are nine rows of flowers passing diagonally around the axis in one direction, and nine in the other direction, forming thus eighteen vertical rows. These rows are apt to be more or less disturbed by lateral pressure, especially at the top of the spadix (fig. 11). In like manner, it will be noticed that the sepals enfold each other in every order possible on the same spadix, so that no conclusions can be drawn from their arrangement.

As to the seeds, there seem to be no radicles, the very first roots being thrust out from the central vascular parts of the ascending stem (figs. 3, 4). This continues to be the manner of production of all succeeding roots. In old rootstocks the vascular portion is yellowish in color; the surrounding parts are almost white. This white portion surrounds the bases of the roots, and is readily separable from the same, suggesting that it is only a pithy structure which has grown out from the more vascular parts of the rootstock, and which in its growth has more or less enfolded the roots. It will also be noticed that the roots are much wrinkled, suggesting a contraction of their length (fig. 5). Knowing that the seeds germinate usually within an inch of the surface of the ground, it has seemed reasonable that this was an arrangement to draw the rootstock, which otherwise would become ærial, down into the loose mud, each year's growth meaning a new grip on the plant, and a renewed hauling process back into the earth, which succeeds so well that the top of the rootstock as a rule is found at least several inches below the surface of the ground.

EXPLANATION OF PLATE LXXXII.

1. The lower part of a seed showing the depression, × ½.
2. A section across the upper part leaving the plumule, × ½.
3. The same, germinated, × ½.
4. A section of a young specimen, showing the origin of the first roots from the stem, × ½.
5. A plant, the earlier scales broken away to reveal the young flower, Feb. 15, × ¼. Also showing the wrinkled roots.

6, 7, 8. Various stages in the variations from scales to leaves in the same, × ½.

9. Scales and leaves removed, showing an aborted flower of the season.

10. The spadix taken from the same.

11. The spadix of a normal flower, × ½.

12. A spadix, the regular spathe broken away, revealing an abnormal second spathe at the base of the spadix.

13. The arrangement of two successive terminal stems of the plant, with their leaf appendages. The leaves are successively numbered, No. III. in each case signifying the spathe, the position of the second spathe being indicated in the first stem.

14, 15. Two methods of representing the arrangement of the plant as it might be expected to exist if the normal one third arrangement were adopted. In Fig. 15 No. II. should be on the second line, not the first.

16. The position of the "flowers" and leaf buds, irrespective of leaves or scales: *a*, *e*, *f* represent membranous aborted spathes; *b*, *c*, *d* represent the bases of the stalk supporting the flowers which arrive at perfection. The remaining flowers are also aborted, although it is barely possible that *l* or *m* are far enough along in the series to develop into mature flowers next season.

17. The same uncoiled and more graphically represented.

18. A vertical section of one of the true flowers while still in the bud, × 2.

The Fresh-water Algæ of Maine.—I.

BY F. L. HARVEY.

The species of Maine Algæ enumerated below were observed during the fall of 1887.

The gatherings were taken from sheltered coves and pot-holes along the Penobscot in the vicinity of Orono; also from the clear running water of spring brooks, and from Chemo Pond and stream five miles east of Orono. Quite a number of species were observed in the stagnant water of an old well on the college farm.

As no observations have before been published upon the fresh-water algæ of Maine, it is thought best to include, with the novelties, all the species observed, for the purpose of showing geographical distribution.

Descriptions are given of the new forms and those not observed before in the United States.

Some of the forms should be figured, but there are not enough to make a full plate, so it is thought best to defer the illustrations until more observations are made, and include them with others in another contribution.

The references to plates and figures are to Wolle's Desmids and Fresh-water Algæ of the United States. The systematic arrangement of the species is that given in the same works.

The writer is greatly obliged to Mr. Wolle for professional courtesies, the majority of the species enumerated having been confirmed by him.

CLASS I.—RHODOPHYCEÆ.

Family III.—Batrachospermaceæ.

1.—*Batrachospermum moniliforme*, var. SUBULATUM, n. var. —A small form, dusky purple, whorls dense, barely distinguishable except by crushing; branches and branchlets terete, somewhat tapering, with a slightly wavy outline; tufts one-half to nearly one inch high. Mr. Wolle considers this a distinct variety. Whether possibly only a condition of growth, remains for future observation to determine. Plentiful on rocks and in pot holes on the Penobscot river at Old Town. October.

CLASS II.—CHLOROPHYCEÆ.

Family VI.—Œdogoniaceæ.

2. *Bulbochæte rectangularis*, Wittr., p. 102, Pl. XC.—In an old well on the college farm. Oct. In fruit. A species of Œdogonium is associated with the above, but the specimens were sterile at the time of examination and not determinable.

Family VIII.—Confervaceæ.

3. *Draparnaldia glomerata*, Ag., p. 108, Pl. XCII.—In constructing a dam across the Penobscot at Old Town quite a number of pot holes were exposed, and in these the above species was found in abundance, associated with the *Batrachospermum* mentioned above. Oct.

4. *Stigeoclonium subsecundum*, Kg., p. 112, Pl. XCIX. In an old well on the college farm, which has been filled to within a few feet of the surface. Plentiful. Oct. Interesting as the only locality given by Wolle is South Carolina.

Specimens of *Ulothrix* were also observed in a gathering from the Penobscot, but were not in a condition for specific determination.

Family XII.—Volvocaceæ.

5. *Volvox globator*, L., p. 158, Pl. CLI.—Found sparingly in several gatherings from pools and small ponds about Orono.

6. *Pandorina morum*, Bory., p. 161, Pl. CLIII.—In stagnant pools. Much more common in gatherings made than *Volvox*.

Family XIII.—Protococcaceæ.

7. *Scenedesmus obtusus*, Meyen., p. 173, Pl. CLVI.—Found in a gathering made from a small pool near the Penobscot, and which stood for two months in the laboratory before it was examined. Plentiful. Oct.

8. *Sciadium arbuscula*, A. Br., p. 174, Pl. CLVII.—Two or three specimens observed in the water of the old well. The specimens invariably had eight rays in the umbel and were simple.

Family XVI.—Palmellaceæ.

9. *Dictyosphærium reniforme*, Bulnh., p. 186, Pl. CLVI.—Quite plentiful in a pool near the Penobscot, opposite Great Works, collected by Mr. L. H. Merrill.

10. *Glœocystis ampla*, Kg., p. 196, Pl. CLXVI.—Common in standing water about Orono. Pool near Penobscot at Great Works (Mr. L. H. Merrill).

11. *Raphidium polymorphum*, Fres., var. *contortum* (Thur.), Wolle, p. 198, Pl. CLX.—Rather common in pools and small ponds near Orono.

12. *Eremosphæra viridis*, D. By., p. 200, Pl. CLXVII.—Very abundant in a gathering made near Great Works by Mr. L. H. Merrill.

Specimens, shedding the membranous envelope, undergoing fission and forming reddish brown resting spores, were observed.

Family XVI.—Conjugatæ.

13. *Zygnema insigne*, Kg., p. 223, Pl. CXLIII.—Common in small spring brooks and ponds. Finely in copulation. Oct.

14. *Zygnema anomalum* (Hass.), Kg., p. 224. This interesting form was collected in abundance in a small spring pond near Orono by Roy Harvey. The colorless gelatinous sheath soon after gathering is liable to become almost invisible. Filaments with sheath, in our specimens, measured 40 μ; without sheath, 22 μ. The specimens were all sterile, though collected from a spring in December, after the pond had been frozen for two months. They were in fine vegetative condition.

15. *Zygogonium pectinatum*, Kg., p. 225, Pl. CXLV.—Abun-

dant in pools along the banks of the Penobscot, also in ponds and springs inland. Finely in fruit. Oct.

Several species of *Spirogyra* occur in abundance in Maine waters, but none have yet been found by me in conjugation.

Family XVII.—Desmidieæ.

16. *Hyalotheca disilliens* (Smith), Breb., p. 22, Pl. I.—Very common in sheltered places along the Penobscot, and in small ponds, springs and stagnant pools.

17. *Desmidium Swartzii*, Ag., p. 26, Pl. II.—Common in shallow streams, small ponds and ditches.

18. *Sphærozosma pulchrum*, Bailey, p. 29, Pl. IV.—Old well on college farm. The gelatinous envelope was apparent in our specimens.

19. *Penium Digitus* (Ehrb.), Breb., p. 34, Pl. V.—Pot holes at Old Town. Pool at Great Works in gathering made by Mr. L. H. Merrill.

20. *P. interruptum*, Breb., p. 35, Pl. V.—Both large and small forms observed in gatherings made at Old Town and Great Works. Not plentiful.

21. *P. Brebissonii* (Menegh.), Ralfs, p. 36, Pl. V.—Pools along the enobscot. Not scarce.

22. *Closterium Lunula*, Ehrb., p. 40, Pl. L.—Pot hole at Old Town; also from Great Works in gatherings made by Mr. Merrill.

23. *C. Cucumis*, Ehrb., p. 40, Pl. VI.—Pools in Penobscot, at Old Town and elsewhere in ponds.

24. *C. striolatum*, Ehrb., p. 42, Pl. VI.—Pools near the Penobscot at Orono. From a gathering made by Mr. Merrill near Basin Mills.

25. *C. Venus*, Kg., p. 44, Pl. VII.—Pot holes at Old Town.

26. *C. Ehrenbergii*, Menegh., p. 45, Pl. VII.—Pools near the Penobscot at Great Works in gatherings made by Mr. Merrill. Also from various small ponds about Orono.

27. *Docidium Trabecula* (Ehrb.), Næg., p. 48, Pls. IX., XI.—(*D. Ehrenbergii*, Ralfs).—Common in stagnant ponds and sphagnum swamps. Orono.

28. *Cosmarium granatum*, Breb., p. 60, Pl. L.—From a gath-

ering made in a pool near the Penobscot, and which stood in the laboratory two months before examination.

29. *C. tumidum*, Lund., p. 61, Pls. XV., XVIII.—Pools along the Penobscot.

30. *C. Meneghinii*, Breb., p. 65, Pl. XVI.—From the gathering which stood in the laboratory.

31. *C. undulatum*, Corda., p. 67, Pl. XVI.—Pools at Old Town, Great Works, etc.

32. *C. crenatum*, Ralfs, p. 67, Pl. XLIX.—Pools and shallow ponds along the Penobscot.

33. *C. pyramidatum*, Breb., p. 69, Pl. XIV.—Pool on the college farm.

34. *C. pachydermum*, Lund., p. 70, Pl. XV.—Pool near the Penobscot, on the college farm.

35. *C. Botrytis*, Menegh., p. 74, Pl. XIII.—Pools near Old Town, Great Works and Orono.

36. *C. dentatum*, Wolle, p. 76, Pl. XIII.—Pools along the Penobscot, Orono.

37. *C. amœnum*, Breb., p. 78, Pl. XIV.—From gathering near Penobscot, which stood in laboratory for two months before examination.

38. *C. sublobatum*, Archer, p. 80, Pl. XVIII.—With the above.

39. *C. Quasillus*, Lund., p. 84, Pl. XVII.—With the above. The form observed was more robust than that figured by Wolle.

40. *C. Broomei*, Thwaites, p. 86, Pl. XVII.—Common in pools and ponds, Orono.

41. *Xanthidium cristatum* (Breb.), Ralfs, p. 93, Pl. XXI.—Old well, college farm, Orono.

42. *X. fasciculatum*, var. *subalpinum*, Wolle. Wolle, Fresh Water Algæ U. S., p. 34, Pl. LVI.—Old well, college farm, Orono.

43. *X. antilopæum* (Breb.), Kg., p. 94, Pl. XXIII.—Old well, college farm, Orono. Plentiful.

44. *Arthrodesmus convergens* (Ehrb.), Ralfs, p. 95, Pl. XXIII.—Old well, college farm, Orono.

45. *Euastrum verrucosum* (Ehrb.), Ralfs, p. 100, Pl. XXVI.—The type form is common in pools at Old Town, Great Works and Orono, associated with the variety mentioned below.

46. *E. verrucosum*, var. *simplex*, Joshua.—This form is new to the U. S. In a paper dated February, 1885, Wm. Joshua, F. L. S., Eng., describes this variety from specimens collected at Pictou, Canada. His diagnosis is as follows: "Of stout habit, terminal lobes very short and with very shallow incisions, central inflation either none or very small; no other. Length, 85 μ; width, 65 μ; apical lobes, 35 μ wide; thickness, 25 μ."

The nearest form to this variety is *Cosmarium trilobatulum*, Reinsch, but not smooth like it, and somewhat larger. It is granular throughout, but most densely at the angles of the lobes. It appears to stand on the border between *Euastrum* and *Cosmarium*.

Shallow pools along the Penobscot at Old Town, Great Works and Orono. Sparingly in the water of springs and sphagnum swamps. Associated with the type form.

47. *E. elegans*, Kg., p. 106, Pl. XXVII.—In gatherings from Great Works (Merrill). Also in shallow pools and ponds, Orono.

48. *E. binale* (Turpin), Ralfs, p. 107, Pl. XXVII.—Associated with the above.

49. *Micrasterias rotata* (Grev.), Ralfs, p. 109, Pl. XXXIV.—From gathering which stood in laboratory two months. Penobscot, near Orono.

50. *M. denticulata* (Breb.), Ralfs, p. 109, Pl. XXXIV.—With the above.

51. *M. Americana* (Ehrb.), Kg., p. 112, Pl. XXXII.—From old well on college farm, Orono.

52. *Staurastrum Avicula*, Breb., p. 123, Pl. XL.—Old well, college farm, Orono.

53. *S. polymorphum*, Breb., p. 126, Pl. XLII.—Old well, college farm; also in stagnant water of small ponds; common.

54. *S. crenulatum* (Næg.), Delp., p. 126, Pl. XLII.—Old well, college farm; also in many ponds about Orono; common.

55. *S. punctulatum*, Breb., p. 127, Pl. XLI.—Pot holes in Penobscot; also in shallow pools, Orono.

56. *S. pygmæum*, Breb., p. 128, Pl. XLII.—From the gathering taken near the Penobscot that stood in the laboratory two months.

57. *S. cyrtocerum*, Breb., p. 128, Pl. XLII.—Small pools and ponds about Orono.

58. *S. macrocerum*, Wolle, p. 134, Pl. XLIII.—Chemo pond, five miles east of Orono.

59. *S. Sebaldi*, Reinsch, p. 138, Pl. XLVI.—Old well, college farm, Orono.

60. *S. Brebissonii*, Arch., p. 141, Pl. XLV.—Old well, college farm. Interesting, as Florida was the only habitat before known.

61. *S. Saxonicum*, Bulnh., p. 141, Pl. XLV.—Pools along the Penobscot at Old Town and Great Works.

62. *S. Saxonicum*, Bulnh., var. PENTAGONUM, n. var.—Structure similar to the type form; size slightly smaller, 62 μ diameter; end view pentagonal; sides somewhat concave or straight.

First observed in gatherings from a shallow pool on the bank of the Penobscot at Old Town. Later it was found at other points along the river about Orono. It is usually associated with the type form.

63. *S. furcigerum*, Breb., p. 146, Pl. XLVIII.—Pot holes and pools, Penobscot River, Orono.

64. *S. spongiosum*, Breb., p. 148, Pl. XLVII.—Pools along the Penobscot, Orono.

CLASS III.—CYANOPHYCEÆ.

Family XVIII.—Nostocaceæ.

65. *Tolypothrix muscicola*, Kg,, p. 264, Pl. CLXXXI.—Old well, college farm. Plentiful.

66. *Hapalosiphon Braunii*, Kg., p. 275, Pl. CXCVI.—With the above.

67. *Nostoc comminutum*, Kg., p. 282.—Abundant in a gathering made from a pool in the Penobscot at Great Works by Mr. Merrill.

68. *Nostoc rupestre*, Kg., p. 283, Pl. CXCVII.—This form was found in a lake near Houlton, Me.

Several species of *Oscillaria* have been observed, but they have not yet been studied enough to give determinations.

Some Peculiarities in the Seed of Smilax, Tourn.

Moderate pressure upon a fresh ripe berry of *Smilax auriculata*, Walt., forces out of it one, two or (commonly) three more or less rounded masses of grayish horny albumen, each enclosed in a thin smooth brownish closely adherent coat, marked with a darker-colored, suborbicular hilum at the base, and with a distinct dark raised point or minute tubercle at the opposite end, indicating the position of the small white oblong embryo. These albuminous bodies have been universally taken for the complete seeds by writers upon *Smilax* from Gærtner to Gray. A careful dissection of some scores of ripe berries of *S. auriculata*, Walt., and green but full-grown berries of *S. lanceolata*, L., enables me to assert positively that this view is not strictly correct, at least as regards these and some other closely allied species.

The firm outer skin of the fresh ripe berry of *S. auriculata* encloses a thin layer of subfarinaceous, but more or less juicy pulp, within which are three cells (sometimes fewer by abortion) with very thin membranaceous walls. Each cell is filled by a transparent bag of more or less elastic tissue, suspended by a short funiculus to the upper inner angle of the cell. In each case this bag contains not only a seed, ordinarily so-called, but also a small quantity of very soft, moist, dark-colored pulp, mainly lodged between the hilum and the funicular extremity of the bag. The elasticity of this bag is such that it may be stretched without breaking, to twice, thrice or even four times its original length, and will afterwards contract to scarcely more than its first size. This peculiarity is so marked that it has given a name to the common southwestern *Smilax* (the subspecies *S. Wrightii* of Alphonse de Candolle) of which a trustworthy Texan correspondent* writes: "It is commonly known as 'bramble' or 'stretch-berry,' the latter name from the thin, rubber-like covering over the seed, which is often used by children to put with chewing-gum, making the gum stretch like rubber." † In the green but full-

* Miss Sarah A. Trimble, Waco, Texas.

† This elastic seed coat is so obvious upon an even moderately careful examination that it is hard to believe that it has altogether escaped the attention of botanical writers. Nevertheless, despite extended and diligent search, I have not yet found the slightest reference to it. Moreover, the phraseology of leading authors, in more than one instance, distinctly implies that they were unaware of its existence. Among

grown berries of *S. lanceolata* the elastic coat is even more readily detected than in the ripe ones of *S. auriculata;* the dark pulp, however, appears as a layer of firm, green, fleshy tissue, thick at the base and thinly enveloping the entire mass of albumen, which is still white exteriorly and yielding (though tough) in texture. Under careful dissection the funiculus sometimes separates at its base and remains attached to the seed—projecting from the elastic coat as a minute thread-form body, perhaps a fiftieth of an inch in length. More often, in the ripe berry, it gives way at the other extremity and remains attached to the angle of the cell, presenting at the free end a saucer-like, sub-circular expansion, by which it was attached to the hilum.

It is absolutely certain that the elastic exterior coat and the enclosed pulp layer are borne upon the funiculus and must be regarded as integral parts of the seed, or as adjuncts to it, and not as any part of the pericarp. It may be questioned whether the elastic coat is testa or aril. I am myself strongly inclined to believe that it is merely the developed outer coat of the ovule and therefore the testa of the seed. Accepting this view, the brownish closely adherent covering of the albumen (testa of A. de Candolle) is really the tegmen. This structure is simple enough, and is paralleled in numerous bitunicate seeds. The fleshy and subsequently pulpy intermediate layer remains, however, a curious anomaly. Gray appears to hold (Struc. Bot., ed. 1879, p. 277) that the coats of the ovule are never separated. They clearly seem to be in this case, and yet to no obvious purpose. It is a suggestive fact that in the ripe fruit the pulp enclosed within the testa (if testa it is) presents decidedly an appearance of decomposition rather than of wholesome maturity. Apparently from some distorted or at least unusual impulse, the outer coat of the ovule begins to develop some little distance below the inner. Nature, it seems, abhorring the vacuum thus formed, fills the gap with tissue, which merely serves as a pack-

writers carefully consulted on this point may be named Tournefort, Linnæus, Gærtner, Michaux, Nuttall, Torrey, Gray, Chapman, Wood, Kunth, Grisebach, A. de Candolle, Bentham and Hooker and Engler and Prantl. The hilum seems to be unmentioned, except by Kunth (Enumeratio) and Grisebach (Mart. Fl. Bras.); only Gærtner notices the tubercle at the apex. Strangely enough, Gærtner figures the embryo at the wrong end of the seed!

ing, and ultimately decomposes without having contributed anything to the vital growth or protection of the seed. Of course this view is speculative, and close microscopic observations upon the ovule, both before and after fertilization, are essential to a decisive interpretation of the structure I have described. It may even appear that the elastic coat and the intermediate layer are both developed after fertilization and are, therefore, of the nature of a double aril, tenacious without and pulpy within. A considerable resemblance certainly exists between the external coat and the loose membranaceous aril in *Castalia*, Salisb., more especially as both originate at a point below the summit of the funiculus. An aril, however (see Gray's definition, l.c., p. 308), is an accessory seed-covering, " more or less incomplete," whereas in *Smilax* the external coat is complete in every respect. At any rate, whether testa or aril, the whole subject is novel and interesting, and is strongly commended to physiological botanists and microscopists, who may have access to the fruit of *Smilax* in its earliest stages. E. E. STERNS.

P. S.—Since writing the foregoing I have examined fresh ripe berries of *S. Walteri*, Pursh, and sub-species *S. Wrightii*, A. DC. (= *S. tamnoides*, of Chapman's Flora, in part.) In the former the exterior coat is thin and easily broken, and its elasticity is not especially marked. In *S. Wrightii*, however, the "stretch-berry" of the southwest, this coat is extraordinarily elastic, and can be readily extended without breaking to five or six times its original length! A still more recent examination, this time of very young berries of *S. pumila*, Walt., barely one-fourth the size of the ripe fruit, shows the outer coat as complete in form at this stage as at maturity, and already strikingly elastic. Although this is a strong confirmation of the testa theory, microscopic study of the ovule is still essential to settle the question absolutely. E. E. S.

Another Station for Rhododendron Vaseyi.

RHODODENDRON VASEYI, Gray. Proc. Am. Ac., xv., 48: Bot. Gaz., viii., 282.—A third locality has at last turned up for this shrub, which is so conspicuous and singular that one wonders at its so long evading notice. The peculiar flower-buds were detected by Mr. S. T. Kelsey, about a month ago, on Grandfather Mountain, Caldwell Co., N. C., and now, 23d of May, he sends vouchers in the form of beautiful clusters of fresh flowers. He writes: "It grows just everywhere in clumps and patches on the southern and southeastern slopes, at 4,500 to 5,500 feet elevation, but most abundant and vigorous in moist stations, and is associated with *Rhododendron maximum*, *R. Catawbiense* and *Kalmia latifolia*. The locality is only two or three miles from Linville."

This ground has been hunted over by famous botanists of old. Both Michaux and Fraser knew Grandfather in the last century, and Lyon and Curtis in the early part of the present one. Dr. Gray, in a letter to Sir William Hooker, has given an account of his predecessors in its exploration, and of his own researches into its Flora. A land made classic by such associations, and rich in numerous rare, and even in some endemic plants, has attracted many herbourizing lesser botanists; but all this time *Rhododendron Vaseyi* has concealed itself even better than its less showy neighbor *Shortia*.

It will be remembered by those who had the opportunity to furnish him specimens, how delighted was Dr. Gray to find an American true Azalea with a rotate-campanulate corolla, which even proved upon better examination to be bilabiately irregular. He considered it one of the most interesting of the now very numerous cases of remarkable relationship between the Chino-Japanese and the Alleghanian floras.

The present flowers are true to the amended description in the Gazette. They are bright purple, varying to pinkish-white, and scentless. The shrub is 10 to 15 feet high and is nearest in habit to *Rhododendron calendulaceum*. Mr. Kelsey states that it is easily transplanted, adapts itself readily to cultivation, and is already an ornamental bush in many house-yards at Highlands, where it flowers profusely before any leaves appear.

BALTIMORE, MD. JOHN DONNELL SMITH.

Aquilegia Canadensis, L., var. flaviflora (Tenney), Britton.

An account of a yellow variety of *Aquilegia Canadensis* in the April BULLETIN suggests calling attention to the following in the Flora of Essex County, Mass. (Essex Institute Bulletin, 1880).

Aquilegia Canadensis, L., var. *Phippenii.*—Flowers salmon colored, leaves lighter green; transplanted to the garden it seeded freely and invariably produced its like. Discovered by Mr. G. D. Phippen in a ravine in Salem pastures, about 1844. Found again in the same locality by the present writer, 1875 and by Mr. David Waters in 1880. A white variety was detected by Mr. Abraham Bosson (1854) among red Columbines, but did not prove hardy on being transplanted. (See "Notice of three varieties of native Columbines," Proc. E. I. Vol. I, 1856, p. 268). The "Notice of three varieties of the native Columbines" in the Essex Institute Proceedings of 1856 is by Rev. John L. Russell and possesses much interest. One was a double flowered form, another the white variety which, transplanted to a garden, perished "after growing two or three years," and the third was the one above referred to.

Mr. Britton's description perfectly coincides with the specimens in our herbarium and my recollection of them in the living state. The fact that seeds "produced their like" is of special interest. As the plant was, so far as I knew, local and as Mr. Phippen was its discoverer, and had made many interesting experiments on this and other Columbines, I was led to connect his name with the variety in the list of county plants.

Since writing the above I have seen Mr. Phippen who says that hundreds of seedlings of this peculiar variety have been cultivated in his and his brother's gardens continuously for forty years and more to the present time, and that watchfulness among the numerous progeny for a more intense color became unnecessary, when at least ten years ago, his nephew, E. A. Phippen, brought home a root with pure yellow flowers from the same locality "Columbine Hill" which has continued to propagate itself and flowered freely the past year.

SALEM, April 9, 1888. JOHN ROBINSON.

[Prof. Tenney's name, published in 1867, antedates the one given the plant by Mr. Robinson.—EDS.]

Saxifraga Virginiensis, Michx., var. pentadecandra, Sterns.

A year ago I recorded in the BULLETIN, (Vol. xiv, p. 122), the discovery near the east shore of Manhattan Island, about on a line with 160th Street, of an apetalous form of *Saxifraga Virginiensis.* In two plants out of a dozen the five petals, in fully half the flowers, had been regularly converted into stamens, making the total number fifteen, five single ones alternating with five anteposed pairs. Visiting the station again this spring, (May 6th), I found three more of these apetalous saxifragas, agreeing exactly with those previously collected, although none of them was so perfectly developed as the best of last year's specimens. Hardly more than one or two of the flowers displayed the full fifteen stamens, and many had fewer than ten, though even in these the characteristic anteposed pairs occasionally occurred. In the three plants in question, there were no indications at all of normal petals; in a fourth, however, with the taller stem and looser flower cluster of the specific type, a great many of them were white and obviously petaloid, and yet much reduced in size and in some cases with partially formed anther cells. This transition state is very common in many plants where stamens are turning into petals. The interest in this case arose from the fact that here the much rarer change of petals into stamens was actually and visibly taking place. The discovery of these additional specimens strengthens my opinion that a saxifrage of this apetalous fifteen-stamened form, occurring by chance, matured seeds from which the plants collected in two successive years were produced. To my mind we have here a very curious and interesting, though as yet scarcely successful, attempt on the part of nature to establish a good variety by perpetuating what must have been originally a mere teratological variation.

E. E. STERNS.

Rules for the Botanical Exchange Club.

It having been decided to organize the American Botanical Exchange in connection with the National Herbarium in the Department of Agriculture, the Botanist of the Department will act as Director of the Exchange, and the following rules will be followed in its managemet, until further notice.

1. Persons desiring specimens are required to contribute a number regarded as equivalent in value to those called for. The specimens wanted in return may be selected when the others are sent or at any time afterward.

2. The number of the specimens returned will be at the discretion of the Director, and will depend on the rarity and condition of those furnished. In the case of well-known plants they will probably nearly equal the number sent.

3. In the case of small plants, several specimens should be furnished under one number, as in such cases a single specimen is not a satisfactory representation of the species.

4. Specimens may be called for by species or genera or by the locality from which they are wanted. To save time the species may be indicated by the numbers which they bear in any well-known American catalogue, the name and the edition of the catalogue being given.

5. Specimens sent must be accurately named and bear the date and locality of collecting, with the name of collector. Little value will be attached to specimens which are imperfect or poorly prepared.

6. The Director of the Exchange will reserve the right to indicate his judgment in cases where specimens seem improperly named, but the responsibility of the names will in other cases rest with the original sender.

7. For the present, well prepared specimens of all phaenogamous and higher cryptogamous plants will be received, and also specimens of thallophytes, the last mentioned to be in charge of the Chief of the Section of Vegetable Pathology. Hereafter lists will be published of plants especially desired or of which no more specimens are needed.

8. An account of the specimens received from each person will be kept, and of those sent in return, and also of any other specimens which he desires or can supply. The Exchange will thus serve as a bureau of information upon this subject.

9. Conditions of membership:—

Any botanist may become a member of the Exchange Club by paying annually to the Director the sum of two dollars, this money to be used in payment for postage, printing and incidental expenses.

10. Address specimens and communications to the Director of the Exchange.

DR. GEO. VASEY,
Botanist Department Agriculture, Washington, D. C.

Reviews of Foreign Literature.

Flora of the Hawaiian Islands: A description of their Phanerogams and Vascular Cryptogams. By William Hillebrand, M.D., annotated and published after the author's death by W. F. Hillebrand, (8 vo., pp. 673, four maps and frontispiece. Heidelberg, London and New York, 1888.)

The Sandwich Island Flora, from its great luxuriance and variety and its marked isolation, is one of the most unique and interesting. It has been studied by botanists of several countries, notably by Dr. Gray, in working up the collections of the Wilkes Expedition, and by Horace Mann, who with W. T. Brigham, collected there during parts of two seasons. The present volume, (for a copy of which we are indebted to Mr. W. F. Hillebrand, now of the United States Geological Survey), brings together for the first time complete descriptions of the species. The author spent some twenty years as a successful physician among the Hawaiians, and his leisure time was mainly devoted to the preparation of this work, which is a model of careful and accurate investigation. The number of new species and varieties described is very great. The total number of species included is about 1,000, of which 155 are Pteridophyta. It is believed that of these, 115 have been introduced since the discovery of the islands in 1779, and 24 others introduced by the natives in pre-historic times. But the most interesting fact given among the statistics of the Flora is, that of the 860 native species no less than 653 are endemic.

Botanical Notes.

From the *Bulletin* of Harvard University of May, 1888, in the Records of the Corporation, we quote the following:—

"Meeting of March 26, 1888.—The President, at the request of Mrs. Gray, as executrix of Dr. Asa Gray, announced the bequest of Dr. Gray to the College, as follows:—

"'I give and devise unto the President and Fellows of Harvard College, in trust, to aid in the support of the Gray Herbarium of Harvard University, all my copyrights of books of which I am the author, upon the condition and obligation that the said President and Fellows shall make proper provision for the renewal and extension of these copyrights by new editions, continuations, and supplements, such as may be needed in the study of botany and as may best enhance and prolong the pecuniary value of this bequest.' "

"And it was thereupon *voted*, that Dr. Gray's bequest be gratefully accepted upon the terms named in his will, and that the thanks of the President and Fellows be sent to Mrs. Gray for the kind manner in which she has given notice of the bequest to the Corporation."

"*Voted*, to proceed to the election of a Fisher Professor of Natural History, whereupon, ballots being given in, it appeared that George Lincoln Goodale, A.M., M.D., was elected."

Trypethelium heterochrous (Mont.), Tuck.—A plant of this name has been announced in the Journal of Mycology as new to the United States. Tuckerman would never have been guilty of such a solecism as giving a masculine termination to an adjective qualifying a neuter noun, and he has in fact only referred *Verrucaria heterochrous*, Mont. to *Trypethelium* by implication in his Genera, p. 260. The same plant is mentioned as North American in the supplement to the Introduction to the study of Lichens under the name of *T. Kunzei*, Fée, on the authority of Dr. J. Müller, in his Pyrenocarpeæ Cubanæ, p. 390, and he is a good authority.—H. W.

Iris cristata in Ohio.—Dr. Watson writes that he has received this plant from Mr. R. H. Ingraham, of Youngstown, collected in ravines in Trumbull Co , and suggests that it should be found in Western New York as well.

Specimens of Hickories wanted.—Dr. Thomas F. Lucy, of Elmira, N. Y., wishes us to state that he desires specimens of the genus *Carya* from all parts of the United States in flower, fruit and leaf, together with notes as to habitat, size of trees and appearance and characters of the bark, as he intends to make a critical study of the genus.

Index to Recent American Botanical Literature.

Asa Gray, Notice of.—Walter Deane. (Pamphlet pp. 24, Cambridge University Press, 1888). In quoting by pages this must not be confounded with the original reprint from the BULLETIN.

Cypripediums.—Rocky Mountain.—Sereno Watson. (Garden and Forest, i., 138.

Dandelion.—The Common.—F. LeRoy Sargent. (Pop. Sci. News, xxii., 65-67, illustrated.)

Delphinium viride.—Sereno Watson. (Garden and Forest, i., 149, fig. 29.)

Entomophthoreæ of the United States.—Roland Thaxter. (Mem. Bost. Soc. Nat. Hist., iv., 133-201; eight plates.

This is in the main a monograph of the fungus genus *Empusa*, the members of which maintain a parasitic existence within the tissues of insects. Mr. Thaxter recognizes twenty-six species, sixteen of them new to science. *Entomophthora and Triplosporium* are relegated to subgeneric rank. *E. Phytonomi*, J. C. Arthur, is referred to *Empusa sphærosperma* (Fres.), Thaxter, and *E. Calopteni*, Bessey, to *Empusa Grylli* (Fres.), Nowakowski. The monograph is prefaced by an account of the structure, life history and habitat of the organisms and of their classification by European mycologists. Besides *Empusa*, the genera *Massospora*, Peck, and *Basidiobolus*, Eidam, are recognized, each with a single species. A list of papers consulted and indices of hosts, and of genera and species are appended. The work is superbly illustrated by lithograph plates of Meisel, from figures drawn by the author, there being 429 illustrations. Mr. Thaxter desires to continue the work so as to include all North American entomogenous plants. Those who have it in their power to aid him in the procuring of additional material, should consider it a privilege, for work of this very high order of merit deserves every encouragement

Flora de Mexico.—Bosquejo de la Geografia y Rasgos principales de la.—W. T. Hemsley, translated by Dr. Jose Ramirez, from the Botany of the Biologia Centrali-Americana. (La Naturaleza, 2d series, i., 67-81.)

Forest Vegetation of Northern Mexico.—C. G. Pringle. (Garden and Forest, i., 70, 116-117, 141-142, illustrated.)

Fucus.—The Apical cell of.—W. McMichael Woodworth. (Ann. of Bot., i., Nos. 3 and 4; reprint, pp. 9, plate x.)

This comprises the ninth contribution from the Cryptogamic Laboratory of Harvard College.

Fungi.—A supplemental list of works on North American.—W. G. Farlow. (Bibliog. Contrib , Library of Harvard University, No. 31, pp. 9.)

17 titles of papers issued before 1887—and thus addenda to the previously published list—are given, while the mycologic literature of 1887 includes about 88. We note with regret that Dr. Farlow does not propose to continue this valuable work.

Germination of Dodder-Cuscuta Gronovii.—Henrietta E. Heaker. (Amer. Nat., xxii., 254.)

Guatemala.— Undescribed plants from.— III.— John Donnell Smith. (Bot. Gazette, xiii., 74-77 ; one plate.)

The third installment of Captain Smith's novelties includes *Mimosa sesquijuga*, *Melampodium brachyglossum*, *Ardisia Tuerckheimii*, *Cobœa triflora*, *Beloperone Pansamalana*, *Thrysacanthus geminatus*, *Scutellaria lutea*, *Dorstenia Choconiana*, Wats., *var. integrifolia* and *Asplenium Vera-pax*, the last represented natural size on the accompanying plate.

Heuchera sanguinea in Mexico.—C. G. Pringle. (Garden and Forest, i., 152.)

Hymenocallis humilis and *H. Palmeri.*—Sereno Watson. (Garden and Forest, i., 114, fig. 23, 138, fig. 25.)

Illinois Grapes.—Notes on some.—J. Schneck. (Bot. Gaz., xiii., 95.) Notes on the habitat and occurrence of six species of *Vitis.*

Lichens from the Easter Islands.—F. H. Knowlton. (Bot. Gazette, xiii., 94-95.)

Usnea barbata (L.), Fr., *Physcia stellaris*, L. and a species of *Parmelia*, all determined by Mr. Willey.

Microbes and Fungi.—H. F. Wegener. (Rocky Mountain Druggist, i., 67.)

Our Native Ferns and their allies, with synoptical descriptions of the American Pteridophyta North of Mexico. By Lucien M. Underwood, Ph. D., Professor of Biology in Syracuse University.—Third edition, revised, 8vo., New York, Henry Holt & Co., 1888.

It is seven years since the first edition of this little book was published, and six since the second. Meanwhile, the number of true ferns known to inhabit the region covered has increased from 140, first to 145 and now to 156, the increase being mainly in the extreme Southwest, though Florida has its share. To the 156 true ferns must be added 11 *Ophioglossaceæ* and 56 other fern allies, scouring-rushes, club-mosses, quill-worts, etc., making the whole number of Pteridophyta here recognized, 223 species. The classification and nomenclature of the ferns in the main follow the system proposed by Mettenius, and accepted by the writer of this notice. A deviation from classical botanical usage is the writing of substantive specific names without a capital initial, as *Equisetum telmateia* and *Aspidium thelypteris.*

The first ten chapters of the book are mainly devoted to the habits, structure and physiology of ferns and their allies, and contain a good deal of interesting reading. Chapter viii, on "The Fern's Place in Nature," contains an attempt to show the position which ferns, etc., hold in reference to plants of higher and of lower rank. The system advocated is called the "American System," though it must be admitted that many American botanists of the highest rank would not recognize it as being of either value or authority. *Spermaphyta,* the name which is offered as superseding Phanerogamia, is scarcely admissible on grammatical grounds, [*Spermophyta* would barely do, but the word should be *Spermatophyta*], and the policy of coining new names for groups already well named is not good. *Pteridophyta* and *Bryophyta* have not yet been generally accepted as preferable to Acrogens and Anogens; and the other four "branches," *Protophyta, Zygophyta, Oophyta* and *Carpophyta,* the "American" representatives of Sach's four classes, *Protophyta, Zygosporeæ, Oosporeæ* and *Carposporeæ,* are of such ill-assorted nature that any conservative botanist who has looked into the matter at all, would expect them to wither away. It is a pity to see such teachings gravely set forth in text-books which are otherwise well-planned and likely to be of use.

DANIEL C. EATON.

Panicum—Synopsis of the Genus. Geo. Vasey. (Bot. Gazette, xiii., 96, 97.)

Phlox adsurgens, Torr.—Sereno Watson. (Garden and Forest, i., 66, fig. 11.)

Preliminary Catalogue of Anthophyta and Pteridophyta reported *as growing spontaneously within one hundred miles of New York City.*—Torrey Botanical Club. (8vo., pp. xvi. + 90, New York, April 25th, 1888; price, $1.00.)

This catalogue has been prepared by a committee of the Club to meet a demand for accurate information regarding the plants of the vicinity of the city, and "especially to provide a convenient check list by means of which to secure from the botanists of the region a series of fresh and detailed reports as to the plants of their respective localities." Maps showing the exact limits of the district included are appended. Bentham and Hooker's "Genera Plantarum" has been closely, but not invariably, followed in the arrangement of orders and genera. A special effort has been made to maintain for each plant enumerated its earliest specific or varietal name, and the reasons for the adoption of this principle are given. This has caused numerous changes in nomenclature, but in all such cases the names used in the last edition of Gray's Manual are all given as synonyms and are thus readily traced. The list of ballast plants is very long and doubtless nearly complete, being compiled from the notes and herbaria of Judge Brown and Messrs. Martindale, Burk and C. E. Smith. The Catalogue is a part of a long-cherished plan of preparing a complete descriptive local flora.

Prunus pumila in North Carolina.—E. R. Memminger. (Bot. Gazette, xiii., 95, 96.)

Relation of Climate to Vegetation.—D. P. Penhallow. (Canad. Rec. Science, iii., 107-124.)

Tertiary Plants of California—List of.—J. G. Cooper. (7th Ann. Rep. State Mineralogist, Cal., 1888, 300-308.)

Tubercles on Leguminous Roots.—W. G. Farlow. (Garden and Forest, i., 135.)

Umbelliferæ—Notes on Western.—I.—John M. Coulter and J. N. Rose. (Bot. Gazette, xiii., 77-81.)

In turning their attention from the East American forms to those of the West, the authors find several new species. Those here characterized are *Peucedanum Canbyi, P. Sandbergii, Angelica Hendersoni* and *Sanicula Howellii,* with notes on other species and genera.

Proceedings of the Club.

The regular monthly meeting was held May 8, 1888, the President in the chair and 44 persons present.

Miss Kittie O. Fernie and Mrs. Theron G. Strong were elected active members.

Prof. Frederico Phillippi, Santiago, Chili, and Miss Jane H. Newell, Cambridge, Mass., were elected corresponding members.

Mr. Sterns reporting for the Catalogue Committee, stated that the work had been finished and the books distributed to all active members. He also expressed the regret of the committee at the accidental omission from the list of authorities consulted, of Mr. Jas. N. Bishop's valuable "Catalague of Phænogamous Plants of Connecticut," an omission doubly regretted, because in addition to his published work, Mr. Bishop had by correspondence rendered efficient assistance.

Mr. Northrop reported the occurrence of a tree of *Prunus serotina*, 13 ft. 2 in. in circumference, on the road from Bridgeton to Roadstown, Salem Co., N. J., remarking that this is probably one of the largest individuals of the species at the North. He also distributed specimens of *Helonias bullata* from Bridgeton, and showed *Draba Caroliniana* from South Amboy.

Prof. Schrenk remarked on the differences between *Mentha piperita* and *M. viridis*. In the former he had found the central spike of the inflorescence invariably over-topped by the lateral ones when the plant reaches maturity. In *M. viridis* the central spike remains the longest. The leaves of the two are readily distinguishable, even from the smallest fragments, for those of *M. piperita* contain in their glandular hairs, abundant crystals of menthol, which are persistent in herbarium specimens collected sixty years ago, while the leaves of *M. viridis* contain no menthol.

Dr. Eccles reported the results of a series of experiments on various liquids as preservatives of the colors of flowers. He found that Simple Syrup gave the best results, lasting over three weeks. Glycerine preserved colors, but caused marked shrinkage.

Mr. Sterns exhibited *Saxifraga Virginiensis*, var. *pentadecandra* from the original station on New York Island, (see this number, p. 166) and requested observations on the fertilization of *Smilax*, stating that he had been unable to find any record of insect agency. Prof. Schrenk remarked on the habit of flies visiting the flowers *S. herbacea* after the plant has been taken indoors.

Dr. Britton spoke of the introduction of *Nelumbo speciosa*, Willd., into ponds and streams in Mercer and Burlington counties, N. J., first planted by Mr. E. D. Sturtevant in a pond two miles east of Bordentown, and read extracts from a letter from Dr. C. C. Abbott as follows: The plant was introduced by Mr. Sturtevant some seven years ago and is now thoroughly established. It has been taken to various parts of Mercer and Burlington counties, and wherever the water has been deep enough to prevent the ice reaching its roots the plant has flourished. When once established it crowds out other water lilies and even *Calamus*. Cows are fond of the leaves and devour them greedily when five or six inches above water. He also distributed specimens of *Viola tenella*, Muhl, collected by Miss A. B. Rich at Bridgeton, N. J., stating that in his opinion this violet is native to America and distinct from *V. tricolor*.

Dr. Eccles spoke of the practice of using the comma after the name of a plant or animal, and thus before the author of the name, remarking that while this was the practice in the BULLETIN and had been adopted by the compilers of the new catalogue, that certain other journals and recent authors were omitting it. The President remarked that the best English authors use it.

Dr. Rusby then read the announced paper of the evening, "On Andean Fern Habitats," profusely illustrated with specimens.

PROCEEDINGS OF THE SECTION OF HISTOLOGY AND CRYPTOGAMIC BOTANY, May 22d.—Prof. Schrenk showed sections from the bulb of *Phajus grandifolius*, illustrating the origin of starch-grains from rod-like masses of protoplasm in the leucoplastids and stated that as the coatings nearer the outside were examined, gradually chlorophyll grains were found instead of starch. He also exhibited two excellent mounts of *Funaria hygrometrica*, (pl. m and pl. f.) the cell contents fixed by chromic acid, one per cent. solution.

Mrs. Britton exhibited twelve slides and some excellent drawings by S. E. Jelliffe of *Ulota phyllantha*, Brid, the flowers and fruit of which she had discovered in Howell's last distribution on specimens from Yaquina Bay, Oregon. The specimens are complete, showing beautifully the "brown articulate cylindrical bodies" at the tips of the leaves. The specimens are mostly old, so that only a few showed well the characters necessary for a description and drawings of the fruit, heretofore unknown, which will appear in a subsequent number of the BULLETIN.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, July 2, 1888. [No. 7.

An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1885-1886.—I.

GENERAL FEATURES OF THE REGION TRAVERSED.

The collections recorded in this series of papers were made during a two years journey along the Pacific coast and across the continent of South America, the special object being the investigation of Medical Botany.

The route of travel covered regions the most diverse as regards all the conditions of plant life. North of Guayaquil the coast is verdant, the luxuriant tropical vegetation reaching the very water's edge. But a short distance south of that city begins an entirely different region. The eastern cordillera of the Andes divides South America into two portions, having almost nothing in common. While only a few miles in width, this cordillera marks differences in soil, climate, and general appearance, as great as any to be observed upon the globe.

Upon the Pacific side there is a very general dearth of moisture, rain being in many places almost unknown, while upon the eastern slope rain is so constant that months may pass when the sun is seen for scarcely an entire hour, and the humidity is so great that clouds of rising vapor sometimes obscure the view of even the nearest objects. The laden clouds that sweep in from the tropical Atlantic lose little of their moisture in crossing the Amazonian basin; any loss is but temporary, the equilibrium being at once restored by the soaking up of a fresh supply from the enormous water surface that the region presents. But immediately on reaching the mountains, great volumes of water are precipitated. The lightened clouds endeavor to escape upward, reach the colder strata, and suffer fresh precipitations. This process is continued over a belt of two hundred and fifty miles of steadily increasing elevation, until the winds which cross the cordillera carry only the merest traces of moisture. Throughout most of this heavily watered region, the vegetation is of the densest character. Allowing for the breaks caused by the streams, it might be said that an arboreal animal, ascending a tree upon the Andean foothills, could pass to the Atlantic without once descending to the ground.

The species and genera of this eastern Andean region have in general a very wide range. With the latitude, varies the altitude at which they grow. As we pass to the cooler southern region, a species or its representative creeps down upon the mountain sides. Thus, the *Desfontainea spinosa*, Remy., which I collected abundantly in northern Bolivia, gradually descends, until in the neighborhood of the cape, Lieutenant Safford finds it near the sea level, constituting a characteristic feature of the landscape. Sometimes also, a species has its limits as to altitude very narrowly and sharply defined, but will be represented at successively lower elevations by other species exceedingly closely related. Of this, the *Cinchonas* furnish us a striking example. Each altitude has its own species—if species they can be called—and they usually overlap to but a trifling extent. I have (in two cases) looked along a mountain side where miles of *Cinchona Calisaya* had been planted, and seen the upward limit defined to within fifty feet by a line of dead or dying trees.

In general, we are disappointed by the scarcity of flowers as compared with the abundance of plants. To this rule, trees and many herbs are exceptions. But in the case of shrubs and vines, of which latter there is everywhere a multitude, it is strikingly true. It is probably to be accounted for by the steepness of the land and a climate highly favorable for the reëstablishment of detached fragments, torn away and carried to a new position. Unable to obtain the light and air necessary for a high floral development, they have learned to depend upon a less complicated method.

Turning to the western side, we find, as stated, a region in which almost every condition is reversed. With more or less scanty rains, strictly limited to a few months or even weeks, we get a treeless and almost shrubless region, with a temperature subject to very sudden and great variations. The amount of moisture increases with the altitude. Upon our school-maps great deserts are located on the table lands of this region. The real deserts, however, are not there, but along the coast. Upon the highlands there is sufficient moisture to redeem the country from barrenness, and it is a fairly good stock country. As upon the eastern side, so upon the western, the highland vegetation creeps down the mountains as we go southward, until at Valparaiso it reaches the ocean. North of Valparaiso there is thus left a true desert along the coast, which widens as we go northward, until at the boundary of Chili and Peru, we find miles of pure, absolutely barren sand. To the patient and industrious botanist this coast desert will furnish a far more interesting field than the luxuriant regions to the eastward. There is no regular water supply, the showers being infrequent and spasmodic, with years sometimes elapsing between them. But when they do occur in sufficient quantity we find a rich and beautiful flora, springing up, maturing and perishing in an incredibly short period of time. What special provisions are required, and what lessons in physiology are to be learned, while watching the processes of birth and extinction which are here going on! Long after the flora of the Amazonian basin shall have been satisfactorily classified, this desert region will be contributing its annual quota of undescribed species.

With this very meagre general outline before us, we shall notice briefly the special localities where the collections were made.

A part of a day each were spent at Guayaquil, Zorritos, Payta and Coquimbo, and two or three days at Lima, but only fragments were collected. Zorritos stands at the northern extremity of the desert, and is watered with moderate frequency. The *Prosopis*, *Cereus*, Amarantaceæ and Chenopodiaceæ, reminded me strongly of the gravelly hills of the Mohave desert. Payta is one of the dryest spots in the world, and Coquimbo is but little better. Lima, like Tacna, stands near the foot of the mountain. At the latter place a week was spent in the early part of February. No rain had occurred, and the fifty species collected were all from irrigated grounds. Tacna has one small stream, conducted through the town by a paved channel, and it does duty in great part as a sewer, besides furnishing the only water supply. From Tacna, the route lay seven days by mule, to La Paz. At nine thousand feet, 17° south latitude,* the vegetation is sufficient to afford pasturage for the llama. At twelve thousand feet we are upon the table-land, which is, in part at least, volcanic, and at first thickly covered with loose rounded stones. Farther on it becomes sandy and rocky by turns. We cross many superimposed small ranges, and skirt the bases of much greater ones. The landscape is much like that of our own south-western plateau, except that there is less grass. What frequently appears like a grassy plain, proves to be covered with plants like dwarf *Hypochœris* or *Perezia*, only an inch or two in height, and presenting a green cushion of needles in the form of spines terminating the erect linear leaves. Numerous species of *Adesmia*, rarely rising above a foot from the ground, and often very closely prostrate, cover much of the country.

Near the eastern verge of this table-land, in a basin two thousand feet deep, with nearly vertical walls of clay or gravel, is situated La Paz, at an elevation of about eleven thousand feet. Here I spent some two weeks during the months of February, March and April, collecting one hundred and fifty or more species. This was during the latter half of the rainy season, when the walls of the basin, and the gravelly and rocky hills along the La Paz River to the south, were richly clothed with plants in flower. The remainder of the time during this period was passed across the range in Yungas. Returning early in April to the coast, I proceeded to Valparaiso, where three months were spent. Here the season is earlier, and winter was just setting in when I arrived. A winter there is about the same as in northern Florida, the orange surviving, but not thriving. Some twenty-five or thirty stray specimens were found in flower before I returned to La Paz. It being then early in June, I found a dry and wintry season prevailing, with a most dreary prospect for a collector. For a long time business detained me in the city, save for a few short excursions across the mountains, and one long stay in the province of Yungas, made, unfortunately, at an unfavorable season for collecting. Just as the rains were beginning the next Janu-

*Distances, latitudes and altitudes are given approximately.

ary, I was obliged to leave La Paz on my journey to the Atlantic. Thus, out of almost a year spent in this interesting region, fortune had favored me with only about two weeks favorable collecting. But extensive collections had been made meantime upon the eastern slope at Unduavi and Yungas. Unduavi is one of several little hamlets upon a mountain stream in the first valley to the eastward of La Paz. But I have characterized by this name the entire collecting station constituted by this valley and its enclosing mountains. At 12,000 feet begins the semi-alpine flora generally associated with *Aspidium aculeatum* and the smaller species of *Acrostichum.* At 10,000 feet the shining, coriaceous leaves of the tropics begin to be seen, and at 8,000 feet the vegetation is truly tropical, including bamboos, fuchsias and begonias. The whole surface is characteristically rocky, the soil being very scanty indeed. but rich. At Unduavi, between 8,000 and 10,000 feet, I collected 150 species in flower in October, in three days.

Crossing the northern wall of this valley, we find upon the summit, at about 11,000 or 12,000 feet, a cold, boggy and cloudy region, where sphagnums and long drooping lichens abound. Upon the other side we are in Yungas, referring not to the political boundary, but to my collecting station of that name. Descending to 7,000 feet, we enter the great Andean forests which become heavier and heavier, though scarcely denser, as we descend. The trunks and greater branches are scarcely to be seen for the epiphytes upon them, chief of which are orchids, bromeliads, ferns, mosses and aroids. At 5,500 feet we strike the coca and cinchona belt, and at 4,000 feet we find the heat becoming oppressive and the air sultry. From 3,500 to 5,500 feet is probably the region of greatest rain-fall. The Yungas collections were chiefly made at elevations of 3,000, 4,000 and 6,000 feet.

Leaving La Paz on the 10th of January, 1886, we were at once overtaken by the unprecedented rains of that season. At Sorata, on the base of Mount Iliampu, we were detained by floods from the latter part of January till about the first of March. But little could be dried, and that little with the greatest difficulty, many of the collections being repeated once and some of them twice. In transit to the coast moreover, the continuous rains succeeded in penetrating some of the bales. A fine and little known alpine flora exists on Mt. Iliampu. The altitude and conditions of this locality are a parallel of those of Unduavi. One day's journey to the northward we reach Ingenio del Oro, a gold washing establishment. This locality is also very similar to Unduavi, but has the richest flora (March) of any locality that I have ever visited. It is above timber line. Three days of miserable exposure were passed here, and all our collections spoiled. Two days more brought us to Mapiri, a section almost precisely like Yungas, where, at 2,500 to 5,000 feet, I remained during March and April, improving the fairly good weather in making enormous collections, which arrived home, after great vicissitudes, in very fair condition. Mapiri is the great centre of *Cinchona* culture in South America, and large collections of these plants were made, among them being many new hybrids. The run of eighty-four miles to Guanai, 2,000 feet elevation, was made on rafts by the force of the current in a little less than eight hours. Arriving at Guanai three weeks earlier, we should have encountered one of the most interesting floras in South America. However, as we lost nearly everything collected at this place, it mattered but little. The forests at that point consist almost wholly of *Mimoseæ*, in prodigious variety. These had all gone to fruit and made rather ill looking specimens. At this point the succulent plants, such as *Begonia, Oxalis* and Bromeliaceæ began to appear much less prominent. I had early abandoned the collection of such plants, foreseeing that they would crowd out all other work, owing to the unlimited time necessary to dry them.

Upon new and larger rafts we floated in eight days to Reyes, the mountains becoming smaller, and the banks lower and lower as we proceeded, until, just at the port of Reyes we cut through the outermost range of the Andean foothills. Here, at an altitude of 1,500 feet, the forests are broken by patches of pampa, which are projected into them from the South, and the varying conditions of lake and river, forest, plain and bog, produce a flora of surpassing interest. Nearly two months were passed in Reyes, and although sickness materially interfered, a handsome representation of between 400 and 500 species was secured. The whole of this collection, with the most of what we had brought from Guanai, 9,000 specimens in all, was found one morning sunken with our boat under fifteen feet of water. From this point on down the Beni, the country rapidly assumes the character of the Brazilian forest, with a dense tangle in the sombre shade below and a wealth of floral life high above upon the tree tops. The month of July was passed in journeying down this river and making occasional short stops to collect. At the junction of this river with the Madre de Dios, the centre of the rubber production of that district, two months were spent, and the finest part of my collection was prepared. Just below this junction begins the series of falls produced by the river's cutting its way through a series of low hills. During the two months that were required to make the tedious transit of these falls, I had ample time to complete my collection with a handsome addition. Many of the Andean species with which we had already become familiar, here re-appeared.

The entire collection includes somewhere about three thousand numbers, of which an average of ten specimes were collected.

THALLOPHYTA.

(I.)—DIATOMS.

The following species were found by Prof. C. H. Kain in a gathering from Sorata, Bolivia:—*Amphipleura Lindheimerii*, Grun.; *A pellucida*, Kütz.; *Amphora ovalis*, Kütz.; *Cocconema lanceolata*, Ehr.; *Cocconeis Pediculus*, Ehr.; *Cymbella stomatophora*, Grun.; *Epithemia gibba*, Kütz.; and var. *ventricosa*, Grun.; *E. Argus*, Kütz.; *Encyonema ventricosa*, Kütz.; *Gonphonema constricta*, Ehr.; *Melosira varians*, Ag.; *Navicula elliptica*, Kütz.; *N. tenella*, Breb.; *Pleurosigma Spencerii*, W. Sm ; *Surirella cardinalis*, Kitton, rare ; *Synedra capitata*, Ehr.; *S. Ulna*, Ehr.; and var. *amphirhynchus*, Ehr.; *S. Crotonensis*, Grun.; var. *constricta*, Kain, n. var,, a provisional name for what may be a new species.

It is sometimes the case in this gathering that *Amphipleura pellucida* and *A. Lindheimerii* are both slightly sigmoid, so that they in some degree appear like *Pleurosigmæ*.

(II.)—ALGÆ.

Determined by Prof. W. G. Farlow.

Coralina Chilensis, Dec., Tacna, Chili, and Pisco, (281, 282).

Prionitis pectinata, J. Ag., Tacna (283).
Gymnogongrus furcellatus, J. Ag., Tacna (284).
Ulva nematoidea, Bory., Tacna (286).

(III.)—FUNGI.

Determined by Prof. Farlow.

Lentinus villosus, Kl., near Yungas, Bolivia (248).
Exidia Auricula-Judæ, Fr., Mapiri, Bolivia (252).
Polyporus sanguineus, Fr., Yungas (254).
P. biformis, Kl., Yungas (255).
Xylaria multiplex, Kunze (?), Yungas (257b).

(IV.)—LICHENS.

Determined by Dr. J. W. Eckfeldt.*

Ramalina calcaris, Fr., var. *fraxinea*, Fr.
Usnea barbata, (L.,) Fr., var. *florida*, Fr., near Yungas (277).
Evernia sulcata, (Sw.), Nyl., Sorata, (269), and Unduavi, (272).
Alectoria Canariensis, Nyl., Unduavi, Bolivia (268).
Theloschistes chrysopthalmus, (L.), Norm., Sorata (270), var. *flavicans*, (Fr.), Wallr., Sorata (267).
Parmelia Camtschadalis, (Ach.), Esch., La Paz, Bolivia (273).
P. caperata, Ach., Yungas (262).
P. perforata, (Jacq.), Ach., var. *hypotropa*, Nyl., La Paz (274).
Physcia hypoleuca, (Muhl.), Tuckerm., Sorata (266).
Sticta damæcornis, Tuck., Yungas and Mapiri (258).
S. crocata (L.), Ach., Yungas (278).
Leptogium foveolatum, Nyl., Syn. i., 124, Yungas (263).
Stereocaulon furcatum, Nyl., Yungas (260).
S. tomentosum (Fr.), Th. Fr., Yungas and Sorata (271).
Cladonia cariosa (Ach.), Spreng., Yungas (259).
C. floerkiana, Fr., Yungas (275).
C. ceratophylla, (Sw.), Eschw., Yungas (276).
Cænogonium Linkii, Ehrenb., Yungas (280).
Bæomyces fungoides, Ach., Unduavi (251).
Cora Pavonia, Nyl., Yungas (249).

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*Dr. Eckfeldt regrets that more attention was not given to the collection of Lichens in a region so interesting. It may be stated that the collection of the lower cryptogams was purely incidental, my excessive labors entirely preventing any special work in that direction. H. H. R.

Bryological Notes.

[For many years Prof. J. Macoun, Naturalist to the Geological and Natural History Survey of Canada, has been collecting, examining, and having accurately determined, by eminent bryologists, the moss flora of the Dominion of Canada. During the past winter he has issued the first century of a series of the Canadian Cryptogams, which will be followed by others. At the last session of the Canadian Royal Society, held in Ottawa, he read a paper, the combined production of himself, Dr. Kindberg, of Linkoping, Sweden, Dr. G. Venturi, Austria, and Dr. Dusén, Sweden. The latter gentlemen examined all the specimens and their determinations are embodied in the paper, together with descriptions of all the new species and varieties.

Up to the present time, 888 + species of mosses are recorded from all North America north of Mexico. In the paper submitted, 467 species were enumerated, and of these forty-one were new species and sixteen new varieties. Besides those new to science, twenty-seven others were added to those enumerated in "Lesquereux and James' Mosses of North America." As only about two-thirds of Mr. Macoun's species have been examined, and much material is still in his hands to work up, we may confidently look forward to many more additions when the remainder of the paper shall appear next year.—ED.]

LIST OF NEW SPECIES NAMED BY KINDBERG.

Dicranella parvula, Rocky Mountains.

Dicranum scopariforme, *D. stenodictyon*, Rocky Mountains; *D. subulifolium*. *D. Columbiae*, Vancouver Island; *D. sulcatum*, *D. rugosum*, Nova Scotia.

Barbula megalocarpa, Vancouver Island.

Grimnia arcuatifolia, " "

Racomitrium Macounii, Rocky Mountains; *R. obscurum*, Vancouver Island.

Merceya latifolia, Vancouver Island.

Physcomitrium megalocarpum, Vancouver Island.

Philonotis leiophylla, Vancouver Island.

Bryum angustirete, *B. Vancouverense*, *B. hydrophilum*, *B. meeseoides*, Vancouver Island; *B. denticulatum*, Rocky Mountains.

Atrichum leiophyllum, Vancouver Island.

Neckera Macounii, Vancouver Island.

Antitrichia tenella, *A. oligoclada*, Vancouver Island.

Thelia compacta, Ontario.

Leskea nigrescens, Ontario.

Pylaisia Selwyni, Ontario.

Homalothecium corticola, Ontario.

Macounia sciuroides, Rocky Mountains.

Thuidium lignicola, Manitoba; *T. Vancouveriinse*, *T. leskeoides*, Vancouver Island.

Hypnum hamatidens, *H. brevinerve*, *H. myurellum*, Vancouver Island; *H. Dawsoni*, from Rocky Mountains; *H. aneuron*, and *H. Americanum*, from Ontario; *H. Macounii*, *H. cristitula*, *H. Canadense*, Vancouver Island.

ADDITIONS TO AMERICAN BRYOLOGY.

Andraea alpestris, Schimp., Nova Scotia; *Andraea Huntii*, Limp., Vancouver Island.

Dichodontium flavescens, (Dicks) Lindb., British Columbia.

Dicranum congestum (Brid.), Lindb., Rocky Mountains.

Pottia intermedia, Turn., Gaspe Coast.

Barbula angustata, Wils., Rocky Mountains; *B. ruraliformis*, Besch., Vancouver Island.

Webera gracilis, Schleich., Gaspe, Quebec.

Bryum Archangelicum, Schimp., Gaspe, Q.; *B. Doni*, Grev., Vancouver Island; *B. elegans*, Nees., Gaspe, Q.; *B. contextum*, Hornsch. and Hoppe; *B. murale*, Wils., Vancouver Island; *B. Blindii*, Bruch and Schimp., Rocky Mountains.

Mnium inclinatum. Lindb., Rocky Mountains.

Polytrichum sexangulare, Floerk., Rocky Mountains.

Orothecium intricatum, Hartm., Rocky Mountains.

Heterocladium heteropterum, Bruch, Vancouver Island.

Thuidium decipiens, DeNot., Rocky Mountains.

Hypnum juratzka, Schimp.; *H. Sommerfeltii*, Myrin., Ontario; *H. fastigiatum*, Brid., Vancouver Island; *H. Vaucheri*, Lesq., Anticosti; *H. Goulardi*, Schimp., Rocky Mountains.

Pottia littoralis, Mitt., British Columbia.

Sphagnum medium, Limpr., Nova Scotia.

Fissidens pusillus, Wils., Ontario.

JOHN MACOUN.

The Genus Disporum, Salisb.

An anonymous writer in the Botanical Gazette for June, selecting the genus *Disporum,* Salisb., 1815, apparently as an example for the basis of argument, discusses the method to be adopted in transferring to it the species of *Prosartes,* Don, 1839, these two genera having long been shown to be practically identical, which circumstance he deplores for the curious reason "that it is an advantage to keep the groups apart on account of their difference of habitat." He gives a list of the presumed American species under *Disporum,* and concludes that inasmuch as this is the first time that these binomials have appeared in print, they must be attributed to the editors of the Gazette, Professors Arthur, Barnes and Coulter, or "in the necessary process of condensation this becomes inevitably A.B.C." He entirely overlooks in his effort to find the just course to pursue, the very simple and advantageous method of citing the author of the original name in a parenthesis, thus giving due credit to all concerned.

Now, leaving out of consideration the injustice done the editors of the Gazette in the assumption of the anonymous writer in supposing that they would have treated the genus in this manner and thus "making them say what they do not say" it is also to be remembered that the printing of a mere list of names does not constitute publication and fortunately the unjust attribution of eight species of *Disporum* to Arthur, Barnes and Coulter can never come to be recognized. It is not as simple as A.B.C.

In the light of present knowledge the species should stand as follows:—

(A) ASIATIC.

D. calcaratum (Wall.), Don.
 var. *Hamiltonianum* (Wall.), Baker.

D. sessile (Thunb.), Don.
 var. *minus,* Miquel.
 var. *stenophyllum,* Franch. & Sav.

D. CHINENSE (Ker). (*Uvularia Chinensis,* Ker, Bot. Mag., t. 916; *D. pullum,* Salisb.)
 var. PARVIFLORUM (Wall.) (*Uvularia parviflora,* Wall., Asiat.

Researches, xiii., 378; *D. pullum*, Salisb., var. *parviflorum*, Baker, Journ. Linn. Soc., xiv., 589.)

D. Leschenaultianum (Wall.), Don.

D. smilacinum, Gray.

(B) AMERICAN.

D. MENZIESII (Don). (*Prosartes Menziesii*, Don, Trans. Linn Soc., xviii., 533, read Dec. 3, 1839, and probably issued during that or the next year, although the volume bears date 1841; (*Uvularia Smithii*, Hook., Flor. Bor. Amer., ii., 174, t. 189, 1840).

D. LANUGINOSUM (Michx.) (*Streptopus lanuginosus*, Michx., Flor. Bor. Amer., i., 201; *Prosartes lanuginosus*, Don., Trans. Linn. Soc., xviii., 532).

D. MACULATUM (Buckley). (*Streptopus maculatus*, Buckley, Amer. Journ. Sci., (II), xlv., 170; *Prosartes maculata*, Gray, loc. cit., xlvii., 201). A specimen from the mountains of Georgia, contributed by Dr. Chapman, has dots on some of the perianth segments and none on others, but possesses the wooly ovary of the species.

D. TRACHYCARPUM (Watson), Benth & Hook. (*Prosartes trachycarpa*, Watson, Bot. King's Exp., 344). This ranges southward to the Mogollon Mountains of Arizona (Mearns, Nos. 41 and 69, 1887; also Bill William's Mt., Central Arizona (Rusby, No. 843, 1881).

D. HOOKERI (Torr). (*Prosartes Hookeri*, Torr., Pacif. R. R. Rep., iv., 144).

var. OBLONGIFOLIUM (Watson). (*P. Hookeri*, Torr., var. *oblongifolium*, Watson, Bot. Cal., ii., 179).

D. TRACHYANDRUM (Torr.) (*Prosartes trachyandra*, Torr., loc. cit.)

D. MAJUS (Hook.) (*Uvularia lanuginosa*, Pers., var. *major*, Hook., Flor. Bor. Amer., ii., 174; *Prosartes Oregana*, Watson, Proc. Amer. Acad., xiv., 271).

D. PARVIFOLIUM (Watson). (*Prosartes parvifolia*, Watson, Bot. Cal., ii., 179.)

N. L. BRITTON.

A Suggestion Concerning Smilax herbacea, L.

The ablest botanists have hitherto failed to deal conclusively with our common herbaceous *Smilax* (carrion flower). Wood accepts three species, *S. herbacea*, L., *S. peduncularis*, Muhl., and *S. lasioneuron*, Hook. Gray includes these all under *S. herbacea*, making Muhlenberg's plant barely a variety, and Hooker's a mere form. Chapman agrees with Wood in accepting Muhlenberg's species as a good one. Alphonse De Candolle distributes the Linnæan species, as found in North America, into five varieties including the type, two of them equivalent to *S. peduncularis* and *S. lasioneuron*.

Ignoring such fluctuating characters as shape of leaf, degree of pubescence and length of peduncle, I find the following four apparent varieties :

a. Peduncles about three, in the axils of bracts below the leaves, which are all in a cluster above, at the summit of the low stem. (Specimens in the Columbia College herbarium.)

b. Peduncles about six, in the axils of the lowermost leaves; stem tall, leafy and branching above. (Plant collected on New York Island.)

c. Peduncles about six, in leaf-axils nearly midway of the plant; leaves and branches above and below on the tall stem. (Plant from J. F. James, Oxford, O.)

d. Peduncles numerous, commonly produced from the same axils with the branches, scattered midway and upward on the tall and leafy stem. (Plant from W. A. Kellerman, Manhattan, Kans., and specimens in C. C. Herb.)

Var. *a*, the simplest form, chiefly southern, the one specially described by Chapman, equals var. *ecirrhata*, A. DC. Var. *b* is much more developed, but the position of the inflorescence is not altered. Var. *c*., however, shows a decided change in this respect, the new position being exactly analogous to that of the fructification in *Osmunda Claytoniana*. In var. *d*. the species reaches the acme of vigorous development, putting forth freely both reproductive and vegetative branches from the self-same axils.

The arrangement of the forms here proposed, although somewhat promising, is still merely tentative, and botanists will confer a special favor and help settle a sadly confused species, by informing me whether the plants in their respective localities fall exactly under one or another of these suggested varieties, or are intermediate in character. The requisite observations are very simple and can be easily made, at least as to pistillate plants, at any time during the summer.

E. E. STERNS,
23 Union Square, N. Y.

On Some Inaccuracies in De Candolle's "Cultivated Plants."

In his "Origin of Cultivated Plants" (Second Edition, Paris, 1883), M. Alph. De Candolle says (page 177), that "the expedition of Alexander is probably the event that made the Peach known to Theophrastus, who speaks of it as a Persian fruit"; and a reference is given to Theophrastus, Hist., iv, c. iv. Now an attentive study of this fourth chapter of the fourth book of Theophrastus can find no mention of a Peach or of any fruit or tree that may be supposed by any stretch of construction to mean a Peach. A μῆλον μηδικὸν ἢ περσικὸν there is, but the description attached to it clearly applies to the citron. This is recognized by M. De Candolle himself in his history of the Citron. "Theophrastus," he writes, "was the first to speak of it, and under the name of the Median or Persian apple in a phrase often repeated and commented on two centuries ago," and the reference to Theophrastus, book iv, chapter iv, is the identical passage given for the Peach.

Again, M. DeCandolle writes of the Bigarade (page 146), "it, as well as the sweet orange, was unknown to the Greeks and Romans"; while on page 148 he says: "If the sweet orange had been cultivated in very ancient times in India . . . it would certainly have been found, cultivated and propagated in the Roman Empire in preference to the Lemon, Citron and *Bigarade*." This last sentence is not only inconsistent with the former so far as regards the Bigarade, but it is inaccurate in the case of the Lemon. The inference that the Lemon was cultivated or known in the Roman world is nowhere supported by M. De Candolle with proof; whereas Gallesio, whose "profound researches" he largely quotes, says that he could find no trace of the fruit in Italy before it was taken there by the Crusaders.

K. B. CLAYPOLE.

Botanical Notes.

Is there a second species of Conradina? Mr. Gerald McCarthy recently found on the banks of the Congaree River, near Columbia, S. C., a "shrubby bush" which closely resembles in foliage and appearance *Conradina canescens*. There were found upon the specimens, however, a few calyxes in fruit, which prove that it cannot be that species. The calyx is not at all villous; the lower teeth are broad and barely acute; the upper lip is narrowed to the obscurely three-toothed apex; and the seeds are more than twice as large. A single imperfect corolla detected among the leaves is very much like that of *C. canescens*, but there is only a single pair of short, stout filaments. Whoever may be collecting in that region during the coming season should look for this plant in flower. S. W.

New Botanical Laboratories and Museums at Harvard University.—We have learned with much pleasure that Professor Goodale has succeeded in obtaining the sum desired for the erection of an addition to the Agassiz Museum. It is, perhaps, known to our readers that the Museum of Comparative Zoölogy constitutes the north wing, and the Peabody Museum of Archæology the south wing of the proposed University Museum. The Botanical Section, now in process of erection, will occupy seventy feet of the Oxford Street front of the quadrangle. In the plans which we have received we note that ample accommodations have been provided for Professor Goodale's and Professor Farlow's laboratories, and for suitable lecture rooms. Parts of the first, third and fourth floors of the building, which is to be six stories high, have been reserved for the Botanical Museum. It is proper to state that these new arrangements do not contemplate any change in the status of the Herbarium. The only essential lack that we notice in the plans is that they provide comparatively little north light, the exposure being chiefly east and west.

A Syllabus of "A Course of Lectures on Forest and Forest Products, by Professor G. L. Goodale, M.D.," delivered before the Lowell Institute, Boston, February and March, 1888, has been issued, including plans for twelve lectures and covering a wide field in structural organography touching upon economic and horticultural questions. We commend the outline to teachers.

Cypress Knees.—Since sending you my note, (p. 137), Professor Shaler has recorded that young trees appear in water-covered districts where it is evident a tree from seed could not have sprung. The suggestion is made that such trees may have sprung from fallen branches rooting in the water and mud. Those versed in the propagation of evergreens could not admit this. All experience is against the power of this class of conifers to push out roots from mature wood, though many will from half-mature wood, or cuttings from the same season's growth. The fact, however, that young trees do appear in places where a seed could not sprout and successfully grow to a young tree, as recorded by Prof. Shaler, is a valuable contribution to our knowledge. It accords better with the English suggestion that the "Knee" is an abortive sucker, than a rooted branch. The arrested growth may be so accelerated as to become a true tree trunk in some instances, just as the branch arrested to make a larch cone, a pear or a rose, will sometimes be so accelerated as to produce another growth from the axis, as is constantly the case in the pineapple. But the "rooting branch" hypothesis of Prof. Shaler, or the "arrested sucker" of the anonymous English writer, ought to be easily confirmed by those who are in the vicinity of a Cypress swamp. Some evidences of these transition stages should surely exist.

The subject has a broad interest. Should it be proved by actual evidence that the "Knee" of the *Taxodium* is an abortive sucker, we shall all want to know how an abortive sucker becomes hollow, and the answer cannot but have a great value in vegetable physiology, and kindred branches of the science.

THOMAS MEEHAN.

In regard to Cypress Knees mentioned by Mr. Meehan, in the BULLETIN for May, I would remark that this tree will certainly make "knees" on high land. They are, however, not so prominent as in the overflowed swamps, since they do not have to project so far to reach the light and air. They certainly do not always have tap roots below them, for I recollect that in the grounds at "Hampton," near Baltimore, in an out-of-the-way spot, when the lawn mower could not work, my men were often bothered by their scythe blades striking the "knees" of a large Cypress tree. I had the "knees" chopped off level with the ground, and each cut off just as an upward curl in the root a little thickened and pointed above, and in most cases the root was entirely severed. These were mere little protuberances, however, as compared with the great knees seen above the water in Southern swamps. A longitudinal section of one of these projections, showing the course of the sap and woody layers, I think would prove them to be merely convolutions of the roots peculiar to the genus, perhaps intended as braces for the tree in the soft soil in which its roots run so shallow.

It may be of interest to note that we have found *Sedum Nevii* on top of the Blue Ridge just north of Rockfish Gap, Va. This is two hundred miles northeast of the most northern point given by any authority at my command. The plant was found among other interesting specimens by Professor Seaman and a party of boys from the Miller School. We note the fact that a great many of the wild blackberries are producing rose-colored flowers this spring. Can it be owing to the cool and wet weather?

W. F. MASSEY.

Stellaria pubera.—"Stem pubescent in one lateral or two opposite lines." Not being able to understand from my own view of the morphological significance of the hairy line as developed in *Stellaria media*, the common chickweed, how there could possibly be hair in two opposite lines, I obtained fresh plants for study. I do not find the two opposite lines in any specimens before me.

But an interesting fact worth recording, is that the flowers are proterogynous, and that not only are the lower verticils arrested in their final development until the pistils have become perfect, but the second movement in the accelerated growth downward is so nicely regulated, that the inner cycle or verticil of five stamens shed their pollen before the five stamens in the outer ones. I have often noted this nice distinction in the double cycles of proterandrous hexandrous monocotyledons, but this is the first instance I can recall in proterogynous flowers.

THOMAS MEEHAN.

The formation of Alkaloids in Plants.—Professor W. H. Dunstan has been indicating to the chemists' assistants of London the proper direction and method of pursuing the investigation of the above subject. The experimental studies of the pure chemist have shown the series of re-actions by which we may pass from starch through carbo-hydrate to organic acid, and thence to alkaloid. In the case of malic acid our knowledge is exceptionally extended, the series of intermediate compounds being almost completely established, and its relations to certain alkaloids very clearly pointed out. These steps being thus shown to be probable, it remains for the pharmacist to complete the evidence by actually detecting the indicated intermediate compounds in the plants. Those interested will find in the Pharmaceutical Record for April 15th, an excellent report of the lecture, taken from the British and Colonial Druggist.

H. H. R.

The Botanical Section of the Academy of Natural Sciences of Philadelphia has organized a series of field excursions similar to those of the Club. On July 4th the trip is to May's Landing, N. J., leaving Market Street at 8 A.M., and on July 11th to Cape May, leaving at 7 A.M. Mr. Martindale will direct the party. We wish our neighbors all success and pleasure in these trips to an extremely interesting region. All interested in botany are cordially invited to join.

Reviews of Foreign Literature.

Die Wechselbeziehung zwischen Pflanzen und Ameisen im tropischen Amerika. A. F. W. Schimper. Jena. Gustav Fischer, 1888.

This is the title of an article forming the first part of a collection of botanical notes from the tropics. The author believes to have discovered some interesting facts in reference to certain relations between animals and plants, by which both are benefited. He states that everywhere in tropical America, in woods or gardens, the traveler is surprised by seeing lines of moving leaf fragments, which are found to be carried by a procession of ants. A similar line of ants may be found traveling in the opposite direction to certain trees and shrubs where they cut out pieces of leaves, some as large as our cent piece, and carry them away, presumably to use them in the construction of their dwellings. This species of ant is named leaf-cutter and is known to be the greatest enemy to vegetation in the tropics. It chooses, for the most part, plants not indigenous to the country. From this fact the author sees a result of natural selection, as only such plants could continue to live and flourish which were not visited by these destructive ants.

There are many other species of ants found there, among which is a kind extremely hostile to the leaf-cutters. It is found that wherever these ants have taken possession of a tree, the leaf-cutters are driven away or hindered from attacking the tree, and the result is a flourishing growth, while those trees lacking this protection are injured and stunted by the destruction of their leaves.

It has long been known that certain plants in the tropics were inhabited by ants, and the idea entertained that a mutual benefit was thereby attained. The previous observations lacked definite proof, but those more recently made by Schimper he believes are of such a nature as to furnish conclusive proof of this theory. He found that a certain species of *Cecropia* was generally inhabited by ants extremely hostile, not only to their leaf-cutting neighbors, but to any other disturber of their habitation. A sharp stroke given to the tree was sufficient to call out a large number of these ants, whose bite was extremely poisonous, and the person rash enough to venture this experiment was glad to escape.

Fritz Müller describes the manner of the development of these ant colonies as follows: The ant who is to become queen mother of the colony bores or eats her way into the hollow stem of the tree. The opening thus made is shortly afterward closed up by the growth of the surrounding tissues, and not only this, but there is a farther development of abnormal tissue at this place, which is filled with a nourishing sap for the food of the ant. She lays her eggs in the cavity of the stem, from which are hatched the working ants, who soon open another communication with the outer world.

Schimper found that the trees containing these ants were never disturbed by the leaf-cutters, while other trees of the same species (*Cecropia adenopus*), but free from these ants, were visited regularly by the leaf-cutting ants and their leaves cut into fragments and destroyed. From this fact he drew two inferences: first, that the *Cecropia* was a favorite of the leaf-cutters; second, that the tree protected itself from their assaults by special adaptation to the wants of the protecting ants. A close examination of the anatomy of the tree confirmed the latter inference, showing a most curious and wonderful contrivance to favor the entrance of the protecting ants. The tree itself has been compared to a huge candelabrum, the limbs growing out horizontally at first, afterward bending sharply upward with few, but large leaves. It was found that the queen mother entered the hollow limb always at at a certain place. This was through a little depression at the top of the internode. This depression originates first from pressure of the axillary bud; when this is grown out and the pressure thus removed, the outer walls of the depression, instead of increasing in thickness like the ordinary outer walls, remain thin and soft, no hardening takes place, the membrane remaining in this condition till after the entrance of the ant has been effected, when the before described abnormal growth takes place. Another species was found to lack these colonies of protecting ants, but in their stead was provided with a wax coating on the outside cells so smooth as to effectually hinder the leaf-cutting ants from reaching the leaves. Now in these trees the same depression is caused by pressure of the axillary bud in the first stages of its growth, but when the pressure is removed the subsequent development of the thin-lined cavity entirely fails. The ordinary thickening processes take place, and no chance is left for the entrance of the protecting ants.

Still another difference was discovered between these two species, which Schimper also regards as an adaptation to the needs of the protecting ants. On those *Cecropia* trees on which they were found, under the petiole of the leaf just at its basis, the surface, for the space of a square centimeter, is covered with velvety hairs. On similar trees, lacking these ants, the same clusters of hairs are found, but on their surface little egg-shaped bodies loosely connected with the hairs. Fritz Müller was the first to suggest the probable use of these bodies, that is, to serve as food for the protecting ants. Schimper found by experimenting that the bodies were constantly reproduced, so furnishing daily food. On cutting through the cushion of hairs the little egg-like bodies were found in all stages of development. Also, by removing the outer leaves of buds on those trees where the ants were living, the bodies were found in abundance and were seized upon and eaten with great avidity by the ants.

These egg-shaped bodies were found to consist largely of albuminous matter and essential oil, substances which are not otherwise given off by plants, except in case of seeds. So rich an offering of plant-production without some corresponding use is hardly credible, therefore Schimper concludes that these are built up by the plant specially to maintain the colonies of ants without whose protection it would be unable to reach any degree of perfection.

Another tree possessing similar features is a species of *Acacia.* Here the ants make their homes in the large hollow thorns. Food is also provided for them, in the shape of similar bodies of an albuminous nature, which occur in peculiar organs on the tips of the leaves. Still other plants are described as possessing similar remarkable examples of adaptation.

In the third chapter of this article, the author treats of the so-called extra-nuptial glands, that is, those not situated in the immediate vicinity of the reproductive organs, whose use, therefore, cannot be to attract insects as aids to fertilization. The so-called Belt-Delpino hypothesis regarding their use was confirmed by his experiments. That is, that these organs serve as a means of attraction to those insects, which, in their turn, protect the plant from insects which are more injurious, in fact fatal to its growth and full development. He found that nearly all the plants supplied with these glands were visited by ants, and, in several cases, was able to prove directly that they afforded protection against the leaf-cutting species. It is difficult to find any other use the plant can make of the honey so secreted; that it is not a waste product, whose retention might injure the plant, was shown by separating the glands from the plant, and it was found to thrive equally well as those whose glands were left intact. A considerable amount of honey was found secreted by these glands, as by carefully removing it the process of secretion was found to be kept up for several weeks. He proved also that the honey was a product of the single leaf to which the gland belonged. By darkening the leaf no honey was secreted. It is also said that these organs are much more common among the tropical plants than among those in the temperate zones, all of which facts go to make probable the theory of plant adaptation to its surroundings. E. L. G.

Peculiar Properties of Adhatoda vasica, Nees.—One of the most interesting, and, as it may also prove, important of recent investigations of plant properties is described by Mr. David Hooper, Government Quinologist in India, in the Pharmaceutical Journal and Transactions of April 7, and is in relation to the Acanthaceous shrub *Adhatoda vasica*, Nees. The leaves, which are variously used as a domestic drug and dye, are chiefly interesting on account of their use in agriculture. Great injury is inflicted on the rice crop of India by the masses of Algæ and other aquatics which infest the partially submerged grounds. It was noticed by Dr. G. Watt that the natives protected themselves against these enemies by casting into the water large quantities of the *Adhatoda* leaves. This observation led Mr. Hooper to undertake the examination of the plant. He succeeded in isolating a peculiar acid which he called adhatodic acid, and an alkaloid which he called vasicine, the adhatodate of vasicine being regarded as the active principle of the leaves.

"A sample of pond-water containing *Spirogyra* and numerous animalcules was mixed with a strong infusion of *Adhatoda* leaves. The chlorophyll gradually disappeared from the weeds, and the cells became broken up. The oxygen was given off with less frequency, and at length ceased. Some insect pupæ rose to the surface of the water and there died. Numerous *Paramecia* remained active for some time, but eventually succumbed to the action of the poison. In twenty-four hours the beaker containing the water showed only a brown mass lying at the bottom, while some water in a beaker at the side, without this treatment, contained the green aquatic weeds evolving oxygen, and the animalcules alive."

Farther experiments upon insect vermin, and upon frogs, promptly produced poisonous effects. But upon the higher animals, no such effect resulted.

Some of the results recorded seem very strange as compared with others, and we shall verify and extend the experiments as soon as a supply of the leaves can be obtained. Should it be found that their destructive effect extends to the lowest forms of vegetable life, it may prove that we at last have an agent of defense against not only insect pests and parasitical diseases of plants, but against some of the sporadic human diseases.

H. H. R.

Index to Recent American Botanical Literature.

Amelanchier alnifolia, Nutt.—S. Watson. (Garden and Forest, i., 185, fig. 34.)

Anthurium Chamberlaini, Mast. n. sp. (Gard. Chron., iii., 462, fig. 67.) This is a new species from Venezuela.

Asimina triloba. (Garden, xxxiii., 321, illustrated.)

Bald Cypress.—How it converts Lakes into Forests.—A. H. Curtiss. (Garden and Forest, i., 123.)

Brodiæa Bridgesii.—Sereno Watson. (Garden and Forest, i., 125, fig. 24.)

Bulletin from the Botanical Department of the State Agricultural College, Ames, Iowa.—Byron D. Halsted. (Pamph., 8vo. pp. 118, four plates, 1888.)

This second of Professor Halsted's bulletins contains detailed accounts of the work accomplished at Ames in 1887. Some of the papers have appeared in other publications. Among those here first printed we note "Preliminary List of the Weeds of Iowa," containing 297 species; "Oil glands on the Anthers of Cucurbitaceous Plants," "Observations on *Oxalis*" a study of dimorphism in the common species, "Notes on Pollen" of numerous plants, "A Provisional List of Fungi," a "List of California Parasitic Fungi," observed by Professor Halsted, and numerous short notes of interest and importance.

Calycanthus floridus and *C. occidentalis.* (Garden, xxxiii, 392, illustrated.)

Camassia Cusickii.—Sereno Watson. (Garden and Forest, i., 172, fig. 32.)

Cassandra calyculata. (Garden, xxxiii., 392, illustrated.)

Castalia Leibergi.—A new Water-lily.—Thos. Morong. (Bot. Gaz., xiii., 124-125, one plate.)

A small pond in Northern Idaho yields this interesting plant, the only species of its genus as yet detected in West America.

Catalpa bignonioides. (Garden,xxxiii., 393, illustrated.)

Celastrus scandens. (Garden, xxxiii, 393, illustrated.)

Contributions to American Botany—XV.—Sereno Watson. (Proc. Amer. Acad. Arts and Sciences, xxiii., 249–287; reprinted.)

Dr. Watson's latest contribution contains (I.) Some new species of plants of the United States with revisions of *Lesquerella* (*Vesicaria*), and of the North American species of *Draba*, the proposed new genus to include all the American plants hitherto referred to *Vesicaria* with the *Alyssum Lescurii*, Gray, 33 species being recognized, several here first described. Of *Draba* we have 32 species, *D. Breweri* and *D. subsessilis* being additions to the previous lists; *D. arabisans*, Michx, is reduced to a variety of *D incana*, L., and several other changes in nomenclature are made. Descriptions are given of the following new species: *Cheiranthus occidentalis*; *Caulanthus Lemmoni*; *Silene Luisana*; *Calandrinia Howellii*; *Sidalcea Hendersoni*; *Trifolium Howellii*; *Astragalus sylvaticus*; *Lathyrus cinctus*; *Ivesia Shockleyi*; *Pyrus occidentalis*; *Saxifraga occidentalis*; *Hartwrightia Floridana*, Gray, a new genus and species in Compositæ; *Pentstemon Shockleyi*; *Eriogonum pendulum*; *E. citharæforme*; *Tillandsia Wilsoni*; *Brodiæa Hendersoni*; *Calochortus Howellii* and *Juncus Oreganus*. (II.) Some new species of Mexican plants, chiefly of Mr. C. G. Pringle's collection in the mountains of Chihuahua in 1887, in which a large number of novelties are characterized, among them *Prionosciadium*, a new genus of Umbelliferæ with three species. (III.) Descriptions of some plants of Guatemala, mainly from Dr. Watson's collections in 1885, containing *Louteridium*, a new genus in Acanthaceæ, and a number of orchids described from specimens which have flowered at Cambridge.

Cypripedium fasciculatum, Kell. (Gard. and Forest, i., 90, fig. 16.)

Delphinium viride.—Sereno Watson. (Garden and Forest, i., 149, fig. 29.)

Douglasia lævigata. (Gard. Chron., iii., 524, fig. 71.)

Epigæa repens. (Garden and Forest, i., 154.)

Contrary to the experience of almost everyone who has attempted to transplant this unwilling emigrant, it has been successfully grown at the Arboretum at Brookline. Much pains were taken to establish it.

Erysipheæ and Peronosporeæ.—Notes on Western—S. M. Tracy and B. T. Galloway. (Journ. Mycol., iv., 33–36.)

Erythronium albiflorum and E. Hendersonii, Watson. (Gard. Chron., iii., 556–652, figs. 74, 86.)

Etudes sur le Péristome, VII.—Philibert. (Rev. Bryol. xv., 37–44.)

This includes comparative studies in homologous parts of the inner peristome and its variations in *Cinclidium* and *Fontinalis.*

Euphorbia Jacquiniæflora. (Garden, xxxiii., 486, plate 650.)

Evolution in the Plant Kingdom.—John M. Coulter. (Amer. Nat., xxii., 322–335.)

Ficus aurea—The wild fig-tree of Florida.—C. S. S. (Garden and Forest, i., 128, illustrated.)

Flora of Bergen County, N. J.—Notes on the—Willard A. Stowell. (Journ. Trenton Nat. His. Soc., i., 345-347.) A brief account of some rarer plants of the region.

Flora of Milwaukee County.—W. M. Wheeler. (Proc. Nat. Hist. Soc. Wisconsin, 1888, 154-190.) A list of 691 species of Anthophyta and Pteridophyta, with localities.

Flora Ottawaensis. (Ottawa Nat., May, 1888.)

The additions made during 1887 number twenty-four species and include eight of mosses, three of which have been heretofore undescribed; *Leskea nigrescens, Pylaisia Selwyni,* and *Homalothecium corticola,* named by Kindberg.

Florule de l'Ile Miquelon, par Dr. E. Delamare, F. Renauld, J. Cardot. (Pamphlet, 8vo., 79 pp. Lyons, 1888.)

The collections on which these lists are based were made by Dr. E. Delamare, including Phanerogams, Vascular Cryptogams, Mosses, Sphagnums, Hepatics and Lichens, with a short list of Algæ. The list is not a bare enumeration, but includes descriptive notes and comments, is written in a pleasant style and records some interesting comparisons in geographical distribution. Among the notable plants the authors record *Schizæa* *pusilla*, though unfortunately without any exact notes as to locality. This may be based on De LaPylaie's specimen, though no mention is made of the fact.

Fungi from various Localities—New species of—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 44-46.) 15 species described.

Gesnera longiflora. (Garden, xxxiii., 340, plate 644.)

Heliconia Choconiana.—Sereno Watson. (Garden and Forest, i., 161, fig. 31.)

Hepaticæ from California.—Some undescribed.—Lucien M. Underwood. (Bot. Gazette, xiii., 112-114, four plates.) Description of three new species and a new variety of *Jungermania* and of *Grimaldia Californica*, from the manuscript of Dr. Gottsche, all collected by Mr. Bolander.

Hepaticæ Paraguayensis, Balansa lectæ, R. Spruce determinatæ. —R. Spruce. (Rev. Bryol., xv., 34.)

This includes thirteen new species of *Frullania*, *Lejeunia*, *Radula*, *Aneura*, *Metzgeria*, *Riccia* and *Anthoceros*.

Hepaticæ in Prov. Rio Janeiro a Glaziou lectæ, a R. Spruce determinatæ.—R. Spruce. (Rev. Bryol., xv., 33.)

Fifteen new species and thirty-three others with varieties are enumerated.

Heterosporum Ornithogalli. (Gard. Chron., iii., 659, fig. 88.)

This fungus attacks the bulbs of *Ornithogallum nutans* and may be looked for on *O. umbellatum.*

Heuchera sanguinea in Mexico.—C. G. Pringle. (Garden and Forest, i., 152.)

Hypoxylon and Nummularia—Synopsis of North American Species of.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 38-44.)

James Bay—Notes on the Flora of.—James M. Macoun. (Bot. Gazette, xiii., 115-118.)

Leersia and Muhlenbergia—Rootstocks of.—W. J. Beal. (Am. Nat., xxii., 351, 352, Plate IV.)

A comparison of these structures in the several species.

List of Diatoms from Granville, Ohio.—J. L. Deming. (Bull. Sci. Lab. Denison Univ., iii., 114, 115.)

List of Plants in the Vicinity of Utica, for April, May and a *portion of June.*—J. V. Haberer. (Pamph., 8vo., 20, 1888.)

A neatly printed paper, published by the Asa Gray Botanical Club. Localities and habitats of the species enumerated are given and special attention devoted to the time of blooming.

Lobelia syphilitica—Cross-fertilization of.—C. L. Payne. (Bull. Sci. Lab. Denison Univ., iii., 111-113.)

Mildews of Illinois—Some.—L. H. Pammel. (Journ. Mycol., iv., 36-38.)

Selaginella Pringlei, Baker.—C. G. Pringle. (Garden and Forest, i., 185.)

This is as much a resurrection plant as *S. leptophylla*, and is recommended for planting on rock-work.

Taxodium distichum—Knaur on. (Gard. Chron., iii., 560, fig. 77.)

Tecoma radicans and Bignonia capreolata. (Garden, xxxiii., 348; illustrated.)

Ulota Phyllantha, Brid., La fructification de.—F. Renauld, J. Cardot. (Revue Bryologique, xv., 36.)

These bryologists have examined and described the fructification of this moss from specimens collected by Thomas Howell in Oregon, identical with ours. I much regret to state that I wrote to J. Cardot in March, calling his attention to my discovery of the fruit, and received a letter from him dated April 3d, acknowledging the interest of the discovery; therefore I claim priority by several months, having illustrations and description ready for publication before this number of the Revue Bryologique was received.* E. G. BRITTON.

Urceolina pendula. (Garden, xxxiii., 436, Plate 648.)

This handsome Amaryllidaceous plant was discovered by Mr. Pearce in Peru in 1863.

Violets of British Columbia.—M. Lopatecki. (W. Amer. Sci., iv., 38.) A list of forms observed, with localities.

Willows, Notes on North American, with a Description of New or Imperfectly Known Species, I.—M. S. Bebb. (Bot. Gazette, iii., 109-112.) *Salix commutata*, with three varieties, and *S. denudata* are new species from the Pacific Coast.

Yucca filamentosa. (Garden, xxxiii., 333; illustrated.)

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*See this volume, p. 176.

Proceedings of the Club.

The regular monthly meeting was held June 12th, 1888, the President presiding, and thirty-two persons present.

Miss Agnes Dash was elected an active member, and Miss M. G. Tyler transferred to the list of corresponding members.

The Secretary read a copy of the circular letter of introduction prepared for the use of the Rev. Thomas Morong in his travels in South America.

Mr. Lighthipe announced that it was proposed to hold a Summer Assembly of the Agassiz Association, at Asbury Park, for one week in August, and invited the members of the Club to attend.

Miss Steele reported *Orchis spectabilis*, *Anemone dichotoma* and *Rhamnus catharticus*, from Garrisons, N. Y., May 30th, and Miss Rich reported a single plant of *Penstemon pubescens* at W. Mt. Vernon, June 9th. Mr. Lighthipe reported *Obolaria Virginica*, from Rocky Hill, N. J. Miss Steele distributed specimens of *Geum vernum*, which is abundantly naturalized in Prospect Park, Brooklyn. Mrs. Britton distributed specimens of *Trifolium incarnatum* and *T. hybridum*, from New Dorp, Staten Island. Dr. Britton showed fresh specimens of *Juncus Balticus*, collected at New Dorp, and new to the local flora. Mr. Northrop reported *Viburnum Opulus* at Whitestone, L. I., and Prof. Schrenk exhibited mounted specimens of *Hypericum Ascyron*, from Sullivan County, N. Y., and a specimen of *Cypripedium pubescens*, from South Yonkers, N. Y., with only one perfect stamen and one aborted into a bract-like appendage. Dr. Rusby exhibited specimens, fresh and dried, of *Anhalonium Lewinii*, Henning, from the plateau of Central Mexico, stating that it is used by the Indians as a non-alcoholic intoxicant, and is now being introduced into medicine.

The paper announced for the evening was given by Dr. N. L. Britton, who exhibited a collection of specimens made by Dr. E. A. Mearns, U. S. A., from the Mts. of Arizona.

Dr. Rusby gave a general description of the region as seen by him in 1883, and Dr. Newberry also remarked upon his exploration in 1858.

On motion the Club adjourned to the second Tuesday in October.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, August 2, 1888. [No. 8.

The Fruit of Calycanthus, L.

A recent close inspection of several hundred ripe pods of *Calycanthus glaucus*, Willd., gathered on the Cumberland Mountains in Eastern Tennessee, enables me to give a somewhat detailed account of this rare and interesting fruit. The best description of it known to me is that of Nuttall (Gen. N. A. Pl., p. 311).

"Capsule turbinate," says this delightful old botanist, "as large as a small pear, marked with vestiges of the calycine laciniæ, at length becoming perfectly dry, but never opening." A few of the pods I examined were almost typically turbinate, perfectly flat across the top and tapering to the base, but curving slightly outwards. The prevailing shape, however, was more nearly obovoid or pyriform, the upper third being rounded. Some were slender and elongated, resembling small cucumbers, and one was distinctly ovoid, broadest below the middle and tapering upwards. Many were very irregularly protuberant or collapsed, these variations in form depending on the development or abortion of the ovaries within, and several were remarkably incurved, the summit and base almost meeting after the fashion of a campylotropous ovule. This curious form results from the development of two or three ovaries one above the other and the abortion of all the rest. Taking the extremes alone, these pods would certainly have seemed to belong to two or three distinct species, but the complete gradation of intermediate forms made it impossible to draw any specific line. As to size, Nuttall's rather vague "as large as a small pear" (or Wood's "size of a fig") may be taken as a correct average statement, but as a matter of fact the pods examined, all mature and containing perfect achenia, ranged from half an inch to over three inches in length, and from one-third of an inch to an inch and a half in greatest diameter. The bulkiest were barely two inches long, those of greater length being invariably somewhat attenuated (cucumber-shaped).

Baillon, in the Histoire des Plantes, Vol. I., figures the fruit of *C. lævigatus*, Willd., as an oblong spheroid, with a distinct cylindrical neck, like that of a bottle. None of the pods I examined showed exactly this form. The summit in some cases was tapering-elongated, quite commonly a little protuberant, sometimes perfectly flat, and in a few instances distinctly umbilicate. (Wood's "involute at top" indicates that his specimens were of this latter form.) Nuttall's "marked with the vestiges of the calycine laciniæ" is equivalent to Wood's "longitudinally veined." These markings are really the ridged margins of the adnate portion of the bracts, the free portion being entirely deciduous. The sepals and petals are also deciduous, but their bases persist, forming a ring often obscure but sometimes quite distinct. Another ring is formed within this by the short, persistent, pubescent and usually more or less recurved filaments. It is worthy of note that these enter the orifice of the fruit and are adnate to its inner surface. In very rare cases this orifice is large enough to allow the ripe achenia to escape; most generally it is too small for this, and not seldom it appears quite closed. Nuttall's statement that the pod never opens is therefore strictly true only in the sense that it never dehisces or ruptures in any way. "Becoming perfectly dry" is a correct characterization; "and rigid" might properly have been added, as they resist considerable pressure but break finally instead of yielding. Nuttall does not note the color. Most of those examined were of a blackish weather-beaten brown. In fact, taken in bulk, the pods of *Calycanthus* at a casual glance closely resemble the perfectly ripe fruit of *Juglans cinerea*, L., though far less uniform in either size or shape. The original color at maturity, judging from the fresher specimens, is an orange brown.

The wall of the pod is thin, and the large cavity is ordinarily about half filled by the loose achenia. When shaken, the resemblance to a baby's rattle is very marked. The inner surface is of a rich reddish-brown color, with a slight and scattered silvery-white pubescence. The adnate filaments mark the surface above with radiating ribs. In well developed specimens slight ridges rise spirally from the base, intersecting each other, and forming shallow, rhombic hollows. The lower angles of these are marked by the white spatula-shaped scars left by the detached achenia. To my surprise these indicated two distinct phyllotaxies, the $\frac{5}{13}$ and the $\frac{8}{21}$. The achenia are more commonly sessile, or nearly so, but are also sometimes raised, not on a stipe, but on a curious rough pedestal—a shapeless hardened mass of tissue, apparently deposited by sheer excess of vital force. Nuttall's account of the achenia, or "seeds" as he naïvely calls them, is sufficiently full and accurate to be worthy of quotation: "Brown, nearly as large as horse-beans, naked, smooth, shining, about sixteen in each utriculus, of a roundish oblong form, marked with a longitudinal suture and a central hilum; shell hard and cartilaginous, perisperm none or a small central portion, gelatinizing when moistened; radicle descendant, cotyledones convolute, white and large, of an oleaginous bitter taste." The color is that of freshly browned coffee, and I have twice known the *Calycanthus* achenia to be mistaken for coffee beans. The length varies from a half to a third of an inch, and the diameter is about half as great. The weight ranges from three to five grains. They are not strictly naked, but have commonly a little spreading silvery pubescence, especially about the base. The number is greater than Nuttall represents. In ten pods of the average full size I counted respectively, 16, 17, 17, 18, 19, 20, 20, 26, 30 and 31, in all 214, or an average of over 21. The pod containing 31 had also five or six abortive ovaries, indicating about 35, or at most 40, as the maximum possible number. The minimum is one, several minute pods being completely filled by a single fully developed achenium. Both sutures are well defined, the one next the wall being marked by a single crest, and the one towards the axis of the pod by two parallel crests with a slight furrow between. These are slender, sharp and more or less corrugate-wavy. The "hilum" (if the term may be used with reference to an achenium), is not central as in a bean, but is distinctly basal. In Gray's Structural Botany, the embryo of *Calycanthus* is figured with the radicle projecting considerably below the cotyledons. In the numerous seeds I dissected it was always entirely enclosed within their coiled bases. The cotyledons are so brittle, that even after prolonged soaking they break into several pieces in unrolling. Their shape is evidently between cordate-orbicular and reniform. The testa is thin, yellowish, membranaceous, only slightly adherent, and marked by a slender but distinct rhaphe. The embryo is decidedly oleaginous, leaving an oily mark when crushed on paper, and, to my taste, is distinctly bitter, though not extremely so. The albumen, ("perisperm" of Nuttall), when present, forms a slender, more or less irregular plug, inserted in the top of the seed opposite the radicle.

The pods are evidently borne, as a rule at least, on two- (rarely four-) leaved stems, these leaves making the stems branches, instead of peduncles, and the inflorescence, strictly speaking, terminal instead of axillary. The pods persist through the winter, and are finally worn or torn off by wind and weather, like the fruit of *Platanus*. It is a curious fact that they are subject to the attacks of birds, several of those examined having large holes pecked in the side. The persistence of the peculiar and pleasant odor of the plant is also noteworthy, even the perfectly dry fruit being strongly aromatic when crushed.

The pods above described were sent me last November by Mr. J. H. H. Boyd, postmaster at Cagle, Tenn. In an accompanying letter Mr. Boyd made the following remarkable statement:

Hundreds of cattle and sheep have died here in the past five years from "bubby" [the eccentric local name of the shrub]. The seeds only are poisonous. When a brute gets a sufficient dose, from five to ten well filled pods, it makes for the nearest water and often falls dead while drinking, or it may live three or four weeks and then die. The symptoms are like those of a man extremely drunk, except that any noise frightens it. Stamp the ground hard, close to a brute poisoned with "bubby," and it will jump and jerk and tremble for several minutes That is our method of telling when they have taken it. The eyes turn white and glassy, and while lying they throw back the head and look as if dead already. "Bubby" does not seem to hurt a brute so much if it cannot get water. Our best remedy is apple brandy, strong coffee and raw eggs poured down as soon as possible after finding. It is certain that "bubby" is the most poisonous of any shrub or weed in existence here, from the fact that when brutes have once eaten it, they will take it every time they can get it. It grows on every hillside, along all branches [creeks], in every fence corner and almost everywhere here.

Inquiries addressed to two other postmasters in the same county elicited replies fully confirmatory of Mr. Boyd's surprising assertions. In other words, three separate individuals, miles apart, with no opportunity for collusion, and with no apparent motive for deception, agreed in declaring that the fruit of *Calycanthus* was fatally poisonous to cattle. Nevertheless, their assertions were discredited because they were not scientific observers, because of the long-established reputation of the plant as perfectly harmless, and especially because, in an experiment made by Dr. T. F. Allen last December, the contents of two pods, administered to a dog, produced no visible effect upon the animal. In this state of the case, and in view of the difficulty of making experiments here upon cattle and sheep, the evidence of a competent local authority became very desirable. This is furnished in a letter dated June 11, 1888, from Dr. B. W. Sparks, of McMinnville, Tenn., who writes in the following unequivocal strain:

In regard to the "bubby," "sweet shrub," (*Calycanthus glaucus*, Willd.), if you ask me, "Do I believe this plant to be poisonous to cattle and sheep?" most assuredly it is. It will poison cattle, sheep, goats, deer and all other ruminating animals, but does not have any effect on the horse, mule and ass. At least this is my experience. It will poison the squirrel, rat and dog, when ground or unground. I cannot speak for the hog family. I have known and made many experiments on rats and dogs; it is as sure death to them as strychnine or arsenic; symptoms in over-doses identical with those of strychnine, which I need not repeat. In my opinion it has an alkaloid allied to strychnia.

This alkaloid, named calycanthine, has been successfully extracted by Dr. R. G. Eccles, who also detected traces of a second alkaloid, provisionally termed calycanthoidine.

Upon the whole, despite the negative result of Dr. Allen's experiment (with an evidently insufficient dose), it seems now pretty well established that the seed of *Calycanthus* contains a virulent toxic quality. Some further scientific experiments are still very desirable, however, to determine fully its exact character, the nature and limitation of its effects, and especially its possible value as a medicine.

E. E. STERNS.

An Inviting Field for a Collector.

BY W. E. SAFFORD.

On sending a package of plants collected by me in the Straits of Magellan to Dr. R. A. Philippi, of Santiago, Chile, the recognized authority on Chilian botany, he kindly determined for me a number of species which I had been unable to classify; and in his letter he says:

"I have received on different occasions lots of plants of the Strait and have been therefore highly astonished to find that among the seventy-eight species you sent me not less than four were undescribed, and of these two may, perhaps, be erected into new genera—the petals of the *Ranunculus* (?) *aberrans* are so aberrant, and the corolla and stamens of *Micromeria*(?) *pusilla* are likewise different enough from the same organs in the genuine species of that genus."

The *Ranunculus* (?) to which Dr. Philippi refers is the glossy-leaved "*Ranunculus* or *Caltha*, somewhat like *R. Ficaria*," which I collected at Gregory Bay, (see p. 19 of this volume), and the *Micromeria* (?) *pusilla*, Phil., is a small labiate from the same locality. The other new species are a *Draba* and a *Vicia*, which Dr. Philippi has described as *D. Saffordi* and *V. Saffordi*. The discovery of these four new species in one day's collecting within a radius of two miles, shows how imperfectly the botanical field of the Eastern Strait-region has been explored. I am sure a botanist could find no field more inviting and at the same time accessible than the immediate vicinity of Gregory Bay. The regular lines of steamers to Valparaiso pass through the Strait, and all stop at Sandy Point, only a few miles farther on. At Sandy Point one could easily get an assistant and proceed in a boat to Gregory Bay. He ought to reach there by the first week in November, taking with him a supply of canned meats and vegetables from the United States. At Gregory Bay he could find comfortable shelter in the home of the shepherd.

He would, I am sure, be amply rewarded for any little privations by the result of his season's work; and if he be fond of shooting, he could vary the monotony of his life when his presses are full, and at the same time supply his table with an abundance of snipe, ducks and upland geese, all of which are remarkably tame and are very good to eat. The field would yield as good results to the ornithologist as to the botanist.

APIA, SAMOA, May 20, 1888.

Cheilanthes vestita, Sw., on New York Island.

The eastern range in the United States of the genus *Cheilanthes*, Sw., was extended to the Hudson and beyond by Prof. Eaton from a report of the collection of *C. vestita*, (Spreng.), Sw., by W. W. Denslow, in "clefts of rocks, island of New York," (*vide* Gray's Manual, p. 659). This collection was made over twenty years ago, somewhere on "Washington Heights," but the exact station seems to be nowhere recorded. I have seached in vain for any mention of a rediscovery of this station, and there has been some fear that this rare fern had become totally extinct on Manhattan Island. It was, therefore, with especial gratification that I found it, on the afternoon of July 15th, upon the summit of the rocky ridge west of the Kingsbridge Road, about on a line, I judge, with the future 195th Street. The bluff at this point is too steep to be climbed with safety, but may be readily ascended farther north by a path just beyond a little white frame building close to the road, called "Beck's Inwood House." The exact station is a number of rods south of the head of this path, near a rounded expanse of naked rock which forms the brow of the bluff at that point.. Eight or ten plants were found within a space of two yards, and a rod or so away there is a scattering cluster of three or four more. They are growing in very thin soil, in shallow hollows (scarcely clefts) of the rock. Most of the fronds are of quite moderate size, only three or four inches in length, the largest under six, exclusive of the stipe. The agreement of the specimens collected (three fronds only !) with the description and figure in Gray's Manual is very close, except that the scattered hairs are whitish in color rather than rusty, and, though the longer ones are discernibly articulated, they are not "prominently" so. Increased age, however, will doubtless bring the fern into conformity with Prof. Eaton's description in these respects also. The only other fern noticed in the immediate neighborhood was *Asplenium platyneuron*, (L.), BSP., (= *A.*

ebeneum, Ait.), which is frequent along the same ridge farther to the south. The most striking feature of the vegetation near the *Cheilanthes* station is the vigorous abundance of *Opuntia vulgaris*, Haw. I also found, close by, *Asclepias verticillata*, L., which I have not detected anywhere else on the island.

E. E. STERNS.

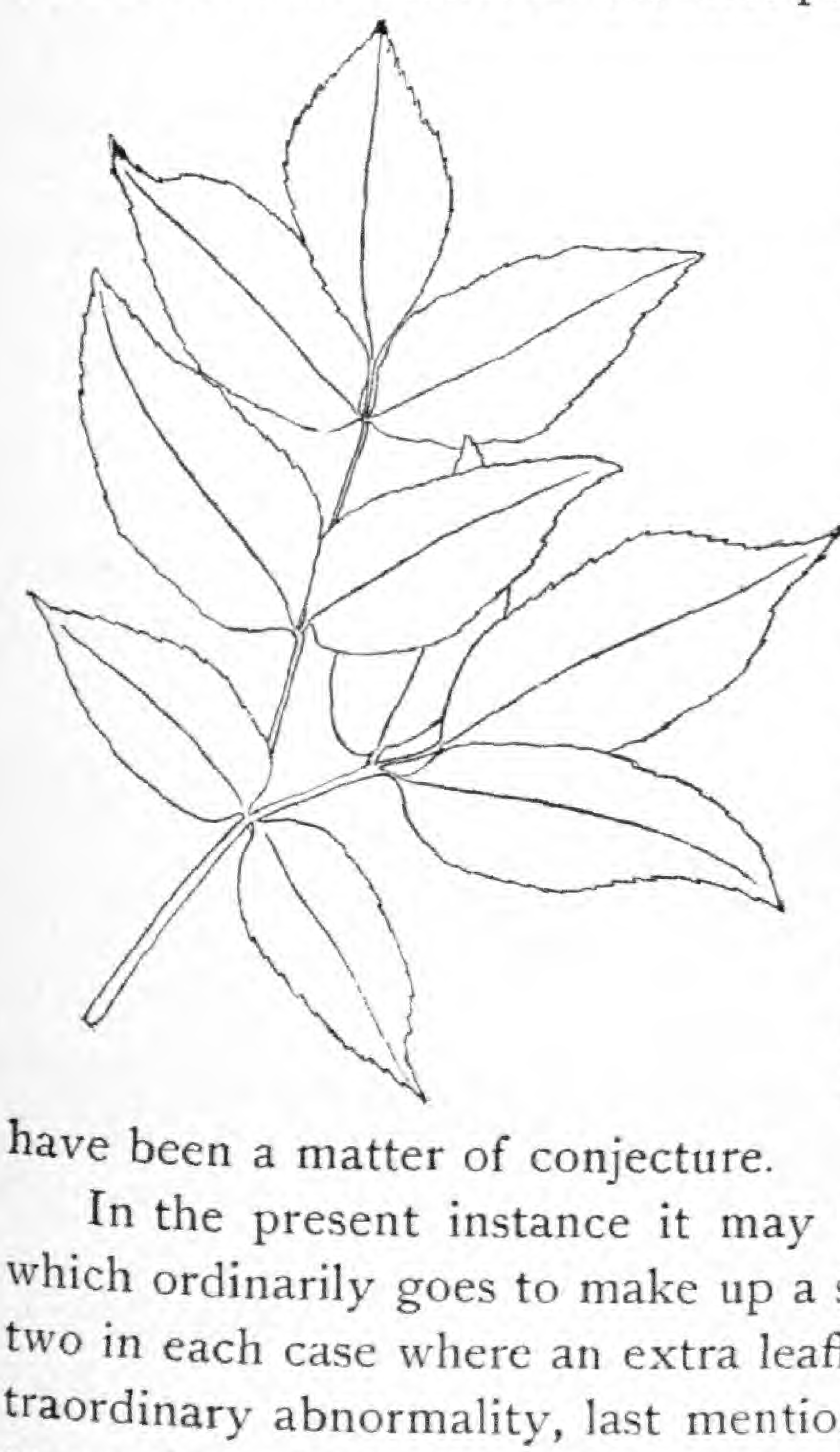
P. S.—Since writing the above, I learn that Judge Addison Brown detected the plant during the interval between Denslow's collection and mine. He says, in a note dated July 25th: "I suspect the location of your specimens is the same that I found, though I do not remember 'Beck's Inwood House.' My location was *near* the *top* of the high ridge, looking west, and about one-fourth mile to the south of the Inwood railroad station. When passing last, in haste, a year or two ago, I missed it." This indicates clearly *two* stations, as mine has an *eastern* exposure, and so had Denslow's, as appears from the ticket on his specimens in the Columbia College Herbarium. E. E. S.

Abnormal Ash Leaves.

A single tree of the green ash (*Fraxinus viridis*, Michx. f.), bore last year a large number of abnormal leaves. Instead of the ordinary three pairs of lateral leaflets and the single one at the top, many of the leaves had two pairs of leaflets in place of the lower pair; others developed two pairs in place of the second pair, and in others the leaf was normal, excepting one additional leaflet at one or the other of the pairs of leaflets. In order to arrive at an idea of the prevailing abnormal forms, one hundred leaves were gathered from various branches of the tree and examined, with the following tabulated results:

Extra pair at 1st and 2d nodes.	Extra pair at 1st node.	Extra pair at 1st and one extra at 2d node.	Extra pair at 2d and one extra at 1st node.	One extra at 1st and at 2d node.	One extra at 1st node.	One extra at 2d node.
15	19	20	7	7	18	14

It will be seen that the larger number have one or two extra leaflets at the basal pair. The abnormality here indicated would have been passed without comment had it been common to all ash trees of the species. Instead of this, a long search failed to reveal anything of the kind elsewhere, and scores of surrounding trees were examined. The nearest approach was the abnormality found in a very rapidly growing leaf upon a young sprout from a stump of a recently cut ash tree. In this the terminal leaflet had one leaflet of the first pair below united with its base.



The leaf to which attention is specially called is shown much reduced in the accompanying outline. In this, instead of the single extra leaflet in the basal pair, there is a lateral leaf-stalk which bears three leaflets in the same manner as in the upper portion of an ordinary ash leaf. If this abnormal portion had elongated farther and formed another pair of leaflets, there would have resulted a symmetrical leaf of a peculiar dichotomous type, and its origin might have been a matter of conjecture.

In the present instance it may be assumed that the tissue which ordinarily goes to make up a single leaflet has divided into two in each case where an extra leaflet is produced. In the extraordinary abnormality, last mentioned, it may not be difficult to see that a lateral leaflet has followed out the method of growth of the terminal leaflet and divided its blade into three nearly equal parts.

BYRON D. HALSTED.

Kansas Botanical Notes.

In a recent brief collecting tour (beginning May 28th) extending as far west as Greeley County, within about fifteen miles of the Colorado line, one of the first things to attract my attention was *Stanleya pinnatifida*, Nutt., which was common in both flower and fruit. A large number of butterflies was noticed on these plants. *Argemone platyceras*, Link and Otto, was just beginning to show its flowers, and was seen in many counties; *Callirrhoë alcæoides*, Gray, *C. involucrata*, Gray, common in many counties; also *Malvastrum coccineum*, Gray, *Linum rigidum*, Pursh, and *L. sulcatum*, Ridd. A few specimens of *Talinum calycinum*, Engelm., were collected in Pratt and Edwards Counties, south of the Arkansas River. *Baptisia australis*, R. Br., *Gaura coccinea*, Nutt., *Œnothera serrulata*, Nutt., and *Oxytropis Lamberti*, Pursh, were seen in many counties; *Rosa Arkansana*, Porter, in several counties. Several other species of *Œnothera* were collected. *Actinella scaposa*, Nutt., and *Erigeron pumilus*, Nutt., were found in Greeley County, the latter not reported from Kansas before, so far as I know. *Pyrrhopappus scaposus*, DC., was seen in several counties; also *Castilleia sessiliflora*, Pursh, *Mimulus glabratus*, HBK., var. *Jamesii*, Gray, *Pentstemon acuminatus*, Dougl., and another species which has not yet been worked out.

J. H. OYSTER.

Onondaga Plant Names.

I have obtained a good many Onondaga names of plants, some of which are now only names, while others have significance. For many the Indians, like the mass of our own people, have no names. They adopt some English names and change others, as "*Ikomatos*" for tomatoes. Some are rather pretty and quite appropriate, as "Indian cradle" for Jack-in-the-pulpit. The cradle on which the baby is placed is a flat board with a foot-rest at one end and a bow at the other. On this the baby is bound, and the cradle is hung up or carried by the bow. From the upper end a scarf is frequently drawn over the bow to shield the face, like the nodding spathe of Jack-in-the-pulpit. The plantain is "the plant that covers the road." Lettuce is "the raw leaf." *Caltha palustris* is *Ka-nah-wah-hawks*, "It opens the swamps." *Sanguinaria* is *Da-weh-ne-quen-chuks*, "It breaks blood." The yellow lady's slipper is *Kwe-ko-heah-o-tah-qua*, "The whippoorwill shoe." Commercial ginseng is *Da-kien-too-keh*, "The forked plant." *Podophyllum* is *O-na-when-stah*, "Soft fruit." Snake-root is *Oh-squen-e-tah*, but of this I got no meaning.

W. M. BEAUCHAMP.

Distribution of the Buffalo Grass (Buchloë dactyloides, Engelm.)

BY DR. VALERY HAVARD.

This noted plant has long enjoyed a reputation to which it does not seem to be fairly entitled. Of its qualities, as a most excellent pasture grass, I do not wish to say a word in disparagement, but, concerning its distribution, I want to call attention to what is probably a very general misconception. In the "Flora of Colorado" it is referred to as follows: "The celebrated Buffalo Grass, known to hunters and trappers as one of the most nutritious Grasses, on which for a part of the year subsist and fatten the immense herds of buffalo and the cattle of the hunter and emigrant. It extends on the elevated plains from the British Possessions southward and westward into Mexico and New Mexico." Dr. Asa Gray in his paper on "The Vegetation of the Rocky Mountain Region" remarks that "The Buffalo Grass *par excellence* and by its abundance, is *Buchloë dactyloides.*" From these and similar authorities the general impression prevails that the Buffalo Grass is the most abundant and widespread, as well as the best, grass on the broad western prairies; that it has been the chief food of the buffalo as it is now that of the immense herds of cattle ranging over those prairies. Let us see how much foundation in fact there may be for such an impression.

I have traveled on horseback over a large part of Dakota, especially north and west, and always with an eye open to its botanical resources, but have failed to discover the Buffalo Grass within its limits. Several writers make the general statement, without specifying localities, that it is abundant on the Upper Missouri. I have traversed the plains bordering the Missouri River from Bismarck to Fort Assiniboine, and thence to Benton and the Falls, but never observed it. Nor is it seen in Southern Dakota, as I am informed by a reliable botanical correspondent from Fort Niobrara.

In my travels through eastern and northern Montana, I have found the Buffalo Grass only at one place (on Sunday Creek near Fort Keogh), in scattered patches, not sufficiently abundant to be of practical importance. F. Lamson Scribner, in his paper on the agricultural grasses of central Montana, the region "lying just eastward from the 'Continental Divide' and extending north and south over the breadth of Montana Territory," gives the list of the more important species, "such as give character and value to the region for grazing purposes," and the Buffalo Grass is not one of them; it was not seen by him. As a noteworthy constituent of grazing ranges, we may therefore exclude it from Dakota and Montana.

In Nebraska, which seems to be, or to have been, one of its most congenial habitats, it is still common in the central and southeastern regions, but quite rare in the northern and northeastern parts of the State. Prof. Bessey, in his instructive paper on the "Grasses and Forage Plants of Nebraska," says: "This remarkable grass is disappearing rapidly from the State, and while it may endure in small isolated patches here and there for perhaps many years, it will ere long cease to have any agricultural interest."

In Kansas, according to the Agricultural Report of 1870 (p. 222), the Buffalo Grass reaches its eastern limits about 100 miles west of Fort Scott, appearing there in small patches at the base of bluffs. It is still common in the western part of the State.

The authors of the "Flora of Colorado" give the single habitat, "Plains around Denver," which makes it probable that this plant is common in the eastern prairie regions of Colorado, although Dr. Rothrock, in the "Botany of the Surveys West of the 100th Meridian" (p. 32), does not mention it among the "Bunch Grasses" of that State.

It extends to southeastern Wyoming, having been recorded as entering into the composition of the sod of the prairie around Cheyenne. That it is quite rare, if not absent, from the northern and mountainous western parts of this territory is sufficiently obvious from the fact that it does not appear in the "Flora of the National Park."

In Texas, according to my own extended observations in that State, the Buffalo Grass is a not inconsiderable element of the grazing ranges of the central and northeastern regions, extending westward to the branches of the Concho River. It does not thrive on the dry, sandy plains of the southwest and is rare beyond the Pecos. I have failed to find it on the southern Staked Plains, but it has been collected by others in the Pan Handle country and in northeast New Mexico. In his mention of the principal pasture grasses of the plateaus of New Mexico, Dr. O. Leow (Surveys W. of the 100th Meridian, Rep. 1875, p. 137) says nothing of the Buffalo Grass.

It seems to have still a good footing in the western part of the Indian Territory, being reported as abundant about Fort Supply.

An accredited writer in the Agricultural Report for 1870, describing the "Grasses of the plains and eastern slope of the Rocky Mountains," states that the *Buchloë dactyloides* as to quantity, stands fifth in the Missouri River region, and eighth in the Rocky Mountain region. I am persuaded that it should occupy a much lower place in the former region, where it is practically absent.

In conclusion, we may say that the *Buchloë* is a widespread grass, still forming a valuable element of many of the grazing ranges of the western plains; but that it is not at all the ubiquitous plant, the chief and most important food of the past buffalo or present cattle which we have been made to believe. There exists a pretty general and well founded opinion that it was formerly more widespread and plentiful, having, during the past twenty years, receded from many regions; yet, this admitted, I cannot think that it has ever been as exclusively abundant as commonly believed. The interest which it aroused in botanists on account of the curious separation of the sexes, may be partly responsible for the utilitarian importance it assumed. Again, I doubt not that it has often been confounded with species of Grama by hurried or incompetent observers.

It may be interesting to glance at the influences militating against the growth and spread of a plant apparently so well fitted by nature for the struggle of life on the arid plains of the West, and causing, as alleged, its gradual disappearance. There have not been such marked changes in climatic conditions as would operate for or against it. There is, I know, a spreading belief that the increased rainfall of late years is accountable for its decline, but I am in a position to state, rather positively, after a careful comparison of statistics, that in the last fifteen years there has been no increased precipitation over the area where the Buffalo Grass is most at home. Two circumstances, however, now exist and have existed only recently, which may act injuriously upon this plant, namely, the extinction of the buffalo and the marked decrease of prairie fires. The Buffalo Grass withstands the treading of herds with perfect impunity; nay, such treading, by tamping the ground around the wandering stolons, secures better rooting and stronger growth; not so, however, with other plants against which the Buffalo Grass must compete, and which are destroyed by the tramping of herds. With the disappearance of the buffalo, these competitors have been gaining strength and, by their larger and longer roots, are steadily driving their weaker sister from the field. In a like manner, we may assume that prairie fires did little harm to the Buffalo Grass, owing to its low stature, while they were injurious to the plants which are now taking its place.

The worst fault of the Buffalo Grass is that, not content with its own merits, it has long usurped, in our esteem, the place of a far more valuable plant, the grass *par excellence* which fed the buffalo and which, to-day, should, *facile princeps*, command the homage of all the raisers of cattle beyond the Missouri River. I refer to the common Grama (*Bouteloua oligostachya*, Torr.) The Grama is found everywhere, the prevailing, predominant, ubiquitous grass of the West, from the Lakes and the Mississippi to the Pacific Coast, and from the British Possessions to Mexico, forming the bulk of the best sod of all the prairie regions of the Western States and Territories, and constituting the best natural resource of several of them. For it I ask, at least, the attention and regard bestowed upon the less worthy Buffalo Grass.

Botanical Notes.

Concerning Nomenclature.—The editor of the Botanical Gazette suggests that at the forthcoming meeting of the A. A. A. S. the pending differences of opinion as to the laws of nomenclature should be taken up and "settled." While the proposition to "settle" this question is somewhat ambitious, and one on which that portion of the scientific world not represented in the A. A. A. S. might wish to be heard, the idea of making it the subject of earnest discussion is a most excellent one. It is just possible that when it is found that the mountain will not come to Mohammed, Mohammed may conclude to move to the mountain; not at all because there is any principle involved, but just for the sake of "uniformity." H. H. R.

Our Native Plants Abroad.—That our native plants are appreciated for their beauty on the other side of the ocean, even if they are neglected by us, may be constantly seen by glancing over foreign botanical literature. Several of our *Solidagos* have long been favorites in England. *Calochortus cæruleus*, *Rubus deliciosus*, *Fothergilla alnifolia*, *Garrya elliptica*, *Gordonia pubescens*, *Gordonia Lasianthus*, *Cypripedium spectabile* and *Camassia Fraseri* have received particular notice lately as ornamental garden plants, and a number of others have been figured, notably in The Gardener's Chronicle and The Garden. The latter says, in a recent issue, in regard to *Robinia hispida*: "This very beautiful tree has been during the week the chief attraction in the collection of pea-flowered trees in the Kew arboretum. It has no rival among hardy trees." A. H.

Rudbeckia hirta, L.—Rudbeckias are classed as perennials, and I suppose they are. Among other plants, I had *R. hirta* growing where a cellar had to be dug this spring. On the removed earth numbers of seedling Rudbeckias sprung. They were all in full flower by July 1st, many in June. . . . One plant produces rayless heads, and what should be discoid florets are diminutive branchlets, in which numerous chaffy scales take the place of bracts. In this condition the involucral scales reflex.

THOMAS MEEHAN.

Physalis grandiflora, Hook.—This species, said in the "Flora of North America" to range from the "south shore of Lake Superior to the Saskatchewan district," was found by the writer in June, growing plentifully on an island of rather more than a hundred acres in area, in northern Lake Champlain. It was in full bloom at the time, and its showy flowers rendered it very conspicuous. The island in question is known as Providence Island, and has been unoccupied, so far as the writer is aware, until two or three years ago, when it was partially cleared and fitted up for picnic parties carried thither by a steamer belonging to the company owning the island. Since that time is has been often resorted to by excursions, but whence came the *Physalis* is a mystery. It grows chiefly upon cleared spaces with *Adlumia cirrhosa* and *Corydalis aurea*. In the "Flora of North America" this species comes under the heading "Corolla pure white, * * wholly destitute of any dark center," but in fact there are five ovate spots at the base of the corolla, of a yellowish-green when the flower first opens, but turning light yellow with age. These spots are perhaps a fourth of an inch long and quite conspicuous, adding much to the beauty of the flowers. The anthers do commonly show a more or less evident "tinge of violet," but not always, many of them being wholly yellow. It is probable that the absence of any mention of the dark center in the corolla is due, as Watson suggests, to the fact that the description of the plant in the "Flora of North America" was taken from dried specimens in which whatever color there was at first had faded. Still it is also possible that our Vermont plants may exhibit this more strongly than those from farther west. In my own dried specimens, thus far, the yellow of the center is more, rather than less, evident than in fresh specimens, although this may not be the case with those long dried. G. H. PERKINS, University of Vermont.

Hypnum (*Thuidium*) *calyptratum*, Sulliv.—A mistake in the locality given in "Lesquereux and James' Manual" has been discovered by Dr. Watson, which dates back to the publication of Whipple's Report, p. 190. Instead of its having been found "near Los Angeles, Cal., on the ground" by Dr. Bigelow, he collected it "on rocks, Ben More, New Mexico, May, 1851," as shown clearly by the specimens in the Sullivant collection.

E. G. BRITTON.

Surirella ovata, Kutzing.—Please add to the list of Sorata diatoms, *Surirella ovata*, Kutzing.

C. H. KAIN.

Stellaria graminea, L., which has recently been making its appearance in so many places, usually introduced in grass seed, has been found by Dr. R. G. Eccles at Catskill, N. Y.

Observations sur les Roses décrites dans le Supplementum Floræ Orientalis de Boissier, par Francois Crépin. (Ex. du Compterendu, xxvii., pp. 17.) A supplementary volume to the Flora Orientalis of Boissier is soon to appear, for which Dr. H. Christ has monographed the Roses. M. Crépin reviews his work, giving his views on the classification and newly described species, and concludes with a table of the distribution of species.

Euphorbias desired.—Dr. C. F. Millspaugh wishes to state to those who have so kindly aided him in his work upon the genus *Euphorbia*, that his field work in his locality this season has compelled him to drop his special study until autumn, when all who have identifications, &c., in his hands will be carefully remembered. The doctor will still be very thankful for specimens (either named or for identification), and also for notes on the genus, sent to his herbarium at Waverly, N. Y.

Posthumous publication of Prof. Tuckerman's Manuscripts.—Mr. Willey authorizes us to announce that it is in contemplation to publish the present season, the lichen manuscript of the late Prof. Tuckerman, comprising the Lecideacei, and the Graphidacei in part. As the edition will not be large, it would be well for those desiring the work to send their names to Henry Willey, New Bedford, Mass.

Hybridization in the genus Citrus.—Prof. J. H. Hart, Superintendent of the Royal Botanic Gardens of Trinidad, expresses the opinion that hybridization in the genus *Citrus* is very common. He says emphatically that they "do not generally come true from seed, unless the trees producing the seed are isolated from other species of the genus, on account of hybridization occurring among them."

Society of American Florists.—The fourth annual meeting of the Society of American Florists will be held in Cooper Union, New York, beginning August 21st. An exhibition of flowers, plants and florists' supplies and apparatus will be held at Nilsson Hall, under the auspices of the society, at the same time, and our botanists will no doubt find that considerable matter of interest to them will be discussed and exhibited. All who desire to become members for the time being with the privilege of attending the meetings and exhibitions, and enjoying the social courtesies extended to the society, may do so by remitting $2 dues to the Secretary, Wm. J. Stewart, Boston, Mass. The Secretary will also be at the Committee Room, Fifth Avenue Hotel, on Monday evening, Aug. 20th, from 8 to 10 o'clock P.M.

We are pleased to announce the safe arrival of Dr. and Mrs. Britton at the Kew Gardens, and the commencement of their researches.

A. H. and H. H. R.

Index to Recent American Botanical Literature.

Amelanchier oligocarpa. (Garden and Forest, i., 245, 246; fig. 41.)

Araucarias (Gard. Chron., iii., 774, figs. 104, 105, 106.)

Astragalus mollissimus. (Pharm. Rec., viii., 197, 198; illustrated.)

Botany as it may be taught.—Byron D. Halsted. (Pop. Sci. Mon., xxxiii., 369-376.)

Chara.—Description of a new fossil Species of the Genus.—F. H. Knowlton. (Bot. Gaz., xiii., 156, 157; two cuts.) *Chara compressa*, described from sporostegia collected by Dr. White, near Wales, Utah. The geological horizon is regarded as lower Tertiary.

Cherokee Rose. (Garden and Forest, i., 234; illustrated.)

Coniferous Tree Seeds.—Notes on the Longevity of.—Robert Douglass. (Garden and Forest, i., 250.)

Cross-fertilization.—Notes on Structures adapted to.—Aug. F. Foerste. (Bot. Gaz., xiii., 151-156, one plate.) A record of interesting observations on fifteen native species.

Effect on Vegetation of the variable Rainfall of Northwestern Mexico.—E. Palmer. (Amer. Nat., xxii., 459-461.)

Epigæa repens. (Gard.. xxxiii., 531; illustrated.)

Eryngiums.—John M. Coulter. (Garden and Forest, i., 206.)

Erythronium Hendersonii. (Gard. Chron., iii., 652, fig. 86.)

Ferns.—W. H. Gower. (Garden, xxxiv., 9; illustrated.) Four species of California Ferns are described, viz.: *Pellæa bella, P. brachyptera, P. andromedæfolia* and *P. ornithopus.* The first named is figured.

Fremontia Californica. (Gard., xxxiii., 562; illustrated.)

Fungi from various localities.—New species of.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 49-59 and 62-65.)

Garden Vegetables.—History of.—Louis Sturtevant. (Amer. Nat., xxii., 420-433.)

A continuation of the series of notes begun in the last volume of the Naturalist and containing references to Fennel (*Fœniculum vulgare* and *F. officinale*); Finocchio (*F. dulce*); Fennel-Flower (*Nigella sativa*); French Scorzonera (*Picridium vulgare*); Garlic (*Allium sativum*); Gherkin (*Cucumis Anguria*); Globe Cucumber (*C. prophetarum*); Good King Henry (*Chenopodium Bonus-Henricus*); Gourd (*Lagenaria vulgaris*); Great-headed Garlic (*Allium Ampeloprasum*); Ground-nut (*Apios tuberosa*); Hedge-hog (*Onobrychis Crista-galli*); Hop (*Humulus Lupulus*); Horehound (*Marrubium vulgare*); Horseradish (*Cochlearia Armoracia*); Hyssop (*Hyssopus officinalis*).

Grasses of the Arid Districts.—G. C. Nealley, S. M. Tracy and Geo. Vasey. (Bull. No. 6, Bot. Div. U. S. Dept. Agric., pamph., pp. 60, thirty plates. Washington, 1888.) A report of an investigation of the grasses of the arid districts of Texas, New Mexico, Arizona, Nevada and Utah during 1887.

Grönlands Flora.—Neuere beiträge zu.—Eug. Warming. (Bot. Jahrb. ix., 274-279)

Guatemala Forests.—Miles Rock. (Am. Nat., xxii., 385-399.)

Halesia tetraptera. (Garden, xxxiii., 588; illustrated.)

Hamamelis Virginica. (Garden. xxxiii., 588; illustrated.)

Hypoxilon and Nummularia.—Synopsis of North American species of.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 66-70.)

Jamaica.—Annual Report of the Public Gardens and Plantations, for the year ending 30th September, 1887.—W. Fawcett. (4to, pp. 29.) *Bulletin of the Botanical Department, No. 7.* (4to, pp. 8, 1888.)

Jamesia Americana. (Garden, xxxiii., 606; illustrated.)

Kalmia latifolia. (Garden, xxxiii, 607; illustrated.)

Marine Algæ of the West Indian Region.—Catalogue of the.—Geo. Murray. (Journ. Bot., xxvi., 193-196.)

Philadelphus Coulteri. (Garden and Forest, i., 232, fig. 40.)

Pines in June.—Among the.—Mary Treat. (Garden and Forest, i., 243.) The Japan Honeysuckle (*Lonicera Japonica*) is mentioned as growing vigorously, clambering over the native shrubs and trees and threatening to "strangle them."

Pines.—Our Native.—N. L. Britton. (Staten Isl'd Mag., i., 14-16.)

Pitcairnia Palmeri.—S. Watson. (Garden and Forest, i., 209, fig. 38.)

Sabal Palmetto. (Gard. Chron., iii., 680, fig. 89.)

South American Drugs.—Homes of our.—H. H. Rusby. (Pharm. Rec., viii., 217-219.)

Staten Island.—A brief account of the plants which have been found growing independent of cultivation on.—Arthur Hollick. (Proc. Nat. Sci. Ass'n of S. I., June 9, 1888.)

Tillandsia usneoides.—The Ash of.—T. Chalkley Palmer. (Amer. Nat., xxii., 458-459.)

Umbelliferæ.—Some Notes on Western.—John M. Coulter and J. N. Rose. (Bot. Gaz., xiii., 141-146.) *Eryngium armatum, E. Vaseyi, E. Floridanum, Peucedanum Martindalei, P. Donnellii, P. Californicum, P. Vaseyi, Selinum Grayi, S. Dawsoni and Cœlopleurum maritimum* are proposed new species.

Uredineæ.—Notes on Western.—S. M. Tracy and B. T. Galloway. (Journ. Mycol., iv., 61, 62.)

Veronica peregrina.—Thos. Meehan. (Bot. Gaz., xiii., 157.) An argument for self-fertilization in this species.

Water Lilies. (Garden and Forest, i., 241-242.) Including a short account of the now famous Yellow Water Lily of Florida.

Water Lily House.—Mr. W. S. Kimball's. (Gard. Chron., iii., illus. supplement.) A full-page "ink-photo.," representing the interior of Mr. W. S. Kimball's water lily house at Rochester, N. Y.

Willows.—Two Interesting. (Garden and Forest, i., 246.) Descriptions and habitats of *Salix candida* and *S. balsamifera* are given, mostly in the form of a liberal excerpt from the BULLETIN.

Yucca filifera. (Gard. Chron., iii., 743, fig. 97, and 751, fig. 100.)

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, September 1, 1888. [No. 9.

Fern Notes.—X.

Cheilanthes fibrillosa, Davenport, in Herb. Mass. Hort. Soc'y, 1884, and in Underwood, Our Native Ferns, 3d Ed. *C. lanuginosa*, Nutt., var. *fibrillosa*, Davenport, Fern Notes, VII., BULL. TORR. CLUB, Vol. XII., p. 21, 1885.

Some recent re-examinations of this fern in connection with Mr. Pringle's 827 from Mexico have led me to remove it altogether from *C. lanuginosa*, under which species it was first published as a variety, for the purpose of calling the attention of California botanists to its existence, and to restore it to specific rank.

Its history and description having already been fully published (*l. c.*), it seems unnecessary to more than briefly recall attention to its essential specific characters here. These are, primarily, in its creeping root-stocks, and secondarily, in the scale-like fibres mixed with its tomentum, as against the tufted root-stocks, and freedom from scale-like fibres in the tomentum of *C. lanuginosa.*

There still remains a reasonable probability that it may ultimately prove to be a form of *C. Parishii*, with the scales of the rachis reduced to mere fibres. But this is a point of which the satisfactory determination requires more specimens of the latter species than are now in existence, and until a re-discovery of that now rare fern supplies such material, it will be as well to consider the present one as a fairly good species.

LIST OF FERNS COLLECTED IN THE STATES OF MEXICO AND CHIHUAHUA, MEXICO, BY C. G. PRINGLE, DURING THE SEASONS OF 1886–87.

(The numbers are, as usual, those on Mr. Pringle's distribution tickets.)

No. 1445.—*Aspidium athyrioides*, Mart. & Gal., (*Nephrodium* *sphaerocarpum*, Hooker). Cool, shaded cliffs, Arroyo Ancho, Sierra Madre, October, 1887.

Specimens small or medium-sized, but answering Hooker's description very well, and agreeing with Schaffner's specimen in the Cambridge Herbarium. The species appears somewhat intermediate between our *A. spinulosum* and *A. patulum*, Swartz, and may be only one of the variable forms of the latter species. Mr. Pringle's specimens resemble some forms of *A. spinulosum* very much in general appearance, but lack the spinulose teeth to the lobes. The sori are remarkable for their great size and prominent involucres.

No. 831.—*Aspidium juglandifolium*, Kunze. Cool, damp cliffs, Mapula Mts., October, 1886.

No. 833.—*Asplenium Glenniei*, Baker. Deep, damp glen, Mapula Mts., November, 1886.

Specimens wonderfully proliferous, single fronds bearing from twenty to thirty tiny plantlets growing from buds situated in the sinus at the apex of the pinnæ (often also from their basal lobes) and frond. This character does not seem to have been noticed before, but appears to be natural to the species. On this point Mr. Pringle wrote: "I am inclined to regard the 'leaf propagation' of *Asplenium Glenniei* as natural to the species. It is the old fronds which put forth young plants in this way as they die. It was the rule among the plants gathered by me; though I damaged some of my specimens by pulling off the old ragged fronds before I detected their importance."

A re-examination of some of Mr. Lemmon's Arizona plants of this species shows the same character in them, though in a less marked degree, owing, probably, to the plants having been collected before the development of the buds had fairly begun. In view of this evidence it seems best not to recognize this character as a varietal one in this species, but to record it here as characteristic of the species itself, it being no less than the culmination of its season's growth, the annual fronds in this way providing for a special renewal before perishing.

No. 1444.—*Asplenium pumilum*, Swartz. Ledges, Arroyo Ancho, Sierra Madre, October, 1887.

A puzzling form, more compound than usual, running away from the type and, except in the deltoid sterile fronds, suggesting a mixture of the coarser forms of *A. Montanum* and *A. Bradleyi.*

No. 828.—*Cheilanthes lendigera*, Swartz. Shaded ledges and cool cliffs, Mapula Mts., October, 1886.

No. 827.—CHEILANTHES MEXICANA, n. sp.

Root-stock rhizomataceous, slender, wide-creeping, clothed with pale brown linear-lanceolate scales, and bearing loosely-scattered fronds, 3 to 7 in. or more tall; stipites 1½ to 3½ or 4 in. long, terete, dark or chestnut brown, slightly scaly at the base only, deciduously chaffy above; laminæ 1¾ to 3¾ or 4 in. long, 1 to 1¼ in. broad, tri-pinnate or through the basal pinnules of the lower pinnæ, quadripinnate; segments reniform with slightly crenate re-curved herbaceous margins, ultimate segments largest; both surfaces, as well as rachises, covered with coarse tomentum, whitish when young, becoming tawny or yellowish brown, and disappearing altogether from old and weather-beaten fronds.

Collected by C. G. Pringle on the verge of a high cliff near the summit of Povtrero Peak (Santa Eulalia Mts.), October, 1886. Alt. 7,300 ft.

This fern, notwithstanding its loveliness, is an unwelcome intruder, since it only adds one more to a series already sufficiently puzzling. I was for a long time in doubt whether it was really distinct from the California plant *C. fibrillosa.* The primary distinction upon which I have relied in keeping them apart is the structure of the root-stock, and the secondary, the absence from the Mexican plant of the peculiar fibres which give to the California one its specific name.

The two ferns resemble each other very much, and both resemble *C. lanuginosa* in the general appearance of their fronds, so that the difficulty of properly placing detached fronds of either, at times, will be readily understood.

For this reason, I have delayed publication as long as I could do so, with justice to Mr. Pringle, hoping that I would be able to accompany my notes with a series of figures, showing all the minor points of difference between these three ferns, and also of

C. Parishii, their nearest congener, and the only other American member of the group to which they belong. The condition of my eyes, however, has been such as to prevent my making the necessary microscopical analysis in the only time I have had to give to such work, and I am obliged to content myself with this general description for the present.

The same cause has delayed, and may prevent altogether, my intended elucidation of the *Myriophylla-Fendleri* section of *Cheilanthes*, for which I have ample material.

Nos. 829–1169.—*Cheilanthes myriophylla*, Desv., var. *elegans*, Hooker. Cold cliffs, Mts. near Chihuahua (829), October, 1886. Ledges, Chapultepec (1169), May, 1887.

Specimens unusually large and fine. It is doubtful if such beautiful specimens as some of those from the Chihuahua mountains were ever before collected in a state of nature. Fronds 16 inches tall, 3 inches broad, and sub-divided four and even five times into innumerable tiny pyriform segments, half hidden by the delicately ciliated elegant scales and tomentum remind one of the superb plants sometimes seen at exhibitions. It is not unlikely that similar specimens suggested to Desvaux his exceedingly appropriate name, and led Fournier to keep this fern apart from *C. myriophylla* as a distinct species. I have elsewhere given my reasons for adopting Hooker's disposition of the two ferns, but specimens such as these of Mr. Pringle justify retaining the present one as a good variety.

No. 826.—*Cheilanthes viscosa*, Link. Base of rocks, cool slopes, Mts. near Chihuahua, October, 1886.

No. 1446.—*Gymnogramme leptophylla*, Desv. Damp, mossy grots, cliffs of river cañon, near Guerrero, September, 1887.

Seedling plants of this exceedingly delicate little annual fern, but most of them quite well fruited.

No. 1179.—*Gymnogramme pilosa*, Mart. & Gal. Walls of cañons, Sierra Madre, October, 1887.

The striking external resemblance of the specimens to some of my *Phegopteris reptans* came very near misleading me, and I am indebted to the kindness of Prof. Eaton for setting me right.

No. 1441.—*Notholæna candida*, Hooker. Shaded ledges, cañons, Sierra Madre, October, 1887.

Specimens very large and fine, and unusually divided, the divisions of the pinnæ being again quite deeply pinnatifid.

No. 1440.—*Notholæna Palmeri*, Baker. Mossy ledges of La Bufa Mt., above Cusihuiriachic, August, 1887.

A very distinct ceraceous fern, with the usual white or yellowish powder, between *N. nivea* on the one hand and *N. Pringlei* on the other. The segments are much like those of *nivea*, for which the looser fronds might be mistaken, but the fronds are shaped more like *Pringlei*, only with the lower pinnæ much reduced, and with very short or scarcely any stalks.

No. 832.—*Pellæa marginata*, Baker. Cool, rocky slopes, Mapula Mts., October, 1886.

No. 1442.—*Pellæa marginata*, var. *pyramidalis*, Baker. Rocky slopes in shade, Sierra Madre, September, 1887.

A very distinct form, and peculiar in the long narrow drooping segments of the tall fertile fronds.

No. 1443.—*Pellæa Seemanni*, Hooker. Dry, rocky slopes, Sierra Madre, October, 1887.

A very handsome *Pellæa*, unlike any of our other species, and suggesting some of the more rigid forms of *Cheilanthes microphylla*, but with stout reddish stalks and rachises.

The specimens are somewhat more compound than the description calls for, but answer to it well enough otherwise, and agree with specimens at Cambridge. The determination is approved by Prof. Eaton, and there appears to be no other disposition to be made of the specimens.

No. 825.—*Polypodium lanceolatum*, L. Cold cliffs, Povtrero Peak, September, 1886.

An interesting dwarf *Polypodium*, with very large sori, and peltate scales on both surfaces, some specimens densely squamose.

No. 1168.—*Polypodium thysanolepis*, A. Br. Ledges, Chapultepec, May, 1887.

No. 834.—*Woodsia Mexicana*, Fée. Damp ledges near Chihuahua, September, 1886.

GEO. E. DAVENPORT.

MEDFORD, June 28, 1888.

The Nomenclature Question and How to Settle It.

Something like a century and a half ago a pretty little ericaceous plant fell into the hands of an illustrious Swedish naturalist, who christened it, after a more or less cursory examination, *Pyrola uniflora.* Some time later an acute English botanist, discovering in this same plant certain peculiarities of structure, erected it into the new genus *Moneses*, and, ignoring altogether the earlier name, styled it *Moneses grandiflora.* After a further lapse of time, the same little plant, with its two entirely distinct names, came successively before two prominent American scientists for a decision as to its nomenclature. One of these, Alphonso Wood, adopted the later name in its entirety. The other, Asa Gray, did not. Accepting *Moneses* as a good genus, he deliberately "increased the number of synonyms" and "added to the perplexities of students" by compounding a new appellation from Salisbury's generic name and the original specific name of Linnæus, and *Moneses uniflora*, Gray, is now the ordinarily accepted designation of the plant.

In this case, whatever the secret reason that actually influenced him, our great leader yielded exact obedience to that law of priority in nomenclature which certain ardent and industrious spirits are now seeking to apply and enforce throughout the domain of American botany. Their primary object is to attain, as closely as possible, that great desideratum, a fixed nomenclature; and, secondarily, they are intent upon doing strict justice, in the case of every North American plant, to the man who first gave it a published name accompanied by an adequate description.

Taking any common binomial (they argue) it is plainly the second, or specific half, that belongs to the plant individually. Except in monotypic genera, the first half is shared equally with an indefinite number of other plants. Moreover, the first, or generic half of the name, is subject, in a constantly increasing multitude of cases, to changes that can not be regulated or controlled in any way. Ingenious botanists have species at their mercy, and are free to combine, separate and re-combine, and to christen the successive groups very much at their own sweet will. No conceivable law can govern the chaos of genera, for a genus is not so much a reality as it is a botanist's idea. A species, however, or a variety even, is a tangible something, with at least a measure of positive identity and fixity, quite independent of botanists' fancies, and the part of the name which belongs to it as a species or variety is the one element of nomenclature which may have, and should have, positive permanence.

This doctrine seems unsatisfactory to some because the specific name is a nullity in itself, a mere adjective in function and usually in form. The present writer has always been secretly amused at the plaintive remarks of the eminent George Bentham concerning certain changes in fern names: "In ferns, the wanton multiplication of ill-defined or undefinable genera, according to the varied fancies of special botanists, has had the effect of placing the same species successively in several, sometimes seven or eight, different genera; and it is proposed to maintain for the specific appellation the right of priority, not only in the genus alone in which it is placed, but in the whole of the genera to which, rightly or wrongly, it has been referred. This has been carried to such an extent as to give to the specific name a general substantive aspect, as if the generic ones were mere adjuncts"! (Jour. Linn. Soc., xvii., Nov., 1878). Would he, then, have preferred the greater confusion resulting from the coinage of a new specific name to go with each new generic one? Surely not! Then why seem to regret the maintenance of the original specific name? In truth, that was the clue to the labyrinth, the chief guide to the student of ferns while that swarm of evanescent genera prevailed.

Whether we like it or not, the fact remains that the *original trivial name* is the only foundation on which we can hope to build anything approaching a fixed nomenclature. To ascertain this as exactly as possible for all our North American plants, to confirm it when already in vogue, and to re-establish it promptly and firmly wherever necessary, is the self-appointed task of an increasing number of American botanists. This movement will naturally encounter the opposition of inertia, perhaps of jealousy, and certainly of honest difference of opinion. The first two may be passed in silence: the third must be met and overcome by candid argument. Exactly who are friendly, who indifferent, and who opposed to this movement in nomenclature is not yet clear. The proceedings of the Botanical Section of the A. A. A. S. at Cleveland will, perhaps, have thrown some light on this point before these sentences meet the reader's eye. Whatever action may be taken there, however, the first duty of the friends of the movement will be to formulate their doctrine exactly, and to organize the entire body of its supporters in some simple but efficient manner. Possibly the best method of doing this would be to present to the botanists of the country for signature some such document as the following:

AGREEMENT OF THE BOTANICAL NOMENCLATURE LEAGUE OF NORTH AMERICA.

We, the undersigned, botanists of North America, hereby mutually agree to use in our herbaria, and in all our published botanical writings, those names which, according to our best knowledge, conform most closely to that LAW OF PRIORITY which requires:

I. That the first published specific or varietal name of a plant, given to it in accordance with the binomial system of nomenclature, whether appropriately or not, shall be perpetually and strictly maintained (only necessary grammatical changes being permitted) as the trivial appellative of that plant, unless by some transfer it should become identical with the generic name, or inadmissible because of previous use in the same genus, in which cases the trivial name next in point of time shall take similar precedence.

II. That when two or more generic names have been regularly applied to the same genus, the earliest shall be maintained, to the entire exclusion of any of later date.

On some such basis as this a sufficient organization might be quickly and easily effected. No officers would be required, except a volunteer secretary to receive the signatures and have them published. The few dollars necessary for postage and incidental expenses would be readily forthcoming without the formality of a treasurer.

The reader is specially requested, however, to bear in mind that this agreement is not now offered for signature, but solely for discussion—for criticism—for amendment, if need be;—or it will be withdrawn altogether if anything more effective and acceptable should be suggested. As it stands, it embodies pretty exactly that form of the law of priority which the writer believes to be the soundest, the broadest in its scope, and the simplest and surest in its application. Nevertheless it is at variance in some points with the views of at least one of the ablest advocates of the movement. Obviously the friends of the revised nomenclature must agree upon a statement of their dogma before they propose it to the general congregation of American botanists. What is desired, therefore, at this time is that those who are satisfied with the agreement as here set forth should informally signify their approval of it, and that any one who wishes modifications should present a revised version embodying the changes believed to be advantageous.*

Something may properly be said here in explanation and support of the form of agreement herewith submitted. It is purposely phrased so as to leave the subscribers free to use for a while yet the current familiar nomenclature in correspondence and in published writings of a merely popular character, inasmuch as amateurs and the general public, in the present state of the case, might be more perplexed than instructed by the new names. But the obligation is binding to use them not only in one's own herbarium but also in all "published botanical writings," that is, scientific papers, catalogues, textbooks and the like. The clause "according to our best knowledge" limits the obligation to such revised names as are now conveniently accessible, or may from time to time become so, in published works of presumably good authority.

The formal statement of the law itself is purposely framed to uphold rigorously the first trivial (*i. e.* individual) name of the plant, wholly irrespective of its higher or lower rank as species or variety. In other words, accepting this definition, an original variety raised to a species retains its original name: an original species reduced to a variety does the same. Whether the vegetable individuality in question is originally reckoned a species or a variety is largely a matter of chance, and is wholly unimportant as far as nomenclature is concerned. *It is the* ORIGINAL NAME *that must rule.* Moreover, it is downright injustice to deny the

* Communications upon this subject should be addressed to the editor of the BULLETIN.

right of priority to the conservative botanist who modestly proposes a variety, and reward the rash species-maker by holding sacred the names of nominally higher rank which he emits upon the least provocation. The only safe, sure rule decrees absolute precedence to the individual portion of the name first duly given to the plant "in accordance with the binomial system." The wording here is designed to admit pre-Linnæan binomials, and to exclude all monomials absolutely from consideration. Prof. E. L. Greene has ably pointed out (Pittonia, Vol. I., pp. 188-190) the poetic justice of recognizing such names as *Rhodora* and *Sarothra*, originally monomial because applied to monotypic plants, and afterwards ranked as generic and provided with specific affixes in mere formal compliance with the binomial law. When ultimately united with other genera the original names were made specific. The argument for awarding precedence to these over the unquestioned specific names first joined with them is eminently plausible; nevertheless, to concede such precedence would be at once irregular and most unsafe. The line must be drawn somewhere, and drawn rigidly, to ensure certainty in the application of the law; and where can it be safely drawn but at binomials? The admission of a single monomial, however deserving (like the rejection of a single false name, however absurd), would be a precedent of fatal import to the stability of the revised nomenclature. Moreover, these names in their monomial state were truly generic and not specific, and were only accidentally and not essentially individual. Another *Rhodora* or *Sarothra* might have turned up any day to share the name and demand recognition as a new species. To be properly maintained under the law of priority a name must be not only original but individual, that is, specific or varietal and not suceptible of being legitimately shared by any other plant. Finally, the fit destiny of the two names in question is to figure as *Hypericum* § *Sarothra* and *Rhododendron* § *Rhodora*, while the plants themselves, in strict and logical conformity with the law, bear the names *Hypericum gentianoides* and *Rhododendron Canadense*.*

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*The writer has the usual keen repugnance to false names and a specially strong liking for appropriate ones; nevertheless, upon mature consideration, he makes, without reserve, the needful sacrifice of these personal preferences on the

Section II. of the agreement is really extraneous, but the movement to reinstate certain wrongfully suppressed genera has by chance gone hand in hand with the movement to maintain original trivial names, and as both reforms are governed by the same general principle of priority, it has seemed best to embrace them both in one agreement. The signer accepts the substitution of *Castalia* for *Nymphæa*, *Belamcanda* for *Pardanthus*, and some other like changes, imperatively demanded of us as simple acts of historic justice.

A third phase of the new movement in nomenclature is the citation in parenthesis of the author of the trivial name, whenever the name as a whole belongs to some one else. Under this system *Moneses grandiflora*, Salisb., implies that Salisbury is the author of the specific name and also of the binomial. *Moneses uniflora*, (L.), Gray, assigns to Gray the authorship of the name as a whole, but gives to Linnæus the credit of first applying the name *uniflora* to the plant. This mode of citing authorities is simple enough; it is preëminently just; and it adds to the history of the name a feature of special moment, now that the trivial appellation is assuming new importance as a key to nomenclature. It is wholly incidental, however, to the main question of enforcing the law of priority, and, if incorporated at all in the agreement, should be introduced in a subsidiary way for separate signature by such botanists as may choose to adopt it.

This somewhat discursive statement of the nomenclature question may be fitly concluded with the observation that the only way to settle it is to organize a league of the supporters of the new movement, and a counter league of its opponents (if any): let each party formulate its doctrine precisely, apply it strictly and defend it boldly, and in due time the right side will convert and absorb all its antagonists and hold undisputed possession of the field.

E. E. STERNS.

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altar of the law of priority—not a flexible law, to be varied now and again to suit individual tastes, but a stern, unyielding, absolute one—in short, a STANDARD LAW—to be literally and unflinchingly obeyed. Surely it is not too much to hope that the friends of the revised nomenclature, both East and West, will vie with each other in the strictest possible maintenance of this law, from which so much is hoped, even at the occasional expense of cherished personal predilections.

Botanical Notes.

The True "Rattlesnake Master" appears to be *Agave Virginica*, L., and not *Eryngium aquaticum*, L., (=*E. yuccæfolium*, Michx.). Gray gives the name to the latter plant, but neither Wood nor Chapman recognizes it at all. A very intelligent correspondent in East Tennessee assures me that the *Agave* (fully identified from specimens sent) is the genuine "Rattlesnake Master." He says: "My experience is this: Take a stick, get a rattlesnake 'mad,' and it will strike the stick as viciously as it would a man. But rub the root of this plant on the end of the stick and put it to the snake's head, and it will run or drop its head as low as possible, and not attempt to strike the stick. I have tried several snakes of the rattler kind, and never could induce one to bite or snap at a stick with this weed rubbed on it." The *Eryngium*, common in the same region, is called "Crow Poison," and is not associated with the rattlesnake in any way in popular estimation. E. E. S.

Urechites suberecta, Muell. An experimental research by Dr. Minkiewicz. (Therap. Gaz., p. 514.) A brief resumé of our knowledge of the physiological action of this plant, from which the doctor concludes that its properties cannot be utilized in medicine. We remember that the same conclusion was reached some years ago concerning "Jaborandi," which has now become one of our important drugs. The same result may yet be reached in the case of *Urechites*. In the article in question the plant, an Apocynacea, is referred to the Asclepiadaceæ.

The "Loco-weeds" of our southwestern region have been still further examined by a Mr. Kennedy, who reports (Pharm. Rec., July 2) that he fails to find any constituent capable of producing toxic effects.

Vernonia Nigritiana. A fresh instance of the remarkable and inexplicable diversity of physiological effects produced by the Compositæ is afforded by the discovery in *Vernonia Nigritiana*, Oliver & Hirn, of Western Africa, of a glucoside which acts similarly to digitalis.

Cineraria maritima, Willd From the reports of Dr. A. Mercer, formerly connected with the Colonial Hospital, Port of Spain, some hopes are gathered that the fresh juice of the *Cineraria maritima*, Willd., may be found to possess the power of causing the absorption of cataract. H. H. R.

Native Flowers of New Zealand illustrated in colors. By Mrs. Charles Hetley. Although not intended as a botanical contribution, the drawings reproduced in these portfolios are true to nature, and include several plants new to the flora of New Zealand. The work has been carefully supervised by native botanists and each plate is accompanied by a short description; it was also intended to give a botanical dissection of the flower in each, but for some reason these have been omitted. Three parts have already appeared, each containing twelve chromo-lithographs, large quarto size, at the price of £3 3*s.* If a sufficient number of copies are sold the work will be continued. A specimen of the plates will be forwarded free on application to the publishers, Sampson Low, Marston & Co., London.

Review of Foreign Literature.

An attempt to answer the question, whether the freezing of the seed influences the development of the plant afterward developing from the same. By L. Kny. (Sitzungsbericht der Gesellschaft Naturforschende Freunde zu Berlin vom 15 Novemb. 1887.)

One of the most marked characteristics of the vegetation of cold climates is the extreme rapidity of its growth, both vegetative and reproductive. Grisebach says that the polar willow, when its shoots are only about one inch long, begins to blossom, and this weeks before the sap begins its upward streaming. Christ says, however much the climate of the Alps excites rapid development of vegetation, plants growing lower down on the sides of the Alps show the same propensity, but with this difference: those of any species above blossom earlier than those of the same species growing lower down, although the latter develop their leaves earlier. He considers this due to increased insolation. Several other authors refer this, not to any direct influence during the time of development, but rather to the influence of extreme cold on perennial plants during the winter season. The writer of the article entitled as above gives the names of several authors, the results of whose experiments go to prove that those plants exposed through natural causes to a low temperature during their period of rest, as well as those artificially exposed, being placed on ice, when given again the conditions of growth develop earlier and faster than others whose winter rest has been passed under a higher temperature. Similar experiments have been tried with seeds, proving that seeds of certain grains grown in an extreme northern climate, when planted in warmer climates, develop seeds again in less time than those grown in the same warmer climate. These results, the author thinks, do not imply with any degree of certainty that the climate is the only factor concerned. The seed of the colder climate may have acquired certain characteristics from a long series of generations, instead of the single seed being affected by the climate of the winter it has passed through. Other experiments touching this latter part of the question have been carried on in St. Petersburg also by Haberlandt. Seeds were exposed to cold after having been swollen by absorption of water. After being exposed some time to a temperature of 17°5. (Celsius) they were allowed to thaw very gradually. Plants obtained from seeds so treated, all other conditions being equal, produced blossoms a few days earlier than those not so treated. The author tried similar experiments with somewhat different results. Seeds from eight different species were taken, divided in three sets, each set treated differently from the other two in respect to the degree of cold they were exposed to during their winter rest. They were not swollen by placing in water, but were simply kept during the winter in rooms of different temperature: one set in a room of about 19° or 20°; another where it varied from 1° to 24°; the third exposed to all the rigors of a Berlin winter, not, however, allowed to be in contact with snow or ice. These seeds, in the spring, were given the same conditions. The plants obtained from the three sets showed no difference, either in time of germinating or of flower and seed producing. The question is one of strong practical interest as well as scientific. In both directions it seems well worth taking up, especially as so little comparatively has been done with it. E. L. G.

Index to Recent American Botanical Literature.

Agave Shawii.—The Most Northern Station of.—C. R. Orcutt (West American Scientist, iv., 68.)

Asa Gray.—Personal Reminiscences of.—C. V. Riley. (Bot. Gaz., xiii., 178-186.)

Asplenium rhizophorum. (Garden, xxxiv., 51; illustrated.)

Botanical Literature, Old and New.—E. L. Greene. (Pittonia, i., 176-183.)

A series of papers designed to extend the knowledge concerning a class of works not readily accessible to many botanists. I. *Catalogus Plantarum circa Cantabrigiam nascentium.* "In this little Cambridge catalogue, which antedates Linnæus' *Species Plantarum* by ninety-three years, there occur, as in common use in Ray's time, more than fifty binary plant-names which are familiar to us now, are always presumed to be of Linnæan origin, and are always credited to Linnæus." A list of these names, with their authorship, is given, and a plea is made for the justice of recording the pre-Linnæan authorship of our names in cases where it is apparent.

Botany of Cedros Island.—The.—E. L. Greene. (Pittonia, i., 194-208.)

An historical sketch of the collections made on this "the largest of the Mexican coast islands," with a pleasing account of three days' botanizing by the writer. Eighty-two species are reported as growing there, two of them, *Sphæralcea fulva* and *Eriogonum molle*, being described as new. *Isomeris arborea*, Nutt., becomes *Cleome Isomeris*, Greene.

Bryology of the Dominion of Canada.—Contributions to the.—Kindberg and Macoun. (Can. Rec. of Sci., iii., 158-159.)

Carpentaria Californica. (Garden, xxxiv., 75; illustrated.)

Catalogue of the Niagara Flora.—David F. Day. (Pamph., 8vo., pp. 67.)

A list of the Anthophyta and Pteridophyta fonnd in the vicinity of Niagara Falls, prepared at the request of the Commissioners of the State Reservation. The area covered by this catalogue is not confined to the State Reservation, however, but includes considerable territory in western New York and Ontario.

A very convenient list for all who may wish to botanize in the region.

Cross-fertilization.—Immediate Influence of, upon the Fruit.— A. B. Crozier. (Report of the Botanist, U. S. Dept. Ag., Rep. for 1887.)

A valuable presentation of all the evidence on this subject, with suggestions for investigation. The author cannot think that such effect is yet proven, except in the case of Indian Corn.

Cypripedium Californicum. (Garden and Forest, i., 281, fig. 45.)

Diervilla rivularis. A. Gattinger. (Bot. Gaz., xiii., 191.)

A description of a new species, founded by Dr. Gattinger, upon specimens collected at Lookout Mountain, Georgia, July 6th, 1880.

Dodecatheon.—On some Species of.—E. L. Greene. (Pittonia, i., 209-214.)

The writer contends that our *Dodecatheons* are not yet correctly distinguished, and describes three species, *D. patulum*, *D. cruciatum* and *D. Clevelandi*, which are not included in any of the published descriptions.

Equiseta.—Revision of the Canadian.—Geo. Lawson. (Can. Rec. of Sci., iii., 157-158.)

Equisetum.—Spore Dissemination of.—F. C. Newcombe. (Bot. Gaz., xiii., 173-178; illustrated.)

Flora of Middlesex County, Massachusetts.—L. L. Dame and F. S. Collins. (Pamph., 8vo., pp. 201; Malden, 1888.)

The list of local catalogues seems ever on the increase, but it can never be too large, provided they maintain the high standard of those which have come to us lately. Early attempts at local cataloguing were little more than bare lists of names and places, with, perhaps, a brief preface. In the one before us now there is, besides the catalogue proper, a Preface, Plan of Catalogue, Introduction, List of Abbreviations, Map of the County, with description, List of Additions and Corrections, Recapitulation, giving the number of genera, species and varieties in each order, besides subdividing the species and varieties into those that are naturalized, adventive, or native; a Summary, in which the numbers are given according to Exogens, Endogens, Pteridophytes, Bryophytes and Thallophytes; and finally an Index. The last page of the Introduction is devoted to a list of the species and varieties which have been founded upon specimens first collected in Middlesex Co., of which there are fourteen noted. Credit to all who have assisted in the work is carefully given, and great care has apparently been taken not to allow any unverified name to be included. A description of the geology and physiography of the county is also included in the Introduction. Anthophyta number 1484; Pteridophyta, 60; Bryophyta, 156; Thallophyta, 361. The typography and paper leave little to be desired. Notes in regard to species occur sparingly throughout, and their value is such that we wish there were more of them. This, in common with many others lately published, essays to include the Bryophyta and Thallophyta, and the lists are doubtless authentic so far as they go and are of value for that reason. A quite extensive and interesting introduced flora is that which has been credited to "wool-waste." Most of these plants that are not familiar and are not described in American works are followed by the description from foreign authors, or else reference is made to where such descriptions may be found.—[We have just received a note from Mr. F. S. Collins, requesting us to state that the name of Mr. I. C. Martindale was inadvertently omitted in the preface when mentioning the botanists who had aided in the work. Mr. Martindale's specialty was the adventive plants.]

Flora Ottawaensis. (Ottawa Nat., ii., 61-64 and 77-80; continued.) The first part includes Menispermum to Cardamine in part; the second completes Cardamine and includes Lychnis.

Florida Keys.—The Flora of the.—A. H. Curtiss. (Garden and Forest, i., 279, 280.)

Forage Plants.—Dr. Geo. Vasey. (Report of the Botanist, U. S. Dept. Ag., Rep. for 1887.)

Economic notes on *Euchlæna luxurians*, Durieu, *Eurotia lanata*, Moq., *Opuntia Engelmanni*, Salm., *Onobrychis sativa*, Lam., *Trifolium hybridum*, L., *T. incarnatum*, L., and *T. medium*, L.; all figured except the latter. In this, as in the rest of the report, the citing of authorities seems to be the exception.

Forests of the United States.—The.—H. C. Putnam. (Garden and Forest, i., 297-298.)

Function of Many Fruits.—An Overlooked.—Chas. E. Bessey.

(Am. Nat., xxii., 531.) A brief argument in favor of the assumption that the "greening" of young fruit is of high importance in producing assimilating tissue, especially before the advent of leaves.

Fungi from Various Localities.—New Species of.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 62-65.)

Fungi of Missouri.—Parasitic.—B. T. Galloway. (Bot. Gaz., xiii., 213.) In the form of a brief note the writer gives a valuable synopsis of the results of several years' collecting.

Glen Cove.—Notes from.—W. Falconer. (Garden, xxxiv., 56, 57.)

Guatemala.—Undescribed Plants from.—IV.—John Donnell Smith. (Bot. Gaz., xiii., 188-190.)

Includes descriptions of *Gonzalea thyrsoidea, Mikania pyramidata, Zexmenia Guatemalensis, Encelia pleistocephala, Gonolobus velutinus,* Schlecht., var. *calycinus, Zamourouxia integerrima, Pitcairnia Tuerckheimii* and *Zanthoxylum Costaricense. Nephrodium Tuerckheimii* is figured and reference made to previous description of species (Bot. Gaz., xii., 133.)

Habrothamnus fasciculatus. (Garden, xxxiv., 107; illustrated.)

Habrothamnus Newelli. (Garden, xxxiv., 107, plate 660.)

Heuchera sanguinea. (Gard. Chron., iv., 122, fig 13.)

Host-Index of the Fungi of the United States.—A Provisional.—W. G. Farlow and A. B. Seymour. (Pamph., 4to., pp. 52.)

Being Part I. of the Index and including all the host plants under Polypetalæ, with the fungi parasitic upon them. A valuable addition to botanical literature which we trust to see continued and completed.

Hypoxilon and Nummularia.—Synopsis of the North American Species of.—J. B. Ellis and B. M. Everhart. (Journ. Mycol., iv., 66-70.)

Ledum latifolium. (Garden, xxxiv., 31; illustrated.)

Liriodendron Tulipifera. (Garden, xxxiv., 31; illustrated.)

Medicinal Plants.—Dr. Geo. Vasey. (Report of the Botanist, U. S. Dept. Ag., Rep. for 1887.) Notes on *Mentha piperita,* L., and *Œnothera biennis,* L., are given.

Mexico.—New Species from.—E. L. Greene. (Pittonia, i., 153-176.)

The following additional species are to be noted: *Muilla* *coronata, Allium peninsulare, A. dichlamydeum, A. crispum, Thalictrum platycarpum* (*T. Fendleri*, var. *platycarpum*, Trelease), *Papaver Lemmoni, P. heterophyllum* (*Mecanopsis heterophylla*, Benth.), *Eschscholtzia modesta, E. tenuisecta, E. leptandra, Potentilla saxosa, Lupinus capitatus, L. polycarpus, Trifolium quercetorum, Syrmatium nudatum, Astragalus circumdatus, Senecio astephanus, Erigeron viscidulus, Troximon Marshallii, Phacelia rugulosa*, Lemmon, *P. leucantha*, Lemmon, *Russelia retrorsa*.

Mitraria coccinea. (Garden, xxxiv., 64; illustrated.)

Mosses of North America.—New.—I.—F. Renauld and J. Cardot. (Bot. Gaz., xiii., 197-203; illustrated.)

Seven new species are described, as follows: *Dicranella Fitzgeraldi, Campylopus Henrici, Rhacomitrium Oreganum, Webera camptotrachela, Polytrichum Ohioense, Fontinalis Howellii, F. placida, Camptothecium Amesiæ.*

Nuttallia cerasiformis. (Garden, xxxiv., 78, 79; illustrated.)

Orchids.—Native.—Lena Leslie. (Vick's Mag., ii., 228-230; illustrated.)

An account of native orchids found in Westchester Co., N. Y. *Cypripedium parviflorum, C. pubescens, Habenaria lacera, Pogonia ophioglossoides, Calopogon pulchellus* and *Corallorhiza multiflora* are figured.

Oxalis violacea.—The Subterranean Shoots of.—Wm. Trelease. (Bot. Gaz., xiii., 191; illustrated.)

Passiflora cærulea. (Garden, xxxiv., 110; illustrated.)

Pavia flava. (Garden, xxxiv., 111; illustrated.)

Pavia rubra. (Garden, xxxiv., 111; illustrated.)

Phlox Stellaria. (Garden and Forest, i., 256, fig. 42.)

Pine.—The Long Leaved. (Garden and Forest, i., 261-262.)

Pines in July.—The.—Mary Treat. (Garden and Forest, i., 290-291.) A brief enumeration of the most conspicuous flowers found in the pine barren region during the month of July.

Pinus monophylla, Torrey and Fremont.—Maxwell T. Masters. (Annals of Botany, ii., 124-126.)

A contribution to the discussion of the morphology of its leaf. The author says: * * * "I investigated the development of the constituent parts of the leaf-bud at various stages of growth, and * * * in the earliest stages examined there were always two foliar tubercles, one of which speedily overpassed the other, so that ultimately all traces of the second leaf were obliterated. The monophyllous sheath of this pine therefore owes its peculiarity to the generally arrested development of one of its two original leaves."

Pinus Sabiniana. (Gard. Chron., iv., 44-45, fig. 4.)

Plants of Nantucket.—Maria L. Owen. (Pamph., 8vo., pp. 87, 1888.)

This addition to the list of local plant catalogues is a model for all of its kind. Its appearance is a credit to the printer, and the contents bear every evidence of careful field work and painstaking compilation by the author. Its value does not alone consist in an accurate list of the plants, but also in the many notes, memoranda and local names which are interspersed throughout, giving just the authentic information that will be appreciated by the botanist of the future, when many of the plants now noted have become exterminated. Due credit is given to all who have assisted in the work, either voluntarily or unwittingly, and the modesty of the author is not its least pleasing feature. Indeed, almost the last words in the catalogue are words of regret that it could not be made more complete by a record of the lichenes and fungi. Four hundred and seventy native and one hundred and sixteen introduced species of flowering plants are named, besides fifty varieties, both native and introduced. Twenty species of Pteridophyta are enumerated. The species of Marine Algæ number one hundred and ten, of which two are said to be "new to America" and four "not in Farlow's Manual." The Characeæ number ten species, but only six Mosses and two Hepatics are mentioned, and doubtless many additions could be made to these latter two orders, in spite of the fact that we are told "The Island does not seem to be rich in these orders."

Any review of the flora of Nantucket would necessarily be incomplete without at least a brief mention of its exceedingly interesting introduced species. Many of them have never been naturalized elsewhere in America, and fortunately they seem to have fallen amongst good friends. Thus in regard to *Erica cinerea*, L.: "The place is also known now to several persons who have come across it by good fortune, as its first discoverer did. Some of these are residents of the Island, some are summer visitors, but they have kept the secret they have surprised, as bound by honor and from true regard for the beautiful little thing, whose place would soon know it no more but for their kindly reticence." *Erica tetralix*, L., *Calluna vulgaris*, Salisb., and *Ulex Europæus*, are other foreigners which seem to have found there a congenial home. It is also interesting to note that *Corema Conradii*, Torr., *Linnæa borealis*, Gronov., and *Chiogenes hispidula*, Torr. & Gr., are found there. The speedy extermination of *Epigæa repens*, L., is deplored, and *Ilex opaca*, Ait., is described as "becoming rare, as it has been cut for fire-wood." On page 55 will be noted a single typographical error, where *S. sylvestris* is made to do duty for *P. sylvestris*. A. H.

Pollination.—Secondary Results of.—E. W. Claypole. (Report of the Botanist, U. S. Dept. Ag., Rep. for 1887.) Read before the Botanical Club of the A. A. A. S. at the New York meeting.

Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing spontaneously within one hundred miles of New York City.—E. L. Greene. (Pittonia, i., 184-194.) A critical review, especially in regard to the principles of nomenclature involved.

Primroses.—American. (Gard. Chron., iv., 38.)

South American Drugs.—Homes of Our.—H. H. Rusby. (Pharm. Rec., viii., 231-233.) The conclusion of the paper continued from p. 217 of the above journal.

Sugar-Producing Plants.—Record of Analyses made by authority of the Commissioner of Agriculture, under direction of the Chemist.—(U. S. Dept. Agric., Div. of Chemistry, Bulletin No. 18.) The plants described as experimented upon are Sorghum and Sugar Cane.

Trinidad Royal Botanic Gardens, and their Work for 1887.—Annual Report on the.—J. H. Hart, F.L.S., Supt. A sketch of the history and administration of the gardens with botanical memoranda, mostly economic; illustrated.

Umbelliferæ.—Some Notes on Western—III.—John M. Coulter and J. N. Rose. (Bot. Gaz., xiii. 208-211.)

The new species described are *Peucedanum Austinæ*, *P.*

Parishii, *P. Pringlei*, *P. Watsoni*, *P. Brandagei* and *P. Hendersonii*. *P. millefolium*, Wats., becomes *P. Grayi*, C. & R.

Uucultivated Pharmacopœial Plants in New York State.—A. B. Huested. (Pharm. Rec., viii., 237, 238.)

Uredineæ.—Notes on Western.—S. M. Tracy and B. T. Galloway. (Journ. Mycol., iv., 61-62.)

Vegetable Pathology.—Report of the Section of.—F. Lamson Scribner. (Rep. U. S. Dept. Ag. for 1887.)

Contains papers on the fungoid diseases of the vine, potato, strawberry, apple, beet, cherry, peach, plum, cotton, raspberry, blackberry, bean, catalpa, rose, gooseberry and Indian corn, with beautiful colored illustrations.

Verbreitung der Pflanzen durch Thiere.—Ueber die.—Carl Mohr. (Pharm. Rundsch, vi., 177-181.)

An account of the spread of plants, through the agency of man and other animals, in the Eastern Gulf Region of the United States. A list of about 200 introduced plants is given, with memoranda in regard to their original habitats, method of introduction, etc.

Weeds of Agriculture.—Dr. Geo. Vasey. (Report of the Botanist, U. S. Dept. Ag., Rep. for 1887.)

Portulaca oleracea, L., *Asclepias Cornuti*, Decaisne, *Ranunculus sceleratus*, L., *Chondrilla juncea*, L., *Hypericum perforatum*, L., *Amarantus hybridus*, L., *Daucus Carota*, L., *Cyperus rotundus*, L., var. *Hydra*, and *Berberis vulgaris*, L., are mentioned and figured.

Willows of British Columbia and Alaska.—The.—M. Lopatecki. (West. Am. Scientist, iv., 64-66.)

Willows.—Notes on North American.—II.—M. S. Bebb. (Bot. Gaz., xiii., 186, 187; illustrated.) *Salix phylicoides*, And., is described and figured.

Wood-Producing Trees of Trinidad.—Classified List of the. (Annual Report on the Trinidad Royal Botanic Gardens and their Work for 1887.)

Zygomorphy and its Causes.—II.—Charles Robertson. (Bot. Gaz., xiii., 203-208; illustrated.)

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, October 3, 1888. [No. 9.

An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America. 1885-1886.—III.

PTERIDOPHYTA.

Determined by Elizabeth G. Britton.*

(I.)—EQUISETÆ.

Equisetum Bogotense, H.B.K., Sorata (2509).

(II.)—LYCOPODIACEÆ.

Lycopodium Saururus, Lam., Yungas (455).
L. linifolium, L., Yungas (449).
L. alopecuroides, L., Mapiri (457).
L. aqualupianum, Spring, Yungas (458).
L. cernuum, L., Yungas (447).
L. clavatum, L., Unduavi (448).
L. scariosum, Forst., var. *Jussiæi* (Desv.), Baker, Yungas (451).

(III.)—SELAGINELLEÆ.

Selaginella macrophylla, Spring, Sorata (456).

S. longicuspis, Baker (?). Possibly *S. substipitata*, Spring, but leaves of the upper plane less than one-half as long as those of the lower. Mapiri (461a). Beyond the recorded range of either.

S. Breynii, Spring, Mapiri (461). Approaching in the auricled bases of the leaves, *S. campylotis*, A. Br.

S. polycephala, Baker, Mapiri and Yungas (462). Young plants like Holton's No. 82, Flora Neo-Granadina Quindiensis.

S. Poeppigiana, Spring, Yungas (452); Unduavi (454).

*In the determination of these plants I have been favored with exceptional advantages, for, in addition to the resources of the Columbia College Herbarium and Library, I have had access to Professor's Eaton's, at New Haven, and those at Kew. To Professor Eaton and Mr. Baker, for their kindly assistance, I hereby tender my hearty thanks.

S. mnioides, A. Br., Mapiri (460).

S. Moritziana, Spring, var. *major*, Yungas (462a). One of the numerous varieties, agreeing with No. 1565 of Lindig from Bogota.

S. radiata, Baker, Yungas, La Paz and Sorata (453).

S. hæmatodes, Spring, Mapiri (450).

(IV.)—Filices.

Gleichenia pubescens, H. B. K., Unduavi (438).

Cyathea Schanschin, Mart., near Yungas (121).

Hemitelia grandifolia, Spr., Mapiri (149).

Alsophila pubescens, Baker, Unduavi and Yungas (424).

A. infesta, Kunze, Yungas (122). "This species exudes much gelatinous matter, which is very styptic."—[H. H. R.]

A. pruinata, (Sw.), Kaulf., Yungas (123).

Woodsia Peruviana, Hook., Sorata (337); Ingenio del Oro (338). Regarded as a variety of *W. obtusa*, Torr., in the Synopsis Filicum.

Dicksonia cicutaria, Sw., Yungas (127).

Hymenophyllum polyanthos, Sw., Yungas (136), typical; Mapiri (186), is *H. protrusum*, Hook.; Mapiri (187), is *H. brevistipes*, Liebm., forma *minima*, Kunze—both forms of *H. polyanthos*.

H. ciliatum, Sw., Yungas (135); Mapiri, (183).

H. microcarpum, Desv., Yungas (137).

H. sericeum, Sw., Yungas (140).

Trichomanes sinuosum, Rich., Yungas (138); not typical, is *T. incisum*, Kaulf.

T. brachypus, Kunze, Mapiri (185). Not typical; fronds shorter and more deltoid.

T. radicans, Sw., Yungas (139); (*T. Kunzeanum*, Hook.)

T. crispum, L., Mapiri (184).

Davallia inæqualis, Kunze, Yungas (126).

D. Saccoloma, Spr., Mapiri (156).

Cystopteris fragilis (L.), Bernh., Sorata (319). Specimens eighteen inches high.

Lindsaya trapezeformis, Dry., Mapiri (161).

Adiantum tetraphyllum, Willd., Guanai (164).

A. Chilense, Kaulf., Unduavi (444). Named by Prof. Eaton.

Regarded as a form of *A. Æthiopicum*, L., in the Synopsis Filicum.

A. decorum, Moore, Gard. Chron., 1869, 582. Near La Paz (166). "Common on walls along roadsides."—H. H. R.

A. cuneatum, Langsd. and Fisch., Yungas (165).

Lonchitis pubescens, Willd., Yungas (145).

Hypolepis repens, Presl., near Yungas (410).

Cheilanthes Matthewsii, Kunze, near La Paz (320).

C. pilosa, Goldm., Ingenio del Oro (330); Mapiri (331).

C. myriophylla, Desv., near La Paz (321); Sorata (322).

Pellæa geraniæfolia, Fée, Guanai (113).

P. ternifolia, Fée, near La Paz (323).

P. marginata (H.B.K.), Baker, Sorata, (328).

Pteris deflexa, Link, Yungas (116); Sorata (163.)

P. pedata, L., Yungas, (112).

P. aculeata, Sw., Mapiri (162.)

P. podophylla, Sw., Unduavi (115).

Lomaria attenuata, Willd., near Yungas (314).

L. Plumieri, Desv., Yungas (318).

L. alpina, Spr., near La Paz (317); Sorata, (316).

L. procera, Spr., near Valparaiso (310) (*L. Chilensis*, Kaulf); near Yungas (311, 312).

L. Boryana, Willd., Mapiri (313).

Blechnum asplenioides, Sw., Yungas (315). Sterile.

B. unilaterale, Willd., Yungas (302, 307).

B. longifolium, H.B.K., Guanai (304).

B. occidentale, L., La Paz (305); near Yungas (396, 309).

B. hastatum, Kaulf., near Valparaiso (303); named by Prof. Philippi.

Asplenium fragile, Presl., Sorata (404); Unduavi (405); Ingenio del Oro (406).

A. Trichomanes, L. Unduavi (407).

A. monanthemum, L. Sorata (400); typically fruited fronds mixed with forms of *A. Menziesii*, Hook.

A. oligophyllum, Kaulf., Yungas (383).

A. lunulatum, Sw., Yungas (398); Unduavi (399).

var. *harpeodes*, Mett. Mapiri (402).

var. *pteropus*, (Kaulf.), Baker, Sorata (401, 403).

A. auriculatum, Sw., Yungas (397).

A. rhizophorum, L., Yungas (396), fronds pinnate, Mapiri and Yungas (389), tripinnate (*A. flabellulatum*, Kunze).

A. serra, Langs. & Fisch., Yungas (384).

A. auritum, Sw., (*A. rigidum*, Sw.), Unduavi (390); Yungas (391).

A. falcatum, Lam., Yungas (388). Approaches a form at Kew, labelled by Mr. Baker "an *A. insiticum*, Brack." More laciniate than any other American specimens seen.

A. fragrans, Sw., (*A. fœniculaceum*, H.B.K.), Unduavi (392).

A. repens, Hook., Yungas (409).

A. delicatulum, Presl., near Yungas (393).

A. Filix-fœmina (L.), Bernh., Unduavi (395).

A. grandifolium, Sw., Mapiri (385). Approaching *A. crenulatum*, Baker.

A. crenulatum, Baker, Yungas (387).

A. Klotschii, Mett., Yungas (394).

A. radicans, Sw., Yungas (386).

Didymochlæna lunulata, Desv., Yungas (117).

Aspidium macrophyllum, Sw., Mapiri (413).

A. aculeatum, Sw. The type is not represented in the collection. The form described as *Polypodium platyphyllum*, Hook., in Synopsis Filicum agrees with specimens from Sorata (414); Ingenio del Oro (417); near Yungas (418, 446.) That known as *P. rigidum*, Hook. & Grev. with Sorata (416); Yungas (419), and Unduavi (420). *Phegopteris cochleata*, Mett., is represented from Sorata and Yungas (415).

A. rivulorum, Link, near Valparaiso, Chili (421); named by Prof. Phillippi.

A. patens, Sw., Yungas (423); approaching *Nephrodium macrourum*, Baker, in the basal pinnules.

A. conspersoides, Fée, in Fourn. Fil. Mex., p. 95 (?); Mapiri (426). An unusual form marked by coriaceous texture and the lowest pair pinnules much prolonged and appressed to the rachis.

A. conterminum, Willd., Sorata (422); Guanai (430, 436); near Yungas (429, 432); specimens approaching *A. Noveboracense*, Sw., from Yungas (435); Unduavi (431); Mapiri (434), (*Nephrodium conterminum*, Desv., var. *A. pilosulum*, Klotsch.) Specimens resembling *A. Thelypteris*, Sw., from La Paz (433). None of the specimens are indusiate.

A. falciculatum, Raddi, Mapiri (437).

A. VILLOSUM (Presl.). *Nephrodium villosum*, Presl., Yungas (425).

A. prætervisum, Kuhn, Linnæa, xxxvi., (411); Mapiri (437a).

Nephrolepis exaltata, Schott., Yungas (411).

Phegopteris decussata, (L.), Mett., near Yungas (427); Sorata (428).

Polypodium serrulatum, Mett., Unduavi (368); Yungas (369).

P. moniliforme, Lag., Mapiri and Unduavi (381).

P. cultratum, Willd., near La Paz (370); Yungas (371).

P. pendulum, Sw., var. *subsessile*, Baker, near La Paz and Yungas (379); Mapiri (380).

P. suspensum, L., Yungas (376). The form *P. mollisissimum*, Fée, near La Paz (373); Yungas (374); Mapiri (375).

P. macrocarpum, Presl., La Paz (365).

P. rigescens, Bory, Mapiri (382).

P. apiculatum, Kunze, Yungas (372).

P. Plumula, H.B.K., Mapiri (366); near Yungas (367).

P. pectinatum, L., Mapiri (356); Unduavi (358).

P. plebeium, Schlecht., Sorata (352); Yungas (353); Unduavi (355). Also a large form from Unduavi (364), agreeing with *P. pleopeltidis*, Fée, Fil. Bras., t. 26, f. 1; approaching some large specimens at Kew, collected by P. L. Sodiro, "Flora Andium Quitensium," Nos. 39, 40 and 48, considered by Mr. Baker to be forms of *P. plebeium*.

P. piloseloides, L., Unduavi (361).
var. *ciliatum*, (Willd.), Baker, Mapiri (361a).

P. glaucophyllum, Kunze, Yungas (362); Mapiri (363).

P. plesiosorum, Kunze, Unduavi (377).

P. loriceum, L., Yungas (357, 378); Ingenio del Oro (359); Unduavi (360).

P. Chacapoyense, Hook, Yungas (354).

P. fraxinifolium, Jacq., Yungas (346).

P. thysanolepis, A. Br., Sorata (344).

P. aureum, L., var. *areolatum*, Eaton, Yungas (343).

P. angustifolium, Sw., Yungas (350); Unduavi (351).

P. percussum, Cav., Yungas (347); Unduavi (348); Mapiri (348).

P. crassifolium, L., Sorata (345).

Jamesonia imbricata, Hook. & Grev., Sorata and Unduavi (141).

Nothołæna ferruginea, Kaulf., Sorata (335); near La Paz (333); Guanai (336); Yungas (332).

N. hypoleuca, Kunze, Yungas (334).

N. tenera, Gill., Sorata (326); near La Paz (327).

N. nivea, Desv., near La Paz (324); near Yungas (325).

Gymnogramme grandis, Baker, Yungas (147).

G. angustifrons, Baker, Unduavi (329); a sterile, narrower and more elongated form from Yungas (408).

G. flexuosa, Desv., Yungas (128); young fronds sterile from La Paz (445); a variety from Ingenio del Oro (160), agrees with No. 239, Pearce, Andes of Ecuador in Herb. Kew; another from near Yungas (129), approaches in coarseness and slight hirsuteness a specimen at Kew collected by R. Pearce in Quenca, (also numbered 239), and labelled var. *hirsuta*.

G. trifoliata, Desv., Guanai (146).

G. tartarea, Desv., Unduavi (132); a variety (*G. ornithopteris*, Klotz), Yungas (133).

G. calomelanos, Kaulf., Yungas (134); Mapiri (148); unusually large and coarse, from Cinchona plantations at Yungas (131); a variety (*G. chrysophylla*, Kaulf.), Yungas (130).

Meniscium serratum, Cav., Guanai (412).

Vittaria stipitata, Kunze, Yungas (339, 340).

V. lineata, Sw., (*V. filifolia*, Fée); Mapiri (341).

Acrostichum conforme, Sw., Mapiri (300).

A. flaccidum, Fée, Yungas (298).

A. castaneum, Baker, Journ. Bot., 1877, p. 166, near Yungas (295).

A. Lingua, Raddi, Mapiri (441).

A. latifolium, Sw., Yungas (296).

A. melanopus, Kunze, Yungas (292).

A. viscosum, Sw., Yungas (301).

var. *minor*, Moore, (*Elaphoglossum tenuiculum*, Moore, Herb.), near Yungas (299).

A. Matthewsii, Fée, Unduavi and Yungas (297).

A. lepidotum, Willd., Mapiri (440).

ACROSTICTUM EATONIANUM, sp. nov. Sect. Elaphoglossum, *A lepidotum*, Willd., proximo. Rhizoma scandentis, densissime squamosis; frondibus anguste-linearis, coriaceis, apice et basi longe acuminatis, margine glabris, revolutis, subtus densissime squamosis; squamis ovatis-lanceolatis, reticulatis, ciliatis; stipes teretes, squamosi, prope basim articulati.

Climbing on trees; rhizome slender, less than 1 cm. in diameter, covered with dark-brown, glossy, stiff, lanceolate scales; stipes clustered, terete, arising from lateral buds, 2 to 3 cm. long, and also covered with short, dark scales, when old of a bright reddish straw-color, showing a well marked joint less than 1 cm. from the rhizome; fronds coriaceous, 30-40 cm. long, 2 to 5 mm. wide, broadest above the middle and tapering to each end, of a light green color when young, becoming tawny and mottled with black on the upper surface when old, densely covered beneath with ovate-lanceolate, ciliate and reticulate scales, naked above except along the midvein; scales of the lower surface of the midvein mottled with black; margins nearly naked and strongly revolute, even when boiled; veins pinnate, about 1 mm. apart, sometimes bifurcate near the midvein. Yungas (342), sterile specimens only; collected also by R. Pearce, June, 1865, at Quichara, Herb. Kew, marked "epiphytal ferns." Another specimen, collected by Pearce at the same time and place, has fronds nearly twice as long and broad, and the scales are round and more deeply laciniate—perhaps a different species. A remarkable species of the section Elaphoglossum not approaching any member of the group that we have seen; its nearest alliance is with *A. lepidotum*, Willd., and probably with var. *vittatum*, Sodiro, Recens. Crypt. Vasc. Quitenses, p. 81. Named in honor of Professor Daniel Cady Eaton, of Yale University, who first declared it to be a new species.

A. cuspidatum, Willd., Unduavi (293); Yungas (294).

A. caudatum, Hook., Mapiri (442).

A. osmundaceum, Hook, Yungas (443).

Aneimia Breuteliana, Presl., Yungas (120).

A. tomentosa, Sw., Yungas (118, 119).

A. Phyllitidis, Sw., Mapiri (155).

Lygodium venustum, Sw., Guanai (144); the form, *L. palmatilobum*, Mart. Flor. Bras., t. 14, No. 6, Guanai (142) and another, *L. hirsutum*, Willd., Yungas (143).

Report upon the Meeting of the Botanical Club of the A. A. A. S., Cleveland, Ohio, August 15th to 21st, 1888.

[Owing to the absence of a number of its more prominent members, the meeting this year was, in some respects, inferior to some of its predecessors, but nevertheless offered much to repay those who attended.

As usual the meetings occupied the hour previous to the assembling of the general sections of the Association and were held in one of the rooms of the High School, which was the headquarters for the whole Association and admirably adapted to its purpose.]

WEDNESDAY, AUGUST 15th.

Meeting called to order at 9 A. M. The President, Mr. David F. Day in the chair. Rev. W. M. Beauchamp was elected Secretary *pro tem.* in the absence of Prof. V. M. Spalding. The President opened the meeting by an address including a memoir of Dr. Gray and a recommendation that the club be incorporated as a section of the Association.

Before the reading of the papers in the day's programme two motions were made and carried: one to the effect that the Secretary should be provided with a book for permanent records of the Club; the other, that a committee be appointed to consider the proposition in regard to uniting the Club with the biological section of the Association. As members of this committee the Chairman appointed Messrs. W. H. Hale, Thos. Meehan and J. F. Cowell.

It was also resolved that a committee should be appointed to provide for the publication of the proceedings of the Club. The committee appointed consisted of Messrs. W. H. Seaman, W. H. Hale and Thos. Meehan.

Mr. Thos. Meehan read papers on "Diœcious Labiatæ," and "The Elastic Filaments of the Stamens of Compositæ;" and Mr. J. F. Cowell followed with "Observations on *Azalea nudiflora* and *Corallorhiza*."

THURSDAY, AUGUST 16TH.

After the meeting had been called to order, the question of making the Club a special section of the Association, or else a sub-section of Section F, was discussed. The report of the committee was read, and in this they strongly recommended that the independent organization of the Club should be maintained. After further discussion, their recommendation was unanimously adopted.

The President then announced that an invitation had been extended to the Club, by Mr. J. D. Rockafeller, to visit his grounds. As, however, the time of the Club was already fully provided for, it was decided that the Club as a body could not set a date when it would be possible to accept the invitation, and, on motion of Prof. C. R. Barnes, the regrets of the Club at their inability to accept the invitation, were ordered to be transmitted to the sender.

Mr. Thos. Meehan spoke of the death of Dr. Gray and suggested that resolutions ought to be adopted by the Club in reference to it, and the following gentlemen were appointed as a committee to draft such resolutions: Messrs. C. R. Barnes, Thos. Meehan and D. S. Kellicott.

Rev. W. M. Beauchamp read a paper on "Onondaga Indian Plant Names."* Mr. Beauchamp also exhibited specimens of *Erythræa Centaurium*, gathered near Oswego, a plant new to many of those present.

Mr. Thos. Meehan read a paper on "Irregular Tendencies in the Tubulifloral Compositæ."†

Prof. E. L. Sturtevant read a paper on "Observations on the genus *Capsicum*," accompanied by numerous beautifully executed colored drawings, showing the great variations in the fruit of different varieties. The author pointed out the difficulty of distinguishing species in plants that had been long cultivated, and expressed his doubts as to the validity of certain accepted species of the genus under consideration. Mr. Meehan expressed his interest in the paper, and said he was inclined to believe that all the cultivated capsicums were merely varieties of a single species.

The last paper was by Prof. B. E. Fernow, on the subject "What is a Tree?" In the paper the author pointed out the desirability of a generally accepted definition of the word "tree,"

* See this BULLETIN, p. 262.

† See this BULLENIN, p. 266.

and showed how authorities differ in regard to it. The following definition was suggested: "Trees are woody plants, the seeds of which have the inherent capacity of forming a definite trunk supporting a crown of branches."

After some discussion of the paper, the meeting adjourned.

FRIDAY, AUGUST 17TH.

After some preliminary business, the following resolutions, in memory of Professor Gray, prepared by the committee appointed for that purpose, were unanimously adopted:

"*Resolved*, That the Botanical Club of the American Association sincerely regrets that, meeting but once a year, it should be among the last to place on record the sense of the great loss which the whole range of science suffers by the death of Professor Gray.

"*Resolved*, That, though among the last to contribute to the wreath of sorrow with which science is everywhere crowning the memory of Dr. Gray, this body takes a mournful pride in remembering that he was one of its honored members, and that it was as a botanist he won such eminent renown. We feel that we have a right to be among the chief mourners at his departure from the field of labor he loved so well. and in a special degree to unite our sympathies with the many thousands who miss him everywhere.

"*Resolved*, That copies of these resolutions be forwarded to the family of our deceased friend and to the botanical and other scientific periodicals for publication."

Papers were read by Prof. C. R. Barnes on "The Cause of the Acridity in the Corm of *Arisæma*," and by Mr. A. A. Crozier on "Secondary Effects of Pollination." Professor Barnes stated that it was probable that the intensely burning taste of the juice of *Arisæma* was due, as suggested by Stahl for the European *Arum maculatum*, to mechanical causes; i. e. the irritation produced by the numerous rhaphides with which the juice is filled. Professor Barnes found that when these were removed by filtering the acrid taste was completely lost.

Mr. Crozier's paper was read by Prof. Cowell, the author being absent. From the author's experiments, mostly in different varieties of apples, he concluded that the influence of foreign pollen did not extend beyond the seeds.

Mrs. H. L. Wolcott exhibited the leaves of a form of choke-cherry which she described as having amber-colored berries and much shorter racemes than the ordinary form.*

Prof. W. R. Lazenby brought up the question as to the dis-

* See this BULLETIN, p. 267.

tinctness of the two forms of Virginia Creeper, which was discussed at some length by several members.

A letter from Dr. Geo. Vasey was read, on "American Desert Plants," after which the meeting adjourned.

In the afternoon the Club made an excursion to Brighton, a suburb of Cleveland, but the flora of the vicinity did not present many novelties. One of the most interesting plants found was *Jeffersonia diphylla*, of which fine specimens were obtained in fruit.

SATURDAY, AUGUST 18TH.

The entire day was devoted to a trip on the steamer "City of Cleveland," to the Put-in-Bay Islands. The trip was such a long one as to allow but little time for botanizing.

MONDAY, AUGUST 20TH.

The following papers were read: by Prof. Jos. F. James on "*Dentaria laciniata*, and *D. multifida*;" by Mr. F. L. Scribner on "Observations on Nomenclature" and "*Sphærella Fragariæ*;" and by Mr. Thos. Meehan, on "Peduncular Bracts in *Tilia*."

Prof. James also exhibited a form of *Asclepias tuberosa* with flexuous stem and sub-opposite leaves, which he thought was sufficiently distinct to be regarded as a variety.

The committee on nominations of officers for the ensuing year reported in favor of Professor T. J. Burrill, of Champaign, Ill., for President, and Douglas H. Campbell, of Detroit, Mich., for Secretary, and also recommended that the office of Vice-President be created, and named Prof. Byron D. Halsted of Ames, Iowa, for the office. The report of the Committee was accepted, and the officers elected.

TUESDAY, AUGUST 21ST.

Prof. W. R. Lazenby read a paper on "The Flowering Plants of Ohio," and was followed by some remarks by Mr. David F. Day on those of the vicinity of Buffalo, and by Mr. Beauchamp on the Cayuga flora.

Mr. F. L. Scribner read a paper upon and discussed the genus *Andropogon*.

Prof. V. M. Spalding contributed a paper on "Changes Produced in the Host Plant by *Puccinia graminis*." The author being absent, the paper was read by Mr. D. H. Campbell.

Prof. M. B. Waite contributed a paper on "Changes in the Local Fungus Flora of Champaign, Ill." In the absence of the author, the paper was read by Mr. Scribner.

Prof. W. J. Beal read a paper entitled "Notes on Some Flowering Plants of Michigan."

At the conclusion of the meeting the Club adjourned to meet next year in Toronto, Canada.

Besides the papers read before the Botanical Club, the following botanical papers were read in Section F of the Association: "A Plea for Uniformity in Biological Nomenclature," N. L. Britton; "A Study of *Hydrangea* as to the Objects of Cross-Fertilization," Thos. Meehan; "A Phase of Evolution," E. L. Sturtevant; "Notes on the Inflorescence of *Callitriche*," Jos. Schrenk; "Hygroscopic Movements in the Cone-Scales of Abietineæ," A. N. Prentiss; "Some New Facts in the Life-History of Yucca and the Yucca Moth," Thos. Meehan; "On the Cause and Significance of Dichogamy in Flowers," Thos. Meehan; "Adaptation in the Honeysuckle and Insect Visitors," Thos. Meehan; "Comparison of the Flora of Eastern and Western Michigan in the latitude of 44° 40'," W. J. Beal; "Observations on the Succession of Forests in Northern Michigan," W. J. Beal; "The Systematic Position of the Rhizocarpeæ,"* Douglas H. Campbell; "Pollen Germination and Pollen Measurements," Byron D. Halsted.

The following botanical papers were read before the Society for the Promotion of Agricultural Science: "Peculiarities of the Plants of Northern Michigan," W. J. Beal; "Notes on the Flowering Plants of Ohio," W. R. Lazenby; "Potato Flowers and Fruit," Byron D. Halstead; "Tomato Flowers and Fruit," Byron D. Halstead; "A Further Study of the Dandelion," E. L. Sturtevant; "Successful Treatment of Black Rot," F. L. Scribner.

DOUGLAS H. CAMPBELL.

The Systematic Position of the Rhizocarpeæ.†

As is well known to botanists, the *Rhizocarpeæ* are distinguished from the other *Filicineæ* in having spores of two kinds,

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* See this BULLETIN, p. 258.

† Read before Section F, at the Cleveland meeting of the A. A. A. S., 1888.

and although the two families constituting the order differ widely in other particulars, this fact has been regarded as of sufficient importance to warrant their union into a special order.

During the past two years the author has had occasion to examine more or less minutely the life-history of several forms, and the results reached do not support the present view. The investigations were made for the most part on *Pilularia globulifera*, L., and *Marsilia Ægyptiaca.* These two plants have been made the subjects of especial papers which will shortly appear, and in which the development of the prothallium, and in *Pilularia* of the sporophyte as well, is discussed in detail, so that no attempt will be made here to give more than a résumé of the results of the investigations. *Salvinia natans*, L. was also examined with some care.

The resemblances between the *Marsiliaceæ* and the true ferns, especially the *Polypodiaceæ*, has been long recognized, but the reduction of the prothallium, particularly the male prothallium, was supposed to be much greater than is really the case.

The *Salviniaceæ*, on the other hand, differ widely both from the *Polypodiaceæ* and also from the *Marsiliaceæ.*

Before stating the conclusions reached it will be well, perhaps, to glance hastily at the development of the different members of the order as far as our knowledge at the present time extends.

MARSILIACEÆ.*

In this order are comprised the two genera *Marsilia* and *Pilularia*, differing mainly in the leaves and fruits, and also in some minor particulars, but on the whole showing very close affinities.

The spores germinate with extraordinary rapidity, especially in *Marsilia*, where in the case of *M. Ægyptiaca*, at least, within thirteen hours from the time the dry spores (in somes cases twelve years old !) are placed in water, at a temperature of about 20° C.

*Hanstein, "Befruchtung und Entwickelung der Gattung Marsilia," Pringsheim's Jahrb., iv., 197. Hofmeister, "The Higher Cryptogamia," Ray Society, 1862, pp. 318–327. Hanstein, "Pilulariæ globuliferæ generatio cum Marsilia comparata," Bonn, 1866. Russow, "Vergleichende Untersuchungen." Archangeli, "Sulla Pilularia globulifera e Salvinia natans," Nuovo Giornale Botanico Italiano, viii., 320.

not only are the sexual organs mature, but fecundation has been effected and the first division of the embryo completed.

As was the case with pretty much all of the higher cryptogams, Hofmeister was the first to make extended observations in regard to the life-history of this group; but as was generally the case, while his investigations were in some particulars correct enough, the details were often very erroneous, owing largely, no doubt, to imperfect methods.

Hanstein* studied in detail the development of various species of *Marsilia*, but owing to his method of treating the young prothallia, made very serious mistakes. Through the action of caustic potash, which he employed freely in order to render the prothallia transparent, the young cell-walls are so much swollen and dissolved as to be practically invisible, and this led him to believe that the female prothallium was at first composed of primordial cells which later became surrounded with membranes, and that the contents of the microspore divided at once into thirty-two primordial cells, the mother-cells of the spermatozoids.

Archangeli,† some ten years later, made *Pilularia* the subject of special study and found that the cell-division in the female prothallium was effected by means of walls, and also demonstrated the presence of a vegetative cell in the male prothallium. The latter fact was also established by Sadebeck‡ for *Marsilia*.

By means of more improved microscopic methods it is possible to obtain thin sections of the youngest stages of the female prothallium of both *Pilularia* and *Marsilia*, and these show an almost identical structure. The plasma of the upper part of the spore becomes cut off by a transverse septum from the cavity of the spore, and from this upper cell is produced by repeated division a single archegonium, all the divisions being effected by cell-walls. The archegonium is of the same type as in other pteridophytes, but has a very short neck, especially in *Marsilia*.

The microspores divide first into two cells, a small basal cell, (the vegetative part of the prothallium) and a much larger one, the mother-cell of the antheridium. The basal cell in *Pilularia* often divides again into two cells of unequal size. The antheri-

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* l. c. † l. c.

† Schenck's Handbuch.

dium mother-cell divides by a series of walls forming an antheridium which in structure is almost identical with that of the *Polypodiaceæ*.* As the vegetative part of the male prothallia of certain *Polypodiaceæ* may be almost as much reduced as in *Pilularia*, the resemblance between such a reduced fern prothallium and that of *Pilularia* is too obvious to be overlooked. Add to these the resemblance in the sporophyte, particularly the similiarity in the sporangia and the peculiar coiled vernation of the leaves, and the conclusion seems justified that the *Polypodiaceæ* and *Marsiliaceæ* are branches, not very widely removed, of a common stock.

SALVINIACEÆ.†

The *Salviniaceæ* differ entirely in habit from the other pteridophytes, being small floating plants which in *Salvinia* are destitute of roots. It is only in regard to their forming two kinds of spores that they resemble the *Marsiliaceæ*, the sporangia and prothallia, as well as the habit of the sporophyte, differing much more widely from the latter than do the *Marsiliaceæ* from the true ferns.

Our knowledge of the prothallia of the *Salviniaceæ* is based mainly on Pringsheim's‡ work, but it is quite likely that his and Juranyi's statement that the young female prothallium is composed of primordial cells, will be found incorrect, as it seems much more in accordance with our present knowledge of cell-division that the process is similar to that in the *Marsiliaceæ*. A striking difference between the latter group and the *Salviniaceæ* is that the *Marsiliaceæ* never produce more than one archegonium, whereas the *Salviniaceæ* invariably produce several.

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*Kny, "Uber den Bau und Entwickelung des Farn Antheridiums," Monatsber. d. Berliner Acad., 1869. Campbell, "The Antheridium of Ferns," BULLETIN TORREY CLUB, 1886.

†Hofmeister, l. c., pp. 328-335. Pringsheim, "Zur Morphologie der Salvinia natans," Jahrb. f. Wissensch. Bot., iii., p. 484. Juranyi, "Uber die Entwickelung der Sporangien u. Sporen der Salvinia natans," Berlin, 1873. Strasburger, "Ueber Azolla," Jena, 1873. Berggren, "Azolla," Botaniska Notiser, 1876. Archangeli, l. c. (See Luerssen-Handbuch, vol. I, p. 599.) Campbell, "Zur Entwickelungsgeschichte den Spermatozoiden," Ber. d. Deutschen Bot. Gesellsch, April, 1887.

‡l. c.

The only reference I can find upon the development of the prothallium of *Azolla* is an article of Berggren's,* the original of which I have not seen. From a reference to this in Luerssen's Handbook of Systematic Botany,† it appears that Berggren finds the young female prothallium to be composed of primordial cells. Nothing is said about the male prothallium.

In the article on the development of spermatozoids‡ the author had occasion to describe the male prothallium and antheridium of *Salvinia natans*. The prothallium consists of a relatively large basal cell and an antheridium which differs widely in structure from those of the *Marsiliaceæ*, especially in the small number of spermatozoids, only eight being developed from each microspore.

Where we are to look for the nearest living allies of the *Salviniaceæ* is at present difficult to say, and the matter must remain in doubt until their own life-history, as well as that of certain isosporous *Filicineæ*, is more thoroughly understood.

CONCLUSION.

The conclusions reached from a study of the facts here presented are the following: That in the *Rhizocarpeæ* are included two groups which represent the last terms of two distinct series of forms. Of these the *Marsiliaceæ* are in all probability derived from forms closely related to living *Polypodiaceæ*. The exact position of the *Salviniaceæ* must remain for the present in doubt, but they certainly should be removed from their present close proximity to the *Marsiliaceæ*.

DOUGLAS H. CAMPBELL.

Onondaga Indian Names of Plants.§

To find appropriate names for plants or other things, shows a sense of fitness, a power of brief description, not very common. An Indian friend suggested giving me not only some Indian names but their meanings, and a portion of the result is embodied

* Berggren. "Forengaende middelande om utvecklingen af prothalliet och embryot hos Azolla," Botaniska Notiser, 1876, p. 177.

† l. c. ‡ l. c.

§ Read before the meeting of the Botanical Club of the A. A. A. S., at Cleveland, Ohio, August 16th, 1888.

in this paper. It happens, of course, that many words have lost their original significance and become mere names. Very few of us could tell why we call grass, wheat, trees and some other things by these names, yet there once was a reason. Others are easily understood. Nor are Indians always exact in distinguishing species, except for special reasons, and for this cause and brevity I use our common names. Thus Onondagas do not separate by name the Virginia and the Poison Ivy. Both are *Ko-hoon-tas*, "The stick that makes you sore." No distinction is ordinarily made in the species of Pine, which is *O-neh-tah*, "Like porcupines holding to a stick." The Hemlock Spruce differs little, and is *O-ne-tah*, "Greens on the stick." The Milkweed is expressive, *O-wah-kwen-stah*, "Milk that sticks to the fingers." Violets are *Wa-keah-nos-wi-dus*, "Two heads entangled;" in allusion to their childish game of interlocking the flowers. The Soft Maple is *Ah-weh-hot-kwah*, or the "Red Flower"; from *Ah-weh-hah*, Flower, and *Hot-kwah*, Red. For the Slippery Elm they say *Oo-koosk-ah*, "It slips." The Apple is simply *Swa-hu-na*, "Big Apple"; perhaps to distinguish it from the Wild Crab. The Yellow Willow is *Cheek-kwa-ne-u-hoon-too-te*, "Yellow Tree." The Red Osier is distinguished by its color, *Kwen-tah-ne-u-hoon-too-te*, or "Red Tree." The Witch Hazel is *Oo-eh-nah-kwe-ha-he*, "Spotted Stick." The Spice Bush, *Da-wah-tah-ahn-yuks*, "Stick that breaks itself," *i. e.*, that is brittle. Sassafras is *Wah-eh-nah-kas*, "Smelling Stick." The Thistle is *Ooch-hah-ne-tah*, "Something that pricks." By adding the syllable *ah*, we have "Small Thistle," *i. e.*, the Canada Thistle. The berries are interesting. The Red Raspberry is *O-nah-joo-kwa*, "A Cap"; add *goo-na*, and we have "Big Cap" for the Thimble Berry. The Blackberry is *Sa-he-is*, or "Long Berry." The Black Raspberry is *Tu-to-hok-toon*, "The Plant that bends over." The Huckleberry is called *O-heah-che*, or "Blackberry." The name of the Strawberry with us expresses its straying habit, with the Indians its frequent situation, *Noon-tak-tek-hah-kwa*, "Growing where the knolls are burned." *Ska-hens-skah-he* is a simple name for Currant; add *goo-na*, and we have Large Currant or Gooseberry. Another adjective expresses the wild thorny fruit. The Wild Grape is *Oh-heun-kwe-sa*, "Long Vine"; add *goo-na*, and it is the cultivated or "Large Grape. *Oo-juh-gwah-sah* defines the Poke-weed as "Color-weed." *Ah-seh-ne-u-neh-toon-tah*, the Red Clover, is "Three Leaves"; the adjective of color distinguishes the White Clover. Timothy is *Oo-teh-à-hah*, "Tail at the end." I am best pleased with the name of Jack-in-the-pulpit, which is *Kah-à-hoo-sā*, "Indian cradle." The cradle has a raised bow near one end of the flat board of which it is made, and over this a covering is drawn to protect the baby's head.

A-ē is Wild Cherry; *Ja-ē*, Red Cherry. *Ja-e-goo-na*, White or Sweet Cherry, is "Big Cherry." *Ne-a-tah-tah-ne*, or Choke Cherry, is "Something that chokes." For the Pear we have *Koon-de-soo-kwis*, "Long Lip"; for Peaches, *Oo-goon-why-e*, "Hairy." Varieties of Squashes or Pumpkins are defined by adding adjectives to *Oo-neoh-sah*. Thus the Squash is *Oo neoh-sah-oon-we*, the "Real Melon" or Pumpkin, probably that which they first had. Similarly the Water Melon is *Oo-neoh-sah-ka-te*, or "Green Melon." The Musk Melon has a distinct name, *Wah-he-yah-yees*, "Thing that gets ripe"; perhaps from the change in color." Among modern names I find that of the Cucumber, *Oot-no-skwi-ne*, "With prickles on it." *Skomatose* is a nickname for Tomatoes, and several names of vegetables are taken from us.

Boneset or Thoroughwort is *Da-uh-kah-tah-ais-te*, "Leaves that come together." *Oo-noh-sah* is Onion; *Oo-noh-so-yah*, the Leek, "A Queer Onion"; *Oo-noh-sah-kah-hah-koon-wa-ha*, Wild Onion, "Onion that grows in the woods"; *Oo-nā-tah-kah-te*, Lettuce, "Raw leaf," i. e., eaten raw; *O-je-kwa*, Turnip, "Hammer Root," from its ponderous form. Among other trees I find a meaning for *Ga-nah-jeh kwa*, the Canoe Birch, which is "Birch that makes Canoes." *Ka-nēh*, White Ash; *Ka-neh-ho-yah*, "Another kind of Ash." This is a variety growing by streams, much used for baskets. The names of nuts are mostly old and have lost their meanings. The Chestnut is an exception, *O-heh-yah-tah*, or "Prickly Burr." By adding *goo-na*, we have the Horse Chestnut, or "Big Prickly Burr." They also translate our name. The Elder is *Oo-sa-ha*, "Frost on the Bush," from its white spreading blossoms. Sarsaparilla is *Ju-ke-ta-his*, or "Long Root." The Thorn-bush is *Je-kah-ha-tis*, "Long Eyelash," from the long thorns. Peppermint is *Kah-nah-noos-tah,* "Colder," or "That which makes you cold." Spearmint has the same name, but is distinguished by the stem. *Ah-weh-a-stah,* Moss, means "Something which grows all over."

The Partridge Berry has the same name as with us, in Onondaga, *Noon-yeah-ki-e-oo-nah-yeah,* the first four syllables standing for the bird. The Wintergreen is *Kah-nah-koon-sah-gas,* "The Birch-smelling Plant." The Plantain is *Tu-hah-ho-e,* "It covers the road." I think from this has come the idea that it means the white man's foot or footstep. Catnip is *Ta-koos-kah-nat-tuks,* "Cat-eating Leaf.' Flax, *Oo-skah,* "Thread-like" or "Making Threads." Aspen, *Nut-ki-e,* "Noisy Leaf." Creeping Blackberry, *O-kah-hak-wah,* "An Eye," or "Ball of an Eye."

The Tamarack is distinguished from other coniferous trees by its name *Ka-neh-tens,* "The Leaves Fall." The Balsam Fir is *Cho-koh-tung,* "Blisters," *i. e.* on the bark. Iron Wood (*Ostrya*) is *Skien-tah-gus-tah,* "Everlasting Wood"; it is used for the best Snow-snakes. Water Beech (*Carpinus*) *O-tan-tahr-te-weh,* "A Lean Tree," from its lacking the rotundity of the true Beech, is expressive. The yellow flowers of the cowslip. or *Caltha,* would not escape attention and are termed *Ka-nah-wah-hawks,* "It opens the swamps." The Bloodroot is *Da-weh-ne-kwen-chuks,* "It breaks blood." The Yellow Moccasin Flower is very prettily termed *Kwe-ko-heah-o-tah-qua,* Whip-poor-will shoe. The Ginseng of commerce is *Da-kien-too-keh,* the "Forked Plant." The May apple, or mandrake, is *O-na-when-stah,* "Soft Fruit." The Mullein has two names, both expressive, *Ki-sit-hi,* "Flannel," and *Oo-dā-teach-ha,* "Stockings." Much like the latter is the name of the Sycamore or Button-wood Tree. It is *Oo-da-te-cha-wun-nes,* or "Big Stockings;" perhaps in allusion to the way in which the bark peels off. It is harder to account for *Te-a-tah,* "She stands over yonder," the name of the common Yellow Dock, unless it describes a young squaw adorned with beads as that is with seeds. They retain the signification but have forgotten its origin.

Among names of which I could ascertain no primitive meaning, are: *O-nā-tah,* Leaf. *O-hoon-tah,* Bush. *Kai-ehn-tah,* Tree. *O-ē-en-tah,* Wood. *Ah-win-noo-kah,* Grass. *Ho-whah-tah,* Sugar Maple. *O-ech-keh-a*, Beech. *Ho-ho-sa*, Basswood. *Oo-ha-what-tah*, Butternut. *Oot-koo-tah*, Sumac. *Oo-nuh-kwa-sa-wa-nehs*, Burdock. *Ne-uh-noo-kwa-sa-saah*, Hound's Tongue. *O-yen-kwa*, Tobacco. *Oo-a-hoot-kwa*, Sweet Flag, Cat-tail and Iris, all named from the leaf. *O-nà-kwa*, Peas. *Oo-sah-ha-tah*, Beans. *Oo-neh-noo-kwa*, Potato. *Oo-neh-nok-tah*, Artichoke. *Oo-nv-soo*, Cabbage. *Oo-ta-yah*, Anise. *Oo-nah-koon-sah*, Birch. *Gah-hoon-wa-yah*, Black Ash. *Ka-nąh*, White Ash. *A-nĕk*, Hickory. *Us-teek*, Bitternut Hickory. *Ko-yen-ta-ka-ah-ta*, Whitewood, White Tree. *O-skwen-e-tah*, Golden Rod. *We-yun-wah*, Golden Rod. *Ki-en-tah-ka-eh-tah*, Oak. *Oo-ne-hah*, Corn. *Oo-na-hah-keh-ha-tah*, White Corn. A curious name is *Hah-ska-nah-ho-nah*, applied to both white *Dicentras*—the Squirrel Corn and Dutchman's Breeches, sometimes called "Boys and Girls." It means "Ghost Corn, or that which ghosts feed upon"; a striking name for the spectral spikes of blossoms. Having always heard of the *Trillium* as an Indian medicinal herb, I was surprised to find my good friend, the medicine woman, not at all familiar with it. She had no name for the purple species, and knew of no virtues in the plant. The White Wake Robin was *O-je-gen-stah*, "Wrinkles on the forehead," from the lines on the petals. The drooping clusters of the Hop are *O-je-jea*, "Like a flower," and an appropriate name it seemed as I stood talking with the Indian hop-pickers. *O-ah-wen-sa* is the Sunflower.

I hope to add others to these, but of many plants the Indians know nothing, or have given them no names. In Schoolcraft's vocabulary I find but little additional, and Zeisberger's Onondaga Dictionary is largely Mohawk. As it is, he gives few plants, a curious omission in most of the old Iroquois vocabularies. The above list is entirely from original sources, and for both words and meanings I am indebted to my Onondaga friend, Mr. Albert Cusick.

W. M BEAUCHAMP.

On Irregular Tendencies in Tubifloral Compositæ.*

In all our systems of classification it is rare that we find exact dividing lines. Distinguishing characters often overlap, and are

* Read before the meeting of the Botanical Club of the A. A. A. S., at Cleveland, August 16th, 1888.

partially embraced by an adjoining section. Hence we come to look for traces of character in one division that are more highly developed in another next to it.

In Compositæ we have section *Tubulifloræ* "corolla tubular and regular in all the hermaphrodite flowers," and section *Labiatifloræ* "corollas of all or of only the hermaphrodite flowers bilabiate. (Gray's Synoptical Flora, pp. 49, 50.) But if we examine some genera of *Tubulifloræ* carefully, we find abundant evidence of irregularity, though in a light degree.

In *Heliopsis*, *Silphium*, and others, we find the irregularity confined to a tendency of the pistil with the syngenesious anther, to bend down and partially overlap one of the lobes of the floret; and in one species of the latter, *Silphium perfoliatum*, the tendency of the floret itself to become bilabiate is quite marked. Two lobes of the floret—and which may be called upper lobes—are more distinct than the other three (lower ones), and the pistil with its subtending column of anthers declines over the central of the three lower lobes, and which might almost be termed the lip.

Again in *Helianthus*, though the florets are regular and the sexual organs retain a central position at the expansion of the lobes, the pistil (in *H. doronicoides*), does not push up through the center of the synthetic anthers, but bursts through the sides, bending somewhat towards one of the lobes of the corolla, all indicating a tendency towards irregularity.

Similar illustrations might be given from other genera or species of the tubulifloral section of Compositæ, showing that the dividing line between it and the labiatal section is not as absolute as we may have supposed. THOS. MEEHAN.

Is the Amber-Colored Choke-Cherry entitled to a distinct Name?*

In August, 1887, in the town of Dedham, Mass., there were to be found growing on a gravelly hillside a small plantation of *Prunus Virginiana;* on the opposite side of the road one smaller in extent; about thirty feet on the road a *Prunus*, differing in many points.

The color of the bark the same; limit of height of common

*Specimens of the leaves were presented at the meeting of the Botanical Club of the A. A. A. S., at Cleveland, August 17th, 1888, with description.

one, 12 feet; of the newly found one, less than 6. Leaves of one like those of peach, of the other more like apple. The fruit in one, 4 to 6 inches in length; in the other, from 1½ to 3. In spring the blossoms were 32+4 buds on the first, 28+4 buds on the other; color of fruit, one red—fruit sparsely set; of the other, clear amber—fruit closely set; shape of one, spherical; of the other, flattened, like the earth at the poles; pits of amber colored one appreciably smaller in the mouth, but they were not measured. The only common characteristic of the two was the astringent quality of the fruit. Correspondence with the places where it was said to have been seen, has been most unsatisfactory in results. I do not know where it can be found. Some improvements cut out the plantation while the beautiful fruit hung on the branches.

From specimens of fruit and flowers sent to the Botanical Garden at Cambridge, Mass., Prof. Watson suggests that it should be called var. *leucocarpa*. H. L. T. WOLCOTT.

Reviews of Foreign Literature.

General Index to the First Twenty Volumes of the Journal (Botany), and the botanical portion of the Proceedings, Nov., 1838, *to June,* 1886, *of the Linnæan Society.* By B. Daydon Jackson, Secretary. (8vo, pp. viii+428. London, 1888.)

In the preparation of this index a great labor has been accomplished for the Linnæan Society by its industrious Secretary, and all those who have occasion to use the Journal will be grateful to him for the saving of time this useful volume will accomplish. As an index it is as complete as could be desired. Every species, genus and order mentioned is referred to, the contributors and their papers are given in detail, and a geographical classification of the papers is also included. Synonyms are printed in italics and names of new species indicated by an asterisk. When we realize that the compilation of this index was not authorized until June, 1886, and that it has been several months in printing, while the editor has meanwhile been continuously occupied with the new Index to Plant Names, the amount of work he has accomplished is surprising, and we congratulate him and the society on its completion. E. G. B.

Ein Beitrag zur Kentniss der Structur und des Wachsthums Vegetabilischer Zellhäute. Von G. Krabbe. (Pringsheim's Jahrbuch, Vol. 18, No. 3.)

In the first part of this article the author treats mainly of the spiral striping of the bast fibres and tries to decide the question, whether in the same layer several systems of stripes cross each other, as Naegeli says, or if each layer possesses only one set of stripes, as claimed by Dippel, Strasburger, and others. He agrees fully with the latter opinion, claiming that this is seen to be true very clearly by focusing on different cross-sections.

In the second part he takes up the manner in which the cell wall thickens. He seems to reach no more than a strong probability, however, that intussusception has nothing to do with growth in thickness. He says that the hypothesis that the wall grows in thickness by the deposition of successive new layers is the only one which makes the stripings of the layers intelligible. The appearance of the wall at the first stages of its growth indicated this; that which appeared to be the first new layer lacking a complete union with the primary wall, or, as the author expresses it, this was seen by the looseness with which the new layer was connected with the old wall. He holds it also probable that each layer is made up of a number of thin layers which unite together before being deposited on the wall. It is supposed by some that this appearance is caused by processes which take place after the wall is completed, but the author finds in the bast fibers of the Asclepiadaceæ and Apocynaceæ indications which fully justify the former theory. A singular fact concerning these fibers has often been described, viz.: that the radial diameter of the single fiber varies in different places along its length. This is explained by a widening of the cell at some places and the wall undergoing thickenings in certain other places, so that the lumen is extremely small. Now at these widened places a process was watched which appears to verify this notion of the component layers forming and afterward uniting together and then finally attaching themselves as a single layer to the wall growing in thickness. The protoplasm at the end of these widened places differentiated into extremely fine lamellæ in the form of caps, also at the sides the same process took place; these lamellæ afterward were seen to unite into a homogenous layer. Thus he believes to have seen the building of the separate thin lamellæ and their subsequent union into a single one.

The widening-out process has its interest in that it furnishes very strong probable evidence that growth in surface is the result of intussusception. In the first place it is noticed that the walls are but very little thinner here than at other places of the cell, the surface meantime has doubled its original size. Now if this were due to extension alone, the elasticity of the wall must equal 100 per cent., which has not been proven by any experiments on the nature of the cell wall. Also to have caused so great an extension, an enormous pressure must be assumed, and this is difficult to account for. The author therefore takes the ground that intussusception must have taken place in producing this growth. He admits, however, that this cannot be considered conclusive proof of this process, but that it furnishes a strong probability to the many already deduced from similar facts.

The system of stripes in each layer, he holds, consists of spiral bands attached to each other, but originating as a differentation of a layer previously homogeneous, and not, as Dippel and Strasburger claim, by a local thickening of the membrane. Besides this, he claims to have discovered lamellæ running in the opposite direction; these, however, disappear with age, and are supposed to be due to different substances in the cellulose of the membrane.

At the close the author makes some general deductions from the facts given, which have already been called in question. (See Botanische Zeitung, June 8, 1888.) He says there is another process in the formation of cell membrane quite independent of apposition or intussusception, and names this a new-building. It is doubtful whether this differs from the process generally understood by the term apposition. The author, it appears, limits this term to the application of continuous, ready-formed layers to the snrfaces of the old walls, while the building of these layers is held to be something entirely disconnected, and therefore requiring a different name. It is objected to this that as long as we know nothing about the manner of molecular building it is useless to add another term, and that until we know more definitely about the separate process, the one term, apposition, is sufficient for both.

The critic adds, however, that this article is a welcome addition to our store of facts in reference to the much discussed question of the manner of cell growth. E. L. G.

On the Origin and Behavior of Nitric Acid in Plants. B. Frank. (Ber. d. d. Bot. Ges., v., 472-487.)

The author, in the first place, discusses the theory prevailing in vegetable physiology, according to which the nitrates taken up by the plant from the soil are conducted upwards into the leaves, where they are utilized in the formation of organic nitrogen compounds, which, in their turn, migrate back to the points at which they are consumed. The facility with which the osmosis of the nitrates takes place, and the actual occurrence of saltpetre, seemed to justify this opinion. From the fact that nitric acid is mostly found in the greatest proportion in roots and stems, diminishing toward the leaves, in which it is either not present at all or in only very small quantities, and from its total absence from the parenchyma of the leaves, it has been concluded that its assimilation must take place in the green cells of the leaf. The absence of nitric acid from the branches of shrubs and trees some have sought to explain by assuming that these plants do not meet with any nitrates, but only with ammonium compounds, in the deeper layers of the soil to which their roots penetrate.

On the other hand, Liebig's opinion that the ammonia of the soil is the only source of nitrogen available to the plant for assimilation has, of late, found new advocates. Berthelot and André* determined the relative amounts of nitric acid in the soil and in plants grown on it, and found, *e. g.*, in *Amarantus giganteus*, 320 kg. of saltpetre per hectar, while the soil itself could not have furnished more than 54 kg., in which calculation, however, the investigators did not consider the stony subsoil. Still they assume that in the tissues of the stem a nitrification of the ammonia, or even an oxidation of free nitrogen, is taking place.

The author then proceeds to give the results of his own investigations. The best reagent for nitric acid was found to be diphenylamin—sulphuric acid—which is the only one producing a distinct blue coloration. All the seeds examined, of plants be-

* Compt. rend., XCVIII., No. 25. and XCIX., Nos. 8-17.

longing to many different orders, contained absolutely no nitrates, nor did their seedlings show any trace of it if the seeds were caused to germinate in water free from saltpetre. Plants were grown both in water containing no nitrogen compounds at all, and in nutrient liquids with ammonium salts, instead of nitrates, dissolved in them. All the experiments proved conclusively that no plants, not even the true "saltpetre plants" (sunflower, tobacco, *Urtica, Amarantus,* etc.), will ever contain any nitrate, unless their roots have been in a position to receive it, and that no plant has the power to form within itself even a trace of nitric acid, either in the light or in the dark.

As to the distribution of the nitric acid in plants, the result is reached that in typical, so-called saltpetre plants, much more nitric acid is received during the period of vegetation than is needed at the time being for the production of new organs. The excess of the unchanged nitrate is stored in all those organs which are available for this purpose, and as cells with large spaces for cell-sap are especially well adapted to keep the nitrates in solution, the parenchyma tissues of root, bark and pith, petioles, and veins of leaves will serve for the temporary storage of the nitrates, so that at the time when the fruit is ripening the suddenly increased demand for nitrogenous substance can quickly be supplied. Even in plants which thus far were supposed to contain no nitric acid (trees, yellow lupine, etc.), it is always found in their roots, not, however, higher upwards, most likely because it is soon assimilated into nitrogen compounds.

The principal argument in favor of the theory that the assimilation of the nitric acid must take place in the green leaf, in connection with the formation of the organic carbon compounds, is, as mentioned above, the observation that in many plants the nitric acid can be demonstrated in the tissues as far as the veins of the leaf, and then disappears. After referring to the fact that in arboreous, and in a few other plants, no nitric acid at all is found in the leaves, the author describes several experiments in order to prove that there is no migration of the nitrates whatever, having the leaf for its terminus, and finally reaches the conclusion that the nitric acid which is taken from the soil as nitrogenous food is not assimilated in the green leaf-tissue, but in any one of the different organs in which it has been stored for future use; or, with many plants, in the roots, soon after its absorption from the soil. J. S.

Hand-book of the Amaryllideæ, including the Alstrœmeriæ and Agaveæ. By J. G. Baker, F.R.S., F.L.S. 8vo., pp. 216. London. George Bell & Sons, 1888. Price five shillings.

We have been accustomed for many years to see occasional descriptions of new species and monographs of genera of this most beautiful order of plants from the pen of Mr. Baker. These he has now brought together in the form of a compact hand-book, suitable alike for botanists and florists, much on the plan of his recent "Hand-book of the Fern Allies." The three tribes, Amarylleæ, Alstromerieæ and Agaveæ, are treated in detail; the other two are omitted, having recently been carefully monographed in the Journal of the Linnæan Society and the Journal of Botany. Sixty-one genera and about six hundred and seventy species are described. The genera are just equally divided between the Eastern and Western Continents, thirty in each, with *Crinum* cosmopolitan. The United States genera are *Zephyranthes*, with four species, *Z. aurea*, S. Wats., becoming *Z. longifolia*, Hemsley; *Crinum*, with one, *C. Americanum*, L.; *Hymenocallis*, with *H. Caymanensis*, Herb. (Curtiss, N. A. Plants, No. 2830; Wright, Plantæ Cubanæ, No. 3245), *H. crassifolia*, Herb., *H. Galvastonensis* (Herb.), Baker (Texas, Drummond, 370, 412; E. Hall, 630), *H. Palmeri* and *H. humilis*, S. Wats., and *H. lacera*, Salisb., and *Agave*, with twelve species. Each genus is preceded by an analytical key, rendering it easy to reach any species. The book is printed in clear type, on good paper, and neatly bound. It should be found in every working botanists' library, as its low price puts it within the reach of all. N. L. B.

On the Presence of Sexual Organs in Æcidium. By George Massee. (Annals of Botany, ii., 47-51; one plate.)

Mr. Massee announces a discovery which, if found constant in the species, is entirely unexpected and will set mycologists a new line of research. It appears that the *Uromyces Poae*, Rab., believed to be a stage in the life history of the cluster cups found on *Ranunculus Ficaria*, is very rare in Britain, while the *Æcidium* is everywhere abundant. This led to the idea that it might have modes of reproduction independent of the *Uromyces*. Careful search among many sections finally revealed the tip of a branch of mycelium ending in a clavate head. Further sections through portions of the leaves first discolored by the fungas showed this body to be an oögonium and accompanied by an antheridium, by the contents of which it appeared to be fertilized. Subsequently it develops into the *Æcidium*. N. L. B.

Index to Recent American Botanical Literature.

Araujа (Schubertia) graveolens. (Gard. Chron., iv., 271; fig. 33.)

Artificially Fertilized Flowers.—A Protection for.—E. S. Goff. (Garden and Forest, i., 339; illustrated.)

Asa Gray and Darwinism.—Lester F. Ward. (Reprinted from The Historical American, for Aug., 1888; illustrated with portrait of Dr. Gray.) A pleasing resumé of the position that Dr. Gray occupied in the controversy over the principles of organic evolution.

Asa Gray.—Memorial of. (Pamph., 8vo., pp. 45.)

An account of the proceedings of the Adjourned Annual Meeting of the American Academy of Arts and Sciences, held in Boston, Wednesday, June 13th, 1888, to commemorate the life and services of the great botanist. The addresses of Prof. Joseph Lovering, Augustus Lowell, Prof. Eliot, Prof. G. L. Goodale, Prof. W. G. Farlow and Sereno Watson are printed in full.

Asterina, Dimerosporium and Meliola.—Synopsis of the North American Species of.—George Martin. (Reprinted from Journ. Mycol.)

Buzzards Bay.—July on the Shores of.—M. G. Van Rensselaer. (Garden and Forest, i., 327.) A popular account of the most conspicuous plants of the region.

Desmids—North Carolina.—A Preliminary List of.—W. L. Poteat. (Journ. Elisha Mitchell Sci. Soc., v., 1-4.) Eighty-one species are enumerated.

Entomophthoreæ of the United States.—The.—C. E. Bessey. (Am. Nat., xxii., 643-645.) A review and synopsis of the work of Mr. Roland Thaxter, as published in the Mem. Bost.

Soc. Nat. Hist., April, 1888. Mr. Thaxter, whose address is New Haven, Conn., desires correspondence on the subject and specimens.

Ephedra. H. H. Rusby. (Drug. Bull., ii., 219-222; illustrated.) An account of the habitat and medicinal properties of the species of this genus, followed by a table of classification for the six species credited to the United States, viz.: *E. Nevadensis,* Wats., *E. antisyphilitica,* C. A. Meyer, *E. pedunculata,* Engelm., *E. trifurca,* Torrey, *E. Californica,* Wats., and *E. Torreyana,* Wats.

Erythronium Hendersoni. (Gard. and Forest, i., 316, 317, fig. 50.)

Forestry.—Annual Report of the Division of—for 1887. (Pamph., 4to., pp. 156; Washington, D. C., 1887.) Mostly concerning the economic aspect of the subject.

Hardy Flowering Shrubs.—Lena Leslie. (Vick's Mag., ii., 266, 267.) A plea for the cultivation of more of our native plants.

Harpalium (*Helianthus*) *rigidum.* (Garden, xxxiv., 223; illustrated.)

Heliotropism: The Turning Motions of Plants.—Conway McMillan. (Pop. Sci. Monthly, xxxiii., 674-682.) A popular resumé of the subject.)

Hybrid Oaks on Staten Island.—Arthur Hollick and W. T. Davis. (Proc. Nat. Sci. Ass'n of S. I., Sept. 8th, 1888.)

The discovery is reported, at Tottenville, Staten Island, of a number of peculiar oaks, amongst which are *Quercus heterophylla,* Michx., and *Q. Rudkini,* Britton, besides others which are described as undoubtedly hybrids between *Q. Phellos* and either *Q. palustris, Q. tinctoria,* or *Q. coccinea.* From its position as one of a series of these peculiar forms the authors conclude that *Q. heterophylla* is plainly a hybrid.

Lichens.—A Synopsis of the North American—Part II.—Edward Tuckerman. (Pamph., 8vo., pp. 176. New Bedford, 1888. Sold by E. Nelson, Amherst, Mass.)

This part, compiled by Mr. Henry Willey from the posthumous manuscript of Prof. Tuckerman, comprises the *Lecideacei* and part of the *Graphidacei.* Mr. Willey also adds an appendix, containing notes of his own on many species. This consists of two portions; the first is composed of *Lecideei* referred to in

Professor Tuckerman's manuscripts, of which Mr. Willey has seen specimens, 13 species; the second, descriptions of native and exotic lichens from his occasional writings, 34 of the former and 110 of the latter. The accompanying index includes also the index to Part I, which was published in 1882.

Lilium Canadense. (Garden, xxxiv., 182; illustrated.)

Lycium pallidum. (Garden and Forest, i., 340, fig. 54.)

Marine Algæ of the West Indian Region.—Catalogue of the.—Geo. Murray. (Journ. Bot., xxvi., 237-243; continued.)

Native Ferns.—Cultivation of.—Robt. T. Jackson. (Gard. and Forest, i., 317, 318, 330, 331, 340-342, 352-354.)

Old Trees—The Rejuvenescence of. (Garden and Forest, i., 349, 350; illustrated.)

Palestine.—Flora of.—Henry Gillman. (Am. Nat., xxii., 642, 643.)

Pentstemon rotundifolius. (Gard. Chron,, iv., 264, fig. 31.)

Primula Rusbyi. (Gard. and Forest, i., 320.)

Pseudophœnix Sargenti. (Garden and Forest, i., 352, figs. 55 and 56.)

Pyrus coronaria. (Garden, xxxiv., 206; illustrated.)

Rhododendrons. (Vick's Mag., ii., 251-263; illustrated.)

Ribes speciosum. (Garden, xxxiv., 230.)

Robinia hispida.—W. Goldring. (Garden, xxxiv., 174; illustrated.)

Rubus deliciosus. (Garden, xxxiv., 230; illustrated.)

Rubus odoratus. (Garden, xxxiv., 230, 231; illustrated.)

Sycocarpus Rusbyi.—Pharmacognostical Notes on the Bark of.—Jos. Schrenk. (Drug. Bull., ii., 222, 223; illustrated.)

Tumble-Weed.—A Miniature.—C. E. Bessey. (Am. Nat., xxii., 645, 646.) This latest addition to the "tumble-weed" literature is *Townsendia sericea*, Hook. The achenes with their pappus comprise the part of the plant that "tumbles."

BULLETIN

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The Genus Hicoria of Rafinesque.

BY N. L. BRITTON.

"*Scoria* (*tomentosa, mucronata, alba, pyriformis, globosa, &c.*) *Juglans alba* L., *tormentosa, mucronata*, Mich., &c. The hickory."

This is what Mr. Rafinesque is made to say in the Medical Repository, 2d hexade, Vol. v., p. 352, in the year 1808, under the title "Prospectus of two intended works on North American Botany."

Those who do not regard priority of publication as the all-important item in biological nomenclature will doubtless consider the facts and conclusions here presented as entirely uncalled for, and will object to them on the ground of unnecessary introduction of new binomials for very familiar plants. While regretting the fact that in proposing changes of this kind it is quite impossible to please everybody, I am also assured that a large number of botanists will cordially welcome any move to restore old names, inasmuch as this tends to bring nomenclature to a stable basis—a result worth much momentary inconvenience. I am thus encouraged in calling the attention of American botanists to Rafinesque's generic name for the hickories, and am persuaded to believe that the literary recognition thus awarded is only too long delayed.

The hickories are among the most characteristic elements of the existing North American flora, and together form a genus as marked in structure as it is in geographical distribution, being entirely confined to East America, with two species occurring in Mexico. For some reason the older botanists failed to recognize their generic validity. They, without exception, grouped the hickories with the real walnuts, regarding and describing all as species of *Juglans*. Rafinesque was the first to record an opinion that they form a distinct genus and the name he proposed this should bear must certainly stand. His opinion is now shared by all.

I do not know which of the old masters was the first to refer to these trees. Loudon says that the Eastern Shag-bark was introduced in English gardens in 1629. Parkinson states on page 1414 of his Theatrum Botanicum (1640), alluding to this tree as "*Nux Juglans alba Virginiensis*, the White Walnut of Virginia. The tree hereof groweth more upright and spreadeth lesse (he is comparing it with the real walnuts), the leaves are alike and the nut smaller, much thicker and whiter in the outer, hard shell than any of the former sort, and the kernel within much lesse also, but white and as sweete." Plukenet's Almagestrum Botanicum (1696) p. 264, indicates four kinds as known to him:

(1). *Nux Juglans Virginiana folius vulgaris similis, fructu subrotundo, cortice duriore lævi.* The Hickory or White Virginian Walnut. Haec est illa nux quam nostrates vocant the Hickery, seu Pick hickery Nut; cujus nucleis lac conficient, Indi quod vocant Hickery Milk. He refers to Parkinson's description above quoted. This description appears to have been applied to the Eastern Shag-bark.

(2). *Nux Juglans Virginiana alba minor, fructo nucis moschatæ simili, cortice glabro, summo fastigio veluti in aculeum producto.* He figures the nut on Plate 309, fig. 2, a and b, representing that of the Small-fruited Hickory.

(3). *Nux Juglans Virginiana alba, fructu parvo anguloso, cortice lævi.* Represented on the same plate, fig. 2, c, being a small nut of the Eastern Shag-bark.

(4). *Nux Juglans angulosa major, Americana, fructu longiore, cortice albo lævi, summo vertice mucronata.* He figures both the foliage and the nut of this species (figs. 2 and 2 d), guesses that it came from New England, and, although he says that the seed is very bitter, I can only associate it with the Balsam Hickory.

Miller's Gardener's Dictionary (1731) rcognized, however, only two of those described by Plukenet, still under *Nux Juglans*, remarking that "the Virginian sorts are preserved as rarities by such persons who are curious in collecting the several sorts of trees."

I shall now attempt to trace in outline the history of the introduction into botanical literature of the names which the species we are now able to differentiate must bear. In this I have freely availed myself of the cited synonymy of the genus, and especially of the exhaustive display of it given by Professor C. S. Sargent, in the Forestry Report of the Tenth Census, comparing the references I have had occasion to use, but without noticing a single discrepancy.

Linnæus carried Miller's process of eliminating Plukenet's species still farther, for he records but a single species, viz: *Juglans alba* (Species Plantarum, Ed. I., p. 997, (1753). While his description and synonyms indicated that he had several species confounded, his specimens are of the Woolly Hickory or Moker Nut, as is stated by all recent authorities, and which I can now confirm from a recent inspection of them; they consist of leaves and staminate catkins. It is quite remarkable that he was unable to separate more species, when we recall the large number of oaks, maples, ashes and other North American forest trees that he described. On one of these old herbarium sheets I was much interested to note the following memorandum written in pencil: "Hickery Nut, forte genus novum, capsula 4-valvis." J. E. S. I cannot find that Sir J. E. Smith ever published anything on the subject. This name was in common use for the Moker Nut up to the appearance of the last edition of Bigelow's Florula Bostoniensis (1840).

The seventh edition of Miller's Gardener's Dictionary, published in 1759, brought in two additional species, *Juglans glabra*, the Pig Nut, and *Juglans ovata*, the Eastern Shagbark.

Humphrey Marshall's "Arbustum Americanum" appeared in 1785. He applied trinomial appellations to most of the species, regarding all the true hickories as varieties of *Juglans alba;* indeed he defines no type of it. His *Juglans alba minima* has been referred to the Bitternut Hickory, and no doubt correctly so, although he calls it the Pig Nut, a name even yet applied to it in certain parts of the country. He names also *Juglans Pecan*, the Pecan Nut; the other forms described by him had already received names.

In 1796 the Western Shell-bark Hickory was described as

Juglans sulcata, by Wildenow, in his Berlinische Baumzucht, p. 154, together with several of the other species previously known.

In 1803, Michaux (Flor. Bor. Amer., ii., 192) divided *Juglans* into two sections, the one containing the real walnuts, the other the hickories, but he did not give them even sub-generic names, and described no species additional to those previously recorded.

The younger Michaux's Histoire des Arbres Forestiers de l'Amerique Septentrionale (1810), brought in *Juglans myristicæformis*, the Nutmeg Hickory, and *Juglans aquatica*, the Water Hickory.

We have now reached the time of Rafinesque, and his statement, given at the head of this article, is the first separation of the Hickories from the Walnuts, under a distinct name. Unfortunately the proof of his paper in the Medical Repository was not well read, and *Scoria* was printed for *Hicoria*. There need be no doubt of what was intended. Rafinesque says in his Florula Ludoviciana (1817), p. 109, "My name, *Hicorius*, long ago proposed, contains all the species of *Juglans*, which have trifid male flowers (instead of six-cleft), generally tetrandrous, and fruits with angular and quadrifid shells." He then characterizes two species, both of which were already known.

The next important phase in the history of the genus was the introduction of the generic name *Carya*, by Thomas Nuttall, in his Genera of North American Plants, published in 1818. Quite ignoring Rafinesque, he publishes the genus as containing species of *Juglans* of Linnæus and Willdenow, gives a list of nine species without their equivalents and with descriptions of three only, yet, inasmuch as many of his specimens are preserved, he is generally cited as author of the binomials. This injustice did not pass without a protest on the part of Rafinesque, for in the very next year he remarks as follows, in "Journal de Physique," &c., p. 260 (Vol. lxxxix., 1819): "*Hicorius*, Raf. Obs. Fl. Ludov., 1817, a été changé sans cause en *Carya*, N., nom posterieur radical et tres-mauvais." It is remarkable that he does not here refer to his publication in the Medical Repository nine years before. But the next statement that Rafinesque made, regarding the genus (Alsographia Americana, 1838, p. 65), makes evident what he had then intended. He says under the caption :

Hicoria or Hickory Trees.

"*Hicoria*, Raf., 1808. *Carya*, Nuttall, 1818, &c. As early as 1804 I proposed to separate the Hickories from the Walnuts, to which Muhlenberg objected. I did so in 1808, in my remarks on Michaux's Flora, and again in 1817, in my Florula Ludoviciana, giving the almost Grecian name of *Hicoria;* yet Nuttall changed it in 1818 (without mentioning my labor) into *Carya*, which merely means nut, and is as bad a name as that of *Nux*, given by Adanson to *Juglans* * * * ; some botanists have, however, adopted this bad name, but it is hoped will have no objection to my previous modification of it when they may know of my previous claim." Then follows a division of the genus into four sub-genera, under which species are mentioned without descriptions or equivalents. He also proposes three new species, all of which were previously known. It will be noticed that Rafinesque here refers to his remarks in 1808, on Michaux's Flora; these I have have hitherto been unable to find, unless he is alluding to the Medical Repository paper, which makes mention of Michaux's book, but his spelling of *Hicoria* in 1838, and reference to his former statements, leave no doubt of what he intended for the orthography of what the printer made *Scoria*. It is very strange that the misprint was never alluded to by the author.

In 1853 Major John LeConte described what he considered a new species of Pecan Nut, in the Proceedings of the Philadelphia Academy, of that year, p. 402. He remarks: "This species of *Hickorea*, which I found cultivated in Georgia, is a native of the State of Texas. * * * I have adopted Mr. Rafinesque's name *Hickorea* for the genus in preference to Mr. Nuttall's *Carya* on the ground of priority. Whatever may have been the errors or aberrations of Rafinesque, Nuttall was not justified in changing a name proposed by the former years before any publication of his own." He then describes *Hickorea Texana*, which Prof. Sargent has reduced to the common Pecan. I have not seen it.

In 1862, Casimir DeCandolle published a memoir on the Juglandeæ in Annales des Sciénces Naturales, (IV.), xviii., 33, where he described *Carya Texana* as a new species based on a specimen collected by Charles Wright in Eastern Texas, but in his subsequent monograph of the order for the Prodromus (Vol.

xvi., 2nd part, p. 145) he regards it as a doubtful species. This I have not seen.

The latest addition to the species is to be found in Hemsley's Botany of Central America, (Vol. iii., p. 162) published in 1883, where *Carya Mexicana*, Engelm., is described from Dr. Engel-
5 mann's manuscript, based on Parry and Palmer, No. 834½ from mountains near San Luis Potosi, at an altitude of 8,000 feet. After a careful examination of the materials preserved in the Philadelphia, Washington, Easton and New York Herbaria, I have not been able to reduce any of the species found in recent writings. I would, however, arrange them a little differently than has hitherto been done in order to bring out more natural alliances. It is a very perplexing genus, and I am not sure that any arrangement would be wholly satisfactory. The salient characters of one species are liable to appear in others, sometimes with considerable prominence, rendering it troublesome to refer certain individuals even when they are well known. Single herbarium specimens are, naturally, even more perplexing. My present notion of them is as follows:

(A.) Subgenus PACANIA, Raf., Alsogr. Amer., p. 65. Nut cylindical or oval, smooth, two-celled; staminate catkins in lateral, nearly sessile fascicles at the summit of shoots of the preceding year.

(1.) H. PECAN (Marsh.) (*Juglans Pecan*, Marsh., Arb. Amer., p. 69; (1785); *Juglans olivæformis*, Michx., Fl. Bor. Amer., ii., 192; (1803); *Carya olivæformis*, Nutt.)

(1a.) *H. Texana*, LeConte, Proc. Phila. Acad., 1853, p. 402. I am not at all satisfied that this can certainly be referred to the ordinary Pecan. There appear to be no specimens extant to illustrate the description, but the characters given would indicate that this may very well be a different species or variety, and this supposition is strengthened by the statement that the leaves of the Pecan are fully formed before those of the tree in question show the least sign of unfolding.

(B.) Subgenus EUHICORIA. Nut more or less compressed (except in the last species), ovate, obovate, oval, or nearly globular; staminate catkins in threes on a common peduncle at the bases of shoots of the season.

*Involucre of the fruit very thick, splitting freely nearly or quite to the base; middle lobe of the staminate calyx at least twice as long as the two lateral broader ones; seed sweet and delicious; nut ridged and angular.

†Leaflets 5; bark shaggy.

(2.) H. OVATA (Mill). (*Juglans ovata*, Mill., Gard. Dict., No. 6, (1759); *Juglans alba*, Michx., Flor. Bor. Amer., ii., 193, (1803), not Linnæus; *Carya alba*, Nutt.)

(3.) H. MEXICANA (Engelm.) *Carya Mexicana*, Engelm., in Hemsley, Bot. Cent. Amer., iii.. 162). This I place here provissionally, suspecting it to belong to this group, but staminate catkins have not been described.

††Leaflets 7 to 9; (rarely, some leaves produce 5.)

‡Bark close, foliage very pubescent and odorous.

(4.) H. ALBA (L.). *Juglans alba*, L., Sp. Plant., p. 997, (1753); *Juglans tomentosa*, Lam., Encyc. Meth., iv., 504, (1797); *Carya tomentosa*, Nutt. Dr. Torrey has described a var. *integrifolia* of this species in Bot. New York, ii., p. 182, t. 100, characterized as having nearly entire leaflets and smaller fruit. I have not seen any specimens with as entire leaflets as those figured.

Var. MAXIMA, (Nutt.). (*Carya alba*, Nutt., var. *maxima*, Nutt., Genera. ii., 221, has fruit twice the ordinary size. Rafinesque called it *H. maxima*. (Alsog., l. c.)

‡‡Bark shaggy; foliage puberulent.

(5.) H. SULCATA, (Willd.). *Juglans sulcata*, Willd.,* Berl. Baumzucht, p. 154, t. 7, 1796; *Carya sulcata*, Nutt. Besides the eastern stations reported for this tree we can add from Professor Porter's Herbarium, Alexandria, Huntingdon County, and Sellersville, Bucks County, Penn.

**Involucre of the fruit thin, not splitting freely to the base; lobes † of the staminate calyx nearly equal in length, the lateral ones broader; bark close.

†Nut compressed-globular, or compressed-pyriform, smooth or slightly ridged.

‡Nut small, thin-shelled; leaflets 5 to 7. smooth.

(6.) H. MICROCARPA (Nutt.) *Carya microcarpa*, Nutt., Genera, ii., p. 221.) This must be regarded as a very critical

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*Casimir DeCandolle cites Duhamel as author of this name, but I have not been able to find it in his writings. If he did describe the tree it was probably before Willdenow's book was published.

†In *H. microcarpa* the middle lobe is sometimes considerably longer than the lateral ones.

species; excepting its thinner-shelled, generally smaller nut, I have been entirely unable to distinguish characters which will always separate it from the next. Professor Sargent has united it with the Eastern Shagbark, referring to it in the Forestry Report of the 10th Census, p. 133, as "a form with small, thin shelled nuts." I am very confident that its alliance is not with *H. ovata*. The mistake may have arisen from the fact that in the Herbarium of the Philadelphia Academy, a label of Nuttall's has been misplaced and pasted alongside of a flowering twig of *H. ovata*. But his original description, his authentic fruiting specimens both at Philadelphia and Kew, and the figure of the plant in his Sylva, prove that its affinities are not with the Shagbarks, but rather as I have placed it.

‡‡Nut larger, thick-shelled; leaflets 5 to 9.

(7.) H. GLABRA (Mill). (*Juglans glabra*, Mill., Gard. Dict., No. 5, (1759); *Juglans porcina*, Michx. f., Hist. Arbres Amer., i., 206, t. 9, (1810); *Carya glabra*, Torr.; *Carya porcina*, Nutt.) The size of the nut is given in Gray's Manual. (p. 449), at from 1½ to 2 inches long. While they do actually grow as large as this in the Southern States, the more correct figures for those of New York and the Middle States generally is not more than half these dimensions.

‡‡‡Nut smooth, very thin-shelled, with a very bitter seed; leaflets 7 to 9, ovate lanceolate, minutely glandular, pubescent beneath.

(8.). H. MINIMA (Marsh). *Juglans alba minima*, Marsh., Arb. Amer., p. 68, (1785); *Juglans amara*, Michx., f., Hist. Arbres Amer., i., 177, t. 4, (1810); *Carya amara*, Nutt.) The name *minima* applied by Marshall evidently refers to the size of the leaflets, which, as a general thing, are smaller at maturity than those of any other Northern species.

‡‡‡‡Nut thin-shelled, angular; seed bitter; leaflets 7 to 13, lanceolate-acuminate, somewhat falcate and inequilateral, slightly pubescent below.

(9.) H. AQUATICA, (Michx., f.) (*Juglans aquatica*, Michx., f., Hist. Arbres Amer., i., 182, t. 5; *Carya aquatica*, Nutt.) The northward range of this species may now be increased to Mob Jack Bay, Virginia, (Leggett.)

††Nut ovoid, smooth, extremely thick-shelled.

(10.) H. MYRISTICÆFORMIS, (Michx., f.) *Juglans myristi-*

cæformis, Michx., f., Hist. Arbres Amer., i., 211, t. 10; *Carya myristicæformis*, Nutt.)

With *Carya Texana*, C. DC., Ann. Sci. Nat. (IV), xviii., 33, I am entirely unacquainted.

The Herbaria are not without indications of additional forms to those I have been able to separate. Noteworthy among these is a specimen collected by Mr. Curtiss at Lookout Mountain, Tenn., and preserved in the National Herbarium. It is in fruit, and belongs, I suspect, to the group with thin husks. The fruit is oblong, an inch in length and strongly four-winged by the projecting edges of the involucre valves. The leaflets are uniformly seven, ovate-lanceolate, acuminate, and remarkably pale beneath, in which character it differs from all the species I know. There is a slight amount of pubescence on the rachis and midveins.

In the mountains of Sussex County, New Jersey, there occurs a form of *H. glabra*, which has more or less pubescence on the lower surfaces of the leaves, and particularly on the rachis at the base of the leaflets.

Bibliographical Notes on well known Plants.—IX.

By Edward L. Greene.

Unifolium.

I have recently, in a single short paragraph,* called attention to this, that neither the name *Smilacina*, which still holds place in our American books, nor *Tovaria*, adopted by Mr. Baker in his late comprehensive revision of the genus, is the lawful generic name of our stellate-flowered kinds of Solomon's Seal.

In the paragraph alluded to I suggested that *Polygonastrum*, Moench, must be older than *Smilacina*, Desf., and so it is; yet even Moench's name is three years later than *Tovaria*, Necker. Dr. Gray, who took exception to the use of *Tovaria* here, did so on the ground that, long before Necker, Adanson had framed the name *Tovara* for a certain ambiguous Polygonaceous type. But that which must more positively and indeed quite unquestionably displace *Tovaria*, as well as *Smilacina*, is the fact that Adanson himself recognized the genus and gave it the name *Vagnera*; so that this is older than *Tovaria* by twenty-seven

*Pittonia, i., 187.

years, and the latter is itself seventeen years older than *Smilacina.* There have been very few botanists of any note, since Linnæus, who were able to accept the Linnæan doctrine that *Polygonatum* and *Convallaria,* together with the plants now under consideration, are all of one genus; but the efforts of a number of authors to distinguish and separate them have resulted in a superfluity of generic names; for Mœnch seems to have ignored the work of Adanson, Desfontaines that of Mœnch and of Necker, while still later Rafinesque, with his pretty name, *Sigillaria,* would have superseded the other three. As for pre-Linnæan authorities, Tournefort and Boerhaave, while distinguishing our plants from *Polygonatum,* confound them with *Smilax,* whence Desfontaines took his suggestion of the name *Smilacina;* and the Linnæan view, that they are all phases of *Convallaria,* is one which Linnæus adopted from another set of earlier writers.

If our genus be limited to those species which have hexamerous flowers, and that is Adanson's position, *Vagnera* is clearly the name it will have to take. If, on the other hand, the two or three tetramerous species are to be included, *Vagnera* must yield to a still more ancient name, one which, although in use in the sixteenth and seventeenth centuries, is, by virtue of Adanson's adoption of it, rendered valid as a post-Linnæan name; that is *Unifolium,* and its priority over *Vagnera* is of place, not of time.

The following, then, appear to be the generic names and their dates; and the choice, it will be seen, lies between the two given by Adanson, if we admit but one genus; both of them being available, and obligatory on us if two genera be allowed.

Unifolium (Brunfels, 1530; Bock, 1552; Dodoens, 1583; Dillen, 1719; Haller, 1742), Adanson, Fam. ii. 54, 1763: *Maianthemum,* Weber, Prim. Fl. Holsat. 1780: *Evallaria,* Necker, Elem. iii. 147, 1790: species of *Convallaria,* Linn., Crantz, Miller, *et al.,* of *Smilax,* Tourn., Boerh., *et al.*

Vagnera, Adanson, Fam. ii. 496, 1763: *Tovaria,* Necker, Elem. iii. 190, 1790; *Polygonastrum,* Mœnch, Meth. 637, 1794: *Smilacina,* Desf. Ann. Mus. Par., 1807: species of *Convallaria,* Linn., Crantz, *et al.,* of *Smilax,* Tourn., *et al.*

My view, which is that of the many botanists who have considered that the tetramerous species here sustain the same relation to the hexamerous which exists between tetramerous and pentamerous or hexamerous species in many other genera of plants, assigns to the familiar northern species the following names:

UNIFOLIUM CANADENSE—*Maianthemum Canadense*, Desf.
UNIFOLIUM BIFOLIUM—*Convallaria bifolia*, Linn.
UNIFOLIUM TRIFOLIUM—*Convallaria trifolia*, Linn.
UNIFOLIUM STELLATUM—*Convallaria stellata*, Linn.
UNIFOLIUM SESSILIFOLIUM—*Smilacina sessilifolia*, Nutt.
UNIFOLIUM AMPLEXICAULE—*Smilacina amplexicaulis*, Nutt.

The name *Unifolium* seems as if it should indicate one-leaved plants, but there is no species of the genus which has strictly that character. The very type is two-leaved, and the other species bear three or more leaves to every stalk. Whence, then, this name? Dillen, who is but one of a long line of authors who adopted it, informs us* that it was suggested by the solitary leaf which, in the original species, comes up from the rootstock apart from the two-leaved proper stem. None of the many-leaved species display any such separate solitary leaf; but that failure can no more invalidate the name *Unifolium* than our considerable group of West American clovers, with leaflets numbering from five to nine instead of the usual three, can require a new and more strictly applicable name in the place of *Trifolium*.

On the Opening of Stomata.

It is a well-known fact that the stomata on the leaves and other organs of plants are found open at one time and closed at another; that they are open ordinarily when the plant is wet, closed when its moisture is largely withdrawn; and that the property of opening and closing is lost with the activity of the guard-cells.

Various hypotheses have been called in to explain the causes, as well as the manner, of this opening and closing. The one generally admitted at the present day is that of Schwendener.†

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*Nova Plantarum Genera, p. 138.

† Ueber Bau und Mechanic der Spaltœffnungen. Monatsberichte der Academie der Wissenschaften zu Berlin, 1881, p. 883.

The following, based on Schwendener's work, may serve the student in better understanding the theory.

Leaving out of consideration, for a moment, the force which does the work, and turning to the structure of stomata, we find that, at least for a great part of the ordinary flowering plants, the stoma of *Tradescantia discolor* may be regarded as a fair representative. In this species each guard-cell, in cross-section, is seen to have a somewhat triangular cell-lumen (see fig. 1 a), one of the apices pointing towards the other guard-cell. Its walls along the slit of the stoma are much thickened, the thickenings consisting of two parallel bars, one above and one below, leaving between them a narrow line of thin cell-wall corresponding, in position, to the apex of the triangle formed by the cell-lumen. The posterior wall, or that away from the slit, is thin

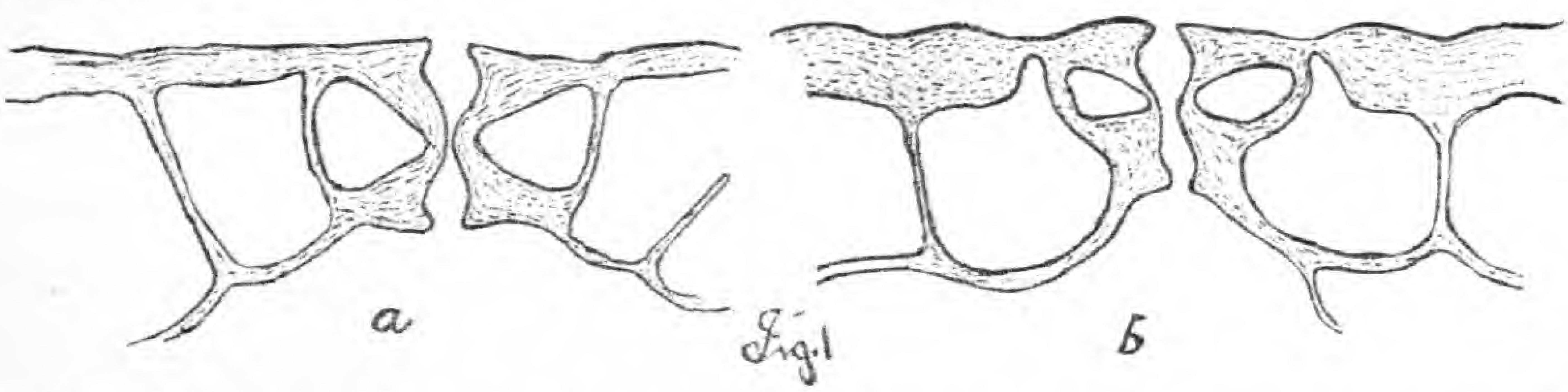


Fig. 1

and uniform, while the upper and lower walls are triangular in cross-section, thickest near the slit, and becoming thinner towards the side away from this. Looking down on such a cell it is seen that these bar-like thickenings are uniform for the whole length of the slit, but are thinner at each end where the two guard-cells meet. Moreover, it will be noticed, in the stoma of *Prunus*, for example (see fig. 1 b), that the outer wall of the epidermal cells, elsewhere quite thick, has a thin place close to its junction with the guard-cell. This thin place is seen as a line from above, and permits a free movement of the guard-cell, like a hinge, which otherwise, owing to the rigidity of the outer epidermal wall, could not take place. Since the other connections of the guard-cell with the cells of the epidermis are formed by thin, easily bent walls, we may regard the guard-cell as a tube fastened at both ends to another tube like itself, but otherwise free to move.

Before trying to explain the manner in which the force is supposed to act, it is well to consider some of the properties of the material of which cell-walls are made.

If we take two pieces of bast (which is nearly pure cellulose), one twice as thick as the other, suspend them, and hang weights at their free ends, we find that these pieces resist a very considerable stretching force. If we continue to add weights, a point is reached where even the thicker piece will become appreciably longer than it was before. If the weight on both pieces is the same, the thinner piece elongates twice as much as the thick piece, showing that this substance resists such a force in direct proportion to the thickness of the pieces. When each of the two pieces has attained its new length it is at rest, and the thin piece stretched to its new length equilibrates the thick piece in its less elongated condition. If now we take such a piece of bast, say only ten times as long as thick, we find that a very small force suffices to bend it to a slight extent, such as is the case in the guard-cells when the stoma is opened. Not that bending and stretching are different in their nature, but it is because a very slight stretching on one side, and a corresponding slight compression on the other, differing, of course, with the relative thickness of the piece, is sufficient to permit such slight bending. We see, therefore, that a small part of the force necessary to stretch the bast through a considerable distance is enough to bend it through a very considerable arc. To illustrate: A strand of *Dracæna* bast, one millimeter in cross-section, is not stretched beyond the limit of perfect recovery, or elasticity, by anything less than a weight of seventeen kilogrammes, while to bend such a thread of about ten millimeters length a very small part of one kilogramme would be sufficient.

Suppose now that we have a tube made up of such bast-like, or cellulose, material, and let its wall be of equal thickness throughout. If this tube is filled with liquid under a high pressure it will become distended, quite firm and rigid, but it will have no tendency to bend in any direction, since its wall will be stretched equally throughout. If, on the other hand, the wall is not of equal thickness, but is thickest on one side and thinnest on the side opposite, the thickness varying gradually between these extremes, this wall can not be stretched equally by a hydrostatic pressure from within, since this power is the same on all sides, and the wall, like the pieces of bast, will be stretched in its different parts inversely to its thickness in these parts. In figure 2 let A A_1 be a part of the thick side, and B B_1 a part of the thin side, so that when the tube is empty A B and A_1 B_1 are parallel lines, and at right angles to the central axis C C_1. If the wall at A is twice as thick as at B, and A A_1 be elongated by a water pressure to a a_1, B B_1 will be elongated twice as much, or to b b_1, and the lines a b and a_1 b_1 will no longer be at right angles to C C_1. But not only will the wall strive, in opposition to the pressure, to regain its former dimensions, but also the relative position of its parts. To regain the former is not possible as long as the pressure lasts; to regain the latter, only the rigidity of the walls has to be overcome. This disturbance of the relative position of the parts which manifests itself in the unequal stretching, is in direct proportion to the pressure. If we let this latter be represented by the line a b, that part which will tend to bring a and b into a line at right angles to C C_1 can be represented by b d, where a d b is a right angled triangle. Since the thickness of the wall varies gradually from one side to the other, the same reasoning applies to all parts of the wall between A A_1 and B B_1, and since A A_1 B B_1 is any part of the tube, it must apply to the whole tube. But in order that all such lines as a b can arrange themselves at right angles to C C_1, or nearly so, it is necessary that C C_1 become a curve, and since B B_1 elongates more than A A_1, the former must lie on the longer periphery; in other words, the tube must bend, and its concave side is the side of the thicker wall. To illustrate this take a rubber tube 5 mm. thick and 60 mm. long, fit into one end a closed glass tube for a stopper, into the other end an open glass tube, pointed at one end to enter the small rubber tube, otherwise considerably larger, to fit a larger rubber tube or bulb. Fill this apparatus with water and apply pressure. The tube will be slightly dilated but will not bend. Take out the small rubber tube, push a glass rod through it, and shave one side of the free portion of the tube. Rearrange the apparatus and again apply

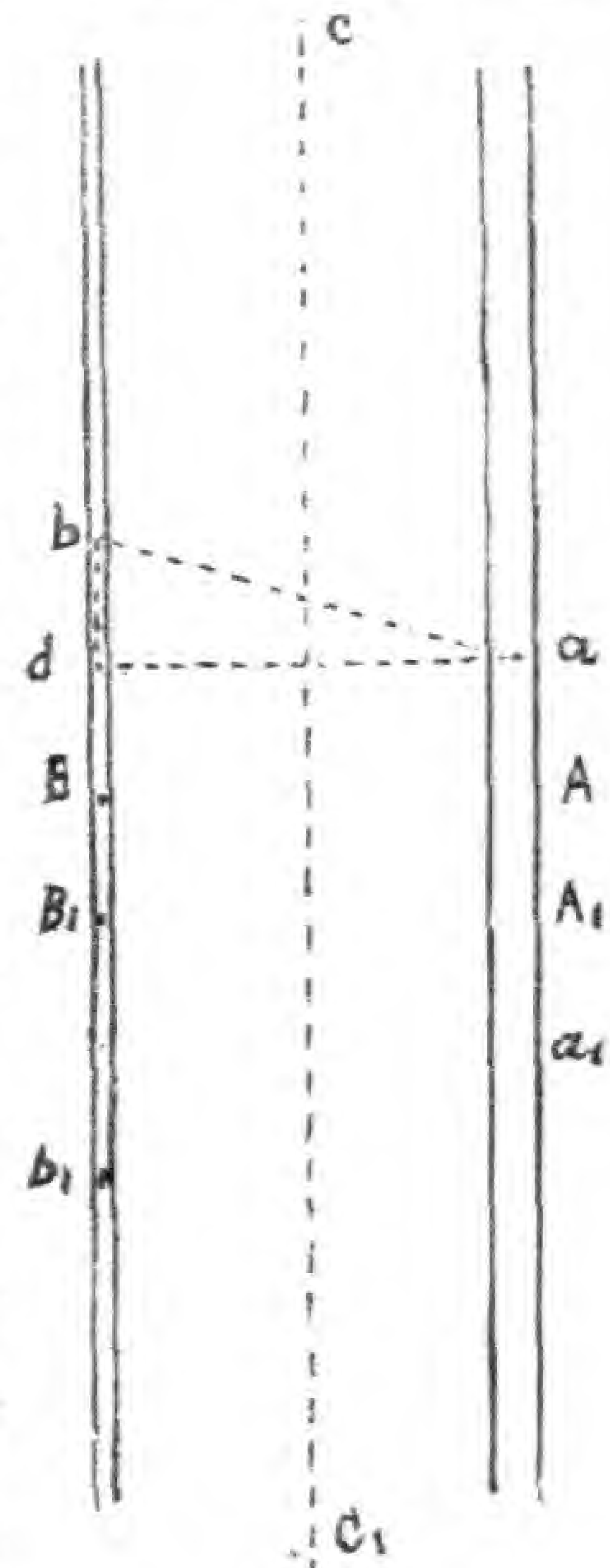


Fig 2

the pressure on the large tube or bulb, and the small tube will be seen to bend quite readily. The more pressure is applied, the more it bends.

Returning to our guard-cell we can at once apply all that we have found to hold in the case of the rubber tube. Furthermore, since both cells share in the movement, a very slight amount of bending suffices to produce the desired opening. When a stoma opens or closes scarcely any change of form, other than a slight bending, is noticed in the guard-cells. We might expect this, as the force will tend to bend the tube just as soon as the stretching begins, and since this begins—theoretically, at least—in the very beginning of the application of power, the bending also begins at that time.

Besides the peculiar thickening of the walls of one side of the guard-cell, it has been noticed also by the same author that many guard-cells are suspended in such a way that the thin posterior walls stand obliquely to the surface (see fig. 3). On being distended this wall is crowded out and becomes uniformly curved, causing the base of the cell, movable on account of the thin cell-wall between the upper and lower thickening, to recede from the other guard-cell.

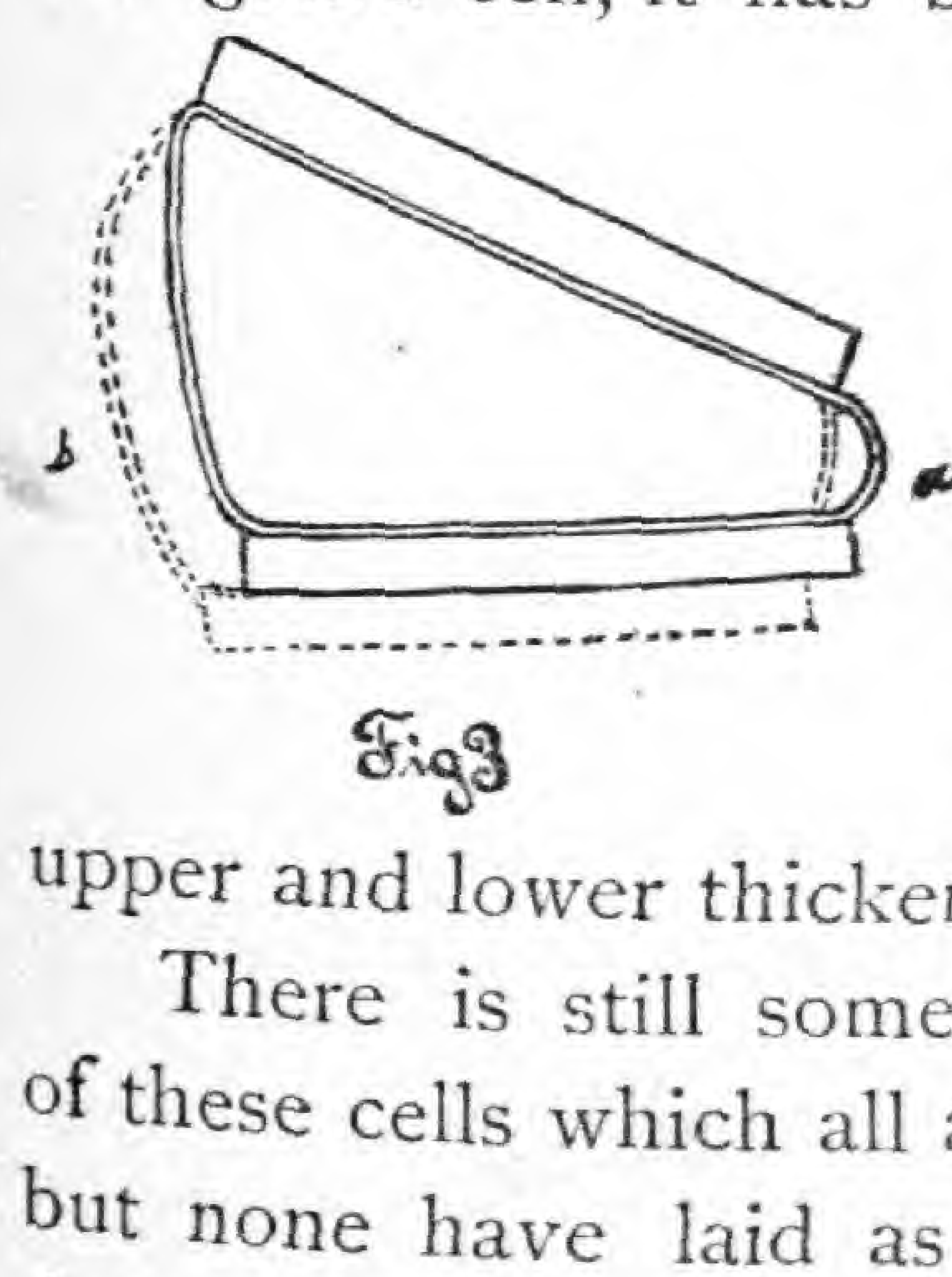


Fig 3

There is still something in the structure of these cells which all authors have observed, but none have laid as much stress on as it deserves. It is the above mentioned fact that the thickenings extend only along the opening rapidly, often suddenly, giving place to a thin cell-wall at the ends where the two guard-cells are united, and also that the thickenings of each cell are independent and do not unite with those of the other cell. Let figure 4 represent a tube, and A any point along the thin end, B a point on the thick part of the wall. Then if a pressure causes B to move to B_1, it will cause A to move through a greater distance, say to A_1, for if the wall is assumed

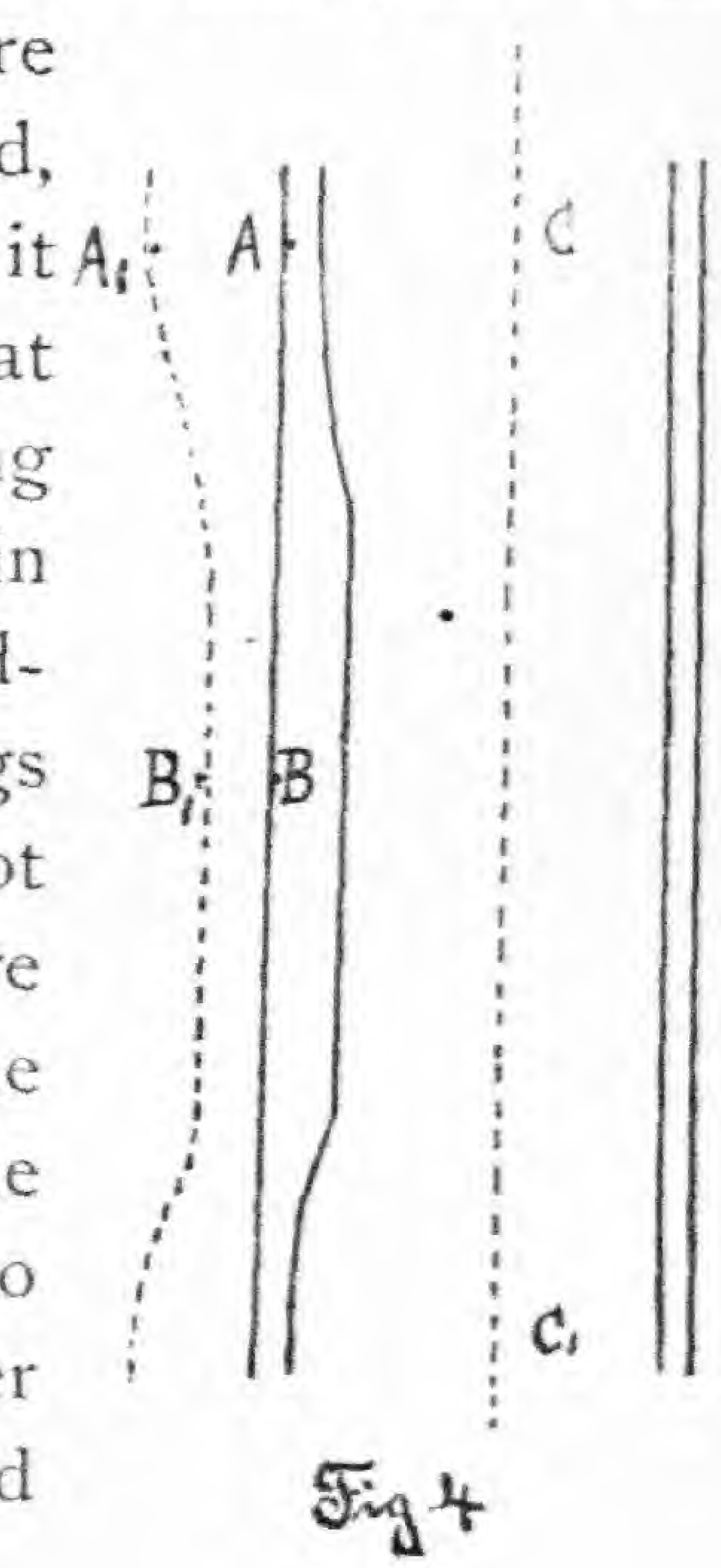


Fig 4

to be twice as thick at B as at A, it is evident that A will move twice as far from a central axis, C C_1, as B. But this causes the line on which A and B are situated to change from a straight line to a curved one. If two such tubes join each other it will leave an opening between them.

As regards the force here employed, the opinion of the best authorities, including Pfeffer, is in agreement on the two principal points :

1.—That the force is a very considerable one, often amounting to several atmospheres ; and

2.—That it is due to the presence of materials in the cell-lumen of the guard-cell which have the capacity to absorb moisture, and thus take it from the neighboring epidermal cells, while its exit is prevented by the protoplasm lining the cell-wall. In this way the cell becomes very turgid, and this turgescence answers to the artificially supplied hydrostatic pressure in the rubber tube. In a manner too well known to justify its exposition in this connection, it is found that a power equal to five atmospheres sometimes exists in the cell-lumen of plants.

FILIBERT ROTH.

Botanical Laboratory of the University of Michigan, July, 1888.

EXPLANATION OF FIGURES.

Fig. 1-a.—Stoma of *Tradescantia discolor*.
Fig. 1-b.—*Prunus Laurocerasus*.
Fig. 2.— Scheme to illustrate bending of a tube with unequal thickness of wall.
Fig. 3.— Scheme of a guard-cell which projects when at rest. The dotted line indicates the same when opened ; a—anterior and b—interior side.
Fig. 4.— Scheme to show bending of bar of unequal thickness. (1 and 3 after Schwendener.

Schweinfurth's Method of Preserving Plants for Herbaria.

H. Schenck* calls the attention of collectors, especially those traveling in the tropics, to a method of preserving plants for the herbarium recommended by Schweinfurth, which he found exceedingly convenient and efficient during his travels in Brazil.

The plants, when collected, are at once put between the sheets of a leather portfolio. On his return from the excursion the collector places the specimens between single sheets of common

*In Bot. Centralbl., vol. xxxv., p. 175.

gray, unsized paper (to be had in every "venda" in Brazil), which are firmly held together between two pieces of stout pasteboard by means of a strap. Then the bundle is set upright into a tin box, and strong sugar cane brandy or common alcohol is poured on the sheets from above, until the paper and the plants are thoroughly moistened and the liquid begins to run off below. The bundle, or bundles, are kept in the tightly covered tin box until a quantity of them has accumulated. Then the straps and boards are removed, the single packages are wrapped up in paper and packed as closely and firmly as possible into a tin box about 60 cm. high, which, finally, is tightly closed by soldering a flat cover to it. Several such boxes are packed into a wooden case for shipping. Some small tin boxes ought to be taken along on more extended excursions.

The preservation of plants after this method requires very little time (an advantage of the utmost importance for a traveler), for it is not necessary to arrange the specimens carefully between the sheets. The plants stay in good order, soft, pliable and moist, for years, and may be dried for the herbarium at the collector's convenience, after his return from his travels. They also remain in good condition for anatomical examination, and all kinds of flowers, as well as thick-leaved plants—like many species of Orchids, Cactaceæ, etc.—will arrive at home in excellent order. Besides, plants may be collected and placed between the sheets in rainy weather.

J. SCHRENK.

On two Species of Gramineæ.

SPOROBOLUS CONFUSUS (Fourn.). That species of *Sporobolus* which has been, with us, called *S. ramulosus*, very common at the West, is not the species of Kunth, which is described and figured in Humboldt and Bonpland's "New Genera and Species of Plants," as *Vilfa ramulosa*. This fact is observed in Fournier's Mexican Gramineæ, page 101, where he mentions our plant and calls it *Vilfa confusa*, and, remarks correctly, that it differs from *Vilfa ramulosa* in its long, linear, flexuous pedicels, with an obconic thickening under the flower; not with short, rigid, divaricate, equally thickened pedicels. As the genus *Vilfa* is now conjoined with *Sporobolus*, our species must be called *S.*

confusus. The true *Sporobolus ramulosus* has not yet been collected within our limits, but it is probably identical with *S. racemosus*, Vasey, collected by Dr. Palmer, and No. 1425 of Pringle, both from Chihuahua, Mexico.

MELICA SMITHII (Porter). I recently received from Prof. W. J. Beal, specimens of *Avena Smithii*, Porter, collected in Northern Michigan. I had long suspected the proper reference of this grass to *Avena*; and these specimens enabled me to make a satisfactory examination, which resulted in the opinion that it should be placed in the genus *Melica*, and therefore *M. Smithii*. It will be observed that in Prof. Porter's description it is stated that the flowers are not hairy-tufted at the base, and the awn is straight, characters which chiefly distinguish *Melica* from *Avena*. The species is very near *Melica aristata*, Thurb.

GEO. VASEY.

Notes on Some Rare Grasses.

The writer, on a recent visit to the West, spent some time at Garden City, in western Kansas. This place is located on the north bank of the Arkansas River. On the south side of the river is a range of sand hills which, the people say, were some years ago bare of vegetation and composed of loose and shifting sand, but which of late years have been gradually acquiring a covering of grass. I went to investigate these ridges or hills and found that the principal vegetation was made up of two kinds of grass, which were deeply rooted in the sand.

One of these was *Andropogon Hallii*, very similar to *A. provincialis*, but with thicker spikes and culms, and more succulent, bluish-green leaves. The other grass was, to my great gratification, *Redfieldia flexuosa*, growing rather sparsely from deep rooted creeping rhizomas, and serving to bind the sand together in the same way that *Ammophila longifolia* binds the sand dunes on the lake shore near Chicago. The history of this grass is interesting. It appears to have been first collected by Dr. J. M. Bigelow on the Canadian River. Next it was collected by Mr. Elisha Hall, in 1862, probably on the Republican River, although the locality is not recorded. The grasses of Mr. Hall's collection were elaborated by Prof. Thurber, and this grass was then described and named, doubtfully, as *Graphephorum flexuosum*. Next, a few specimens were collected by Rothrock and Wolf, on Wheeler's Exploration, in the San Luis Valley, Colorado, in 1873. From these sources were obtained all the specimens of which I have knowledge in existing herbaria. I have been for years past hoping that it would again be found, and its rediscovery at Garden City is therefore very satisfactory. Here it is in abundance. Probably it is common enough in similar situations at many points on the Canadian and Arkansas rivers. The leaves are thick and rigid, channelled and terminating in long, involute points. It should hereafter become well known to botanists.

Confusion has sometimes occurred as to the distinction between *Sporobolus cuspidatus* and *S. depauperatus*, (*Vilfa*, Torr.). I found abundance of the former on the prairies of Dakota. It grows in strong tufts, with *erect* culms and *appressed* leaves, and a long, slender panicle, and approaches *Muhlenbergia Wrightii;* indeed, it belongs rather to *Muhlenbergia* than to *Sporobolus*. *S. depauperatus* is a species of the Rocky Mountains, with decumbent culms, shorter panicle, and glumes wanting the long cuspidate point.

GEO. VASEY.

Index to Recent American Botanical Literature.

American Woods, exhibited by actual specimens and with copious explanatory text.—Romeyn B. Hough, B.A., Part I., *Representing twenty-five species by twenty-seven sets of sections.*

This very neat and interesting collection will be a welcome surprise to those who are not already familar with Mr. Hough's beautiful wood-sections, and the accompanying pamphlet, with many illustrations supplemented by a glossary and descriptions of species, makes a complete little text-book. A novel feature will be noted in finding three keys, one based upon the flowers, one upon the leaves and a third upon the fruit, so that having either, a novice may find his way made easy to determine the specimen.

August in the pines.—Mary Treat. (Garden and Forest, i., 362.)

Botanizing tour in the South.—Gerald McCarthy. (Vick's Ill. Monthly, pp. 295-297, illustrated.)

This proves to be an interesting account of Asheville, the

French Broad and the Swannanoa, with pretty views and popular references to the plants collected.

Black Rot en Amerique—Le Traitement du.—M. P. Viala. (Extrait du Progres Agricole et Viticole.)

Salts of copper have been found efficacious in experiments made at Vineland, N. J., by A. W. Pearson. The treatment met with great success, as only ten to fifteen per cent., instead of ninety-five per cent., of the fruit was lost.

Calostoma, Desv.—A. Monograph of the Genus.—George Massee. (Annals of Bot., ii., 25-45, one plate ; also reprinted.)

The generic name antedates *Mitremyces,* Nees, under which most of the species have been described. The American species recognized are *C. cinnabarinum,* Desv., and *C. Ravenelii* (Berk.), Mass. The development and structure of the former are well illustrated.

Catalogue of Canadian Plants, Part IV.—John Macoun. (8vo., pp. 248, Montreal, 1888.)

This part is devoted to the Endogens, numbering seven hundred and forty-seven species. The genera and orders are arranged in accordance with Bentham & Hooker's Genera Plantarum. As in the preceding parts, this is beautifully printed, the only serious blunder in that line we have noticed being on page 9, where all except the final letter of *Goodyera* have slipped in the presses, and a curious result been attained. The system of nomenclature adopted is that of Gray's Manual, except in *Disporum,* where Mr. Macoun has followed the practice of some zoologists of citing the author of the earliest specific name as author of the accepted binomial, which is a good deal better than the plan current in this country, but certainly open to the objection that it falsifies the record. Mr. Macoun notes that *Luzula* seems to be in great confusion, and needs complete revision, in which we are disposed to agree with him, although a bringing together of scattered observations is probably what is needed. *Potamogeton Claytoni,* Tuckerm., is antedated by *P. Pennsylvanicus,* Cham., and *P. lonchites,* Tuckerm,, by *P. fluitans* L., as has already been shown. I credited *Cyperus flavescens* to Canada on a specimen from Niagara, from Herb. Leggett, marked "Niagara, Canadian side." *Eleocharis obtusa*, Schultes, is antedated by *E. ovata*. *Scirpus polyphyllus*, Vahl., is referred to *S. atrovirens*, Muhl., a reduction which we cannot approve, for these are certainly very distinct; if they could be regarded as con-specific, Vahl's name is much the older. In *Carex* several new varieties, and *C. albata* are given by Prof. L. H. Bailey. *Scirpus riparius*, Spreng., is probably *S. cernuus*, Vahl., which leaves *S. riparius*, Presl, to replace *S. Tatora*. The question of *Oryzopsis cuspidata*, Scrib., brought up at Cleveland, is added to by referring it to *O. cuspidata*, Benth., Journ. Linn. Soc., xix., 82, but an inspection of that page does not reveal the name. Of course it ought to be *O. membranacea*. Dr. Vasey contributes several new varieties of grasses, and Mr. Macoun names two species of *Deyeuxia*—*D. Columbiana* and *D. borealis*, the latter of which he says is the same as Dr. Vasey's *D. Vancouverensis*,* with whose permission he changes the older name to *D. borealis*—and *Elymus Columbiana*. This great work of Mr. Macoun and his colleagues must give a decided impetus to the study of natural science in the Dominion. We need a similar catalogue for the United States. Why cannot our Government botanists give us such a publication, based on a rational system of nomenclature?

N. L. B.

Catalogue of the Flora of Vermont.—George H. Perkins. (Large 8vo, pp. 74, Burlington, 1888; from the 10th Report of the State Board of Agriculture.)

Local catalogues have been issued in quick succession during the present autumn, and they indicate a very satisfactory state of activity among our systematic botanists. The present one is in a measure a revision of the author's previous essay in the same field in 1882. It includes Anthophyta and Pteridophyta, 1,360 species and varieties in all. The Gymnospermæ are placed in their proper position at the end of the Anthophyta. Localities for the rarer species are given.

Ceanothus—Synoptical List of North American Species. Wm. Trelease. (Proc. Calif. Acad. Sci., 2d Series, i., 106-118, reprinted.)

*This Journal, Vol. xv., p. 48.

A recast of the genus, with descriptions of *C. Palmeri*, from Southern California (E. Palmer, 1875, No. 42), *C. Parryi*, described from specimens cultivated at Calistoga, Cal., collected by Dr. Parry under No. 33, in 1881, and *C. impressus* from Santa Barbara County, Cal. *C. eglandulosus* is *C. divaricatus*, var. *eglandulosus*, Torrey, and *C. parvifolius* is *C. integerrimus*, var. *parvifolius*, Watson. *C. floribundus*, Hook., and *C. Lobbianus*, Hook., are provisionally referred to *C. dentatus*, T. and G., as sub-species, a rank, which we venture to hope, Professor Trelease will not maintain in his final treatment of the genus. Thirty-two species are recognized, twenty-five of them Euceanothus, the remaining seven forming the section Cerastes, having the fruiting carpels each with a dorsal horn. N. L. B.

Forest Conditions of the Rocky Mountains, and other papers. (Dept. of Agric., Forestry Div., Bull., No. 2, p. 252, with accompanying map.)

Of these papers the one purely botanical is on the Forest Flora of the Rocky Mountain Region, by George B. Sudworth, containing an analytical key, and descriptions of eighty-eight species of trees and a list of shrubs. To those more interested in the economic questions which are assuming such serious dimensions in our forestry administration, this voluminous report will be of great value.

Fresh-water Algæ. Edward S. Burgess. (Amer. Nat., xxii., 669-678.)

How to Study Botany. Dr. T. J. W. Burgess. Read before the Hamilton Association, Ontario, May 10, 1888.

Lista de las Plantas encontradas hasta ahora en Costa Rica y en los Territorios limitrofes, extractada de la Biologia Centrali Americana. A. Alfaro. (*Anales del Museo Nacional de la Republica de Costa Rica,* 3d Part, 4to, pp. 101, 1887.)

A list culled from Mr. Hemsley's Central American Botany. 1,218 species are certainly attributed to Costa Rica, while those whose range would indicate that they should grow within the republic increase this number to 3,386.

Lycoperdon Missouriensis—Description of. Wm. Trelease. (Trans. St. Louis Acad. Sci., v., 240, Pl. viii., reprinted.)

New or Noteworthy Species.—III. Edward L. Greene (Pittonia, i., 215–225; advance sheets, Oct., 1888.)

Lupinus malacophyllus; L. ligulatus; Ptelea crenulata (*P. angustifolia*, Brew. & Wats., not Benth.); *Tropidocarpum capparideum; Streptanthus barbiger; Erigeron Sonnei; E. petrophilus; Cacalia Palmeri; Senecio aphanactis* (*S. sylvaticus*, Gray, Bot. Cal., not *L.*); *S. hydrophilus*, var. *Pacificus; Lasthenia conjugens; Campanula aurita; Collomia Rawsoniana; Lycium Hassei; Sonnea foliacea; Phacelia suaveolens; P. Arthuri; Ribes Victoris* and *Epilobium Oreganum* are here described. Prof. Greene points out that *Lupinus variicolor*, Steud., is his *L. Franciscanus* and that *Sedum Pringlei*, S. Wats., and *Calochortus Madrensis*, S. Wats., are synonyms for *S. Forreri*, Greene and *C. venustulus*, Greene respectively.

Nymphæa tuberosa. Garden and Forest, i., 368, figs. 58, 59.) The occurrence of this species of *Castalia*, in a depauperate form at Trenton, New Jersey, detected by C. C. Abbott, adds another species to the local flora. It should be carefully looked for higher up the Delaware.

Oxalis Suksdorfii—Measurements of the Trimorphic Flowers of. W. G. Eliot, Jr., and Prof. Trelease. (Trans. St. Louis Acad. Sci., v., 278-291; reprinted.)

Rhode Island—Native Plants of the Island of. Mrs. J. M. Smith. (Proc. Newport Nat. Hist. Soc., Doc. 6, p. 24.)

A list of nineteen species, additional to former records.

Rhode Island—Plants of, being an enumeration of plants growing without cultivation in the State of Rhode Island. James L. Bennett. (8vo, p. 128, Proc. Providence Franklin Soc., 1888.)

This is a handsomely printed catalogue of plants, comprising 3,158 species and varieties. Localities are noted for the rarer species. In many ways it is a very inconsistent production. The plan of nomenclature taken for the flowering plants is very different from that accepted for the Lichens, Hepaticæ and Algæ. The part devoted to the Fungi is a mere list of names. In the Bryophytes the habitat of species is quite thoroughly indicated, but no attempt is made to do this in other groups. The Anthophytes reach 1,259.

Rhododendron arborescens. (Garden and Forest, i, 400, fig. 64.)

Rhododendron Vaseyi. (Garden and Forest, i, 377, fig. 60.)

Sporocarps discovered by Prof. E. Orton in the Erian Shale of Columbus, Ohio. J. W. Dawson. (Canad. Rec. Sci., iii., 137-140; one figure.)

Notice of *Protosalvinia Huronensis and Sporocarpon furcatum*, regarded as Rhizocarps by the author.

Tigridia Pringlei. S. Watson. (Garden and Forest, i., 389, fig. 61.)

Botanical Notes.

On two recently published Genera. Two plants of very great interest have recently been made known through the pages of Annals of Botany. The one, *Hydrothrix*, a new genus of Pontederiaceæ, was published in Vol. i., No. 2, by Sir J. D. Hooker, from specimens collected by Gardner in tropical Brazil in 1838. Its affinities with *Heteranthera* were first suggested by Dr. Gray. While placed in this natural order, it is remarked that it is a very aberrant member: "in all respects of habit, foliage, inflorescence and flowers it is totally unlike any known genus of Pontederiaceæ." It is a cæspitose, aquatic annual, rooting in sand, very densely leafy, with minute axillary flowers. Through some mistake, it is denominated *H. Gardneri* in the text and *H. verticillaris* on the accompanying plate.

The other plant here alluded to is a native of central China, bearing a curious resemblance in its habit and appendaged fruits to the "water chestnut" (*Trapa*). It has been described by Prof. D. Oliver in Icones Plantarum, t. 1595, as *Trapella Sinensis*, and made the subject of an extremely interesting and complete monograph by Dr. F. W. Oliver in Annals of Botany, Vol. ii., No. 5. Its botanical relation is regarded as with the Pedalineæ, and its floral structure is compared by Dr. Oliver with that of *Pedalium.*

Proceedings of the Club.

The regular meeting was held on Tuesday evening, October 9th, the Vice-President in the chair and 30 persons present. The committee appointed to consider the question of more frequent meetings reported in favor of holding a second meeting on the fourth Wednesday evening of each month, and proposed an amendment to the By-Laws in order to make this feasible.

Mr. Sterns described the so-called bulblets of *Lycopodium lucidulum*, and exhibited a stalk of *Angelica atropurpurea* four and one-half feet long, averaging four inches in circumference, weighing but one and three-fourth ounces, remarking that it was doubtful if any other North American plant yielded a stem of equal dimensions and yet weighed so little.

Dr. Rusby showed *Prenanthes racemosa*, both typical and the var. *pinnatifida*, from the Hackensack Meadows, New Jersey.

Dr. Britton read the announced paper of the evening, "On the Genus *Hicoria* of Rafinesque.

At the adjourned meeting of October 24th, the President was in the chair, and 32 persons present. Mr. Sterns acted as Secretary.

Dr. Northrop exhibited thin sections of *Cuscuta Gronovii* growing on *Impatiens biflora*, and containing a green substance, apparently chlorophyll. This substance was confined to the portions of the Dodder in contact with the host-plant or with itself, the rest of the parasite being of the usual orange color. The green pigment was apparent in the stems to the naked eye, which led to its detection. He referred to notes in Bot. Jahresb., 1883, (II), 436 and 417, where the same occurrence is reported in a European species. Prof. Schrenk remarked that searching tests should be applied before deciding that it was common chlorophyll.

Mr. Sterns exhibited a long shoot of some species of wild rose, on which more than half the prickles were arranged in a uniform and orderly fashion, three to each internode—an infrastipular pair, and another one lower down on a line with the midvein of the leaf above. He remarked that a different but equally definite arrangement of prickles is often observable in *Smilax rotundifolia*, namely, two pairs placed near the middle of the internode and alternating in position and direction with the adjacent leaves.

Dr. Rusby presented specimens of a lily intermediate between *L. Canadense* and *L. superbum*, having the flowers of the former, but the inflorescence and foliage of the latter. It was collected in abundance by Dr. A. L. Koenig and himself near Pittsburg, Pa. Dr. Bitton remarked that there is much reason to regard the two as confluent species, notwithstanding their separation by Linnæus, and cited other cases of a similar character. Judge Brown said that according to his experience, they differed much in time of flowering, *L. superbum* being from two to four weeks later. Dr. Britton observed that if this were generally the case, it would be strong evidence for their specific validity. Dr. Rusby showed also specimens of *Monarda fistulosa* var. *rubra*. with most of the flowers imperfect or deformed, and seldom producing seed, stating that this form might prove to be a hybrid between *M. didyma* and *M. fistulosa*.

Miss Steele exhibited *Physostegia Virginiana*, collected twelve miles above the mouth of the Connecticut River and remote from gardens. It is rarely found native so far east.

Prof. Schrenk showed specimens of *Echinocystis echinata* from the Upper Delaware, near Cochecton, New York, where he pronounced it native. *Aster subulatus* from the serpentine rocks at Hoboken, N.J., away from marine influence, and *Symphoricarpus racemosus* var. *pauciflorus* from Niagara, with leaves quite hairy beneath instead of glabrous as described. Dr. Britton remarked that the finding of *Echinocystis* at another eastern station is extremely interesting, and would practically complete the identification of the plant with Rafinesque's genus *Micrampeles*, which is older than *Echinocystis*. He also remarked on the evidence that the "husk" of the hickory-nut is an involucre and not an exocarp, referring to the BULLETIN (vol. xi., p. 69), and to the Proceedings of the Natural Science Association of Staten Island.

The following proposed amendment to the Constitution was referred to a committee under the rules:

"That Section XIV of the Constitution be amended to read instead of "two dollars," "four dollars, which shall include all the publications of the Club."

Mrs. Britton gave a description of the Botanical Establishment at Kew, illustrated by diagrams and photographs.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XV.] New York, December 4, 1888. [No. 12.

A Recent Discovery of Hybrid Oaks on Staten Island.

By Arthur Hollick.

Plates LXXXIII–LXXXV.

One day during the past summer Mr. Wm. T. Davis, of Tompkinsville, Staten Island, brought to me some leaves of an oak tree which he had found growing in the neighborhood of Tottenville, Staten Island, N. Y. To my surprise and delight I recognized them as belonging to *Quercus heterophylla*, Michx.—the celebrated "Bartram Oak." On September 2d we visited the locality and found not only typical *Q. heterophylla*, but also a number of other peculiar forms, evidently hybrids, and including *Q. Rudkini*, Britton. On September 22d the trees were again visited; a careful study was made of them and their surroundings and a fine series of leaves and fruit collected. Probably no better opportunities for observation or finer specimens for study and comparison have ever been obtained, and the results have proved to be highly interesting. Two recognized species are added to the local flora of Staten Island and to the flora of New York State, and the northern range of *Q. heterophylla* is extended about thirty miles from its nearest previously-reported station. Considerable new light is also shed upon the question of the proper status of this latter form, in the botanical world, whether as a species, a variety or a hybrid, and, if the latter, what species are the probable parents.

The limits of this paper forbid an extensive review of the literature concerning these two interesting oaks, but for the benefit of all who may wish to study the subject I would refer to the account of *Q. Rudkini*, by Dr. N. L. Britton, in Vol. IX. No. 2, of the Bulletin, and for *Q. heterophylla* to Mr. I. C. Martindale's "Notes on the Bartram Oak," read before the West New Jersey Surveyors' Association, Jan. 6, 1880, and subsequently published in pamphlet form by the author. As, however, everyone may not have access to these documents, I have thought that the following brief account of this latter oak—its history and the controversy regarding it—might not be out of place:

Some time during the early part of the last century a peculiar oak tree attracted the attention of botanists and others. It was a single individual, growing on the farm of Mr. John Bartram, on the banks of the Schuylkill, just above Philadelphia. From its location it received the name "Bartram Oak." It was also called "Burriers Oak," though why this latter name I have never been able to obtain the slightest clue. Just when the tree was first observed there does not appear to be any record, but it must have been prior to the year 1750, for on page 183 of Darlington's "Memorials of Bartram and Marshall" there is printed a copy of a letter which was written by Peter Collinson to John Bartram, from which I extract as follows:

Mch. 5th, 1750-1.

MY GOOD FRIEND JOHN:

Pray what is the reason I have no acorns from that particular species of oak that Dr. Mitchell found in thy meadow? And I observe, in thy specimens, two other narrow leaved oaks. As I have now ground enough I wish for a dozen good acorns of each. * * * *

Thine, P. COLLINSON.

This is, I believe, the earliest reference in literature to this oak. No scientific name was given to it nor was it even mentioned in Humphrey Marshall's "Arbustrum Americanum," published in 1785. Andreas Michaux's "Flora Boreali-Americana," published in 1803 and reprinted in 1820, does not enumerate it among the oaks, although it is evident that he must have been aware of its existence, as his son, F. André Michaux, says in his "Histoire des Arbres Forestiers de l' Amerique Septentrionale," published in French in 1810 and republished in English in 1819: (See Vol. 1, p. 75, 76; plate 18.) "BARTRAM OAK. *Quercus heterophylla*. Every botanist who has visited different regions of the globe must have remarked certain species of vegetables which are so little multiplied that they seem likely at no distant period to disappear from the earth. To this class belongs the Bartram Oak. Several English and American naturalists, who, like my father and myself, have spent years in exploring the United States, and who have obligingly communicated to us the result of their observations, have, like us, found no traces of this species except a single stock in a field belonging to Mr. Bartram on the banks of the Schuylkill, 4 miles from Philadelphia. This is a flourishing tree, 30 feet in height and 12 inches in diameter; and seems formed to attain a much greater development. * * * * I was at first disposed to consider this tree as a variety of the laurel oak, to which it bears the greatest affinity; but the leaves of that species are never indented, and not a stock of it exists within a hundred miles of Philadelphia."

This is no doubt the first published description and representation of this oak, and the very appropriate specific name given to it at that time by Michaux has fortunately not been subjected to any change by later botanists, so that there is no tangled skein of synonomy to unravel, and the specific title, *heterophylla*, "various leaved," will always serve it as its name, no matter whether it be classed as a variety, a species, or a hybrid. From the time of Michaux's description until about the year 1850 no other trees seem to have been found, and the only ones known were the original and a few seedlings from it. In fact, when the original tree was cut down, about the year 1840, it was thought that the species, if such it was, was exterminated. So that for a period of a hundred years the only material for study was from a single tree and its immediate progeny. This, however, did not prevent the botanists of that time from recording opinions in regard to it. Michaux, as before stated, gave to it a specific rank. Pursh said: "* * It is probably only a hybrid plant." * * Nuttall asked: "May not this be an anomalous variety of *coccinea?*" Torrey states unequivocally: "A hybrid." Gray, in his Manual published in 1848, says: "* * * doubtless a hybrid between *Q. Phellos* and *Q. falcata*, or some other species of that section." In the second edition of the Manual, published in 1856, he changes his opinion, and says: "* * * apparently a hybrid between *Q. Phellos* and *Q. tinctoria?*" In the fifth edition, published in 1867, he quotes De Candolle as referring it to a variety of *Q. aquatica*, and then says: "It is as likely to be a variety of *Q. Phellos*, with dilated and toothed or cut leaves." About the year 1855, however, some trees were discovered at Mt. Holly, N. J., (*Fide* specimen in Herb. Columbia College, marked "Mt. Holly, N. J., Aug. 25, 1855, W. Proctor,") and others were subsequently found at stations in New Jersey and Delaware by Messrs. Smith, Leidy, Burk, Martindale, Meehan, Austin, Canby, Commons and others, which have been the subjects of numerous papers, notes and discussions. Even in the light of this new material, however, I find that there is as much difference of opinion as ever. Englemann first considered it as a good species and subsequently decided that it was hybrid with probably *Q. Phellos* and *Q. coccinea* for parents. Leidy considered it a hybrid between *Q. Phellos* and *Q. palustris*. S. B. Buckley says, in describing the tree at Mt. Holly: "It is * * * in a thicket near several willow oaks (Quercus phellos), of which it is plainly one." Cope and Smith rather lean to the opinion that it is a variety of *Q. Phellos*. A number of other botanists might be quoted as naming *imbricaria, nigra* and other species from which it may have been derived, but in nearly every instance *Q. Phellos* is mentioned as being connected with it in some way. Trees have also been reported from the District of Columbia, Maryland, North Carolina and Texas, but I have not seen specimens from any of these localities and the published descriptions of them are rather vague and indefinite. If all the localities where *Q. heterophylla* has been found, between Newcastle County, Del., and Staten Island, N. Y., were marked upon a map, they would be included in a straight narrow strip of country about ten or twelve miles in width; and this limited belt would probably include nearly every specimen of this tree now definitely known to be in existence.

The Staten Island station, is, like all the others, on the Cretaceous formation. The situation is a low piece of wet, sandy woodland, about a quarter of a mile from the beach. This piece of woodland is several acres in extent and its most conspicuous trees are *Castanea, Pinus rigida, Quercus alba, Q. rubra, Q. stellata, Q. nigra, Q. coccinea, Q. tinctoria, Q. palustris*, and *Q. Phellos*, but the hybrids are confined to a very limited area, not more than half an acre in extent and entirely within the very restricted territory where *Q. Phellos* occurs*. The immediate neighbors in this group at the present time are *Q. palustris, Q. nigra, Q. tinctoria* and *Q. coccinea*. A careful count was made of all trees

*In this connection it is a matter of interest to know that *Q. Phellos* does not grow in any other part of Staten Island.

which were considered hybrids, and an enumeration of twenty was the result. Three of these were *Q. Rudkini* and the others either typical *Q. heterophylla* or else members of the same series, showing *Q. Phellos* to be undoubtedly at one extreme and some one of the broad, lobed-leaved species at the other. Not more than fifteen trees of *Q. Phellos* were noted. The trees of *Q. Rudkini* are mostly low, with dark green coriaceous foliage, showing their relationship to *Q. nigra.* These, however, need not concern us, as I consider their proper status and relationship to be definitely settled, so that in what follows I shall confine myself to a discussion of the forms which include *Q. heterophylla.* These are evidently designed to be large, the tallest one being about 50 feet in height and 3 feet 8 inches in circumference, and having the appearance of a young and vigorous growing tree. The leaf and fruit of this tree are shown at fig. 1, plate LXXXV. As a rule the largest trees are those having the leaves most cut or lobed and the largest acorns, while the smaller trees approach nearer to the *Phellos* type. The leaves upon each tree, however, vary a great deal, although there is generally enough of some one prevailing form to give to each a decided individuality, and if they could be arranged side by side according to leaf form a graduated series would be the result, showing an almost imperceptible change from member to member.

The petioles are of medium length, varying from ¾ in. in the large, deeply lobed leaves, to ¼ in. in the entire leaved forms. The margins are either entire, wavy, lobed on one or both sides, or sinuate toothed with the teeth bristle pointed. In some there are bristles on the margin where a tooth or lobe is merely indicated by a slight inequality. As a rule they are rather thin, green both sides, somewhat tomentose along the midrib or at the junction of the midrib and main veins. In others the texture is somewhat coriaceous—approaching forms of *Q. Rudkini.* Fig. 3, Plate LXXXIV. represents an anomalous form, with thin, sparingly lobed leaves, covered over the entire under surface with a close light brown tomentum. The acorn is globose, flattened and with a deeper cup than the others. The general habit of the tree is slender and willow like, and it hardly appears to be a member of the series.

The venation is also a character which shows the transition between the simply pinnate veining of *Phellos* and the more complex branching of the broad, lobed forms. The acorns vary in shape from ovoid to almost globose, and, in size, from those of *Phellos* to others almost an inch in length by ¾ in. in diameter at the largest part. The cups are invariably saucer shaped, with closely appressed scales.

I made a special journey late in the season, to ascertain, if possible, whether anything could be learned from the autumnal coloring of the leaves, but I found them to be a uniform light yellow, turning brown.

From these observed facts I have finally come to the conclusion that we must consider. *Q. heterophylla* to be a hybrid, and further, that one of the parents is *Q. Phellos.* They are invariably associated together, or at least the former has never been found except in the immediate vicinity of the latter; and, added to this, we know that *Q. Phellos* does produce a hybrid with *Q. nigra* and that this hybrid occurs associated with *Q. heterophylla.* It would not, in fact, be a matter of surprise to me if we should eventually find that other hybrid forms have resulted from the influence of *Q. Phellos* over other species of the black oak group. As to the other probable parent of *Q. heterophylla* there is yet room for careful research, although I think that the discovery of these trees on Staten Island has considerably simplified the matter. The species mentioned by those who have written upon the subject are *aquatica*, *imbricaria*, *falcata*, *coccinea*, *tinctoria* and *palustris.* The first three may be thrown out of the calculation at once on account of their geographical range—not a single specimen of either having ever been found or reported within miles of our station. *Coccinea* and *tinctoria*, while showing a leaf form that is satisfactory, have acorns with deep cups, entirely distinct from those of *heterophylla.* *Palustris* has a cup of the required form, but the acorn is far too small, and the lobes of the leaves have a distinctive divergent characteristic which those of *heterophylla* have not. The only other probable species, and it is the only one which does not seem to have been considered by our botanists, is *rubra.* Why this species has not received the attention it deserves in this connection I am at a loss to understand, as both the leaf and acorn are eminently fitted to terminate one extreme of the series of which *Phellos* is the other, as I have endeavored to show in the accompanying plates. The only cause for hesitation which I have in accepting this as a satisfactory conclusion is that I failed to find trees of *rubra* growing in the immediate vicinity, although there are a number of them only a few hundred yards away. We should however remember that this species may have been present, associated with *Phellos*, years since, at the time when the existing large specimens of *heterophylla* were produced, probably 50 or 75 years ago. It may be that hybridization has not taken place in many years and that the young trees are merely seedlings from a few originals. This idea is strengthened in my mind from the fact that the largest and oldest trees come nearest to the type of *rubra*, while the smallest or youngest trees show a preponderance of the *Phellos* type—apparently showing a tendency to revert back to it. Dr. N. L. Britton has also pointed out to me a significant fact in this connection, viz.: that throughout the region where *heterophylla* has been found *Phellos*, *rubra*, and other members of the black oak group occur, but that to the eastward, in the Pine Barren region, *heterophylla* or *rubra* are not reported, although *Phellos* is abundant and *palustris* and other black oaks are present. In fact *heterophylla* only seems to occur where *Phellos* and *rubra* occupy a territory in common.

Algæ from Atlantic City, N. J.

COLLECTED BY S. R. MORSE.

The following species were collected at various times during the years 1884 to 1888 inclusive, and the specimens sent to me for examination; also in May, 1885, Mr. Morse and myself spent a few days together collecting. While this is certainly not a complete list of the algæ of Atlantic City, it contains quite a large number for a locality having no rocky shore whatever, but an open sandy beach in front, and muddy creeks and marshes in the rear.

Glœocapsa crepidinum, Thuret. Common on woodwork.

Entophysalis granulosa, Kütz. On shells, etc. Not previously reported on the American coast.

Polycystis pallida (Kütz.), Farlow. Mixed with other Cryptophyceæ.

Clathrocystis roseo-persicina, Cohn. Abundant on the marshes.

Sphærozyga Carmichælii, Harv. Common on muddy flats, and in shallow pools in the marshes.

Spirulina tenuissima, Kütz. In small quantity, mixed with *Oscillarias*, etc.

Oscillaria subuliformis, Harv. Mixed with other Cryptophyceæ.

O. subtorulosa (Bréb.), Farlow. With the preceding species.

Microcoleus chthonoplastes, Thuret. On the marshes, mixed with other algæ.

Lyngbya majuscula, Harv. Not uncommon, floating.

L. æstuarii, Liebm. Common on marshes, etc.

L. tenerrima, Thuret. In small quantity, among other algæ.

Calothrix confervicola, Ag. On various algæ.

C. crustacea (Schous.), Born., et Thur. On various algæ, frequently mixed with the preceding.

C. scopulorum, Ag. On woodwork, etc.

C. pulvinata, Ag. Common on piles of wharves and bridges.

Rivularia hospita, Thuret. On an oyster shell.

Isactis plana. Thuret. On shells.

Monostroma crepidinum, Farlow. On woodwork in a tidal creek.

Ulva Lactuca (L.), Le Jolis. Common, including var. *rigida*, Le Jolis, and var. *latissima*, Le Jolis.

U. enteromorpha, Le Jolis. Very common, including var. *lanceolata*, Le Jolis, var. *intestinalis*, Le Jolis, var. *compressa*, Le Jolis.

U. clathrata, Ag. Common, including var. *ramulosa*, and var. *erecta*, Le Jolis.

U. Hopkirkii (McCalla), Harv. Not very common.

U. marginata, Le Jolis. Not very common.

U. percursa, Ag. Rather common in tide-pools, mixed with other algæ, from which it is hardly distinguishable except by microscopic examination.

U. aureola, Ag. Not uncommon on woodwork.

Ulothrix flacca (Dillw.), Thuret.

U. isogona, Thuret. These two species not uncommon on woodwork and other algæ. A very slender form grows on *Bos-*

trychia rivularis, possibly distinct from either of the foregoing.

Chætomorpha Picquotiana (Mont.), Kütz.

C. Linum, Kütz. It is impossible to draw the line between these two species in the Atlantic City specimens. Typical forms of each may be found, and so can every shade between them.

Rhizoclonium riparium, Roth. Common.

Cladophora albida (Huds.), Kütz. Beside the type, a plant occurs, which seems to be the *C. refracta* of Harvey, (Phyc. Brit.,) and is probably a form of *C. albida*, in which Hauck (Deutschland's Meeresalgen) includes *C. refracta* of Harv. and Kütz. The plant of the New England coast which I take to be the *C. refracta* of Farlow's Man., is quite distinct. Hauck places the latter as *forma refracta* in *C. hamosa*, Kütz.

C. glaucescens, Harv. Not uncommon.

C. Hutchinsiæ, Kütz. Not uncommon. Luxuriant specimens from Longport, collected by Mrs. Lawton.

Cladophora flexuosa, Harv. A doubtful species, but some specimens found at Atlantic City seem to belong here.

C. gracilis (Griff.), Kütz. Common and variable.

C. expansa, Kütz. Common, especially in marsh tide-pools.

Bryopsis plumosa (Kütz.), Ag. Not uncommon.

Phyllitis fascia, Kütz. Common.

Scytosiphon lomentarius, Ag. Common.

Punctaria latifolia, Grev.

P. latifolia, Grev., var. *Zosteræ*, Le Jolis.

P. plantaginea (Roth.), Grev. All three forms rather common.

Dictyosiphon fæniculaceus, Grev. Common, including forms which appear to be var. *flaccidus*, Aresch.

Myriotrichia clavæformis, Harv.

M. clavæformis, Harv., var. *filiformis*, Farlow. On *Scytosiphon* and *Phyllitis*.

Ectocarpus terminalis, Kütz. On *Zostera*.

E. tomentosus (Huds.), Lyng. Rather common.

E. granulosus, Ag. Not uncommon.

E. confervoides (Roth.), Le Jolis. Very common.

E. confervoides, var. *siliculosus*, Kjellman. Almost as common as the type.

E. littoralis, Lyngb. Very common and variable. Among other forms the var. *brachiatus*, Ag. (*E. ramellosus*, Kütz.)

Myrionema vulgare, Thur. Common.

Elachistea fucicola, Fries. Common on *Fucus*.

Leathesia difformis (L.), Aresch. Not very common; generally of small size, growing on *Zostera*.

Chordaria flagelliformis, Ag. Have only seen a few plants.

Mesogloia divaricata, Kütz. Not uncommon.

Ralfsia verrucosa, Aresch. A small form, growing on wood-work.

R. clavata (Carm.), Crouan. With the preceding.

Laminaria saccharina (L.), Lamour. Not rare, but not so common nor so luxuriant as further north. Washed ashore from below low water mark.

Ascophyllum nodosum (L.), Le Jolis. Common.

Fucus vesiculosus, L. Common.

F. furcatus, Ag. A single plant, washed ashore, apparently having grown on a mussel bed below low water mark. Not exactly like the form as found on the New England coast; having some resemblance to *F. evanescens*, Ag.

Sargassum vulgare. Ag. Have only seen a few plants; apparently not very common.

Vaucheria Thuretii, Woronin.

V. litorea, Nordstedt. Have seen only sterile plants of these two species, so that the determination is not certain.

Trentepohlia virgatula (Harv.), Farlow. On *Zostera* and algæ.

Porphyra laciniata, Ag.

P. leucosticta, Thuret. Both species common and often confounded.

Bangia fusco-purpurea, Lyngb. Rather common.

Erythrotrichia ceramicola (Lyngb.), Aresch. On various algæ.

Callithamnion cruciatum, Ag. Not uncommon. This species is distributed along the Atlantic coast of Europe and North America, and also in the Mediterranean, and is not a rare species anywhere in those limits. The cystocarpic fruit, however, has been considered extremely rare, the only record of its occurrence being at Brest, France, reported by Crouan. At Atlantic City, however, the cystocarpic fruit seems to occur quite commonly, a considerable proportion of the plants collected by Mr. Morse having it in abundance.

C. Borreri, Ag. Common.

C. roseum (Roth.), Harv. Sterile, and therefore doubtful.

C. byssoideum, Arn. Rather common.

C. tenue, Harv. Not uncommon in thoroughfares, etc. Though this species has been known for forty years or more, the cystocarpic fruit has never been found, and by European writers it is generally placed in the genus *Griffithsia*, which it resembles in habit more than it does *Callithamnion*.

Ptilota elegans, Bonnem. Not uncommon, washed ashore.

Ceramium rubrum, Ag. Common.

C. strictum (Kütz.), Harv. Common, varying from the type to a robust, widely branching form, which is very near, if not actually, *C. diaphanum*, Roth.

C. fastigiatum, Harv. Not uncommon.

C. tenuissimum (Lyngb.), Ag. Not uncommon.

C. tenuissimum, var. *patentissimum*, Harv. With the type.

Spyridia filamentosa, Harv. Not uncommon.

Phyllophora Brodiæi, Ag.

P. membranifolia, Ag. Both from deep water; not very common nor very large plants.

Cystoclonium purpurascens, Kütz. Not uncommon.

Chondrus crispus (L.), Stack. Common.

Rhodymenia palmata (L.), Grev. Not uncommon.

Lomentaria uncinata, Menegh. Common; often luxuriant and very handsome; sometimes appearing to be var. *robusta*, Harv.

L. uncinata, var. *filiformis*, Harv. With the type, less common.

Champia parvula (Ag.), Harv. Common.

Gelidium crinale, Ag. Probably not uncommon, but inconspicuous and easily overlooked.

Rhabdonia tenera, Ag. Common.

Grinnellia Americana, Harv. Abundant and luxuriant.

Delesseria sinuosa, Lamour. From deep water; not uncommon.

D. Leprieurii, Mont. Abundant at low water mark on the piles of railroad bridges, etc., with *Bostrychia rivularis*.

Gracilaria multipartita, Ag.

G. multipartita, var. *angustissima*, Harv. Both type and variety common.

Chondriopsis tenuissima, Ag.

C. tenuissima, var. *Baileyana*, Farl. Both common.

Polysiphonia urceolata (Dillw.), Grev. Not very common.

P. Harveyi, Bail. Common.

P. variegata, Ag. Common.

P. atrorubescens, Grev. Not very common.

Polysiphonia nigrescens, Grev. Common and variable; including many forms between the two extremes, var. *fucoides*, Ag., var. *affinis*, Ag.

Bostrychia rivularis, Harv. Common on bridges, etc.

Dasya elegans, Ag. Common.

Melobesia farinosa, Lamour. On *Phyllophora*; rare.

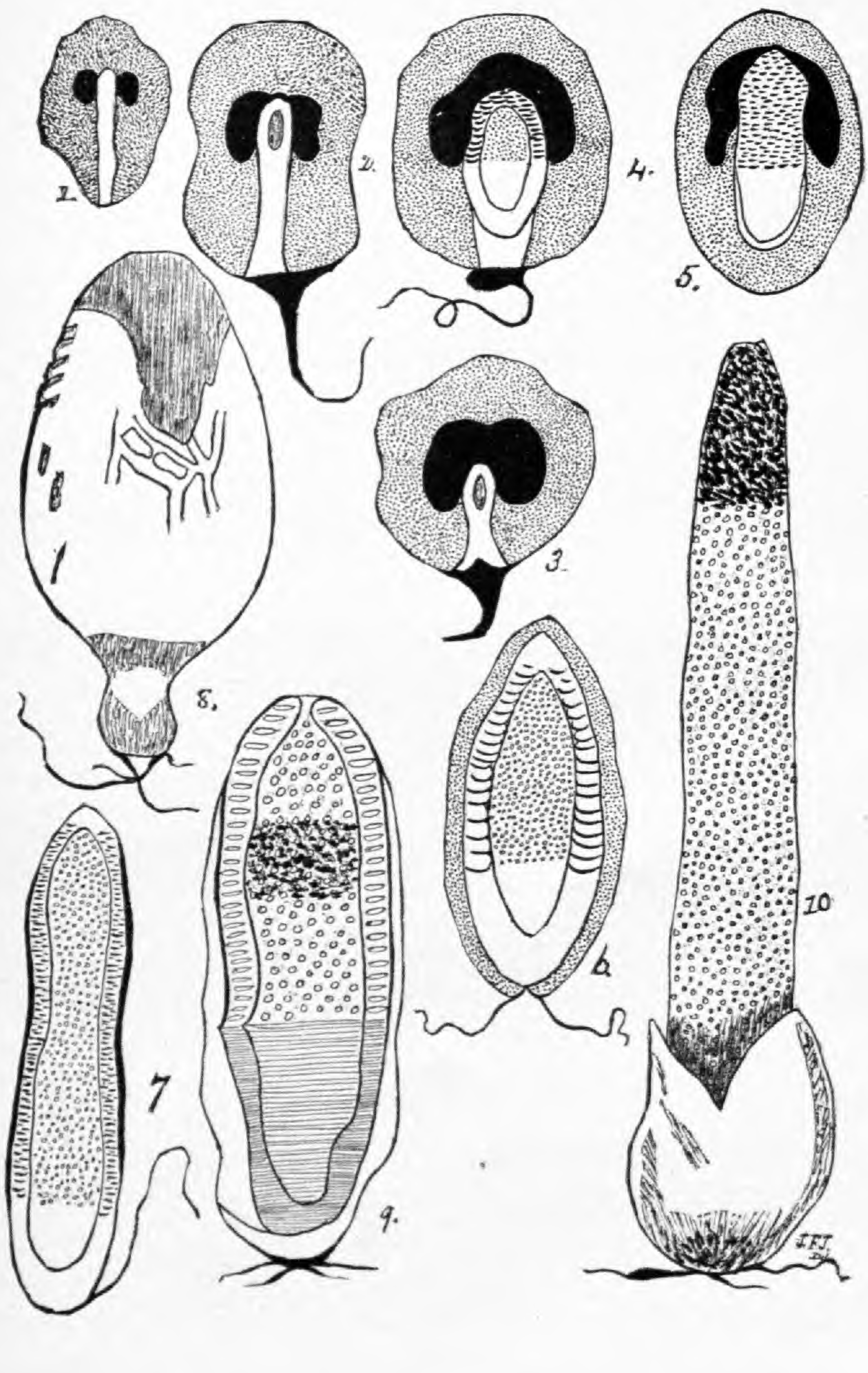
FRANK S. COLLINS.

Notes on the Development of Corynites Curtissii, B.

Plate LXXXVI.

In July, 1887, while studying at Cambridge, I was fortunate enough to find in a small patch of woods a number of specimens of undeveloped *Phalli*. Watching them with interest for a week or ten days, a fully developed specimen was found which proved to be *Corynites Curtissii*. The development of these specimens was so interesting that it is here put upon record, together with some of the figures drawn at the time.

Arranged in the apparent order of their development they are numbered one to ten on the plate. The first figure shows the outer wall surrounding a mass of grayish, glairy matter, in the centre of which is a white column, surmounted by a two-lobed mass of dark brown or blackish matter. Figure 2 shows the beginning, in the centre of the column, of what is eventually to be the stipe, the dark mass still present at the top. In figure 3 the dark mass is larger. Figure 4 shows a marked change. The stipe begins to be plainly manifest. The little pits represent what develop finally into openings; the second layer represents the inner wall of the peridium, while the dark mass of matter at the top, gradually diminishing in size, is what probably eventually forms the gleba and contains the spores. Figure 5 does not show the stipe, a fact which may be due to a defect in sectioning, but the gleba (?) has diminished in size and is partly torn away from the central column. Figure 6 is a much more advanced



Development of Corynites Curtissii.—J. F. James.

state. Here the sac is considerably elongated, the stipe is larger, the pits are more perceptible, and the wrinkled inner wall of the peridium is plainly apparent. Finally the thickness of the outer layer of the peridium, filled with grayish matter so abundant in the preceding figures, has diminished greatly. Figure 7 is still more elongated, the stipe is well developed and the inner wall of the peridium is nearly perfected. The outer layer of matter has almost disappeared. Figure 9 is apparently the last stage before final development. The outer skin is very thin at the apex, the future point of rupture, the inner layer is well developed, and the stipe is nearly ready to appear. Lastly, figure 10 represents the fully mature fungus, which is bright pink, full of small holes, surmounted by the gleba, and springing from the ruptured sac which formerly enclosed it. Figure 8 shows the outward appearance of the fungus in its immature state. The specimen from which figure 9 was drawn, contained a considerable quantity of liquid, and what seemed to be a mass of froth near the centre of the stipe. This is shown by the dark shading.

The disproportion in size between the fully mature fungus and the ruptured sac is considered by DeBary as due to the fact that before rupture takes place the fungus is really mature, but is crowded into a small space; and that the apparent great rapidity of growth is due merely to the straightening out of the wrinkles, as it were, in the fully formed stipe. As the latter elongates, the peridium shrinks downward, and so becomes greatly diminished in size.

The odor of the fully developed specimens is extremely fetid and disagreeable, equalled only by *Phallus*. As the specimens get older the gleba disappears, the odor is dissipated and the whole assumes a bright pink color. In one example the blackish slime was found near the base, just above the ruptured sac, the apex being bright pink. That the stipe elongates rapidly was shown in one specimen collected. This was not fully mature, but it lengthened half an inch or more in the course of an hour while lying on the table.

JOSEPH F. JAMES, M. SC.

AGRICULTURAL COLLEGE, MARYLAND.

On the Bract in Tilia.*

The small leaf adherent for some half its length to the common peduncle in the Linden tree, is known as a wing-bract. I do not know that any purpose has been suggested for this bract, except for aiding in the distribution of the seeds. In the Hungarian Silver Linden, *Tilia petiolaris* (not probably distinct from *T. argentea*) which I have had the opportunity to examine closely this season, they evidently possess a lifting power which must have had some office of usefulness connected with it. The common peduncle itself is comparatively weak, and only for the attachment to the leaflet would hang loosely from the axis. But the leaflet being greenish, and with the usual power of a green leaf, turns up toward the light, and draws up with it the common peduncle, so far as the attachment thereto. From that point the peduncle curves downward. In this way the cymes are kept much wider apart than they would be if each dropped loosely from the axil, where they would be in each other's way.

The leaves of Lindens are arranged in horizontal lines on each side of the branch. This does not seem to be advantageous if the purpose of the various methods in phyllotaxy be to secure to the leaves the most light. In this species of Linden the leaves are comparatively large, and the nodes comparatively close, so that a large portion of one leaf is overlapped by another, as in shingles or thatch on a roof. In rainy weather they act as shelter tents to the flowers beneath. The cyme is lifted up right under the leaf by the upwardly curving power already noted. During an incessant rain storm of two days' duration, I found the flowers securely protected from the rain by this arrangement.

For the whole of this time the honey-bees in great numbers from hives some 1,000 feet away, were incessantly at work. I do not remember observing bees at work in rainy weather as these were working here. If the Lindens had been purposely adapted to find a wet-day job for the bees, the arrangement could not have been any more perfect. It is difficult to understand how such adaptation could have been evolved from the standpoint of any especial use to the plant itself. Nor is it

*Read before the meeting of the Botanical Club of the A. A. A. S., at Cleveland, Aug. 20th, 1888.

clear that the immense amount of sweet secretion, or the honeyed fragrance, can serve any such purpose. The enormous number of flowers produced keep the bees busily engaged on one tree; and, as the use of pollen by flowers of one tree of pollen from the flowers of the same tree is not cross-fertilization, no benefit from that score is derived from insect visitors.

The use of the dried bract as a wing to aid in the distribution of the seed, can scarcely be the sole purpose. Most of the seeds, though many of the early ones are light, separate and fall to the ground before the common peduncle is detached. In many cases when detached it flies away with no seed. When it has one or more seeds developed, it does not go far, very little farther than the seed can be carried in a high wind without it.

But the lifting power of the growing bract is apparent, and though it is difficult to understand under modern views of evolution how the adaptations are of much use to the plant, it will, perhaps, be more difficult to believe that the adaptations have been made solely in the interest of the insect world, though, so far, the facts barely admit of any other interpretation.

My view is that nature has not made variety in structure and character solely for the peculiar advantage of the plant itself, but that a variety of purposes are involved. It would be absurd to say the various forms of plants have not, in general, a relation to individual good. Often they have none whatever; but they have a relation, at times wholly, to the general good in which the plant is then a mere incident in the purpose and at times they have but to create a variety for variety sake, which is a necessary element in the order of things.

THOS. MEEHAN.

The "Bulblets" of Lycopodium lucidulum, Michx.

The description of *L. lucidulum* in Gray's Manual (ed. 1867, p. 673) closes with the statement, "Little bulblets form in the axils of the leaves of young shoots (*Austin, Rothrock*)." The citation of authorities evidently implies that Gray had not seen these "bulblets" himself, and as I have failed to discover any mention of them elsewhere, even in the writings of Baker, Underwood and others who have made a special study of pteridophyta, it seems fair to suppose that they are quite commonly wanting. I was, therefore, somewhat surprised to find them well developed in nearly every one of some twenty specimens which I collected on the 24th of last September in Western New York (Chautauqua County), a mile or so from the Pennsylvania line. And I was still more surprised to find, not only that Gray's statement regarding their "axillary" position is incorrect, but also that their structure is much more intricate and methodical than the term "bulblet" would suggest.

In each fully developed specimen the year's growth of stem—an inch or more in length—presented, below, the usual cluster of yellowish axillary sporangia, and, a little distance above, from one to four (more commonly two) six-bracted stipes, each terminated by a single "bulblet." These stipes are short, thickish subterete ascending branches, not axillary in any sense but occupying, side by side, the exact position of leaves.* Each bears, close to the summit, two lateral pairs and one antero-posterior pair of bracts. The former (exterior and interior) are small, slender, pointed, triangular-lanceolate and curved-divergent like the open mandibles of an ant. The other (middle) pair is much larger and presents a bilabiate aspect, the upper bract being broad, flat, oblong and obtuse, the lower one channeled and curved (sigmoid-sulcate) and about twice the length of the upper. The four smaller bracts, though laterally inserted, are somewhat elevated, and the entire structure, upon casual observatian, singularly resembles a short, stout peduncle, surmounted by a horizontal calyx with a five-toothed upper lip, the middle tooth broadest, and a much longer and narrower entire lower lip.

The "bulblet," which is borne upon this like the ovary of an apetalous pistillate flower, looks oddly like a small plump dust-pan! The body of the "pan," which is horizontal inclining to cernuous in position, is formed of two broad oblong scales, subconcave at base and placed closely side by side. A third scale,

* It is perfectly clear, from their form and function, that these stipes are caulomes. It is equally evident, from their position, that they are metamorphosed leaves. The necessary inference appears to be that the so-called "leaves" of *Lycopodium* are really cauline and not foliar,—branchlets and not leaves at all—a curious evidence (if any were needed) that the pteridophytic frond is altogether stem notwithstanding its foliaceous appearance.

oblong in shape, narrower, and with remarkably straight parallel edges, is fitted over the line between these, just as one roof-shingle covers the crack between the two below it. The acute tip of this is hooked downward and fits accurately into a notch between the two broader scales beneath. A short, slender, triangular-lanceolate scale covers the line between the two halves of the "pan" on the under side, and a corresponding but seemingly superfluous one above partly covers the base of the hook-tipped upper scale. Finally, the germ, for which all this complex arrangement of bracts and scales exists, is concealed within the base of the "pan," and consists of a minute axial protuberance, bearing four rudimentary lanceolate leaves, extremely small and yet visible to the naked eye upon careful dissection.

As to size, the stipe, the large anterior bract, aud the bulblet itself are subequal in length, a scant quarter of an inch or somewhat less. The structure is entirely glabrous and of a uniform green color, not unlike that of the ordinary foliage of the plant.

Here, then, we have a stipe, six bracts, five scales and a germ—in all thirteen separate elements, completely differentiated, regularly combined and adapted to each other in the most systematic fashion. Six of these elements are in consimilar pairs; the other seven are unique, thus making ten distinct individual forms, or eleven if the stem and leaf components of the germ are reckoned as separate. The vocabulary of botany affords, apparently, no better name than "bulblet" for this complicated structure, but a brief consideration of it must enlarge materially our notion of what this modest term may signify. Perhaps no more curious mimicry of a flower has ever been recorded among the heterophyta.

When mature these curious "pans" separate readily from the stipe, and in the specimens collected a majority of them had already fallen. The stipes persist, however, with all their bracts, and those of previous years were readily detected down the stem, regularly accompanied by the equally persistent empty sporangia of the corresponding season. Unfortunately the bulblets were not noticed in the field, and I missed thereby the chance of detecting new plants springing from those that had fallen. Whether they take root at once or lie dormant till spring is still a matter of conjecture.

E. E. STERNS.

Reviews of Foreign Literature.

A Flora of the Northeast of Ireland. By S. A. Stewart and T. H. Corry. 8vo, p. 331. Published by the Belfast Naturalists Field Club, 1888.

Local floras are always of interest, and when done with the thoroughness of the one here noticed, are of much value and importance. The present one follows the usual custom of giving full and accurate stations for all plants of uncommon occurrence, in the counties of Down, Antrim and Derry, including the Bryophytes. It demands more than casual attention from the fact that the authors have adopted a rational system of nomenclature, not carried out with the thoroughness that we could wish, but still a great improvement on most works of the kind. We can not do better than cite a few sentences from their preface: "As to nomenclature, the rule of priority has been observed, and wherever it required the substitution of a less known name, this has been done. * * * Further, there has been an attempt made here to retain in all cases as authority for the species, the name of its earliest describer." After the general run of local floras it is really quite refreshing to read *Habenaria viridis* (L.), Brown, *Rhynchospora alba* (L.), Vahl., and the like. The most numerous changes of name are made in the Bryophytes, many of them applying to species of American distribution, such as *Hepatica conica* (L.), Lindb. for *Fegatella conica*, Micheli's genus *Hepatica* having priority both of *Fegatella* and of the anthophyte genus of the same orthography, now sunk in *Anemone*, where we hope it will be allowed to remain. N. L. B.

The Origin of Floral Structures. By the Rev. George Henslow. Pp. xix, 349. Eighty-eight illustrations.

The acute Professor of Botany at Queen's College has given us, in this latest volume of the International Scientific Series, a forcible presentation of the theory that plants altogether tend to repeat their parents and vary, as a rule, only in response to external stimuli. In Darwin's view the two innate principles of heredity and variation are constantly at war: spontaneous and apparently purposeless changes continually tend to occur: the new forms survive or perish, by "natural selection," according as they are or are not in sympathy with the environment. In Prof. Henslow's view heredity entirely prevails, and it is the "environment" that directly inspires whatever variations may occur. In a general way this is obviously true. The "environment" that gardeners supply has wrought a multitude of variations in cultivated plants, while in nature, under extreme conditions of heat and cold, dryness and moisture, fertility and sterility, the offspring of a single plant may easily, in one generation, vary almost beyond recognition. For a single instance, how often have merely "depauperate" forms been reckoned as distinct varieties, or even species! But is the "environment" potent enough to have evolved the existing multitude of floral forms, ranging from the simple flowers of *Ranunculus* to the highly complicated ones of *Orchis* and *Asclepias?* Prof. Henslow answers with a bold affirmative. While conceding that "to some extent the attempt must be regarded as speculative," he aims "to refer every part of the structure of flowers to some one or more definite causes arising from the environment taken in its widest sense" (p. xi.). No originality is claimed for this view. The author's avowed object is to go back to 1795 and revive Geoffroy St. Hilaire's "conditions of life" (*monde ambiant*) as the "primal cause of change."

Of all the factors concerned in floral development Prof. Henslow reckons insects as by far the most active and influential. Protoplasm promptly responds to the stimulus of mechanical irritation, especially in such sensitive tissues as those of flowers. The punctures and pressures and thrusts and tensions of insects, repeated and continued through succeeding generations, are held to have developed nectaries, produced hairs, enlarged petals, lengthened stamens, and otherwise modified floral organs in an endless variety of ways. In "galls" and similar morbid plant-growths we have constant evidence of the effect of insect irritation in stimulating and diverting the action of protoplasm. The fasciated leaves common in *Solidago* furnish another striking example. Still more notable are the "leaf-cones" of some species of *Salix*, "probably occasioned by the puncture of insects" (Gray, Manual, p. 462.) The present writer has repeatedly opened these cones without being able to find any larva or other indication of insect agency. It is possible that we have here a result of insect action becoming hereditary. If so, these cones would furnish an additional and excellent proof of the principle which Prof. Henslow supports by an abundance of ingenious argument and illustration.

A specially interesting part of the book is the author's summary of his reasons for rejecting the famous Darwinian theory embodied in the aphorism, "Nature abhors close fertilization." He concludes that the benefits of cross-fertilization are comparatively transient, and that naturally self-fertilized plants are, upon the whole, more successful in the struggle for life than those with ingenious appliances for heterogamy. Not a little force is added to Prof. Henslow's controversion of some of Darwin's most important doctrines by his quotations from the great naturalist's later writings, showing that the trend of the latter's views, near the close of his life, was directly towards the conclusions here reached.

E. E. S.

Index to Recent American Botanical Literature.

Arctic Plants growing in New Brunswick, with notes on their Distribution. James Fowler. (Trans. Roy. Soc. Canada, v., (1887), 189-205.)

Prof. Fowler demonstrates the remarkable fact, that of 257 native arctic plants in New Brunswick, 241 are natives of Arctic Europe, and in particular of Scandinavia and Lapland, while but 167 are indigenous to Arctic East America. He accounts for this distribution by climatal and regional similarities. The old theory is maintained that a homogeneous arctic flora covered the polar regions before the Glacial Epoch, and on the advent of the cold and ice was driven southward on both continents; that on the recession of the glaciers this flora, decimated and considerably modified, crept back until it reached its present condition, local differences being due mainly to climatal causes. It is a very pretty theory and one could desire no better explanation of the present state of arctic vegetation, if we only knew that its premises were correct. Unfortunately we do not know this, but instead, the researches of Heer have shown that in late Tertiary time the arctic flora was almost tropical in character, and no indication of the present boreal vegetation has been had prior to Glacial time. While this fact remains it appears that we cannot regard the prevalent theory as wholly acceptable. Mr. Fowler's tabulations of the Flora are of great interest and a valuable contribution to geographical botany. N. L. B.

Asclepias tuberosa, var. flexuosa, n. var. Joseph F. James. (Bot. Gazette, xiii., 271.) This novelty is native in the Cumberland Mts., Tennessee.

Botanical Nomenclature in North America. Edward L. Greene. (Journ. Bot., xxvi., 326-328.)

This forms another chapter in a discussion now in progress, and we commend its perusal to those botanists who are still anxious to use binomials as against specific names of greater antiquity, while the many who hold to the other view will find in it facts and arguments which cannot fail to strengthen them in the better practice.

California Woods in Autumn. Edward L. Greene. (Garden and Forest, i., 422-423.)

Carex Notes from the British Museum. L. H. Bailey. (Journ. Bot., xxvi., 321-323.)

Professor Bailey is doing Cyperology valuable service in examining old types in the great Herbaria of the Old World. If we mistake not, he will be able to show that such comparisons were much needed. In the present paper he gives us a few of the results reached at South Kensington, including descriptions of *Carex nova*—surely a fitting name for a new species—the *C. atrata, var. nigra* of various American botanists, a native of the Rocky Mountain region.

Concerning the Citation of Authors. Edward L. Greene. (Pittonia, i., 231-237.)

Prof. Greene here gives especial attention to the faulty practice adopted by some writers of citing Bentham and Hooker as authors of binomials which they never created. His arguments are, we judge, conclusive on this point. He also consistently maintains the position that accepted and familiar binomials, if pre-Linnæan, should be cited as of pre-Linnæan authors, and gives us examples of cases where this has been done by botanists of as good repute as Dr. Gray and Baron von Mueller. The reasons assigned are certainly weighty, and must command our most serious attention. The writer, in common with many others, has thought that the science of nomenclature would be best served by stopping at some especial date, and thus obtaining a fixed point from which to proceed. Linnæu's Species Plantarum of 1753 has been quite generally adopted as this point of departure by botanists; ornithologists go back a few years farther. No particular reason may perhaps be assigned for 1753 as over the date of Rivinus, which Prof. Greene alludes to, other than one of convenience as a problem widely considered as settled. But a thorough discussion of the principles involved can only be productive of good. N. L. B.

Desmids of Maine. Wm. West. (Journ. Bot., xxvi., 339-340.)

An enumeration of species found in a collection made by Prof. Aubert at Orono, being 73 species additional to Prof. Harvey's published list.*

Ephedra.—The Stem of.—Walter H. Evans. (Bot. Gazette, xiii., 265-269; one plate and cuts in the text.)

Figuring Against Weeds. Byron D. Halsted. (Amer. Nat., xxii., 774-779). Statistics of Iowa weeds, which are divided into 84 Annuals, 27 Biennials and 186 Perennials. As to origin 87 are exotics and 210 American.

Flora of the Santa Barbara Islands. T. S. Brandegee. (Proc. Cal. Acad. Sci., 2nd Series, i., 201-226.)

This includes (1) additions to the Flora of Santa Cruz Islands, including about 80 species not recorded in Prof. Greene's Catalogue; (2) Flora of Santa Rosa Island, this making up the greater part of the paper. No new species are described, but no less than 21 of those characterized by Prof. Greene from this archipelago are stated to be forms of or identical with old ones. This sweeping reduction must command our wonder, and we can but admire the intrepidity with which it is done. But we may naturally inquire, will these species stay reduced?

Mr. Brandegee visited these islands to obtain wood specimens of the curious trees which grow thereon, for the Jesup wood collection at the American Museum of Natural History, brought together by Prof. Sargent. Dr. Watson is recorded as assisting

* BULLETIN, this volume. pp. 155-161.

in determining several species, while all the grasses collected were submitted to Dr. Vasey. N. L. B.

Florida.—A Floral Almanac of.—Dr. A. Schaffranek. (4to, pamphlet, pp. 37, Palatka, 1888.)

A list of plants arranged in order of flowering, from January to December, 1,700 species in all, the first being *Ulmus alata* and the last *Borrichia arborescens.*

Fungi Fuegiani. (Bull. Acad. Sci. de Cordoba, xi., 176. 1887.)

Fungi Patagonici. (Bull. Acad. Sci. de Cordoba, xi., 61. 1887.)

Ginsengwurzel (*Aralia quinquefolia*). Fr. Hoffman. (*Pharm.* Rundschau, vi., 258-259, one figure.)

Hibiscus lasiocarpus. Sereno Watson. (Garden and Forest, i., 425-426; fig. 68.)

History of Garden Vegetables. E. Lewis Sturtevant. (Amer. Nat., xxii., 802-808; continued.)

Ice Plant, (*Mesembryanthemum crystallinum*); Italian corn salad, (*Valerianella eriscarpa*); Jerusalem Artichoke, (*Helianthus tuberosus*); and Kale in its many modifications, (*Brassica oleracea acephala*) are here discussed.

Lichenes Montevidenses, quos legit et communicant Prof. Arechavaeleta. Determinavit Dr. J. Mueller. (Revue Mycologique, x., 1-5.)

Lichenes Paraguenses a Cl. Balansa lecti. Dr. J. Mueller. Revue Mycologique, x., 53-68.)

List of the Writings of Dr. Asa Gray, chronologically arranged. Sereno Watson and Geo. L. Goodale. (Amer. Journ. Sci., xxxvi. Appendix, pp. 68; reprinted.)

This list is divided into: (1) Scientific Works and Articles, comprising 359 separate items; (2) Botanical Notices and Book Reviews, among which we find mention of almost every botanical work of importance which has appeared in fifty years; and (3) Biographical Sketches, Obituaries, &c., mainly from the pages of the American Journal of Science, of which Dr. Gray was botanical editor for nearly the same period. The pamphlet is carefully indexed, which adds very greatly to its value. Prof. Goodale requests that any corrections or omissions noted be promptly forwarded to him.

Morels and Puff-balls of Madison, Wis. Wm. Trelease. (Trans.

Wisconsin Acad. Sci., Arts and Letters, vii., 105-120; three plates. Reprinted.)

A list of species of *Morchella, Lycoperdon, Secotium* and *Scleroderma* with complete descriptions and critical notes and abundant references to authorities and illustrations.

Mycologic Flora of the Miami Valley, Ohio. A. P. Morgan. (Journ. Cincin. Soc. Nat. Hist., xi., 86-95; continued.) This part completes the enumeration of the Hymenomycetes.

Nutzpflanzen Brasiliens. Theodor Peckelt. (Pharm. Rundschau, vi., continued through several numbers.)

Dr. Peckolt, an apothecary at Rio Janeiro, is contributing a series of valuable notes on the economic plants of Brazil.

Phlox nana. Sereno Watson. (Garden and Forest, i., 413, fig. 66).

Dr. Watson notes that this species shares with *P. Drummondi* the unusual character of producing in the wild state flowers of several different colors.

Pollination of Phlomis tuberosa, and the Perforation of Flowers. L. H. Pammel. (Trans. St. Louis Acad. Sci., v., 241-277; two plates; reprinted as Contributions from the Shaw School of Botany, No. 1.)

The elastic-hinged upper lip of the corolla in the Jerusalem Sage is pushed back by visiting insects, whose backs are dusted with pollen from the anther cells lying within this arched upper lip. The process is described in detail. The seeond part of Mr. Pammel's interesting paper is a valuable review of the whole subject of flower perforation, accompanied by a lengthy and doubtless very complete bibliography.

Rosa Nutkana. Sereno Watson. (Garden and Forest, i., 449; fig. 70.)

Stuartia pentagyna and *Aralia spinosa.* C. S. Sargent. (Garden and Forest, i., 415.)

Both recorded as very abundant: and in their greatest perfection on the western slopes of the Big Smoky Mts. of Tennessee.

Süsserwasser und Luftalgen.—Ueber einige in Porto Rico gesammelte, M. Möbius. (Hedwigia, xxii., 221-249; two plates.)

Dr. Möbius has worked up the fresh water algæ collected by P. Sintensis in Porto Rico. A form identified as *Compsopogon chalybeus,* Kg., is correlated with one figured in Wolle's Fresh

Water Algæ, t. 70 from Florida. *Phyllactidium tropicum* is a new genus and species from the leaves of species of Orchidaceæ, and is thoroughly described and illustrated, its symbiotic nature being discussed at length. *Microcoleus thelophoroides* (Mont.), Möbius, is a new species in Cyanophyceæ.

Useful plants of Southern California. C. R. Orcutt. (Garden and Forest, i., 414-415.) Notes on *Romneya Coulteri, Simmondsia Californica* and *Prunus ilicifolia.*

Proceedings of the Club.

The regular meeting was held at Columbia College, November 12th, the Vice-President in the chair and 39 persons present.

Mrs. Sarah D. Robinson and Miss Sarah J. Agard were elected active members.

Dr. A. Rimondi, of Lima, Peru, Don José Arechavaleta, of Montevideo, and Prof. W. D. Alexander, of Honolulu, were elected corresponding members.

Mr. E. P. Bicknell read a series of notes on the flora of the Palisades of the Hudson and the opposite New York shore.

Mr. Hollick read a paper on a recent discovery of hybrid oaks on Staten Island, illustrated by drawings and specimens of *Quercus Phellos, Q. heterophylla* and *Q. rubra.*

Professor Schrenk read a paper on the inflorescenee of *Callitriche*, illustrated by microscopical preparations, specimens and drawings. He held that the two bracts or sepals at the base of the flower are in reality floats, as he had found them in *C. heterophylla* to be hollow and filled with air.

At the adjourned meeting held November 28th, the Vice-President was in the chair and 23 persons present.

Mr. Justus F. Poggenburg, Chairman of the Field Committee, submitted a report on the excursions held during the past season, from which the following is extracted : In all, 28 excursions were arranged, the Committee endeavoring to select localities not before visited by the Club, or such from which no reports were available. All plants seen were carefully noted at the several localities, and specimens of the rarer or more interesting species preserved. The lists thus obtained will be available for the use of the Flora Committee. No plants new to the 100 mile circle were observed, but much information has been obtained regarding the geographical distribution of many rarer species. *Dirca palustris* and *Tephrosia Virginiana* were found at Lake Mahopac. Mr. Poggenburg detected the rare *Sagittaria subulata* at Highland Falls.

Miss Steele read a paper "On the July Flora of the Southern Catskills," illustrated with specimens.

Miss Rich read a paper "On the Summer Flora of the Central Catskills."

Dr. Britton remarked on the similarity of the floras described to that of the Pocono plateau in Pennsylvania, which is geographically and geologically the southwestern continuation of the Catskill mountain system.

Mr. Bicknell and Miss Steele remarked on the character of a *Rhododendron* which grows at high altitudes in the Catskills, it having pubescent leaves, distinctive odor and other peculiarities.

Mr. VanBrunt reported *Polemonium cœruleum* growing in abundance at Balsam Lake, Catskill Mountains, being another station for a plant extremely rare east of the Alleghanies.

Mr. Sterns remarked at considerable length on the residuary native flora of Manhattan Island.

Mr. Hollick called attention to the recent articles published in the New York Herald, urging the establishment of a great botanical garden in one of the new parks. The subject was discussed by several members, the great desirability of such an establishment being generally conceded, and a resolution approving the movement was adopted.

Dr. Britton stated that Dr. Thos. Morong had arrived safely at Buenos Ayres, Argentine Republic, and had commenced his work of studying and collecting the plants of that country. He read extracts from a letter received from Dr. Morong dated October 10th. Dr. Britton also exhibited specimens of *Artemisia Stelleriana*, Besser, from several points along the coast within the radius of the 100 mile circle. It has very generally been mistaken for the "Dusty Miller," *Senecio Cineraria*, and indeed its leaf-form is very similar. Recent flowering specimens collected by Mr. Rudkin at Long Beach leave no question as to the plant's identity. In the Synoptical Flora it is attributed only to Nahant Beach, Mass.

New or Little Known Grasses. F. L. Scribner.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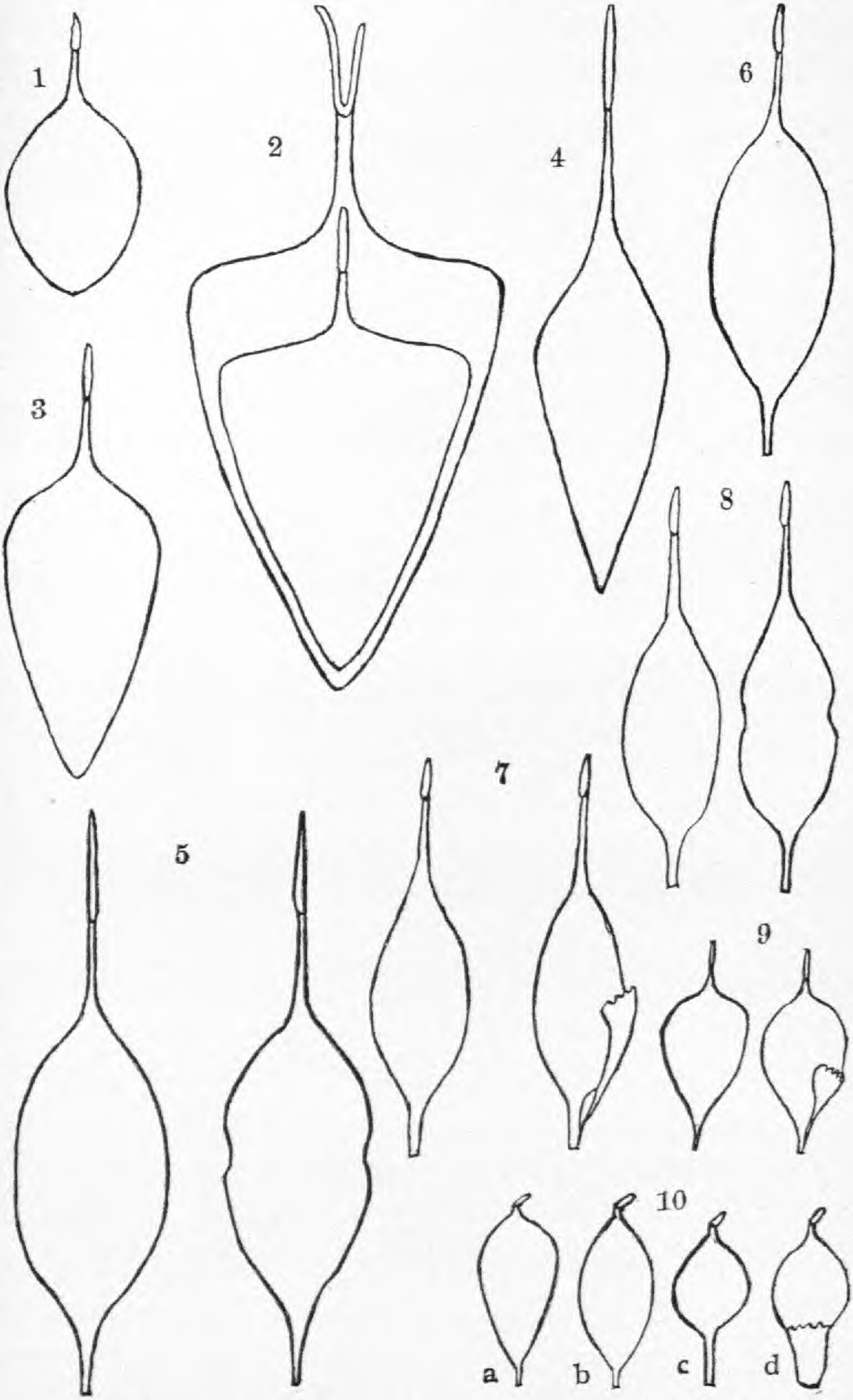
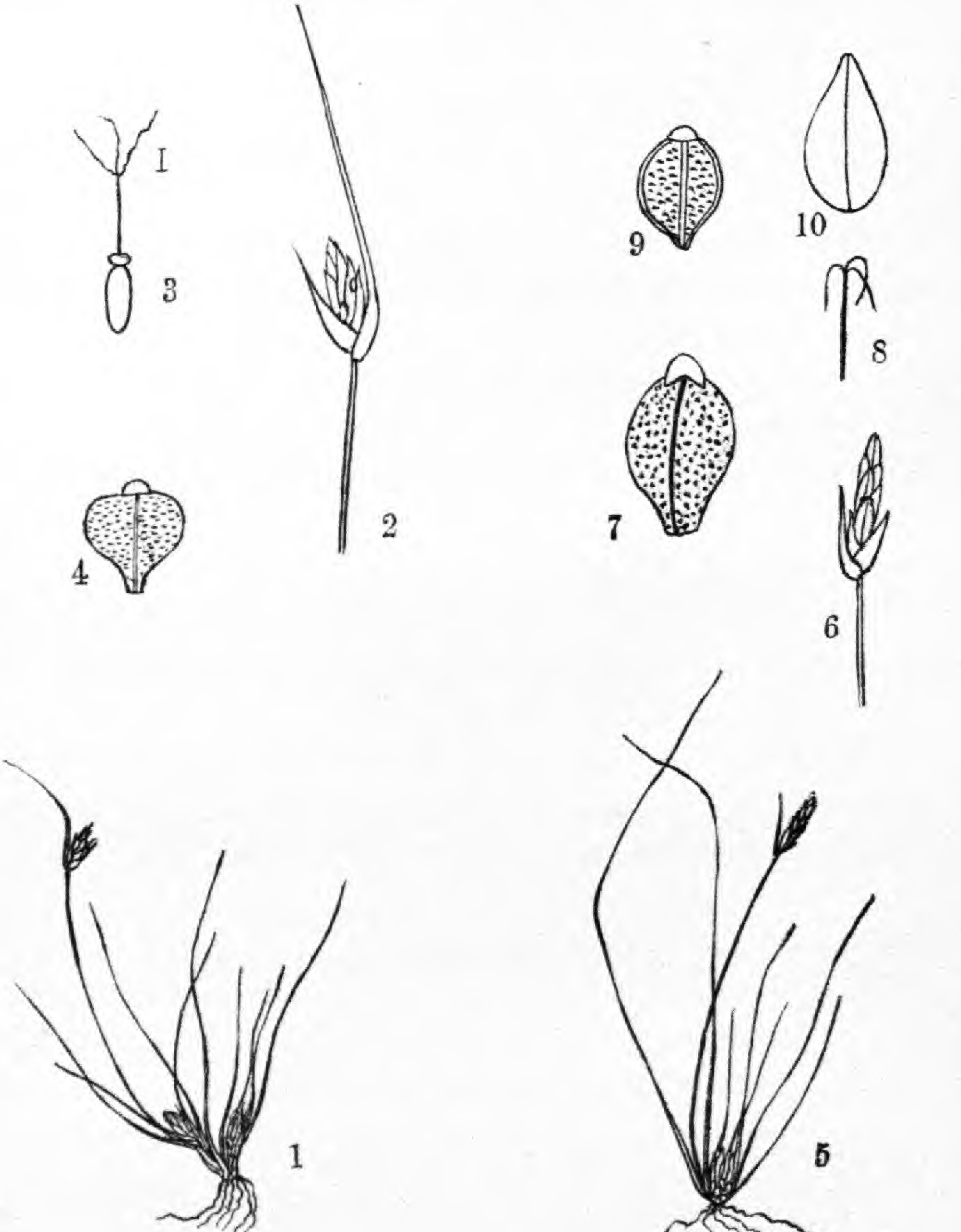
BULLETIN OF THE TORREY BOTANICAL CLUB.

Asa Gray

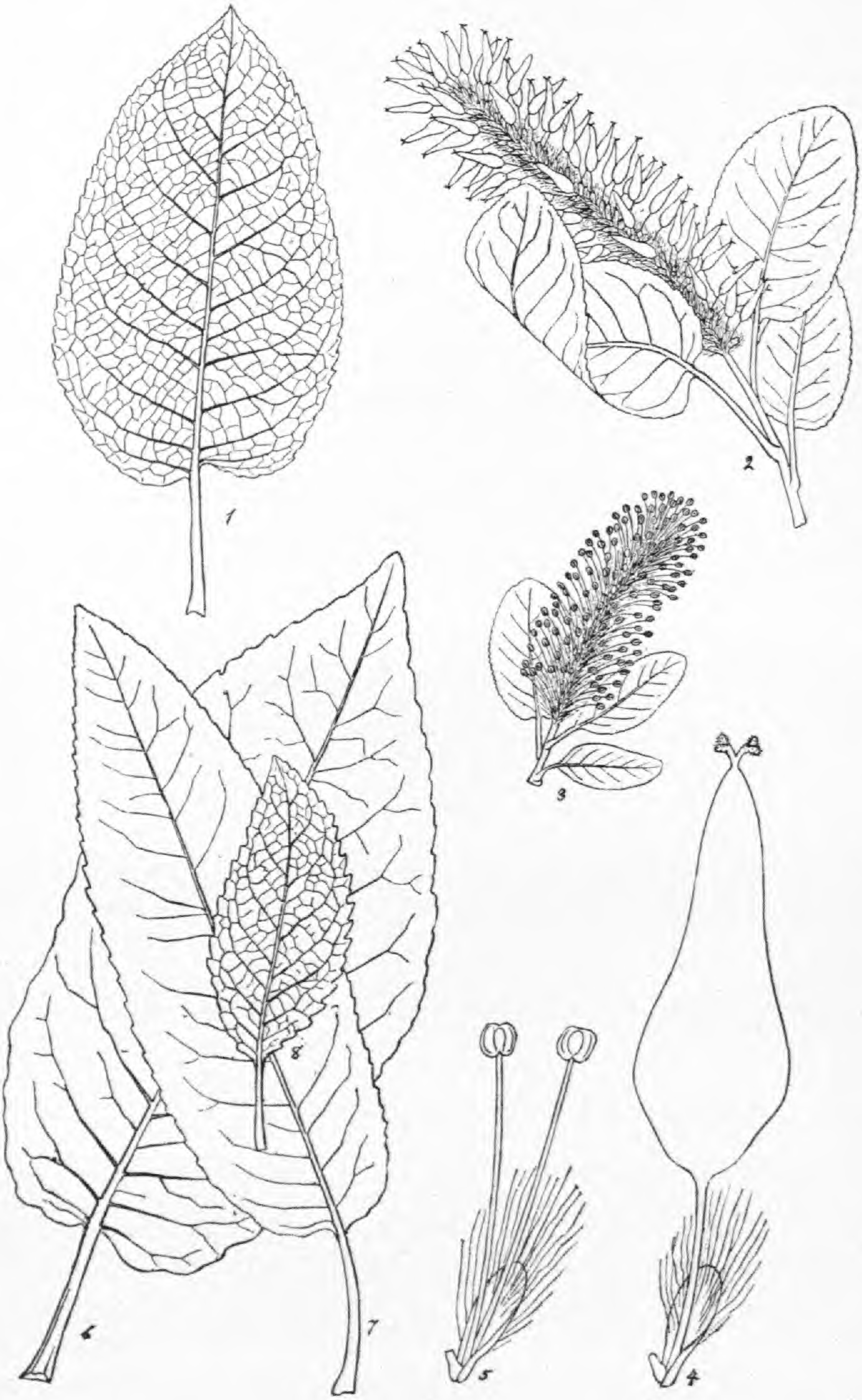


Fruit of various species of Sparganium. Thomas Morong.

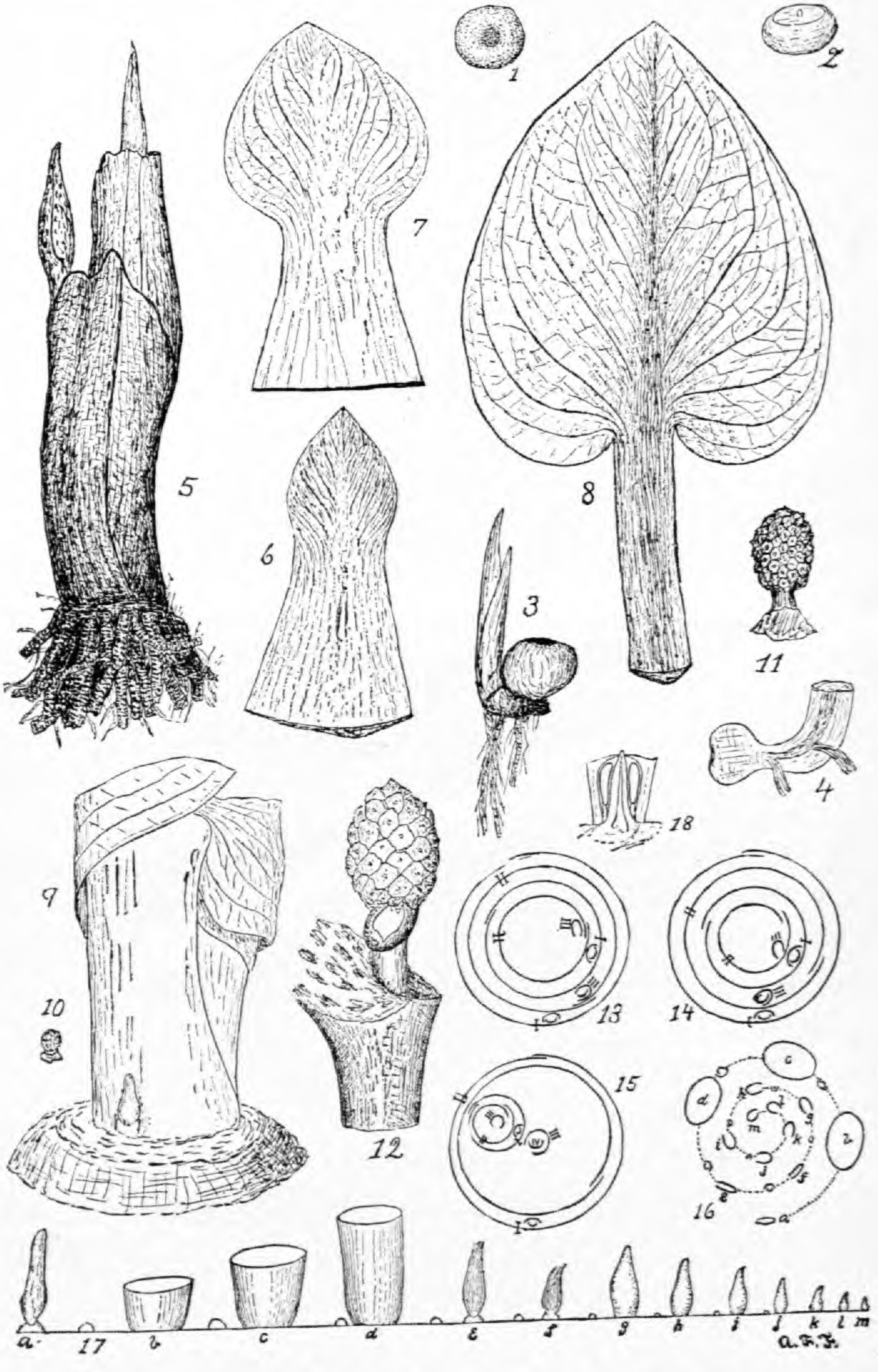


Scirpus Pringlei, Britton. | Scirpus heterocarpus, Watson.

Bulletin of the Torrey Botanical Club. Plate LXXXI.



Salix balsamifera, Barratt. M. S. Bebb.



Development of Symplocarpus. A. F. Foerste.

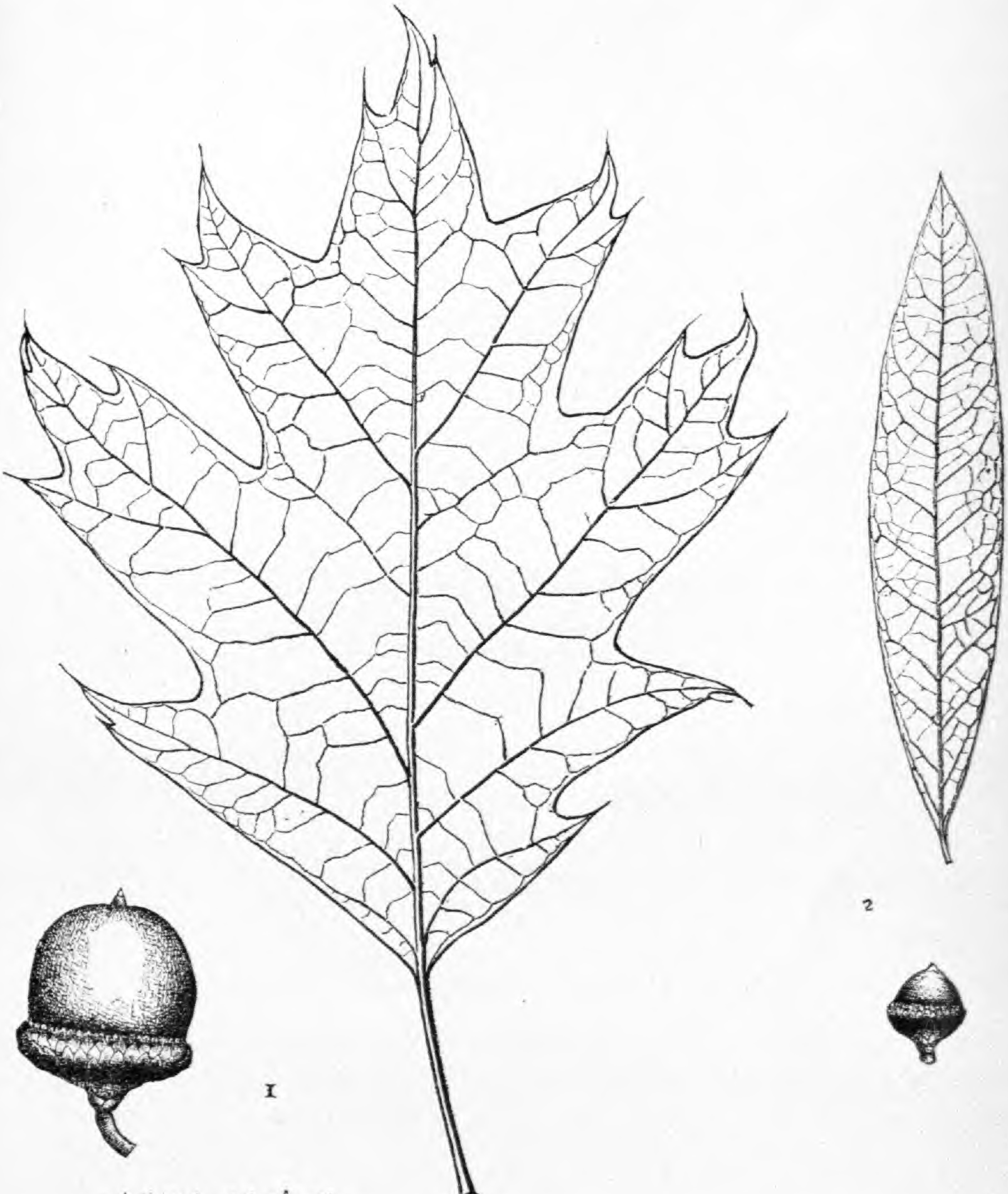
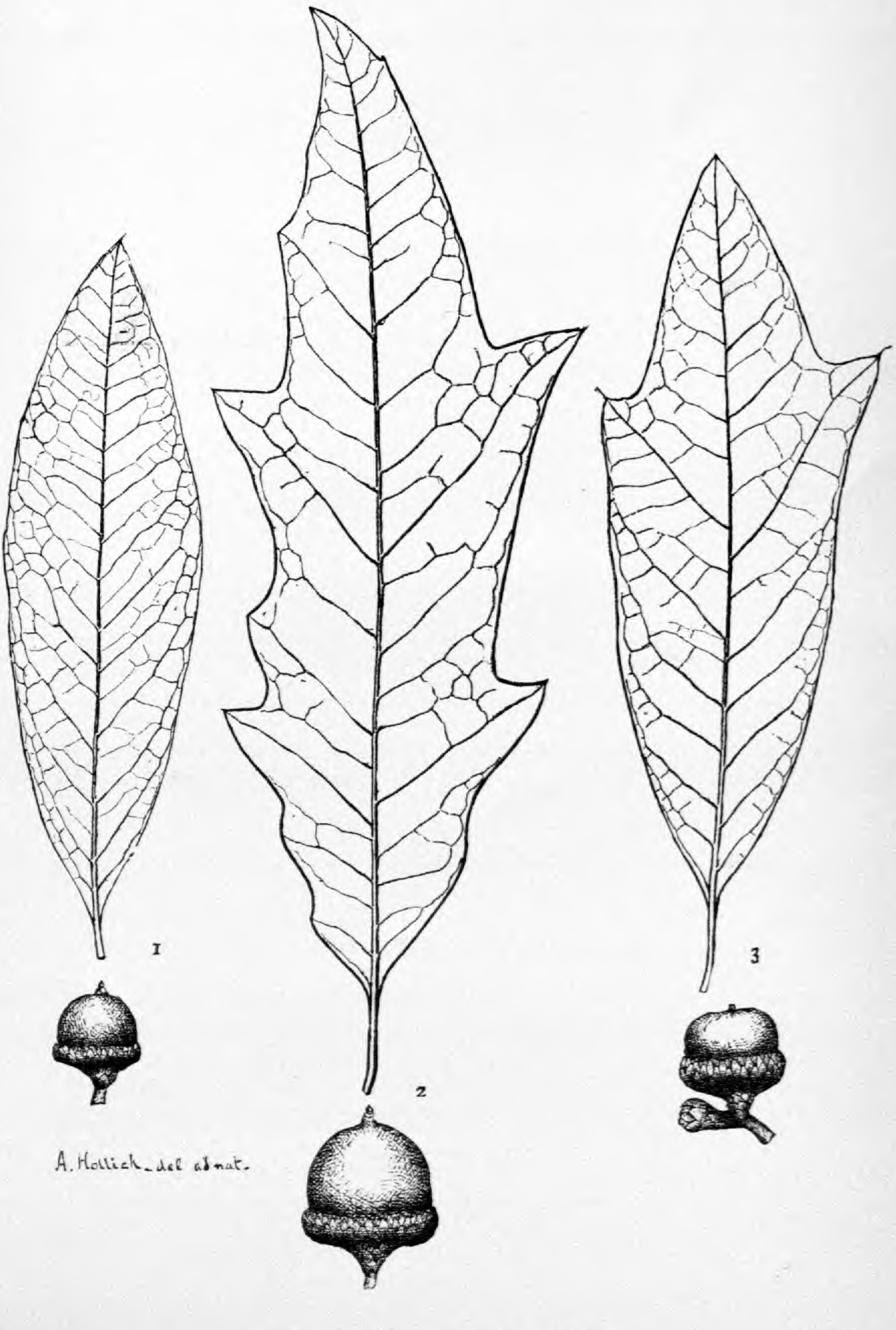
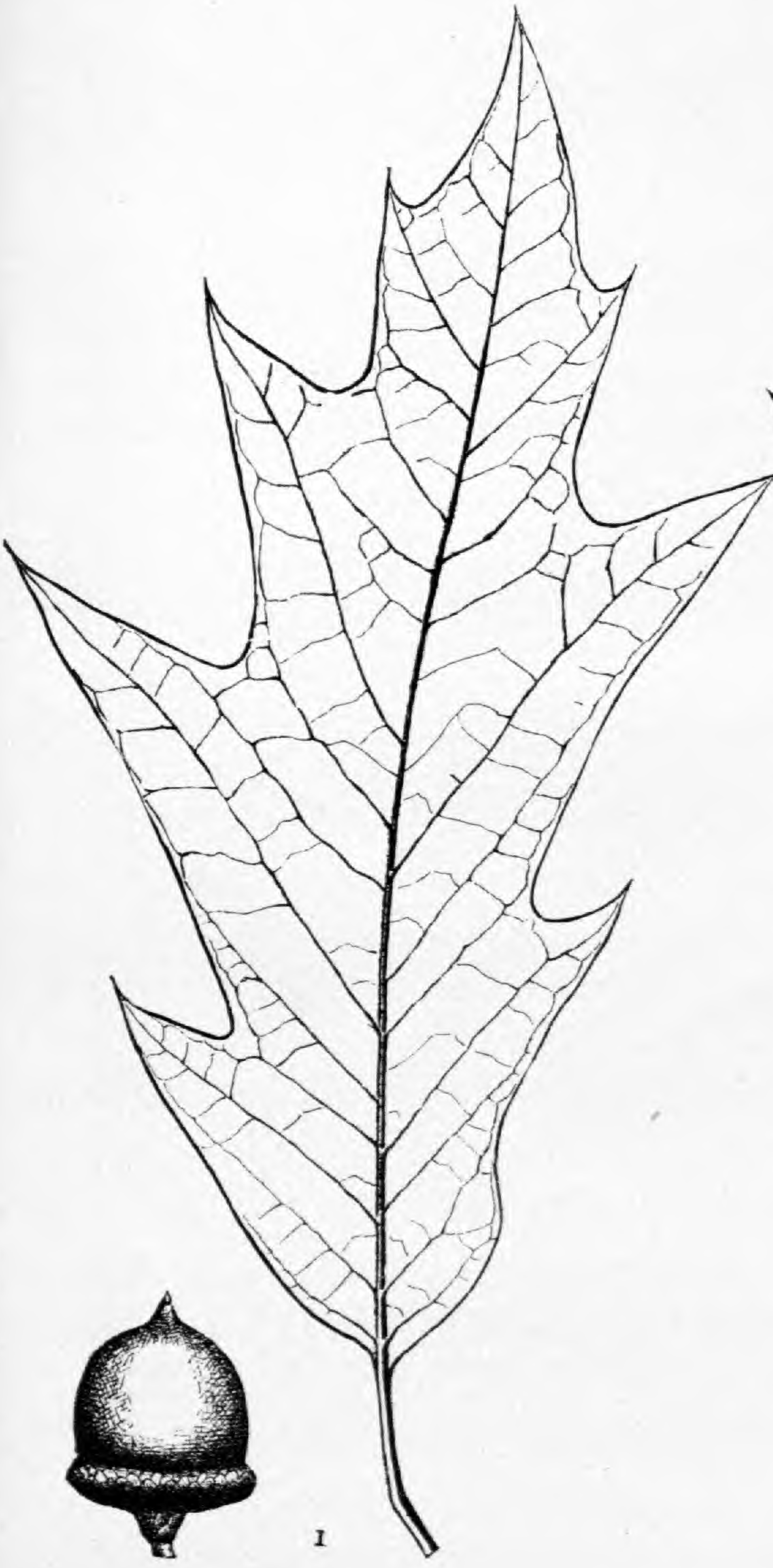


Fig. 1. Quercus rubra, L. Fig. 2. Quercus Phellos, L.



Quercus heterophylla, Michx.



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Quercus heterophylla, Michx.

VOL. XV. JANUARY, 1888. NO. 1.

BULLETIN

OF THE

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A MONTHLY JOURNAL OF BOTANY.

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ELIZABETH G. BRITTON,

AND OTHER MEMBERS OF THE CLUB.

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